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Septic Systems and Ground-Water Protection A Program Manager's Guide and Reference Book

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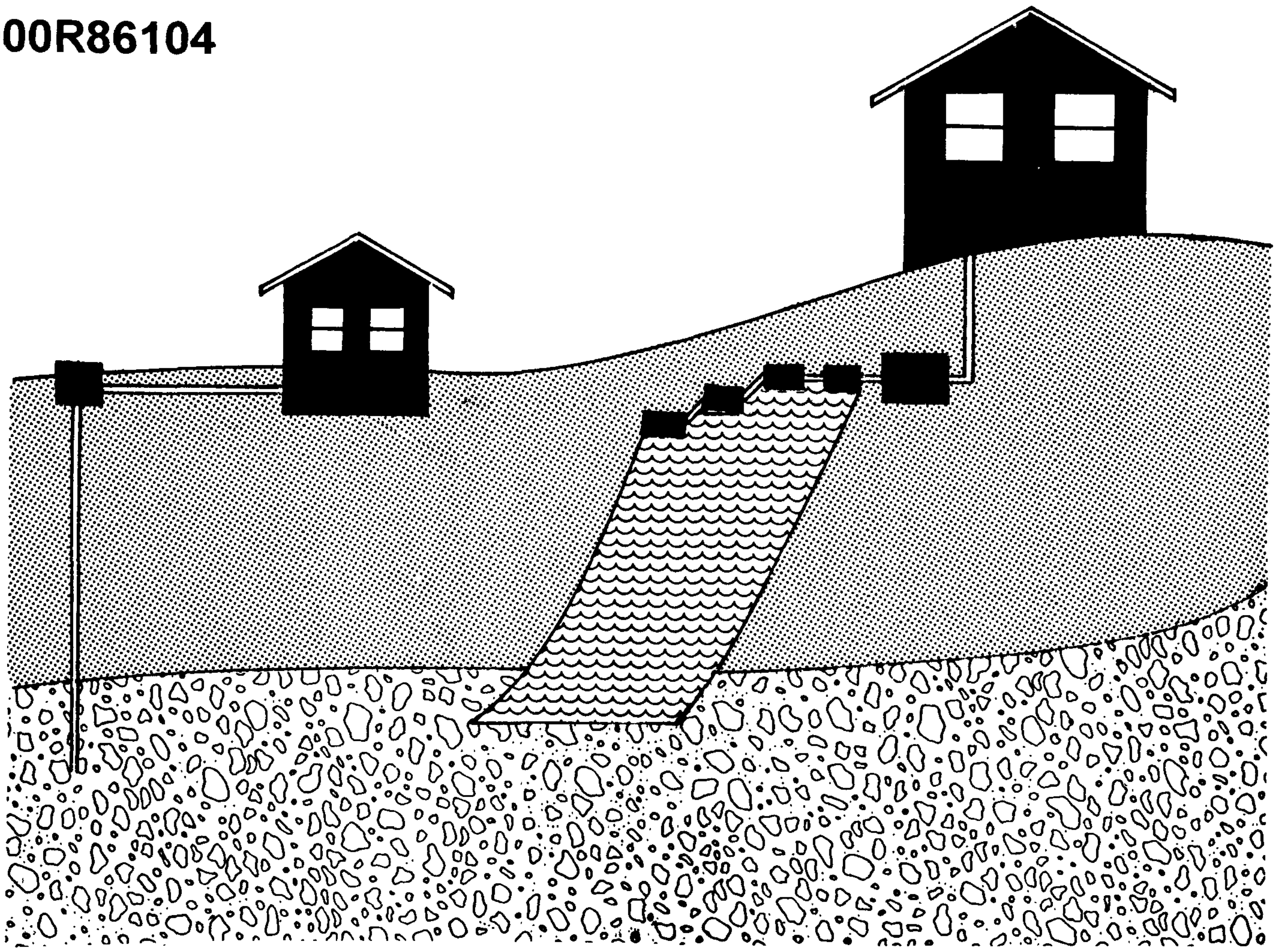

Septic Systems and Ground-Water Protection
A Program Manager's Guide and Reference Book

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ABSTRACT

The USEPA's Office of Ground-Water Protection has recently developed a publication for local government officials that addresses the problem of ground-water contamination caused by many of the over 22 million commercial and residential septic systems in this country. EPA has found that septic systems are a major contributor to ground-water contamination, and the Agency believes that strengthening local control programs is the best way of preventing future contamination. EPA's "Septic Systems and Ground-Water Protection: A Program Manager's Guide and Reference Book" was written to assist local government officials and their technical staffs. The Reference Book describes the potential hazards to public health and ground-water supplies from the improper use of malfunctioning, improperly maintained, or poorly sited septic systems, and offers ideas for improving septic system management programs.

A more brief overview document, entitled "Septic Systems and Ground-Water Protection: An Executive's Guide" also is available. It provides a quick description of the relationship between septic system use and ground-water contamination, and conveys the main points discussed in the "Program Manager's Guide and Reference Book":

- Septic systems are an effective, low-cost alternative for domestic waste management if properly sited, designed, installed and maintained;
- Individual property conditions have a substantial effect on septic system performance;
- Integrating recent technological scientific developments and flexibility into existing regulations is necessary to improve septic system control programs;
- Developing public education programs to encourage property owners and contractors to be active participants will improve waste management practices;
- Using water conservation techniques will improve system performance and extend system life;
- Strong provisions for septic system operation and maintenance, proper septage disposal, and enforcement techniques are important aspects of comprehensive control programs; and
- Controlling the use of septic tank cleaning solutions and commercial and industrial uses of septic systems is necessary to protect against ground-water contamination.

The "Program Manager's Guide and Reference Book" contains detailed and technical information concerning septic system management and control and provides program options and regulatory language from existing septic system management programs.

The documents are available from the Government Printing Office. To obtain the "Executive's Guide", request GPO Document No. 055-000-00257-6. To obtain the "Program Manager's Guide and Reference Book", request GPO Document No. 055-000-00256-8.

ACKNOWLEDGEMENTS

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The approaches and recommendations described in this document reflect the views of a Technical Panel on Septic System Management that was organized under the auspices of the Office of Ground-Water Protection. The views of the Technical Panel do not necessarily represent EPA policy. The Technical Panel included the following members:

William Boyle	University of Wisconsin - Madison
Jerry Canfield	Minnesota Pollution Control Agency
Frank Gargiulo	Palm Beach County Health Department
Carol Kocheisen	National League of Cities
Jim Kreissl	EPA Municipal Engineering Research Laboratory
Nancy Kuhn	Garden Club of America
Terry Langan	Indian Health Service
Jay Lehr	National Water Well Association
Ted Loudon	Michigan State University
Ken Lustig	Idaho Panhandle Health District
Michael Luzier	National Association of Home Builders
Randy May	Connecticut Department of Environmental Protection
Joseph McDade	Dow Chemical
Carl Myers	EPA Office of Water Regulations and Standards
Elissa Parker	Environmental Law Institute
Marie Perez	EPA Office of Municipal Pollution Control
David Rickert	U.S. Geological Survey
Frank Sagona	Tennessee Valley Authority
Dick Scalf	EPA Office of Research and Development, Kerr Lab
Velma Smith	Environmental Policy Institute
Mark Sobsey	University of North Carolina - Chapel Hill
Edith Tanenbaum	Long Island Regional Planning Board
Bill Tenison	National Association of Home Builders
Mike Thomas	EPA Office of Toxic Substances
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1. INTRODUCTION

Septic systems[1] have long been an effective means of on-site domestic waste treatment and disposal when designed, sited, installed, operated, and maintained properly. There are approximately 22 million septic systems operating in the United States today and more are installed every year. Together, they introduce about one trillion gallons of effluent to the environment every year. Under the appropriate environmental circumstances, and with proper management, they provide a safe and effective means for domestic waste disposal, especially in areas of low housing density, where public sewer systems are not available or feasible. Without proper management, however, septic systems can contribute to ground-water pollution and threaten private and public drinking water sources.

As the number of operating septic systems has grown and our ability to detect contamination has improved, incidents of ground-water and drinking water contamination that can be traced to septic systems have become increasingly common. Illnesses associated with drinking ground water contaminated by untreated septic system effluent include gastroenteritis, typhoid, and hepatitis. In addition, some effluent also may contain toxic and/or carcinogenic chemicals. Site discovery activities under EPA's Superfund program have identified many sites at which septic tanks containing toxic industrial or commercial waste are substantially contributing to ground-water contamination. For example, contamination of the ground-water supply for the Lakewood District near Ponder's Corner, Washington, was in part the result of disposal of cleaning solvents in a septic system by a local dry cleaning establishment. State and local government officials, therefore, are realizing that past efforts to regulate septic systems have often proven to be inadequate. As a result, many are now considering or actively taking steps to improve septic system management programs at the state, regional, and local levels.

This document is designed to provide officials responsible for developing state or local codes with information concerning effective septic system management. The following chapters provide ideas, alternatives, and real-world examples for modifying existing codes or writing new codes to address the most important issues affecting current state and local septic system regulations.

This document will not serve as a "cookbook" for designing a septic system regulatory program, nor does it restate the large body of technical information on septic systems that has already been published. Several states and professional organizations have produced model codes and ordinances. Unfortunately, many local governments have adopted the model language without gaining an accompanying appreciation for the rationale behind the code provisions and their potential inapplicability to local conditions. The result is inadequate regulation.

This publication takes a different approach. We seek to give the reader a better understanding of the workable options for managing septic systems. By providing a comprehensive discussion concerning the design and implementation of a septic system management program, the reasons for including certain regulatory requirements or non-regulatory incentives should become clear to the reader.

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[1] Throughout this document, we refer to on-site wastewater treatment systems as septic systems. Our use of this term is intended to encompass conventional septic systems that consist of a tank and a soil absorption or drain field, less conventional designs that are variations on the traditional system (such as mound systems), and other alternatives (aerobic treatment systems, or waterless toilets, for example).

The approaches discussed in this document are based largely on recommendations provided by a panel of nationally recognized experts; federal, state, and local government officials; and special interest representatives. The members of this panel identified the critical problem areas encountered in septic system management and recommended approaches for improving management programs. Their recommendations are not necessarily EPA policy.

The companion volume to this publication, "Septic Systems and Ground-Water Protection: An Executive's Guide" provides a general overview of the need for septic system regulation and an introduction to some of the improvements that can be made in septic system management. The "Executive's Guide" is intended for mayors, county executives, and state officials who have an interest in or executive responsibility for septic system management and ground-water protection. This document, the "Program Manager's Guide and Reference Book," presents a more in-depth discussion of management and control options. The discussion is organized into four chapters with two appendices.

Chapter 2 offers a brief overview of management and control programs for septic systems. We identify and describe the basic components of septic system management. We also discuss alternative approaches for modifying existing codes.

Chapter 3 outlines specific approaches for modifying management and control programs to help protect ground water. These approaches address the following nine critical problems affecting septic system programs:

1) Failure to adequately consider site-specific environmental conditions;

2) Codes that resist adaptation to local hydrogeologic conditions and are unable to accommodate effective innovative and alternative technologies;

3) Ineffective or non-existent education programs;

4) Failure to promote water conservation;

5) Ineffective controls on operation and maintenance of septic systems;

6) Lack of control over septage disposal;

7) Lack of control over the use of septic system cleaning solvents;

8) Failure to consider the special characteristics and requirements of commercial, industrial, and large residential systems; and

9) Weak compliance and enforcement programs.

For each, we discuss resource requirements and practical implementation concerns. We also present general perspectives on the benefits that can reasonably be expected from implementing the different management and control options. Representative regulatory language is either supplied or provided by reference.

Chapter 4 contains a listing of comprehensive general references and other sources of technical information on septic systems.

Appendix A provides a glossary of technical terms as well as references containing further information concerning each of the nine issues addressed in Chapter 3.

Appendix B contains excerpts from several state codes that illustrate workable septic system management programs.

2. OVERVIEW OF MANAGEMENT AND REGULATORY PROGRAMS FOR SEPTIC SYSTEMS

There is no single approach to septic system regulation that will ensure protection of public health and the environment in all circumstances. The type of program chosen by individual governments depends upon local circumstances and traditional levels of regulatory authority. However, there are several program components that should be considered if a septic system management program is to be effective.

First, the jurisdiction and level of regulatory authority should be considered. For example, should responsibility for implementing or developing septic system programs be focused at the state or local level? If at the local level, are there any state requirements that override or influence local codes?

Once the appropriate jurisdiction is established, it is important to consider the types of management tools that might be used. These can range from strict site inspection and maintenance requirements to licensing the contractors who install and service septic systems. This document describes the many program options that can be used. Finally, it is important to consider the role that community involvement and public education can play in improving septic system maintenance.

Effective management programs combine strong technical guidelines governing siting, design, operation, and maintenance, with evaluation and implementation procedures that accommodate differing site conditions. Some states have also begun using performance standards or allowable waste effluent concentrations to guide the choice and assessment of appropriate treatment technologies for individual sites.

An effective regulatory program should establish procedures for ensuring compliance. Compliance is typically addressed in a variety of ways from permitting and inspections to technical training programs. Most jurisdictions use a combination of approaches. Effective permitting programs require detailed permit application reviews and individual site inspections. At a minimum, most areas require the granting of a construction permit prior to septic system installation. The professionals involved in the siting, design, installation, and maintenance of septic systems should be licensed to ensure their technical competence. Some jurisdictions also issue operating permits and ground-water discharge permits to further manage system operation and maintenance. Financial incentives also aid compliance and may vary from small fines for poor system maintenance to preventing the sale of a house if its septic system is not functioning properly.

The State of Maryland has recently enacted revised regulations for septic system management. Many aspects of the new program have grown out of the experiences of state and local government officials and their desire to assure that individual decisions concerning septic system siting, design, and installation are made on the basis of complete information and sound technical judgment. The new Maryland program is comprehensive in scope and, in many respects, includes the concepts advocated in this document. Exhibit 1 presents an outline of a comprehensive code, which is based in part on the new Maryland State code; it can be used as a generic "check list" by those developing new or improved programs.

EXHIBIT 1

SAMPLE REGULATORY CODE PROVISIONS AND ORGANIZATION

I. Introduction

- A. Purpose and Authority
- B. Jurisdiction and Policy
- C. Definitions

II. General Standards, Requirements, and Procedures

- A. Availability of Sewer Hook-Up
- B. On-Site System Construction Permit
- C. Permit Application Content
  - 1. Site evaluation
    - a. Topography, geology, and hydrology
    - b. Soil borings, classification, and percolation tests
    - c. Drainage
    - d. Depth to ground water
  - 2. Location
    - a. Site plans
    - b. Separation distances
    - c. Lot size
  - 3. On-site system design
- D. Permit Review and Approval/Denial
- E. Appeal Procedures
- F. Fees
- G. Pre-Cover Inspections/Certificate of Completion

III. Conventional On-Site Septic System Design and Construction

- A. Hook-Up to Home
- B. Grease Traps
- C. Septic Tank Size and Design Criteria/Materials
- D. Absorption Area Size and Design Criteria/Materials

IV. Innovative and Alternative Systems

- A. Limitations on Siting and Use
- B. Types of Systems
- C. Design and Construction Criteria
- D. Maintenance and Monitoring Requirements
- E. Experimental Systems

EXHIBIT 1 (Continued)

SAMPLE REGULATORY CODE PROVISIONS AND ORGANIZATION

V. **Large Residential/Cluster Systems**
   - A. Limitations on Siting and Use
   - B. Construction and Design Criteria

VI. **Commercial and Industrial Systems**
   - A. Limitations on Waste Types, Siting, and Use
   - B. Construction and Design Criteria
   - C. Monitoring Requirements

VII. **Operation and Maintenance**
   - A. Permissible Waste Types
   - B. Owner Inspection and Repair Responsibilities
   - C. Ban on Use of Septic System Cleaning Solvents
   - D. Regular Septic Tank Pumping
   - E. Procedures for Alteration or Repair of Systems
   - F. Procedures for Abandonment of Systems

VIII. **Compliance and Enforcement**
   - A. Permits
     1. Construction
     2. Operation
     3. Septage Disposal
   - B. Licensing
     1. Site Evaluators
     2. System Designers
     3. Installation Contractors
     4. Septage Pumpers
   - C. Inspections
     1. Pre–Cover
     2. Operation
     3. Pre–Sale
   - D. Monitoring, Recordkeeping, and Reporting
   - E. Penalties and Fines

IX. **Special Provisions**
   - A. Protection of Sensitive Recharge Areas
   - B. Set–Backs on Riparian Lots
   - C. Water Conservation

A state or local official responsible for developing a new septic system management program may choose to scrap the existing code or to draft a new one. Starting from scratch creates an opportunity to take a new approach to controlling on-site wastewater management. In many areas, however, such a drastic step may not be necessary. Existing codes generally have evolved over time to control perceived problems in the community and protect public health. Therefore, the basic framework for most codes probably is sound. By modifying only selected aspects of the existing sanitary code, specific problems can be corrected and the need for ground-water protection can be addressed.

Whether a government chooses to draft an entirely new septic system code or to revise portions of an existing program, the changes should be made as part of a community-wide land-use and ground-water protection plan. Such a plan may rely upon public health, environmental protection, and zoning authorities to regulate septic systems. For example, zoning and minimum lot size requirements control septic system density, and special limits on septic system design and placement can be used to protect sensitive ground-water recharge zones, surface water bodies, or existing wells. Land-use controls may be needed to protect sensitive land that could be opened for development if non-conventional systems are approved for those sites. Most importantly, community-wide plans should account for all potential sources of ground-water pollution and ground-water recharge; they should also consider all present and projected water needs. Septic system management is just one part of this important, comprehensive plan.

The planning process should use

- general regulatory authority,
- the sanitary code,
- zoning, and
- land-use controls

to limit ground-water degradation from septic systems and from other sources. Officials should take into account local environmental conditions and current septic system use when developing strategies for modifying existing codes. In addition, the planning process should acknowledge that septic systems are an effective means of waste disposal when sited, designed, installed, maintained, and operated properly, and that the systems can provide benefits such as ground-water recharge in addition to domestic wastewater treatment and disposal.

3. MANAGEMENT AND CONTROL OPTIONS

Just as septic system performance depends upon many site-specific and user-related characteristics, the elements of a successful septic system management and control program vary depending upon many local factors. Programs that are successful in one region of the country may be inappropriate in others due to differences in economic constraints, the characteristics and use of ground-water resources and other environmental factors, and community or state ground-water protection objectives and concerns. Certain components of septic system management programs, such as enforcement programs and septage disposal requirements, have nearly universal applicability. Other components, such as educational programs and water conservation efforts, may be of greater concern to some communities than to others.

This chapter has been designed to take into account the variety of community needs and concerns related to septic system management. In the following sections, we examine nine important aspects of septic system management and control programs to protect ground water:

1) Site evaluations;

2) Making codes more comprehensive so that they account for a variety of hydrogeologic conditions and accommodate innovative and alternative on-site system designs;

3) Education and public outreach programs;

4) Water conservation programs;

5) Controls on operation and maintenance;

6) Controls on septage disposal;

7) Controls on the use of septic system cleaning solvents and other hazardous chemicals that may be discharged to septic systems;

8) Special provisions for commercial, industrial, and large residential septic systems; and

9) Compliance and enforcement programs.

For each, we provide information that will be useful to government officials who may need to evaluate state regulations or local codes and consider options for improving existing septic system management programs. Each section in this chapter addresses one of the nine aspects of management programs by discussing key issues, providing examples taken from existing codes and regulations that exemplify the range of possible control or management practices, and by outlining the advantages and disadvantages of the different approaches.

We, therefore, take a "modular approach" to examining septic system management and control programs. Information in this chapter can be applied to improve specific aspects of existing programs or to develop the components of a new program. Chapter 4 provides sources for further information on each of the program components discussed in this chapter.

3.1 Requiring Site and Soil Evaluations

Septic systems are designed to work best under a specified set of environmental conditions and may not function properly under other conditions. More specifically, because conventional septic systems depend on the soil for wastewater treatment and disposal, consideration of soil and site conditions is critical to designing and siting an effective septic system. Ground-water contamination occurs when the hazardous constituents in septic system effluent enter the ground water without being adequately treated or retained by the soil. This may be caused by soil or geologic characteristics such as highly permeable gravel layers, creviced limestone, clay layers with major macropores caused by shrinking and swelling, or other formations that allow partially treated effluent to bypass soil layers and enter the ground water.

When designing and siting an on-site waste treatment and disposal system, two essential pieces of information are needed:

1) the characteristics of the waste to be disposed, and

2) the soil and hydrogeologic characteristics of the site where the system will be installed.

These factors work together to determine the choice of an appropriate septic system design. Assessing the characteristics of the waste flow is straightforward. The type of structure connected to the septic system (e.g., residential or commercial) and the number of individuals using the system (e.g., number of family members or number of customers) will dictate the anticipated waste constituents and volume. Evaluating the characteristics of the site of installation is a more complex process, typically involving some type of site and soil evaluation. This section outlines a recommended approach for organizing and conducting these site and soil evaluations to ensure that septic systems will operate properly and prevent ground-water contamination.

Effective septic system management programs generally mandate the collection of information to support site evaluations in two basic steps. First, state or county planning agencies collect regional information, such as soil surveys, ground-water logs, and topographic maps, to characterize those areas that are or are not suited for the installation of septic systems. This regional information can guide region-wide planning and direct development toward those areas that are best suited for the use of septic systems. Such regional evaluations also provide valuable data to guide the initial choice of an appropriate septic system design for a particular lot or parcel. Sound management programs do not stop there, however. Effective programs require a further site-specific evaluation involving field measurements to guide the final siting, design, and installation of the septic system. This site-specific information is critical to the proper design of an individual septic system.

This section outlines the basic approaches that should be taken when conducting site evaluations.[2] The specific approach chosen by a given region will depend on the soil and hydrogeologic conditions of that area. Several examples are provided to illustrate how site evaluations are organized in different parts of the country. The discussion emphasizes that regional evaluations are appropriate for planning and guiding an initial choice of a septic system design for a site, while site-specific field measurements are needed to evaluate individual septic system installations. Regional, comprehensive site-specific, and limited site-specific evaluations are described in Exhibit 2.

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[2] This approach is discussed further in the "U.S. EPA On-Site Waste Water Treatment and Disposal Manual." A reference to the manual is provided in Chapter 4.

EXHIBIT 2

HYDROGEOLOGIC EVALUATION PROGRAM

APPROACH	RELEVANT PROGRAM COMPONENTS	RELATIVE ADVANTAGES	RELATIVE DISADVANTAGES
1. **REGIONAL EVALUATION:** Set installation specifications and design criteria based on a region-wide evaluation of hydrogeologic characteristics that identifies zones where particular systems will or will not be allowed due to site characterizations.	Region-wide review and evaluation of hydrogeologic characteristics that affect septic system performance. Analysis of regional hydrogeologic data to establish zones based on soil types, topography, hydrology, and/or other characteristics. Guidelines establishing allowable septic system designs for the different zones.	Costs of data collection and interpretation are incurred once, at the time of program inception. This option also preserves the concept of linking system designs to site characteristics. Useful for initial regional planning.	Regional hydrogeologic evaluation and guidelines development can be costly. Establishing zones will require making assumptions and generalizations, reducing the overall degree of confidence that individual systems will perform well over the long term. Must be supplemented with a site-specific evaluation.
2. **COMPREHENSIVE SITE-SPECIFIC EVALUATION:** Require site-specific evaluation of all hydrogeologic characteristics that influence septic system performance.	Technical guidelines for conducting site evaluations and making field measurements. Training and/or certification program for site evaluators. Procedures for review and evaluation of site information. Technical guidelines for selecting system designs and installation specifications based on site information. Procedures for review/inspection of system designs and installations to assure that guidelines have been followed.	Provides the greatest assurance that septic system designs and installations make the best possible use of site characteristics. Cost of training and certification program is easily recovered through fees.	The most resource-intensive option: property owners must bear the cost of site evaluations; state or community must fund guidelines development and review process.
3. **LIMITED SITE-SPECIFIC EVALUATION:** Require a limited site evaluation that involves collecting data on a few of the most important characteristics (e.g., soil properties, site dimensions, topography, depth to water table).	Technical guidelines for conducting site evaluations and making field measurements. Procedures for review and evaluation of site information. Technical guidelines for selecting system designs and installation specifications based on site information. Procedures for review/inspection of system designs and installations to assure the guidelines have been followed.	Costs are relatively small. May be used when resources do not allow Approach 2. This option preserves the concept of linking system designs to site characteristics without the expense of a detailed site evaluation by a trained and certified engineer or scientist. Review requirements are also less detailed than for Approach 2.	Reduced site-specific information limits the designer's ability to take advantage of site characteristics and may lead to somewhat lower degree of confidence in long-term system performance.

3.1.1 Regional Evaluations

Regional evaluations of environmental characteristics are conducted by a wide variety of federal, state, and local health agencies, environmental agencies, and land-use planning authorities throughout the country. These evaluations are used to support a variety of planning decisions, including septic system management. The data collected can be used to assess the conditions of a given area to determine its overall suitability for waste treatment and disposal by septic systems. This information should be used for general septic system management and planning purposes.

Regional evaluations generally rely on readily available, existing information, such as local annual rainfall, topography, and the location of ground and surface waters. Soil Conservation Service district offices and local agricultural extension services are good sources of soil survey reports and other useful data. Because soil survey maps are based on units much larger than the area of a typical soil absorption field, any extrapolation from a soil survey report to a specific site should be made with caution. In all cases, the validity of such extrapolation should be confirmed with field observation.

An example of a regional evaluation is outlined in the wastewater management plan for the Cedar Creek Reservoir area developed by the Tennessee Valley Authority (TVA) to prevent potential water quality degradation resulting from failing septic systems. The plan provides a tool for screening potential residential development sites with regard to soil suitability for conventional septic systems.

TVA developed maps on two scales summarizing soil suitability to provide a rapid and straightforward assessment of proposed development sites. The features of interest include:

- Depth of nonclay soil;
- Depth to water table;
- Soil percolation rate; and
- Flooding frequency.

Soil descriptions and properties were interpreted by a soil scientist and classified into one of four suitability categories for on-site septic systems. The smaller-scale TVA maps delineate these four categories. The larger-scale TVA map delineates seven suitability categories reflecting better resolution of restrictive soil and/or site limitations. The large-scale map is intended for use as a working document by health department personnel. The soil ranges used to interpret and categorize the physical soil properties are presented in Exhibits 3 and 4. For a more detailed discussion of the soil ranges and of the methodology used in this analysis, refer to the TVA booklet listed in Chapter 4.

TVA notes that within any given cell on the suitability maps, isolated areas may contain site and soil characteristics that are not representative of the cell as a whole. Therefore, a field evaluation is still recommended prior to final septic system design selection and installation to verify on-site soil conditions.

EXHIBIT 3

RANGES OF SOIL PROPERTIES USED FOR SOIL INTERPRETATIONS FOR CEDAR CREEK RESERVOIR, ALABAMA

SUITABILITY CATEGORY	SOIL DEPTH TO BEDROCK (Inches)	DEPTH OF NONCLAY SOIL (Inches)	PERCOLATION RATE (Minutes/Inch)	DEPTH TO WATER TABLE (Inches)	SLOPE %	FLOODING FREQUENCY
Suitable [a]						
Preferred	60	-	60	60	<25	None to rare
Modified	40	-	60	48	<25	None to rare
Alternative - Level 1[b]	40	20-30	120	20	<25	None to occasional
Alternative - Level 2	20	12-20	120	20	<25	None to rare
Unsuitable	<20	<12	Slower than 120	<20	>25	Frequent

[a] Interpretations for this suitability category include Alabama Department of Public Health (ADPH) regulation limits (preferred) and limits which are often allowed (modified).

[b] TVA categorized soils suitable for alternative systems into two levels to reflect the severity of various soils or site limitations. Generally, soils categorized as Alternative - Level 1 should require less system modification for sewage disposal than would Level 2 soils.

Source: Adapted from TVA, 1985. *Conceptual Onsite Wastewater Management Plan for Residential Developments Along Cedar Creek Reservoir.*

EXHIBIT 4

RANGES OF SOIL PROPERTIES USED TO CATEGORIZE ON-SITE WASTEWATER DISPOSAL SUITABILITY FOR CEDAR CREEK RESERVOIR, ALABAMA

SUITABILITY CATEGORY	GENERAL DESCRIPTION OF SOIL OR PROBLEM	SOIL DEPTH TO BEDROCK (Inches)	DEPTH OF NONCLAY SOIL (Inches)	PERCOLATION RATE (Minutes/Inch)	DEPTH TO WATER TABLE (Inches)	SLOPE %	FLOODING FREQUENCY
Suitable [a]	Deep, well-drained	40	-	60	48	<25	None or rare
Alternative - Level 1[b]	Fairly permeable, Fragipan soils	40	20-30	60-75	24-36	<25	None or rare
Alternative - Level 2	Flooding or high water table	40	-	60	18	<3	Occasional
Alternative - Level 3	Slow permeability, clayey subsoils	40	-	60-120	48	<25	None
Alternative - Level 4	Shallow soils	20	12-20	60-120	20-48	<10	None
Alternative - Level 5[c]	Cuthbert and Ruston soil mapping units	-	-	-	-	-	-
Unsuitable	One or more severe soil properties	<20	<12	Slower than 120	<20	<25	Frequent

[a] According to ADPH regulations, conventional septic tank systems require at least 60 inches to bedrock; however, 40 inches may be approved.

[b] The five alternative categories are appropriate for alternative systems. This exhibit uses five levels to show greater resolution of the restricted soil and/or site limitations than shown in Exhibit 3. Limitations include shallow soil depth, inadequate soil permeability, and flooding frequency.

[c] This category includes Cuthbert and Ruston soils in close association and would require an on-site evaluation for accurate soil determination. Cuthbert soils are clayey and slowly permeable, while Ruston soils are sandy and permeable.

Source: Adapted from TVA, 1985. *Conceptual Onsite Wastewater Management Plan for Residential Developments Along Cedar Creek Reservoir.*

3.1.2 Comprehensive Site-Specific Evaluations

While regional evaluations are useful for planning purposes and help guide the initial selection of a septic system design that is appropriate for a site, the data contained in these regional evaluations generally are not of sufficient detail to support the assessment of a specific septic system installation. Therefore, additional site-specific information concerning soil and hydrogeological characteristics is needed.

By first reviewing the existing data from a regional evaluation, assessors can gain a fundamental understanding of the site and focus their assessment on the parameters that may have the greatest influence on the performance of the septic system. Once a review of existing data is complete, a site evaluation should be conducted to (1) update and confirm the existing data, and (2) fill in any deficiencies and necessary details. Some questions that should be addressed by a detailed site evaluation include:

- How will water behave upon entering the soil?
- What are the saturated (and unsaturated) hydraulic conductivities of the various soil strata?
- Will the soil attenuate the transport of nutrients (phosphates and nitrates), metals, pathogens, and toxic organics?
- To what extent will ground water be affected beyond the property boundary?

Other, more specific, questions may also be identified based on local conditions.

Parameters that should be considered in answering these questions include the soil classification, structure, texture, depth, drainage, and permeability;[3] ground and surface water location and seasonal high elevation; and geology, topography, and climate. Each of these factors plays a role in the proper treatment of effluent from a septic system, and if not considered appropriately, can contribute to improper and incomplete sewage treatment. The evaluation should also yield a measure of the ability of the site to transmit effluent. By assessing the hydraulic conductivity and hydraulic gradient at the site, the evaluation can determine whether the site will transmit the volume of water that will be discharged from the system. If the evaluation finds that the anticipated volume of waste discharge will not be readily transmitted, the drain field system eventually will fail.

Some sites, such as those underlain by karst terrain, require special attention. Approximately 10 percent of the nation is underlain by karstified carbonate rocks (limestones, dolomites, and/or gypsum). Ground water in a karst area is susceptible to contamination due to thin soil cover and/or the presence of sink holes which present a direct hydrologic connection for drain field waste leachate to enter ground water. Once contaminated, ground water can show up quickly in a spring, well, or surface water supply, since travel time in a karst aquifer can be very rapid (on the order of 30 to 300 feet/hour). Standard site evaluation techniques are not always effective in karst terrain. Instead, special techniques such as lineament analysis, penetration borings, rock corings, dye tracing, and surface geophysics analyses are used to characterize karst sites.

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[3] Many existing sanitary codes require a percolation test to approximate soil permeability. While relatively simple to perform, percolation tests are limited in their usefulness as indicators of septic system performance. Results are highly variable and depend upon the season. For these reasons, this test is not considered adequate for a site-specific evaluation, though it may be used for planning as part of a regional evaluation. Soil borings provide a better indication of the ability of a site to treat and dispose of waste effluent. Percolation tests do, however, yield a useful measure for sizing a soil absorption field.

Regulations generally specify the information to be obtained in the site evaluation as well as how the data should be applied in locating, designing, and maintaining the system. However, the site characteristics should still be assessed by a professional engineer, geologist, and/or comprehensive site evaluator to assign the design and location requirements appropriate for that site.

The Standards of the Minnesota Pollution Control Agency (MPCA) for Individual Sewage Treatment Systems exemplify programs that include site evaluation requirements at sites proposed for sewage treatment systems (see Appendix B). These site evaluations are required by the State for all installations treating more than 15,000 gallons per day or for collector systems that serve more than 15 dwellings or treat over 5,000 gallons per day. Local governments are also encouraged by the State to use the Standards as guidelines in adopting local ordinances that require site evaluations for smaller systems serving single-family dwellings. The Standards for large systems are administered and enforced in conjunction with local governments because Minnesota's experience has shown that sanitary ordinances can most effectively be administered at the local level.

Sites are evaluated under Minnesota's Standards to obtain data in six categories:

1) Depth to the highest known or calculated ground-water table or bedrock;

2) Soil structure and texture;

3) Slope;

4) Topographic anomalies such as lowlands, local surface depressions, and rock outcrops;

5) All legal setback requirements; and

6) Surface water flooding probability.

The site evaluation consists of two parts: a preliminary investigation and a field investigation. The preliminary investigation assesses the adequacy of existing data to characterize the site. When the state is the permitting authority, the consulting team performing the evaluation must meet with Agency staff to discuss the site evaluation upon completion of the preliminary review. Where preliminary investigations do not provide enough information on the six categories to locate and design a sewage treatment system, a field investigation is performed, including soil borings and percolation tests. The consultant must demonstrate that the detailed work being proposed will be sufficient to characterize the site.

The Minnesota regulations provide for the data gathered in these investigations to be used in designing and constructing the system. Percolation tests and soil texturing must be used to establish the necessary drain field area. The sizing and spacing of the drain field trenches must take into consideration water movement into the soil. Design of a monitoring system capable of evaluating the system's performance also must be based on data collected in the site evaluation, if monitoring is deemed necessary.

In Mower County, Minnesota, site evaluations are most commonly performed by licensed contractors. For individual family homes, the contractor or owner digs test holes according to county health office specifications. Health officials go to the site, however, to assess the water table level, general topography, and site layout.

Implementation of the site-specific evaluation program can be relatively expensive. Regulatory staff must work with contractors and review their recommendations. Implementing agencies may encounter resistance to comprehensive site-evaluation requirements because of the increased cost and complexity that they entail for both property owners and governments. For example, in Minnesota, policies for financing site evaluations vary from county to county. While a few counties charge no fees for percolation tests and site evaluations and finance the work with public funds (Mower County among them), other counties assess fees of up to $120 (Saint Louis County) to perform an evaluation.

3.1.3 Limited Site-Specific Evaluations

Where resources are not available to conduct detailed site evaluations, the cost of site-specific evaluations might be reduced by collecting only limited data on one or several critical parameters. However, such limited evaluations are appropriate only in areas where the local soil and hydrogeologic conditions are well known and homogeneous and where there is a history of properly functioning septic system installations.

Of the many factors that determine on-site system performance, some soil characteristics are among the more easily evaluated and provide very important information. Soil is the final treatment medium for most private systems--filtering septic tank effluent, facilitating biodegradation of the organic materials, and removing fine particles, bacteria, pathogens, and nutrients. A complex community of bacteria and other microorganisms in the soil treats the wastewater and purifies it before it reaches the saturated zone. For the soil to treat wastewater effectively, the wastewater must pass through slowly enough to have adequate contact time with soil particles and microorganisms.

To determine whether there will be adequate contact time at a given site, the soil should be evaluated, at a minimum, for classification, texture, depth to creviced bedrock, depth to seasonal high water table (saturated soil condition), depth to impermeable soil layer or rock, drainage, and slope. In some areas, many of these parameters may be well characterized on a region-wide scale. Therefore, the site evaluation could be limited to confirming the regional data and collecting information on the remaining critical parameters that are unknown.

In the past, percolation rate has been used to indicate a soil's suitability for accepting effluent, but in recent years the percolation rate has been shown to be only a marginal indicator when used alone. Other information should, therefore, be used instead of or in addition to percolation rate. For example, soil borings indicate the textural characteristics of soil and how they change with depth. Depth to high water table is important because a prescribed minimum depth must be maintained between the drain field and the ground water to ensure adequate filtration and biological treatment of effluent before it reaches ground water. Impermeable bedrock and soil layers (hard pan or fragipan) can severely or completely restrict the downward movement of water.

There are no definitive rules for applying the data gathered in either a comprehensive or a limited site evaluation for selecting the appropriate septic system design. Numerous guidelines for applying these data are available (see references in Chapter 4). Although guidelines should be carefully qualified so that engineers can consider data in the context of specific site conditions, they can be helpful in suggesting particular design options. Exhibit 5 shows guidelines published by the Midwest Plan Service, listing suitable site criteria for common

EXHIBIT 5

EXAMPLE CRITERIA FOR SELECTING BETWEEN WASTE MANAGEMENT ALTERNATIVES ON THE BASIS OF SITE CHARACTERISTICS[a]

Site Criteria	System: Conventional: Trench	Conventional: Bed	Mound	Treatment with Surface Discharge
Soil percolation rate in minutes per inch				
1–30	X	X	X	
30–60	X	X	X	
60–120			X	
More than 120			X	X
Depth to high water table or creviced bedrock				
More than 10 ft	X	X	X	
5–10 ft	X	X	X	
2–5 ft	X	X	X	
Less than 2 ft				X
Depth to impermeable layer				
More than 10 ft	X	X	X	
5–10 ft	X	X	X	
2–5 ft			X	
Less than 2 ft				X
Site Slope				
More than 15%	X			X
5–15%	X		X	X
Less than 5%	X	X	X	X

[a] An "X" indicates that a system is suitable

Source: Midwest Plan Service. 1982. *On-Site Domestic Sewage Disposal Handbook.*

types of septic systems. By matching the characteristics of a given site with the criteria, potential system types are identified. The more site characteristics a particular system matches, the stronger its potential applicability. These guidelines, however, can only support the choice of a general system design. It is up to the engineer's best professional judgment to match a specific system to the peculiarities of a particular site. In the case of the limited site evaluation, which results in less detailed on-site scrutiny by a trained engineer than does a comprehensive site evaluation, it becomes necessary to rely upon standard guidelines, such as those of the Midwest Plan Service, to a greater degree. This greater reliance on standard guidelines reflects the compromise, and decreased expense, of the limited on-site evaluation.

3.2 Making Regulatory Programs More Comprehensive

State codes dealing with septic systems have, in general, undergone significant revisions in the past three decades. Probably the most important revision has been a shift in emphasis from unnecessarily rigid and simplistic design and location standards to more comprehensive requirements that account for the capacity of the soil absorption system and other factors that affect system performance. The acknowledgment that site characteristics can vary considerably over a region and the development of new technologies has led to the replacement of restrictive codes with more comprehensive and effective guidance and performance criteria.

Sanitary codes have traditionally relied on two methods to ensure ground-water protection. Originally, septic tank design standards were very specific. For example, earlier codes were quite restrictive about the allowable shape of the septic tank. These restrictions are now being modified as codes are revised. For example, state and local government officials have found that shape restrictions are not as important as encouraging larger tanks overall.[4]

Land use provisions were also enacted to keep septic systems and drinking water sources physically separated. These, too, were typically very rigid provisions and did not allow for changes based on site-specific conditions. Because rigid, one-dimensional design and location requirements failed to account for the complex set of factors that determine septic system performance, many systems have been designed and installed under circumstances that make failure a foregone conclusion. Accordingly, septic system management programs should be designed to account for all potential factors that affect system performance.

Exhibit 6 illustrates the evolution of approaches to septic system regulations for six main components of a septic system management program. The different levels of regulatory control or oversight are categorized from least comprehensive and/or environmentally protective (Phase I) to most comprehensive and/or environmentally protective (Phase III). Individual approaches vary, of course. The Exhibit, however, illustrates the general evolution of regulatory approaches for each of the program components.

The progression from Phase I to Phase II is a move toward a more comprehensive regulatory approach under each of the management program components. For example, soil type analysis and site modifications are acknowledged as important aspects of siting and constructing drain fields, and the disposal of certain waste types is noted as a concern under Phase II. The move to Phase III represents the adoption of improved technical approaches. In Phase III, codes have evolved to take advantage of better site evaluation practices and increased use of innovative and alternative technologies. Phase III approaches also acknowledge the strong relationship between improper septic system control practices and ground-water contamination, a type of system "failure" not accounted for in the earlier Phases.

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[4] Kreissl, J.F. 1982. Evolution of State Codes and Their Implications, in *4th Northwest On-Site Wastewater Disposal Short Course Proceedings*, Seattle, Washington.

EXHIBIT 6

EVOLUTION OF REGULATORY CONTROL APPROACHES FOR COMPONENTS OF A SEPTIC SYSTEM MANAGEMENT PROGRAM

	SITE EVALUATION	SEPTIC SYSTEM DESIGN	CONTROLLING WASTE DISPOSAL	CONTROLLING SYSTEM OPERATION	CONTROLLING SYSTEM DENSITY	GOALS OF MANAGEMENT PROGRAM
PHASE I	• Analysis for: o percolation rate o depth to ground water	• Only standard system design (septic tank soil absorption system) permitted • Certain rigid code specification standards for: o tank dimensions o soil absorption system sizing o distance to property boundary, wells, and buildings o allowable materials	• No definitive controls on the types of waste disposed in septic systems	• No plan or design reviews • No permitting • System registration required in some jurisdictions	• Reliance on zoning controls, but septic system density a secondary concern	• Prevent surfacing of effluent from septic system to protect public health
PHASE II	• Increased reliance on soil classification (local or regional) to determine proper soil types for system installation, and • Percolation tests	• Some modifications to standard septic system design o soil absorption system modifications: mounds, pressure distribution • Limited I/A technologies permitted	• Codes call for "only domestic waste disposal" • Increased controls for large systems (including commercial and industrial)	• Required design and plan reviews • Construction permits • Pre-cover inspections • Occupancy permits • Licensing of designers, contractors and pumpers	• Setbacks for shoreline lots • Minimum lot sizes	• Stronger emphasis on preventing drinking water contamination • Protecting surface water quality
PHASE III	• Require detailed site soil characterization by trained inspector • Use percolation test only as supplementary information	• Support for I/A systems including testing new technologies • Allow experimental systems under controlled circumstances • Rely on performance standards to determine appropriate system designs • System design more closely tied to site characteristics	• Controls on the sale and/or use of tank cleaning solvents • Controls on commercial and industrial systems (apart from large systems) • Public education efforts to control the disposal of toxic chemicals	• Pre-sale inspections and sanitary surveys to assess condition of existing systems • Operating permits and ground-water discharge permits • Establishment of regional sanitary management districts to ensure proper system maintenance • Requiring ground-water monitoring to assess the operation of large and commercial/industrial systems	• Linking density controls to protection of public health by assessing pollutant loading rates and use of models	• Stronger emphasis on ground-water protection and preserving water quality for differing uses

The more comprehensive approaches shown in Exhibit 6 were adopted to make regulatory programs more effective and better able to respond to different conditions. In so doing, the evolution from Phase I to Phase III has generally made codes more comprehensive. One additional benefit derived from more comprehensive septic system regulation is a decrease in the lag time between the development of technological advances in waste disposal and their widespread implementation.[5] In states such as Oregon, North Carolina, and Maine, for example, where the management of on-site systems has improved through a stronger reliance on site evaluations and alternative technologies, changes in septic system management practices closely follow developments in the field. These changes are prompted by feedback from the regulatory personnel who are closely involved with the evaluation and development of specific design parameters and technical approaches.

The following sections address two of the most important mechanisms for making septic system control programs more comprehensive. We first provide examples of existing programs that apply detailed site characterization information to aid in designing septic systems that are compatible with their environments and have a high potential for many years of good performance. We next describe programs that encourage the use of innovative and alternative technologies.

3.2.1 Accommodating Variations in Site Characteristics

Some existing codes control septic system location. Such codes generally rely on two types of provisions:

1) Minimum lot sizes, which stipulate that residences with septic systems must be built on lots no smaller than a specified size. Several states, for instance, have minimum lot sizes of one-half acre for homes using on-site septic systems.

2) Minimum distance requirements, which stipulate that septic systems must be a specified distance from buildings, property lines, and drinking water sources.

Although these provisions control system location and density and, therefore, provide some environmental protection, such rigid location requirements have resulted in unanticipated side effects. Minimum distance requirements can severely affect the location or type and size of a structure that a property owner may build on his tract. Similarly, minimum lot sizes may force homeowners to purchase larger lots, a practice which some believe has contributed to local housing price increases and loss of prime agricultural land. These problems have led jurisdictions to adopt more comprehensive practices that allow for varied siting while providing for public health and ground-water protection.

One good approach to accommodating special site conditions is to include in the regulations varied siting requirements for a number of different settings. This is particularly effective for dealing with lots next to surface waters. Because lakes and other surface waters are sensitive to pollution by nitrogen and phosphorus, both of which may leach from absorption fields in high concentrations, several states have special regulatory requirements for the installation of septic systems on riparian lots. These limits are intended to ensure that a sufficient depth of soil is available on the lot to remove nitrogen and phosphorus from the septic system effluent before it reaches the surface water. This assurance must take into account the special hydrologic and soil conditions found in the area.

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[5] Plews, G.D. 1977. The Adequacy and Uniformity of Regulations for On-Site Wastewater Disposal - A State Viewpoint, in *National Conference on Less Costly Wastewater Treatment Systems for Small Communities*, U.S. EPA

Minnesota has developed three classes of shorelands with different levels of protection under the Minnesota Shoreland Management Act: Natural Environment lakes and streams; Recreational Development lakes and streams; and General Development lakes and streams. The special controls established under the Act for riparian septic systems include adequate setback distances from the shoreline for absorption fields and minimum lot sizes. The Natural Environment class has the most stringent controls (150 ft. setback; 40,000 ft^2 minimum lot size), and the General Development class has the least stringent controls of the three classes (50 ft setback; 15,000 ft^2 minimum lot size). Furthermore, where areas are defined as shoreland under the Act, local units of government are required to adopt and enforce the state's minimum standards for septic systems.

Where setbacks and minimum lot sizes still cannot adequately protect surface waters, many areas are advocating the use of cluster systems. These systems link groups of homes together through a central wastewater collection system. The wastes are then pumped back to a central treatment and disposal facility. Idaho is promoting the use of these systems for developments on inland lakes. Cluster systems are discussed further in Section 3.8.2.

The use of variances has been a common approach for accommodating unique site conditions within a standardized regulatory framework. Through variances, regulatory authorities can grant waivers from specified provisions in a zoning or sanitary code. These variances are granted on a case-by-case basis, when an authority such as a Board of Appeals determines that a provision is causing undue hardship for a property owner by constraining the individual from developing his property to its maximum potential. For example, Florida, Arkansas, and Minnesota allow variances from system design and construction requirements if the proposed design adequately protects human health and the environment.

Section 2.4 of the Arkansas Rules and Regulations pertaining to sewage disposal systems reads as follows:

> **Variances.** Requested variances from these Rules and Regulations will be considered only in isolated locations and must be approved by the Arkansas Department of Health, Division of Sanitarian Services or its authorized agent. However, submission of alternate designs for underground or aboveground individual sewage disposal systems for sites found not suitable for standard systems is encouraged. Submission of an alternate design shall include engineering data on the efficiency of operation of the proposed alternate system. Submissions of proposed alternate systems may be approved, approved on a trial basis for a specific period of time, or disapproved. Such approval or disapproval shall be at the sole discretion of the Arkansas Department of Health, Division of Sanitarian Services or its authorized agent. Where alternate systems are approved such systems shall be included by amendment, in these Rules and Regulations, as alternate systems approved for use under specified conditions and subject to case by case approval or disapproval by the Arkansas Department of Health, Division of Sanitarian Services or its authorized agent.

In order for variance provisions to be effective as a means for improving ground-water protection, they must be administered with a high degree of commitment by government officials. Procedures and policies for thorough and consistent review of variance applications must be established and implemented. Moreover, these procedures and policies must reflect long-term community goals regarding ground-water protection.

In some areas, variances are granted too readily and variance decisions have compromised ground-water protection goals for the sake of other short-term objectives. For example, when reviewing a variance request, boards of appeals in some areas consider only the effects of the provision on the individual parcel under review without considering how many other septic systems in the area already have variances, and whether the total number of variances might lead to ground-water contamination. This potential problem is best handled by drafting a code that provides regulatory options for a wide variety of environmental conditions, thereby reducing the need for variance requests. Thus, a broader and more comprehensive regulatory outlook is needed at both the state and local level. Accounting for variance requests in this way can also help to insulate local officials from charges that their decisions are arbitrary.

The State of Maryland has adopted a more formal approach to variances that incorporates long-range planning goals (see Appendix B for the relevant regulatory language). In Maryland, the State Department of Health and Mental Hygiene has mandated that drain fields can be constructed only in areas that contain at least four feet of unsaturated soil. However, the State allows counties to identity specific areas where the four-foot depth standard may be waived. The State requires these counties to draft a Ground-Water Protection Report (GPR). These reports are intended to address the impacts of siting on-site sewage disposal systems in areas of high ground-water elevation. When drafting the reports, the counties identify specific areas where the state-mandated design requirements for soil absorption system location and construction may be waived. The State has found that allowing variances to the four-foot depth standard does not pose a threat to public health so long as the counties adopting the variance also follow a sound general ground-water protection plan.

Many other states also are using a variety of approaches to develop comprehensive and environmentally protective septic system management programs. The best way to ensure that controls imposed on septic system use are environmentally protective is to tie these controls explicitly to the soil characteristics and hydrogeological conditions found at the site (see Section 3.1).

Maine's Subsurface Wastewater Disposal Rules govern siting, design, construction, and inspection of subsurface wastewater systems. The rules provide minimum State design criteria for subsurface wastewater disposal systems and are intended to complement municipal planning, zoning, and land use controls ("Subsurface Waste Disposal Rules," 10-144A CMR 241, see Appendix B).

Provisions in the rules that make Maine's management process more comprehensive include:

Site evaluation. Before any septic system is installed, a site evaluation must be conducted by a licensed Site Evaluator. The Site Evaluator examines the site and fills out an application form, on which he or she indicates the suitability of the soil and the site conditions for subsurface wastewater disposal. The Rules prohibit installation of new disposal systems where limiting soil and site conditions exist. It is possible, however, to obtain a variance from this restriction. In certain situations, a Site Evaluator may determine that a site has the "potential for an adequate disposal system." If this determination is made, the installation may be permitted provided that special design features (such as curtain drains) are added to improve the limiting soil and site conditions. The Rules also give municipalities the option to waive the site evaluation for system replacements, provided that certain minimum requirements are met.

Minimum setback distances. The Rules establish minimum setback requirements from water bodies, slopes, buildings, and property lines. Such setbacks are critical to water quality preservation. If systems are being replaced or upgraded, it is possible to obtain a variance to reduce the distance requirements a specific number of feet.

Washington State also allows for local variation to State-wide requirements. The Washington On-Site Sewage Disposal System Regulations were established "as minimum requirements of the State Board of Health."[6] They provide a uniform set of guidelines for local boards of health to use in establishing local regulations. Provisions in Washington's regulations that incorporate flexibility into the planning process include:

Minimum land area requirements. The regulations have two methods for determining minimum land area requirements for septic systems:

1) A table in the regulations notes minimum land area requirements per unit volume or single-family residence, based on soil type and type of water supply.

2) For Type 1 soils,[7] the local health officer may allow a reduction in the above requirements, provided that guidelines are in place for these allowances. The regulations further provide that anyone seeking these reductions must submit a justification report demonstrating that the on-site septic system "has a sufficient amount of area with proper soils in which sewage can be retained and treated properly on-site."

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[6] "On-Site Sewage Disposal Systems," Rules and Regulations of the State Board of Health. Published by the Office of Environmental Health Programs, Health Division, Olympia, Washington, July 1983. (see Appendix B)

[7] Defined in the Rules and Regulations as coarse sands and other soils or conditions where treatment potential is ineffective in retaining or removing substances of public health significance to underground sources of drinking water.

Providing two methods for determining minimum land area requirements gives a homeowner or developer an opportunity to let design improvements compensate for small lots or poor soil conditions.

Replacement of existing systems. The regulations make allowances for instances where septic systems are extended, altered, or replaced due to system failure. In these instances, the regulations would apply "to the maximum extent permitted by the site."

Designing a comprehensive septic system management program offers the advantage of providing maximum protection to ground-water resources, while allowing system owners an opportunity to make the best use of their property. For example, the site evaluations required in Maine's Subsurface Wastewater Disposal Rules determine appropriate septic system capacity for a site. Should the soil quality prove poor, the rules allow property owners to compensate for these conditions with special design features. This provision helps to assure that property owners will not be unnecessarily constrained from developing their property. However, even with the use of special design features and site modifications, many parcels will still not be able to be developed due to extremely limiting soil and hydrogeologicl conditions.

The major disadvantage of a more comprehensive management approach is that more staff and financial resources are required to implement the provisions. For example, in Washington State, an equivalent of 90 full-time employees in the State's 39 county health departments are committed to issuing permits for septic systems. Permits are issued for the installation, alteration, or repair of an on-site system. Over 18,000 septic system permits were issued in Washington in 1985. There is also one full-time State employee who monitors new guidelines developed for septic systems.

There are numerous ways to finance a comprehensive septic system management program in addition to using a local government's general funds. Maine, for example, has approximately 250 licensed plumbing inspectors and over 100 site evaluators to help implement its on-site disposal regulations. The plumbing inspectors are paid a small fee each time they perform an inspection. This fee is paid by the applicant seeking to install a septic system. This approach does not completely remove the financial burden from a local government, however. The local health agency is responsible for administering the licensing program, which includes developing and administering an exam and associated study materials, advertising when the exam will be held, and issuing the licenses for those who pass the exam.

One additional disadvantage of requiring site-specific evaluations is the financial burden that is placed on property owners to pay for the assessments. Washington State has attempted to alleviate some of this burden by allowing homeowners to comply with minimum design and location standards in place of conducting an extensive evaluation. However, a property owner may choose to pay for a site evaluation and thereby be able to develop areas that otherwise would not meet the minimum siting requirements.

3.2.2 Allowing Innovative and Alternative (I&A) Technologies

Throughout the country, local health and environmental officials have discovered that conventional septic systems, composed of a septic tank and a subsurface soil absorption field, are not appropriate for wastewater treatment in some soil types and under certain environmental conditions. However, sanitary codes in these areas are often not suited for addressing this problem because the codes are rigidly tied to conventional septic system designs and allow only minor variances. The result is often poor septic system performance and ground-water contamination. Several states have broken away from codes that allow only the use of conventional septic system designs. These states, including Maine, Connecticut, Idaho, Maryland, and Washington, allow innovative and alternative technologies for on-site wastewater treatment. In general, alternative systems provide improved wastewater treatment because the technologies are chosen to respond to the unique needs of individual sites.

Both communities and individual property owners can benefit from the introduction of alternative technologies. A code that does not allow homeowners to use alternative systems and prohibits soil absorption fields where soils are not suited for waste disposal can hamper development and keep property values low, especially when sewers are not available or are economically prohibitive. In addition, a code that allows installation of conventional systems regardless of soil conditions may ultimately result in system failures and cause health hazards, property damage, and ground-water contamination. Allowing property owners to take advantage of technological advances or new thinking in wastewater treatment can protect public health, increase public welfare, and foster orderly community growth. Alternative systems also provide additional options for replacing failing conventional systems.

Allowing the use of innovative and alternative technologies is not a panacea, however. Although such technologies allow for improved wastewater management in problem soils, these systems do not allow for development under all circumstances. Many sites are simply not suited for on-site wastewater disposal. Further, in certain areas, alternative technologies may be too expensive or their implementation may be beyond the management capabilities of the local jurisdiction. Local officials must critically evaluate the available technological options and choose those best suited to their needs.

Non-conventional on-site waste management technologies, often referred to as innovative and alternative (I&A) technologies, include:

- Mound or fill systems that use sand or other fill material to create an artificial drain field when the original soil at the site is inadequate;

- Curtain and drain systems that use drain tile or other materials to lower a high water table under the drain field artificially;

- Pressure distribution systems that provide uniform distribution of effluent over a drain field to maintain vertical unsaturated flow and retard clogging;

- Buried, intermittent, and re-circulating sand filters that may be used with a conventional septic tank to treat effluent when natural soils are inadequate;

- Evapotranspiration systems that rely on excess evaporation from a soil surface and the natural ability of plants to absorb effluent, retain water and nutrients as needed, and release excess water to the air as vapor;

- Alternating bed systems that allow for dosing and resting cycles in the drain field;

- Water conservation techniques, including low water-use toilets and waterless toilets that use chemical or biological techniques to treat human sewage in the home;

- Physical and chemical processes, normally used in large-scale wastewater treatment, designed on a smaller scale to treat waste from a single home or business or a cluster of homes or businesses; and

- Aerobic treatment devices that provide for aerobic degradation or decomposition of wastewater by using mechanical means to bring the waste in contact with air.

These techniques can be used, under appropriate circumstances, to replace and/or supplement conventional systems and give developers, builders, and property owners new on-site waste management alternatives. References containing detailed information concerning each of the above technologies are listed in Chapter 4 of this document.

All of the above mentioned systems are not considered "new" in all areas. For example, mound and fill systems are used commonly throughout the states of Minnesota and Wisconsin. Pressure distribution devices also are gaining widespread acceptance throughout the country. Therefore, some of these "I&A" systems may be considered conventional or standard practice in certain parts of the country.

For the most part, I&A technologies are designed to provide waste disposal alternatives for properties that have unique soil, geologic, ground-water, climatic, or topographic conditions (see Section 3.1 for a discussion of these conditions). As a result, it is very difficult to design a code that anticipates each potential situation and specifies the best possible waste management system design. Evaluating a proposed system often requires case-by-case consideration by trained personnel. Other approaches are effective, however, especially where resources and information are available to allow community-wide approval of specific alternative technologies. For example, communities located in regions where soils are marginally impermeable (i.e., mostly clay) might adopt codes that allow mound systems.

Nevertheless, allowing the installation and operation of alternative systems does lead to some additional regulatory cost. Most codes require that experienced engineers and sanitarians review individual or community-wide applications of the systems. Some states share these costs by providing technical assistance to local governments. Local costs also may be offset by increasing permit fees for alternative systems. Such fees typically range from $50 to $200.

Because many alternative systems have not been fully tested under a wide range of environmental conditions, their use should be carefully assessed and closely monitored. Before any alternative system is installed, the ranges of environmental and wasteflow conditions that are suited to the operation of that system should be established. Some governments allow the installation of untested alternative or experimental systems, but only with strict operating and monitoring requirements. Installation of these experimental systems can provide valuable operating information that may lead to expanded use of the systems. Currently available information on the development and testing of alternative and innovative technologies is available in the trade literature, from alternative system manufacturers, from USDA Cooperative Extension Service offices, and in the sources listed in Chapter 4 of this document.

Since most alternative on-site systems are more complex than conventional systems, there are increased opportunities for error in their design, installation, and operation. As a result, alternative system users should be made well aware of the special operation and maintenance requirements for their systems. This awareness must also be passed along to future system users, should the property change hands. Because the community has a strong interest in preventing ground-water degradation and preserving public health, local regulators must take an active role to ensure that both present and future users know how to operate and maintain their alternative systems properly (see Section 3.3).

Many communities hesitate to allow I&A technologies due to concern about their liability in the event of a system failure. Careful review before approval complemented by a program of regular maintenance, routine inspections, and performance monitoring should protect against possible failures. However, the costs involved in conducting such reviews also inhibit jurisdictions with limited resources. Nonetheless, a well-designed and well-implemented program that allows for controlled use of alternative technologies under carefully monitored circumstances can serve a community well by providing options for the development of non-sewered areas and by providing for selection of optimal waste management techniques based on state-of-the-art technical knowledge and good judgment.

There is no best approach for establishing a regulatory program that allows alternative system installation and use. However, there is one common and essential characteristic among the programs currently in existence: a high degree of involvement from local officials. Only with local involvement can proper evaluations be made concerning whether conditions are appropriate for specific system designs. State health officials can provide useful assistance and guidelines, but local regulators must implement them. The level of local review may differ. At one extreme, local officials may become part of a dynamic regulatory process and implement those aspects of state guidelines that best suit local conditions. At the other extreme, local officials may rely more strongly on state guidelines and approve only those systems that meet pre-determined conditions. The following two examples illustrate the differing approaches.

The State of Washington has developed a comprehensive regulatory program that both evaluates and provides guidance for the installation and operation of alternative technologies and also allows for careful introduction and use of innovative or experimental systems. Under Chapter 248-96 of the Washington Administrative Code (see Appendix B), three different categories of on-site systems have been established, including standard septic systems, alternative systems, and experimental systems. Different technical criteria and levels of administrative review are associated with each system category.

The regulations leave the review of individual on-site system designs to the local health officer and board of health. The State regulations and technical guidance are intended to provide a uniform framework to aid local boards of health in establishing regulations that best suit local conditions. The State framework establishes minimum design, installation, and management requirements for on-site septic systems to accommodate long-term sewage treatment and disposal. The regulations encourage local boards of health to adopt more stringent regulations to account for local environmental conditions. Because of the highly divergent conditions found in eastern and western Washington, local involvement in implementing state regulations is critical. The State does retain final review authority over local codes and enforcement programs, however.

The Washington State Board of Health created the above three regulatory categories for septic systems because the State concluded that three different levels of technical criteria and regulatory review were appropriate for each category. The first category encompasses a standard design including a septic tank and subsurface soil absorption field. The State regulations refer to the U.S. EPA "Design Manual: On-Site Wastewater Treatment and Disposal Systems" (or "the Purple Book"; see Chapter 4) for design criteria. Several more specific criteria have been added by the State, but detailed amendments to the design standards are left to local boards of health.

The State is far more involved in the development of technical criteria and design reviews for the second category of systems. This category encompasses alternative systems, which are defined as "any on-site sewage system consisting of treatment and/or disposal components other than a septic tank and a subsurface soil absorption system" (Chapter 248-96 WAC Section 046). The State publishes technical guidelines governing the design, construction, operation, and monitoring procedures for a wide variety of alternative systems. To date, the State has issued guidelines for the following types of systems: pressure distribution, aerobic treatment, incineration toilets, composting toilets, vault and pit privies, sand filters, alternating and dosing systems, and fill and mound systems.

The State has assembled a Technical Review Committee composed of seven knowledgeable professionals in the waste disposal field to write the guidelines. The committee reviews alternative technologies as they are developed. Their technical evaluation is based on a review of available information and testing data. It involves the following criteria: life expectancy, reliability, performance testing, installation requirements, operation and maintenance requirements, possible applications, costs, energy requirements, and aesthetics. Once a technology has met the standards of the Technical Review Committee, guidelines are developed. In addition to generic system reviews, the Committee also reviews the products of individual alternative system manufacturers and publishes a device report certifying that the products meet the Committee's technical guidelines.

The Washington regulations state that, "once guidelines for an alternative system have been established by the technical review committee, that system can be permitted for use" (see Chapter 248-96 WAC 046). In addition,

> the health officer shall require monitoring of the performance of any alternative system installed for which guidelines have been developed. The frequency and duration of monitoring shall be in accordance with guidelines developed by the Technical Review Committee. Costs for monitoring and/or reporting may be included as an addition to the permit fee (248-96 WAC 046).

Thus, the State provides the technical guidance, while the local health officer applies those guidelines in a manner that best suits the local environmental conditions.

The third category of on-site systems established by the State encompasses the remaining innovative technologies that have not yet been reviewed and approved by the Washington Technical Review Committee. These remaining technologies are defined as experimental systems. The State "allows the installation of a limited number of experimental on-site treatment or disposal systems, provided supportive theory and/or applied research exists" (248-96 WAC 047). Prior to the installation of such a system, an experimental system permit must be obtained from the local health officer. The use of an experimental system is considered when:

> a) the proposed system is attempting to correct a failing system and other conventional or alternative systems are not feasible, or b) the experimental system is for new construction where it has been determined that a (conventional) on-site sewage system could be installed in the event of failure of the equipment (248-96 WAC 047).

Further guidelines have also been developed by the Technical Review Committee covering the application, evaluation, and performance monitoring of experimental systems.

The flexible nature of the Washington program has encouraged the installation of alternative technologies throughout the State. As of 1986, over 1,000 mound and fill systems, over 1,000 aeration systems, approximately 200 composting systems, and over 100 sand filters had been constructed. The major expense to the State for the program involves funding the activities of the Technical Panel. One staff position has been created to keep track of the guidelines and the permitted systems operating in the State. Because the permitting process is focused at the local level, most of the staff requirements are there. Thirty-two of Washington's 39 health districts or county-operated programs take full responsibility for local permitting. The inspection and monitoring procedures involved in alternative system regulation has led to an average staffing increase of approximately 1.5 man years in each local jurisdiction. Approximately 18,000 permits per year currently are issued in Washington for all types of septic systems. Each permitted alternative system generally is inspected on a three-year cycle.

The State of Minnesota has also adopted an alternative system permitting program, although this program is less comprehensive in its approach than the Washington program. Under Minnesota Rules, Chapter 7080.0180, alternative systems are allowed "where limiting soil characteristics exist." The systems may be employed provided that:

1) Reasonable assurance of performance of the system is presented to the permitting authority;

2) The engineering design of the system is first approved by the permitting authority;

3) There is no discharge to the ground surface or to surface waters;

4) Treatment and disposal of wastes protects the public health and general welfare; and

5) The system complies with all applicable requirements of (State) standards and with all local codes and ordinances.

The permitting authority is generally a local board of health.

The State of Minnesota provides guidance describing the soil conditions that require alternative systems to treat wastes (see Appendix B). The State standards also prescribe minimum design criteria for a number of alternative systems. The State standards are not meant to limit local discretion, however. The rule states,

> local units of government may adopt (the standards), in whole or in part, as part of a local code or ordinance. Nothing in M.R., Chapter 7080, however, shall require the adoption of any part of (the standards). Further, nothing in M.R., Chapter 7080, shall require local units of government to allow the installation of any (alternative) system in (the standards) (M.R., Chapter 7080, Appendix A).

Although most counties in Minnesota have adopted the standards, some counties do not have the staff to administer the program or do not allow alternative systems since they have not adopted the rule's appendix for alternative systems. It should be noted, however, that the State is currently revising the body of the rule to allow the use of some alternative systems. This should allow greater flexibility in the choice of the most appropriate system.

Crow Wing County, Minnesota, does permit the installation of alternative systems. Many systems in the county are mound or fill systems and some also use pressure distribution of effluent. Most of these systems were constructed on riparian lots to protect inland lakes. Crow Wing County has approximately 15,000 operating septic systems, and 300 to 500 new systems are constructed each year. County health officers oversee the installation of alternative systems by conducting pre-cover inspections to ensure that the minimum State construction standards have been met. County officials generally leave the design of the systems to licensed contractors. The county health official will become involved in system design only if special site circumstances are found and his assistance is requested by the homeowner or system installer. Crow Wing County allots approximately 1.5 full-time professional staff equivalents for overseeing all septic systems.

The local officials generally are not involved in the detailed site evaluation and system design process. Their involvement is limited primarily to assuring that the State-mandated design standards are fulfilled. Local officials can require modifications to account for site-specific conditions; however, application of the State standards appears to be the main concern of most county health agencies in Minnesota.

Both the Minnesota and the Washington programs will lead to improved ground-water protection by encouraging local governments to approve alternative systems where appropriate. However, the Washington program goes one step further than the Minnesota program in allowing experimental system installation and encouraging active local participation in developing site-specific guidelines for each alternative system installation.

Of course, allowing innovative and alternative systems will not solve on-site waste management problems at all sites. Regulators must recognize that at some sites, on-site waste management is inappropriate. For example, the community of Crystal Lake, Illinois, has prohibited the use of septic systems in its most sensitive watershed areas in order to achieve community water quality goals.[8] Judicious application of innovative and alternative systems, however, can be an effective means of balancing ground-water protection concerns with community development objectives.

3.3 Educational Programs

Educational and public relations programs are an important part of septic system management. Septic system control programs are most effective when the public understands the relationship between ground-water protection and proper septic system siting, design, installation, use, and maintenance. Monitoring compliance with operating and maintenance regulations can be a difficult and expensive task. Responsible property owners who are educated in proper waste disposal and maintenance practices and who are familiar with the consequences of system failures can make positive contributions to ensuring compliance. Further, as the technologies and processes used in on-site waste disposal become more complex and the number of septic systems in use increases, it will become more important that those who design, install, operate, maintain, and review septic systems have an adequate level of knowledge. Education and outreach programs, therefore, play an important role in septic system management and should be directed to a wide audience, including homeowners, commercial and industrial establishments, builders, system installation contractors, inspectors, and those who review and approve new systems. This section outlines the basic content of educational programs and describes several examples of successful programs.

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[8] DiNovo, F., and M. Jaffee. 1985. Local Groundwater Protection: Midwest Region. American Planning Association, Washington, D.C.

Local officials and residents should have an inherent interest in proper wastewater management and ground-water protection, because property values and drinking water supplies can be damaged by poor waste control practices. Once citizens are aware of these relationships, they can contribute to pollution control planning and prevention. An informed public can also generate support for local and state programs. Technical contractors should also be made aware of their important role and the need to cooperate effectively with regulatory officials. By working together, property owners, contractors, and regulators can ensure that septic systems function properly within the community.

The educational needs of these different groups vary, depending upon their prior level of technical understanding and the purpose of the education. Different programs should thus be geared to the different audiences. One type of program, designed for the general public, should include basic information for owners and operators of residential, commercial, and industrial septic systems. Septic system inspectors and the personnel responsible for reviewing conventional or innovative system designs comprise the audience for a second type of program covering more technical and regulatory issues. A third program should focus on site-specific concerns and provide technical information for septic system designers, builders, and installers, who need information similar to the second group but whose education may dictate a somewhat different approach. Because the technical needs for regulators and contractors are similar, one program with a strong technical orientation can fulfill the general requirements for both of these groups, if necessary.

In communities where innovative or alternative on-site systems are used, it is especially important that property owners be well educated. These systems generally require more maintenance and strict adherence to use restrictions. Because innovative and alternative systems tend to be somewhat more sophisticated than conventional systems, their owners or users must possess a more sophisticated understanding of the necessary operation and maintenance practices.

Public relations programs are an integral part of any education effort. Through the use of basic public relations techniques, a wide audience can be made aware of the need for septic system management. Public relations programs should target individual system owners, community waste cooperatives, and commercial and industrial system operators. Most users of on-site systems do not understand the basic principles governing system operation and maintenance. While it may not be necessary for users to understand all of the technical aspects of septic systems, a rudimentary knowledge of the principles of on-site disposal is critical to promote proper system operation and maintenance.

Homeowners and commercial and industrial operators may lack interest in proper septic system operation and maintenance simply because they do not understand the consequences of system failure. It is therefore important to first make the public aware of the importance of proper septic system operation. Important messages to be conveyed may include:

- The potential liabilities for contamination of ground water;
- The potential harm to humans caused by even small quantities of certain pollutants in drinking water;
- The harmful effects of septic tank additives and septic system cleaners and of the disposal of other hazardous materials sometimes disposed in commercial and industrial septic systems;
- The potential for declining property values if the underlying ground water is contaminated;

- The importance of protecting both the quantity and the quality of water for future needs; and

- The ethical need to protect ground-water resources.

Septic system owners will become more responsible users if they are given information about:

- Obtaining septic system and well permits;

- The septage disposal process;

- Proper maintenance of a sewage disposal system; and

- Proper use and disposal of the many consumer products (e.g., household cleaners) often inappropriately disposed in septic systems, including the safe disposal of unused containers of septic tank cleaners where such cleaners are banned.

An effective public relations program should make this information as accessible to the public as possible by presenting it in a catchy and non-technical format. Local health departments can serve as clearinghouses and resource centers for printed material (brochures and pamphlets), slide shows, and other useful information. They can distribute information to the public through a variety of means including (see Chapter 4 for several sources of information):

- Newspaper articles;

- Radio and TV programs;

- Speeches and presentations;

- Exhibits;

- School programs;

- Films;

- Newsletters;

- Reports;

- Letters; and

- Conferences or workshops.

In Idaho, where septic systems contaminated an important aquifer, officials have begun educating system users through a public relations program in which representatives travel to small gatherings of interested groups and give slide shows and presentations. They have met with civic clubs, school groups, professional organizations, such as realtor boards and building associations, and environmental organizations.

While basic information on aquifers and septic systems is presented to all groups, the Idaho presentations are geared to the special interests of each audience. For example, presentations to builders, bankers, and insurers differ from presentations to schools and environmental groups. Information concerning septic system installation and maintenance is provided when appropriate. Idaho officials have also broadcast television and radio spots on public stations to reach a wider audience.

The Idaho program has reached a large number of people, and has been quite successful. In the ten years since the program began, a number of towns have developed sewage management plans and installed public sewers and treatment plants. Although the Idaho program began in response to specific aquifer contamination problems, its impact has been more general and widespread, increasing public awareness of the potential problems with septic systems and highlighting alternative solutions to these problems.

Many communities have also adopted innovative educational programs. Fairfax County, Virginia, supplements its septic system management program with public education to encourage homeowners to voluntarily maintain their septic systems; for example, the Fairfax County Health Department reminds homeowners by mail to turn the diversion valves on their alternating drain fields. In Stinson Beach, California, detailed drawings noting the location, dimensions, and condition of all on-site systems are given to system owners to facilitate maintenance and promote property owner awareness. In Florida, organizations engaged in the manufacture, installation, repair, and maintenance of septic tanks have formed an organization, the Florida Septic Tank Association, which publishes and distributes a booklet outlining proper septic system operation and potential problems for both homeowners and commercial establishments. U.S. EPA Region V, in Chicago, Illinois, has developed a series of five slide shows geared toward a wide audience covering such issues as: general wastewater management approaches and needs documentation for unsewered communities; on-site system technologies and system failures; and the relationship between land-use planning and small waste flows. Finally, the Tennessee Valley Authority (TVA) has prepared a student activities book entitled "Groundwater: A Vital Resource." This publication, which targets children in grades 3 through 12, is complemented with classroom demonstrations and field visits and is part of TVA's overall program to increase public awareness of ground-water quality in the TVA region.

Educational programs with a technical orientation enhance the effectiveness of rules for the design, installation, and maintenance of systems. State or local health departments or agricultural extension services can offer technical education in a variety of forms, including:

- One-to-one technical assistance;
- In-service training programs in local health departments;
- Workshops and seminars throughout the state;
- Soils evaluation and state-of-the-art technology conferences;
- Designer-installer workshops; and
- Regularly published newsletters on regulatory and technical developments for the technical community.

An excellent example of an educational program with a technical orientation is the Onsite Sewage Treatment Workshop co-sponsored by the Minnesota Pollution Control Agency and the University of Minnesota Agricultural Extension Service. In an effort to promote the proper siting, design, installation, use, and maintenance of individual sewage treatment systems, a number of Minnesota counties have adopted installer certification requirements as part of their codes regulating septic systems. The On-Site Sewage Treatment Workshop is conducted throughout Minnesota each year to train and certify installers, site evaluators, designers, inspectors, and septic tank pumpers.

The three-day Minnesota training session covers the following major topics:

- Sewage treatment by soils;
- Soil identification;
- Soil treatment system sizing;
- Drain field trench construction;
- Effluent distribution;
- Soil treatment systems design;
- Problem soil conditions;
- Mound design and construction;
- Preliminary site evaluations;
- Site evaluation field procedures;
- Sewage tanks;
- Pumping stations;
- Small collector systems; and
- Septic tank cleaning and septage disposal.

Although the program is designed for a technical audience, some of the information in the program can also be used to explain the design and operation of on-site sewage systems to homeowners. In addition, local regulators can benefit from the course. The course is accompanied by a very detailed technical manual (*On-Site Sewage Treatment Manual*, University of Minnesota Agricultural Extension Service and Minnesota Pollution Control Agency, St. Paul, Minnesota, 1986) that includes codes, descriptions, instructions, technical criteria, and several extension service bulletins.

Since the certification program began in 1980, 1,001 individuals have passed the four-hour written examination given during the third day of the workshop. A total of 574 individuals are presently certified as either inspectors, contractors, site evaluators, designers, or pumpers. Because certified designers and installers are more familiar with technical regulatory criteria and therefore more likely to comply with the guidelines, State officials believe the manual and educational workshops have made significant contributions to the effectiveness of sewage treatment codes, and consequently to the health and welfare of the public in Minnesota.

Education programs necessarily involve some expense. To some extent, these costs can be offset by charging for educational materials and assessing fees for workshops and certification courses. Nevertheless, the success of a septic system management program depends on the public understanding the basic concepts involved. The costs of education are, therefore, a sound investment in the protection of ground water and of the public health and welfare.

3.4 Promoting Water Conservation

Conserving water at its point of use is one method of reducing the potential for ground-water contamination by pollutants from residential and commercial septic systems. Eliminating or reducing waste flow and pollutant loads at the source will extend the life of soil absorption systems, save money over the long run, and decrease the possibility of system failure. This section provides examples of conservation practices and discusses their applications.

Household or commercial water-use patterns and waste characteristics are the two main factors that affect the choice of a conservation practice. In general, laundry, bathing, and toilet use are the greatest contributors to household wastewater flow, constituting approximately 70 percent of total wastewater generated on average.[9] Thus, total water use will be most affected by instituting conservation practices in those areas. Garbage disposal wastes, toilet wastes, and basin, sink, and appliance wastewater produce the greatest pollutant loads from a household (i.e., compounds that must be treated and removed by the septic system). Eliminating or decreasing wastes from those sources will reduce the total amount of pollutants entering the septic system, and thereby reduce the waste disposal load for the absorption field.

Two strategies for conserving water and improving septic system performance overall are waste flow reduction and waste load reduction.

Waste flow reduction is a decrease in the volume of wastewater produced. Three general methods for reducing wastewater flow include:

1) Reducing non-functional water use by eliminating wasteful water-use habits, keeping plumbing in good repair (eliminating leaks and drips), and maintaining non-excessive water pressure in the house (i.e., adequate pressure so that appliances function properly, but no more).

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[9] Otis, Richard, J., William C. Boyle, James C. Converse, and E. Jerry Tyler. 1977. *On-Site Disposal of Small Wastewater Flows*. Environmental Protection Agency Technology Transfer. University of Wisconsin, Madison.

2) Installing low water-use toilets, composting toilets, reduced-flow showerheads and sink faucets, clothes and dishwashers with adjustable cycles, and other water-saving devices and appliances in homes or commercial businesses. A water level selector on a clothes washer may reduce the volume of water used for laundry by as much as 10 percent,[10] but the greatest savings in water can be achieved by modifying or eliminating conventional toilets, which may contribute as much as 35 percent of total household flow.[11]

3) Using wastewater recycle-reuse systems that use bath/laundry water ("greywater") for non-potable uses such as toilet flushing and lawn sprinkling. These are also known as waste segregation techniques. Because greywater has been found to contain potentially harmful bacteria and viruses, its use as a water source should be carefully investigated and controlled.

Waste load reduction (usually used in concert with waste flow reduction techniques) involves decreasing the mass of waste constituents going to the septic system. These waste constituents may include: phosphorus and other filler solids from detergents, wastes from toilets, and garbage disposal wastes. Waste load reduction techniques include:

- Eliminating the use of garbage disposals (these wastes can be effectively handled as solid wastes);
- Eliminating the use of detergents with phosphorus and other filler solids;
- Installing "suds-savers" in laundry machines; and
- Reducing or eliminating toilet discharges (by installing composting toilets).

Eliminating the use of a garbage disposal will reduce the total suspended solids entering the wastewater flow by as much as 37 percent[12]; a "suds saver" will reduce organic liquid residuals by as much as 25 percent[13]; and eliminating toilet wastes will result in as much as a 61 percent reduction in total suspended solids, an 82 percent reduction in total nitrogen, and a 30 percent reduction in total phosphorus added to the wastestream.[14]

In general, the conservation practices that are most successful are independent of user habits, such as wastewater recycling-reuse systems. Techniques involving choices by the user, such as dish- or clothes-washers with variable cycles, are less successful.

Cities in the arid regions of the West and Southwest have been among the first to implement water conservation programs. For example, Denver, Colorado, and Phoenix, Arizona, have comprehensive water conservation programs.

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[10] Kuhner, Jochen, Daniel Lueke, and Ronald Sharpin. 1977. "Water Use and Wastewater and Residuals Generation in Households: Potential for Conservation," in *Home Sewage Treatment, Proceedings of the Second National Home Sewage Treatment Symposium*. American Society of Agricultural Engineers Publication 5-77, St. Joseph, Michigan.

[11] Siegrist, Robert L. 1977. "Waste Segregation to Facilitate Onsite Wastewater Disposal Alternatives," in *Home Sewage Treatment, Proceedings of the Second National Home Sewage Treatment Symposium*. American Society of Agricultural Engineers Publication 5-77, St. Joseph, Michigan.

[12] *Ibid*.

[13] Kuhner, Jochen, Daniel Lueke, and Ronald Sharpin. 1977. *Loc cit*.

[14] Siegrist, Robert L. 1977. *Loc cit*.

The Denver Water Board has recently announced its intention to fund the cost of installing water meters for the 87,500 single-family residences currently not metered. The Water Board anticipates that allowing homeowners to monitor their water use and see how much it costs per unit per service period will serve as an incentive for conserving water. Denver also currently operates a leak detection and water pressure check program for municipal pipes and is examining the possibility of expanding the program to include a "water audit" service for homeowners in conjunction with the Public Service Company of Colorado. A water audit would include checking for leaks in the home and evaluating household water use patterns. Auditors would then offer suggestions for implementing water conservation practices. Currently, the Water Board is working to educate the public concerning the use of water-saving devices and is investigating the possibility of providing funds to partially offset the cost of installing devices such as low-flow showerheads and toilets in individual homes. In addition, Metropolitan Water Conservation, Inc., a Denver area group composed of members of the seven city water districts surrounding the Denver area and organizations such as the Home Builders Association, landscapers' associations, and Denver's Metro Sewage Disposal, Inc., has proposed designating water conserving homes as "gold medal homes," rewarding gold medal homeowners with reduced tap fees.

The City of Phoenix's Water and Wastewater Department recently retrofitted 41,000 homes with low-flow showerheads and low water-use toilets at city expense in response to an emergency sewage situation. Phoenix also operates an industrial water conservation program which encourages businesses to develop a plan to reduce their water consumption by 10 percent over the next two years. In addition, Phoenix has conducted a public awareness week, sponsored public awareness messages (i.e., radio, TV, and newspaper announcements) and youth education programs.

There are many benefits derived from these conservation strategies. Water conservation and waste load reduction extends the life of existing and especially over-loaded septic systems, protects water resources, and saves money.

3.5 Assuring Proper Operation and Maintenance

Providing proper operation and maintenance is a basic requirement in a management program geared toward reducing the potential for ground-water contamination from septic systems. There are a variety of ways to ensure proper operation and maintenance; each method has its own advantages and disadvantages. Some programs are more costly to implement than others, but may offer greater protection against system failures and ground-water contamination. Several approaches for controlling septic system operation and maintenance are discussed in this section.

In general, septic systems are a very effective and trouble-free method for disposing of household wastes. However, septic system users must follow sound operating procedures to ensure that their systems continue to function properly. These procedures are simply a matter of controlling the substances that enter the septic system. Every septic system is designed to handle a certain volume of flow and is able to treat only certain types of wastes. If a system user is not aware of these limitations or does not operate the system properly, septic system failure and/or ground-water contamination can result.

Guidelines for proper septic system operation include the following:

1) *Do not overload the septic system.* Systems are designed for a specified number of users and/or waste flow. If the number of users increases over time, the volume of waste flow will also increase and the septic system may eventually become overloaded and fail.

2) *Dispose only domestic waste in a septic system.* Stanaard septic systems are designed to handle domestic wastewater from showers, washing machines, toilets, and sinks. These systems are not able to treat and dispose of other wastes, such as pesticides and other synthetic chemicals that will pass through the septic system and may contaminate ground water. Even household cleaning chemicals can damage the bacteria that treat and degrade wastes in the septic tank.

3) *Do not dispose of grease or cooking fats in a septic system.* Grease congeals and solidifies in the septic tank and inhibits the bacteria that break-down the wastes in the tank. Over time, the grease also will accumulate and may eventually clog the inlet and outlet to the septic tank.

Following these procedures will help ensure that septic systems function properly. Unfortunately, there is no way to guarantee that every system user will follow these operating practices. Nevertheless, homeowners have an interest in ensuring that their septic systems do not fail. Therefore, once they are made aware of the need for these operating procedures and of the potential consequences of improper operation, most system users will choose to adopt good operating practices. Many communities are promoting sound operation through public education. Several of these education programs are discussed in Section 3.3.

In addition to following sound operating practices, septic system users must also ensure that their systems are maintained properly. Even a well-designed and properly operated septic system will eventually fail if it is not also maintained. Tank maintenance involves measuring, pumping, and hauling sludge and scum from the septic tank to a disposal facility. Most tanks require pumping every three to five years; however, some may need to be pumped as frequently as every year, depending on tank size and how heavily the system is used. Regular maintenance can prevent failures such as clogging of the soil absorption system and sewage back-up into the home.

Clogging is often the result of an excess build-up of solids (scum and sludge) in the septic tank, and the subsequent passage of incoming solids to the drain field. To ensure that the layers of solids have not exceeded "safe" levels, the amounts of scum and sludge should be measured annually. Septic tank servicing firms can conduct these inspections. In addition, many communities have published pamphlets explaining how to measure scum and sludge levels for the "do-it-yourself" homeowner. Layman-oriented publications are often distributed by public agencies that issue construction permits or by contractors who install systems. Regular tank inspections allow for a quick check of the structural integrity of the septic tank and will reveal whether tank pumping is necessary.

A tank generally needs to be pumped if:

- The scum layer (i.e., the layer of solids collecting on the surface of the wastewater) is less than three inches away from the bottom of the tank outlet or baffle; and/or

- The sludge line (i.e., the level of heavy solids collecting on the bottom of the tank) is within 18 inches of the outlet fitting.

The septic tank and drain field will usually work satisfactorily until the sludge fills over 40 percent of the volume of the tank or the scum fills the available air space in the tank.

Solvents are sometimes used by homeowners and owners of commercial septic systems to dissolve the scum layer accumulating at the top of the tank. However, such "scum-dissolving" products are typically ineffective and do not reduce the need for regular tank pumping. Even if the solvents are effective at dissolving the scum layer, they may create more serious problems in the drain fields. In some areas, the use or sale of these compounds has been banned in order to protect ground water from contamination. Consequently, the use of these cleaners should be discouraged or eliminated (see Section 3.7).

If the septic tank is not pumped regularly and the drain field becomes clogged, one simple method of rejuvenating the field involves allowing the absorption field to rest. Resting the absorption field allows the clogging materials to be broken down by physical and biochemical processes thus restoring the treatment capacity of the soil. Resting may take several months and prevents use of the septic system unless an alternate absorption field is available. Septic systems may be designed with several beds to allow for alternate dosing and resting cycles in the drain fields if clogging is anticipated as a problem. Trench systems that use serial loading devices such as drop boxes can also continue to be used if the damage is caught before all trenches have been clogged. The clogged trenches can be allowed to rest while continuing to use the undamaged trenches and reducing water use.

Many homeowners are unaware of the proper procedures for and the importance of septic tank maintenance. In some cases (e.g., new owners of older homes), residents are even unaware that they have a septic system instead of a municipal hook-up. Therefore, sanitary codes or city ordinances that rely on homeowners to handle maintenance of their septic systems may not adequately address the problem.

One solution is to establish a program that involves periodic (e.g., yearly) inspection of all septic tanks in a community. The community or municipality may conduct the inspections if issues such as right of access, authority to inspect, and liability for repairs are covered by ordinance or law. Communities also may contract for the services of a private maintenance firm, thereby taking advantage of economies of scale. For example, a septic tank pumping firm may agree to pump the tanks in a community at a reduced per tank fee if the firm is guaranteed a consistent volume of business. The choice of firms may also be left to the homeowner while the local government agency assures a certain level of competency by licensing and certifying qualified inspectors and pumpers. The organizational and administrative costs of such programs may be high. However, these costs can be minimized by requiring each homeowner to pay a fee for maintenance service.

The Stinson Beach County Water District (SBCWD) in California, provides for design, installation, financing, and other support activities in addition to operation and maintenance of septic systems. Every on-site system within SBCWD's authority is inspected on a biennial basis to determine the need for pumping, to examine the absorption field (for surfacing effluent), and to determine whether an odor investigation is necessary.

A few communities subscribe to a concept of "total management." This involves organizing special purpose agencies (e.g., a centralized management entity similar to a sewer utility) that provide all major functions related to on-site wastewater management. Based in part on SBCWD's program, the California legislature passed Senate Bill 430 (SB430) in 1977 which enables public agencies that manage sewers to form "wastewater disposal zones" (i.e., boundaried areas within which on-site systems may be regulated) to provide for the collection and treatment of effluents from private or community septic systems. Stinson Beach homeowners remain responsible for all costs of repairs or periodic maintenance, such as pumping.

The State of Illinois has developed similar legislation (P.A. 80-1371 Chapter 24, Parts 1401-1422) allowing any "corporate authority" (e.g., the governing authority of a municipality) to develop wastewater disposal zones. This legislation allows governing authorities to impose a tax upon all property owners located in the zone to pay for the costs of construction, operation, and maintenance of septic systems and/or to impose a user charge to defray the costs of routine operation and maintenance (see Appendix B).

Other possible approaches for ensuring septic system maintenance include:

- A permitting system which requires homeowners to certify periodically that a licensed septic maintenance firm has inspected and, if necessary, pumped their septic tanks.
- A program requiring certification that the septic system is functioning properly prior to mortgage approvals.
- A program requiring pre-sale inspections.
- A permitting program requiring a guarantee of permanent maintenance for community or multiple housing unit septic systems before an operating permit is issued.
- A program involving periodic sanitary surveys in order to identify failing or inadequately designed on-site systems.

In addition to making it unlawful to use a septic system not meeting pre-defined performance standards, fines, liens, and injunctions are possible program enforcement tools. In California, Article 10 (beginning with Section 31145) of the California Water Code empowers the Stinson Beach County Water District, as part of its total management program, to enter private property to inspect and abate public nuisances resulting from septic system failures. The District has the option of recovering abatement costs (i.e., costs of repairs or maintenance) by imposing liens, filing a civil suit against the property owner, or discontinuing water service to owners of failing systems. In addition, the District issues discharge permits and charges an annual fee of $108.00 to cover program operating costs. In several communities, fines, liens, and service charges serve as a valuable source of revenue for funding publicly owned or operated systems or publicly managed maintenance programs (enforcement techniques are discussed further in Section 3.9.).

Communities in the State of Idaho use a combination of techniques to regulate septic tank maintenance (see Appendix B). First, lenders use a mortgage survey system requiring homeowners applying for mortgages or mortgage renewals to provide the Regional Health District with verification of a recent inspection of their systems and, if necessary, verification of pumping or any improvements needed to bring the system up to standard. If information provided by a homeowner satisfies the Health District's requirements, official verification is then sent to appropriate lending institutions. Mortgages are not approved in the State without verification that the septic system is functioning properly.

Second, the Idaho Panhandle Regional Health district employs a contract system which involves the drafting of a "sewage management agreement" (or "SMA") between a municipality and the health district.[16] The agreements state, generally, that in order for the health district to continue issuing permits for septic systems in the area, a municipality must take responsibility for all aspects of management outlined in the agreement.

For the City of Dalton Gardens, the Idaho Panhandle Health District negotiated for a city ordinance setting the standards for septic system operation and maintenance, as part of the terms of a Sewage Management Agreement (see Appendix B). The ordinance requires that:

- *Septic systems be pumped once every five years or when the sludge in a tank equals one-third of the volume of the tank (whichever comes first); and*

- *That verification be recorded with the city clerk's office.*

The terms of this contract were the result of Dalton Garden's decision to rely on septic systems as its permanent method of sewage treatment, whereas most other communities in the Panhandle Health District are in the process of converting to municipal sewage treatment plants.[15]

[15] The shift away from on-site sewage treatment in the Panhandle region resulted from contamination of the region's sole source aquifer from non-point sources, primarily septic systems.

[16] Title 39-414 (8) of the Idaho Code enables the district boards of health "to enter into contracts with other governmental agencies...as may be deemed necessary to fulfill the duties imposed upon the district in providing for the health of the citizens within the district."

The SMA system allows these cities such as Dalton Gardens to operate and maintain septic systems -- specifically community drain fields -- until a municipal sewer system is installed. It also permits residents to be charged a monthly fee for use of the community drain field and service by the city sewage management system. All nine municipalities in the Panhandle district have SMAs, each one tailored to meet specific needs.

The main advantage of Idaho's SMA system is that it allows for a more comprehensive and adaptable approach to meeting environmental objectives. SMAs have been successful in Idaho because they have involved municipalities in developing their own programs and have enabled agreements to be tailored to the specific needs of a community. Under the SMA agreements a community may choose a management program that best suits its resource and planning needs. Larger communities may have a broader revenue base and therefore greater financial resources with which to undertake management options directly, while smaller communities may rely on county or regional authorities. Thus, SMAs provide a framework for establishing a management approach that is best suited to the individual needs of a broad range of communities.

3.6 Controlling Septage Disposal

Although septage disposal (i.e., disposal of the residual scum and sludge pumped from septic systems) is usually addressed as an issue separate from other septic system management practices in local codes, it should be viewed as one component of a comprehensive program for septic systems. Septage (or "scavenger waste") is made up of an anaerobic slurry of residual wastes and consists of solids (such as grit and grease), water, and organic wastes. It is usually high in bacteria, viruses, ammonia, and organic nitrogen compounds. Hazardous chemicals may also be found in septage originating from printing, photographic, and dry cleaning businesses; restaurants, beauty shops, and service stations; commercial and educational laboratories, and other businesses (see Section 3.8 for more information on chemicals originating from commercial sources). Thus, proper septage disposal is essential for the protection of public health. EPA has addressed septage disposal both through regulations (40 CFR Part 257) and by developing guidance (see Chapter 4). This section will outline several local regulatory approaches for managing septage disposal practices.

Several factors may lead to improper septage disposal. First, lack of readily accessible, approved disposal areas may encourage illegal dumping of septage by some haulers. In addition, the fees charged by haulers that dump illegally are probably lower than those charged by firms dumping legally (especially if they must travel long distances to an approved site), which may result in more homeowners contracting with illegal dumpers. Second, without public agencies having adequate manpower for inspecting and sampling septage delivered to approved areas, hauling practices may go unobserved and haulers may attempt to mix industrial wastes with septage in order to increase their profits. This practice can lead to contamination of both approved and unapproved sites and can create a threat to ground water. Finally, inadequate inspection and maintenance of equipment used in hauling septage can result in leaks or spills during transportation, leading to direct exposure of people to harmful pathogens or chemicals as well as endangering the potability of ground and surface drinking water sources.

Because proper disposal of septage is important in assuring ground-water protection, the following basic issues should be addressed in any comprehensive septic system program:

- Establishment of an adequate number of conveniently located septage disposal or treatment sites.
- Licensing and certification of individuals or firms involved in pumping septage, servicing tanks, or hauling septage.
- Establishment of standards for the tank trucks and equipment used to pump and transport septage for disposal.
- Oversight of operation and maintenance of disposal facilities (including inspections during construction as well as operation).
- Periodic inspection and certification of all vehicles used to transport septage.

Various components of a septage disposal program may be owned or operated by either private or public parties, or a combination of both. Exclusive public ownership and management of pumping operations and/or disposal sites may prove to be costly to a community, but this arrangement provides for strict control over disposal practices, and therefore a greater level of protection against ground-water contamination. One possible arrangement for management of disposal practices by public agencies would involve:

- State responsibility for setting all relevant performance standards and criteria for licensing programs; local responsibility for the surveillance of hauler activities and inspection of actual equipment and disposal facilities;
- State or local (e.g., regional or multiregional) ownership of a disposal facility, possibly in conjunction with a municipal wastewater treatment facility;
- Local government or private ownership of pumping and transporting services (if privately owned, the local authority performs the function of licensing, certifying, and inspecting; if owned by local government, all responsibilities are assumed by the agency managing the program); and
- Homeowner or community responsibility for all charges related to pumping and servicing and perhaps disposal fees based on the volume of waste.

The above represents a typical division of labor among relevant private and public entities. Private ownership of disposal facilities (usually land disposal facilities), however, is common in rural or semi-rural areas. Private ownership is also found in areas where the local municipal treatment plant is unable to handle the additional septage from on-site systems. Septage may be refused at treatment plants that are already operating at full capacity or that are experiencing a temporary overload.

When municipal sewage treatment systems and disposal facilities are unavailable for septage disposal, there may be adequate demand to encourage private ownership and operation of new disposal sites. General Utilities Development (GUD) of South Florida is an example of a private utility managing septage disposal. In addition to several wastewater treatment plants, GUD also owns and operates vehicles for pumping and hauling septage as part of their "septic tank effluent pump" (STEP) system. Special purpose agencies may also opt to include septage disposal as part of their total management system (see Section 3.5).

Counties and cities use a variety of programs and techniques for managing septage disposal. For example:

- The City of Acton, Massachusetts, and Fairfax County, Virginia, operate septage treatment facilities restricted to the use of private haulers servicing individual or community septic systems within their regions. Acton requires haulers to purchase a coupon from the City Clerk that is turned in at the time of disposal. Fairfax County uses a system of color-coded decals displayed on truck windshields as proof of payment of an annual licensing fee.

- In Seattle, Washington, METRO (a special purpose agency) has devised an electronically controlled and monitored disposal site. Magnetic pass cards issued to approved haulers record the amount of septage delivered, when it was delivered, and by whom (using the hauler's license number).

- In Idaho, one of the conditions for acquiring a license to pump septic tanks is that the hauler demonstrate that the septage will be disposed at an approved site. With the approval of the State Board of Health or Regional Health District, septage may be disposed of at a municipal wastewater treatment plant (considered the most suitable and desirable method by the Board of Health) or by land-spreading on public or private land with the written permission of the landowner and only under certain circumstances. Septage generally may not be applied to floodplains, porous soils, or land used for root crops.

Legal authority for programs such as these is usually found within state codes. For example, Title 39, Chapter 1, of the Idaho code "grants authority to the Board of Health and Welfare to adopt rules, regulations and standards to protect the environment and the health of the State for issuance of pollution source permits." Title 1, Chapter 15, of "Regulations Governing the Cleaning of Septic Tanks" (see Appendix B) promulgated by the Board of Health outlines the types of equipment that may be used for pumping and hauling septage, methods of disposal, and permit requirements, including: information that must be included in permit applications; permit fees; assigning a number for each vehicle with a permit to be displayed on its side, and the terms of permit suspension and revocation.

The New York State Environmental Conservation Law (NYS-ECL), Article 27, Title 3, authorizes the New York State Department of Environmental Conservation to regulate and require registration of all persons engaged in the business of pumping septic tanks, cesspools, or marina sanitary wastes. New York's county departments of health are responsible for administering and enforcing the State laws affecting on-site systems. For example, Nassau County's Charter, Article XII, authorizes the County Board of Supervisors to establish sewage disposal districts and prepare a general sewage facility plan that includes septage disposal.

Regulating septage and sludge disposal does add to enforcement and administrative costs for local governments. However, a program addressing only septic tank operation and maintenance and not the accompanying disposal of the residual wastes neglects a serious potential source of ground-water contamination.

3.7 Keeping Hazardous Cleaning Solvents and Other Dangerous Chemicals Out of Septic Systems

Many hazardous chemicals, because they are resistant to biodegradation, pass through septic systems and contaminate ground water. Such chemicals originate from many sources. They may be added directly to septic tanks as cleaning solvents. They are contained in household products used for cleaning, painting, or maintaining automobiles and appliances and may be dumped down the drain. They are also discharged by commercial and industrial businesses that use septic systems. Because toxic chemicals originate from so many sources and end up in septic tanks as a result of normal daily activities, keeping them out of septic systems is difficult. This section discusses several approaches to controlling discharges of toxic chemicals to septic systems.

Many brands of septic system cleaning solvents are currently on the market. Makers of these solvents, which often contain halogenated and aromatic hydrocarbons,[17] advertise that they reduce odors, clean, unclog, and generally enhance septic system operation. Manufacturers also advertise that cleaning solvents provide an alternative to periodic pumping of septage from the septic tank. However, there is little evidence indicating that these cleaners perform any of the advertised functions. In fact, their use may actually hinder effective septic system operation by destroying useful bacteria that aid in the degradation of wastes. In addition, the organic chemicals in the solvents are highly mobile in soils and toxic (and some solvents are suspected carcinogens), thus they can easily contaminate ground water and threaten public health.

Organic chemicals can enter ground water via septic systems not only through the use of cleaning solvents, but also from the disposal of household wastes. Household cleaners, drain cleaners, stain removers, paint thinners, and petroleum products often are disposed by simply pouring them down the drain. Unfortunately, homeowners frequently may not be aware that such products contain toxic chemicals, have the potential to contaminate drinking water, and may damage their septic systems.

Many industrial facilities also discharge organic chemicals into their septic systems. Process wastes from certain industrial facilities have been discharged to systems that are designed to handle only non-industrial wastes.

Several major ground-water contamination incidents have occurred as a result of industrial discharges to septic systems (see Section 3.8).

An option for controlling future ground-water contamination from septic tank cleaning solvents and other dangerous chemicals is to prohibit the use of the solvents and the discharge of toxic chemicals to septic systems. Cleaning solvent prohibition tactics may include banning their sale and/or use. A ban demonstrates to the public that these cleaners and other organic chemicals have the potential to contaminate ground water. Such bans are more strongly supported if the public is made aware that the cleaning solvents do not provide an alternative to periodic maintenance and can harm public health.

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[17] The Environmental Protection Agency has demonstrated a concern over the detection and control of many halogenated and aromatic hydrocarbons in the environment by requiring testing for these compounds in the ground water at some hazardous waste management facilities (for a list of the compounds see 40 CFR Part 261, Appendix VIII). Two of the more common compounds in septic tank cleaners, methylene chloride and 1,1,1-trichloroethane, are also listed on EPA's priority pollutant list and have had health advisories issued for them by EPA's Office of Drinking Water.

Some governments are relying on public education programs to control the use of septic tank cleaning solvents as an alternative to a direct ban on the sale of the products. Although these programs do not carry the weight of an enforceable ban, they do aid in controlling the problem.

Providing alternative disposal options is an important aspect of controlling the disposal of hazardous chemicals. The State of New Hampshire has sponsored collection efforts to encourage homeowners to dispose of toxic household products such as cleaners and pesticides in approved facilities. Communities in Illinois and New York have also sponsored such "collection days" to focus attention on the need to dispose of hazardous compounds properly.

Although banning organic chemical discharges to septic systems and the use of septic system cleaning solvents may sound like a simple method of controlling ground-water contamination, enforcing such a ban is difficult. The degree of control (state, county, or local) and the public awareness of potential hazards associated with toxic chemicals and septic systems each plays a critical role in determining the success of any ban.

State-wide bans are far more effective than regional or local controls. For example, if one town places a ban on septic system cleaning solvents while surrounding towns do not, people in the town with the ban will still have easy access to the solvents. If the boundaries of control grow to the county or state level, it becomes more difficult for the septic system owner to purchase cleaning solvents. For this reason, jurisdictions should cooperate to create as large an area of control as possible.

Although a broadly based control program increases the effectiveness of a ban, the importance of informing the public of potential hazards associated with the chemicals should not be overlooked. For example, even though septic system cleaning solvents may be difficult or impossible to purchase, other types of solvents, such as industrial degreasers, may still be available. Septic system owners might use these products as a substitute for the packaged septic tank cleaning solvents unless they are made aware of the potential dangers.

Regulatory codes managing the discharge of toxic chemicals to septic systems have been established and implemented by several communities and states. These codes are designed to control the sale and use of septic system cleaning solvents, prohibit discharge of toxic organic chemicals to ground water, and educate the public on potential ground-water contamination problems.

In New York State, restrictions on the discharge of toxic chemicals to septic systems and the use of septic system cleaning solvents are part of a comprehensive set of state and county laws. County health departments administer and enforce the state laws (see Appendix B). The New York State legislation:

- *Prohibits the sale of septic system cleaners and additives containing halogenated and aromatic hydrocarbons; and*

- *Prohibits the discharge of halogenated and aromatic hydrocarbons to ground and surface waters.*

Long Island's Suffolk County has adopted codes for controlling the use of septic system cleaning solvents, including:

- *Prohibiting sales of organic chemicals or compounds for the purpose of cleaning or unclogging on-site systems or sewer drains; and*

- *Prohibiting discharge of industrial, toxic, or hazardous materials into on-site subsurface systems.*

Many states and localities have adopted legislation prohibiting the use of septic system cleaning solvents, including the State of Maine, the State of Delaware, the New Jersey Pinelands Regional Commission, and several local jurisdictions in Massachusetts. The State of Rhode Island prohibits the disposal of acids or organic chemical solvents in septic systems and specifically discourages the use of septic tank cleaners. The State of Connecticut Department of Environmental Protection has taken the process one step further by not only banning the sale and use of all cleaning solvents, but also implementing the new law through press releases, state-wide surveys, direct manufacturer contact, and contact with the State retail merchants association.

In general, controlling the disposal of toxic chemicals in septic systems can be a difficult task to accomplish, primarily because violations cannot be easily detected. Homeowners can circumvent the controls by simply going to the next jurisdiction to buy septic tank cleaning solvents or by disposing of similarly formulated household cleaners down the drain. However, controlling discharges of toxic chemicals is made much easier if the public is aware of the potential hazards associated with the chemicals. An effective program for controlling the discharge of toxic chemicals to ground water, therefore, requires not only a wide scope of control, but also efforts to inform the public of potential hazards.

3.8 Managing Commercial, Industrial, and Large Residential Systems

Several states now recognize that larger on-site waste disposal systems, especially those operated by commercial and industrial establishments, require special regulatory controls due to both the larger volume and the types of waste they treat and dispose. Although the majority of septic systems are installed for and used by single-family homes, a significant number of larger systems are operated by commercial and industrial establishments and groups of single-family residences. These systems have caused ground-water contamination due to improper siting, construction, operation, maintenance, and waste disposal practices.

Ground-water degradation can, to a large extent, be prevented by acknowledging that commercial, industrial, and large residential septic systems require different construction and maintenance practices than than those used for smaller single-residence septic systems. Regulators and septic system users must recognize that septic systems are designed to handle only certain types of wastes, and most standard systems cannot adequately treat the constituents in many commercial and industrial waste flows. This section discusses construction and operation practices for these systems and outlines regulatory programs that are designed to protect ground water. Because the technical and management requirements differ for commercial/industrial and large residential systems, we discuss the two general system types separately.

3.8.1 Commerical and Industrial Septic Systems

In the past, very few jurisdictions made any distinction between domestic and commercial/industrial wastewaters or types of use when regulating septic system design and operation. As incidents of ground-water contamination caused by the disposal of toxic commercial and industrial wastes became more common, many states began to regulate the types of wastes that could be introduced into septic systems. This has led to a number of regulatory initiatives, including limits on commercial and industrial waste flows. These controls identify and limit the constituents that can be disposed in septic systems based on the hazardous characteristics of those constituents. Adopting such measures reinforces the points that septic systems can treat only certain types of wastes, and that many inorganic and organic pollutants that cannot be removed by soil absorption are introduced into the ground water by non-domestic sources.

For example, on Long Island, New York, local health officials have closed private and public water supply wells due to the presence of organic and inorganic chemicals at concentrations exceeding guidelines for drinking water. Virtually all of the chemicals found in the wells are associated with a wide range of commercial, industrial, and institutional establishments. This problem is not limited to Long Island, but is widespread throughout the country. Printers dispose of organic solvents and metal degreasers, and the photoprocessing industry disposes of many organic and inorganic chemicals. Laundries and laundromats dispose of soil and stain removers. Dry cleaners discard used solvents such as trichloroethylene and perchloroethylene. Paint dealers and hardware stores discard many harmful solvents and cleaning products. Restaurants must dispose of large volumes of grease and cleansers. Funeral homes handle hazardous chemicals. Gasoline and service stations discard waste oils, degreasers, and other automotive fluids. Laboratory wastes also contain many harmful chemicals. Even beauty shops must throw away potentially harmful products such as dyes. All of these establishments may dispose of the hazardous substances they use in septic systems.

States with strong regulatory programs for commercial and industrial septic systems include Florida, Massachusetts, New York, Maryland, and New Hampshire. Each of the states designed the programs to help protect potentially vulnerable drinking water supplies. This goal involves a number of different factors, including the characteristics of the regulated waste flows, the vulnerability of the ground water in an area, and the proximity of populations using the ground water.

Massachusetts has imposed controls on commercial and industrial wastewater disposal in septic systems as part of a general ground-water protection strategy (see 314 Code of Massachusetts Regulations 1.00-7.00; selected regulatory language is provided in Appendix B). The protection program began in 1983 and has placed under State regulation all commercial and industrial facilities that dispose of waste water in subsurface systems. Commercial and industrial wastewaters are defined by the chemicals or constituents contained in the waste flow. These chemicals include organic pesticides such as lindane and toxaphene and metals such as lead and mercury.

Any discharger who falls under waste characteristic control thresholds must obtain a State ground-water discharge permit. Permit applications list the expected waste effluent volume and composition and describe the proposed waste treatment process. The permits are issued for a specified duration not to exceed five years and outline the restrictions on effluent discharge to the ground water. The effluent limitations are designed to ensure attainment and maintenance of ground-water quality standards. The quality standards list allowable ground-water concentration levels for a variety of compounds. These allowable concentrations are set at levels that will maintain existing ground-water quality for use as drinking water or prevent degradation of the resource beyond usable levels. The Massachusetts program assumes a priori that all ground-water sources or aquifers should be protected as potential drinking water supplies. A potential discharger to the ground water may argue that the existing quality of the underlying aquifer is poor and therefore cannot be used as a drinking water source. In such a case, the regulations allow the controls on ground-water discharge to be less strict. However, the burden for proving that an aquifer is a poor drinking water source lies with the ground-water discharge permit applicant.

In order to ensure compliance with effluent limitations and ground-water quality goals, Massachusetts imposes monitoring, recordkeeping, and reporting requirements upon all permit holders. The monitoring requirements may include periodic sampling and analysis schedules for the waste flow and the installation of ground-water monitoring wells to ensure that the waste effluent is treated properly. The permitting agency outlines the number, location, dimensions, method of construction, and method of sampling for the monitoring wells. Monitoring and reporting requirements also include measurements of the mass of each pollutant limited in the permit and the volume of effluent discharged from the facility. The reporting frequency is specified in the permit.

This regulatory program has imposed additional costs on the Massachusetts Division of Water Pollution Control. As of 1986, approximately 300 permits have been granted and permitting is expected to continue at a rate of approximately 300 permits per year. Six full-time employees are devoted to the application review process. The average review time for a permit application is four to five months. Regulatory enforcement generally is handled by the legal staff within the Division of Water Pollution Control. However, the Massachusetts Attorney General's Office has also been involved in prosecutions.

The State of New York has developed a regulatory program that requires high volume and industrial discharges to ground-water to be permitted by the State. This program has been applied most effectively in Nassau and Suffolk Counties on Long Island. Under the New York Ground-Water Classification/Quality Standards and/or Limitations Title 6, Part 703, all dischargers of greater than 1,000 gpd and all industrial dischargers must obtain a State Pollution Discharge Elimination System (SPDES) permit. Many types of commercial establishments exceed the 1,000 gpd discharge threshold, including smaller restaurants and laundromats. Nassau and Suffolk Counties assist in the administration and enforcement of the permit program within their jurisdictions.

The New York permitting process is similar to the Massachusetts program. New York requires discharge monitoring and treatment processes that ensure the preservation of ground-water quality. In addition, the two counties have established other protective provisions:

- Nassau County monitors any changes in use at commercial and industrial establishments. If a change causes an increase in waste flow volume or results in the discharge of commercial or industrial wastes, the discharger must obtain a permit.

- Suffolk County also regulates discharges of toxic and hazardous materials under Article 12 of the County Sanitary Code (see Appendix B), and the county prohibits the discharge of industrial, toxic, or hazardous wastes into on-site sanitary systems.

Both Nassau and Suffolk counties have ground-water recharge areas or hydrogeologic zones that are sensitive to contamination and require special regulatory protection. In these areas in Suffolk County, the County Sanitary Code requires developers of new commercial establishments, shopping centers, and individual buildings to provide additional treatment for the removal of nitrates from waste effluent if the density of these non-residential properties is equivalent to or exceeds comparable allowable densities for single-residence systems. The Long Island Regional Planning Board has recommended that the counties require commercial and industrial establishments to sign an agreement and to post a bond guaranteeing adequate pollution control. The Board also suggested that owners of such establishments obtain pollution liability insurance.

Nassau County has allocated additional resources to its Department of Health as a result of its ground-water protection programs. Since 1982, two new staff positions were created to deal specifically with ground-water discharge permitting. As of 1985, 42 industrial facilities were permitted.

By focusing on the constituents in the waste rather than simply the volume of the waste flows, regulatory programs for commercial and industrial systems represent a relatively new and more active approach to managing waste disposal. These programs require two important evaluations. First, the amount of each individual constituent of the waste flow is identified. Second, the ability of the treatment process to remove the harmful waste constituents before they enter the ground water is evaluated.

By focusing on the treatment and disposal process, many jurisdictions have effectively banned the use of soil absorption systems for disposing of industrial wastes. Past experience has shown that soils cannot adequately treat or bind many of the harmful organic and metal compounds found in industrial waste flows. Subsurface soil absorption systems, therefore, do not provide adequate waste disposal. These regulatory initiatives have thus led to widespread changes in waste disposal practices. Although commercial and industrial establishments are not yet generally banned from using on-site waste disposal systems (those in portions of Long Island may be an exception), ground-water protection programs are forcing dischargers to upgrade their waste handling practices.

Commercial and industrial responses to ground-water discharge controls may include any of the following: First, many companies are choosing to hook up to public sewer systems. Although most states require both residential and commercial/industrial establishments to use public sewers when possible and economically feasible, on-site systems may be used if sewers are not available. Nevertheless, some industries have chosen voluntarily to pay for sewer hook-ups to avoid the burden of ground-water discharge permitting. Second, establishments are adopting more advanced physical and chemical treatment processes. In Massachusetts, system operators have opted to install more advanced wastewater pre-treatment technologies ahead of the subsurface disposal system. Third, when possible, industries are altering their manufacturing processes and their use of primary materials to remove or lower the concentrations of hazardous materials in the waste effluent. When deciding to make such process changes, the company must weigh the cost of making the change against the expense of more advanced waste treatment. Finally, under some limited circumstances, ground-water dischargers have chosen to redirect their effluent to discharge into surface waters. This option is feasible only for waste constituents that have less stringent effluent limitations for surface water discharge due to the better ability of surface waters to assimilate and degrade the constituents. The choice of an appropriate response depends on the circumstances of the discharger and the local or state regulatory criteria.

3.8.2 Large Residential Septic Systems

Many areas rely on large, centralized septic systems to dispose of waste from clusters of homes. These "cluster collection systems" receive the wastes from each home at a central disposal facility, which may consist of a large septic tank and soil absorption field, for example. Large systems also treat wastes from apartment complexes, motels, and other residential institutions. One important advantage of these centralized treatment processes is the ability to focus operation and maintenance and public management resources at one facility. The systems must be designed, sited, installed, operated, and maintained properly, of course, and their performance must be monitored to ensure sound operation. Proper regulatory management is the key.

During the past several years, there has been a growing interest in the use of centralized or cluster facilities to treat domestic wastewater. The practice of pumping wastewater from riparian lots to treatment facilities set back from the shoreland has been adopted as a surface water protection strategy in some areas. Many municipalities that have a high density of failing single-family septic systems have also turned to the use of cluster systems as an effective remedial measure.

Because cluster systems have many "users," it is often difficult to assign individual responsibility for repair of a failing system. Assigning responsibility is especially difficult when the large system is managed by a Homeowners' Association. Such Associations are notoriously poor managers of large septic systems, because no one individual has the permanent responsibility for ensuring that the system is maintained properly. As a result, local government authorities provide better managerial oversight for these systems. Therefore, once a large system is installed, the developer or contractor should turn over daily management of the system to the local government. The homeowners using the system can then support its operation through taxes or special fees.

The regulatory definition of a "large" septic system is generally made in terms of the volume of wastewater the system is designed to treat and dispose. In most states, the wastewater volume threshold, above which the septic system is defined as "large," lies in the range between 2,500 and 5,000 gpd. In contrast, the approximate wastewater flow volume from an average single-family home is 150 to 200 gpd.

In the past, most areas regulated larger domestic systems by simply "enlarging" the criteria used for the smaller, single-family septic systems. Recently, this practice has come into question. In 1984, the Minnesota Pollution Control Agency outlined five general areas of concern:

1) The ability of soils to treat and dispose of large volumes of waste over a long time period;

2) The creation of a ground-water mound under soil absorption fields due to the disposal of large volumes of waste;

3) Absorption field failures caused by contact with a ground-water mound;

4) Ground-water contamination caused by incomplete effluent treatment; and

5) Surface-water contamination caused by premature surfacing of waste effluent.

Minnesota has developed technical guidance to address these concerns, and the State works with local authorities to closely monitor large system design and operation. Several other states, including Connecticut, North Carolina, Oregon, Washington, and Maine have also promulgated special design criteria for larger systems.

Oregon defines any treatment system that receives over 2,500 gpd of wasteflow as a large system (see Appendix B). Oregon requires the following special design criteria for the systems:

- *The use of pressure distribution;*
- *Effluent distribution to prevent any unit in the disposal field from receiving more than 1,300 gpd;*
- *Providing sufficient site area for locating replacement soil absorption disposal areas next to the active units if necessary;*
- *Alternate dosing of waste flow distribution between soil absorption fields to allow saturation and drying cycles for soil absorption disposal units; and*
- *Providing a written assessment of the impact of the proposed system upon the quality of drinking water and public health.*

Oregon also requires that all large systems be designed by competent professionals in the septic disposal field.

In Connecticut, the Department of Environmental Protection is responsible for reviewing all systems that receive more than 5,000 gpd of wastewater. The major focus of these reviews is the establishment of a proper size for the effluent absorption system, a characterization of the true hydraulic capacity of the site, and an evaluation of the potential for contamination from the site.

The Minnesota guidance for large soil absorption systems (see reference in Chapter 4) emphasizes that the type of wastewater entering the system must be strictly controlled. This guidance states that,

> large soil absorption systems shall be constructed and operated to treat only domestic waste. Connection to the system from any source that would allow other than domestic waste to enter a soil treatment system shall not be permitted unless the wastewater components and concentrations are determined and submitted to the permitting authority for review. Approval/disapproval is based on available information on the possible impacts that may result from the proposed waste constituents.

Along with the changes in technical guidance and criteria, a number of states are also developing new regulatory strategies. Because of the need for more thorough technical review of the systems, many states are retaining strict oversight over the permitting process. New Hampshire reviews all large septic system site plans at the State level as part of a larger land development and ground-water degradation control program. The permit review process is a shared responsibility between the technical system experts within the Small Systems Division and planners within the New Hampshire Water Supply and Pollution Control Commission.

Under the provisions of Sections 323.1 through 323.13 of the Compiled Laws of Michigan, Act 245, the Michigan Water Resources Commission has the authority to permit and regulate large residential systems. The Commission may require large systems to meet specific performance standards for certain characteristics (e.g., levels of BOD_5, pH, and suspended solids) and require regular ground-water monitoring for levels of chloride, nitrate, phosphorous, and pH, for example. A permit may also establish a construction and operations schedule, facility construction standards, ground-water monitoring well installation standards, monthly reporting requirements, management requirements, and any special conditions the Commission deems necessary for the proper operation of the system.

Other states tend to take a less direct role in large system review. In Washington, local health departments are responsible for permitting all systems that dispose of between 3,500 and 14,500 gpd. The State health agency provides technical assistance for design reviews and may take over the permitting process in place of the local health department. In Maryland and Illinois, all large septic systems are regulated by county health departments with state agencies offering technical assistance or project reviews on a request basis.

Those areas that have adopted strong management programs for large residential and commercial/industrial septic systems share several common characteristics. The regulatory requirements involve a high degree of individual review by the regulating authority. Each system must be analyzed, and the review process can take several months. The ground-water protection programs also require that allowable concentration levels in the ground water be set for a wide range of potential contaminants. The regulator must evaluate the contaminant removal capability for many treatment technologies. Clearly, this process involves increased expense for all parties. Monitoring and recordkeeping requirements impose additional costs. However, the process yields important benefits for the community. Detailed reviews encourage industries to use technologies that are most appropriate for the local environmental conditions and the characteristics of the waste flows.

3.9 Strengthening Compliance and Enforcement Programs

A septic system management program will not be effective if measures for ensuring compliance with the program's requirements or prohibitions are not established. Programs can be implemented in a number of ways: by requiring direct permitting, inspections, education, and training. In general, compliance with provisions of a management program is bolstered by making the provisions enforceable and providing for direct and/or indirect financial incentives or sanctions.

Enforceable standards are applied to the system user through permitting. Requiring permits for the construction of septic systems is a very common regulatory practice and is followed throughout the country. However, jurisdictions vary in the amount of information required in the permits and in the level of effort put into permit review and individual site inspections. Some jurisdictions also are relying on occupancy permits that prohibit the use of a septic system until it is determined that the system is operating properly. Such permits must generally be renewed when homes change owners. Thus, the new owner is made aware of the condition of the septic system. Finally, a few regions are turning to the use of discharge permits to control the introduction of contaminants into the ground water. Direct financial incentives also vary from imposing minor fines for poor system design or maintenance to requiring replacement of a failing system. Indirect incentives include prohibiting the sale of a home if its septic system is not functioning properly.

The type of regulatory program chosen by individual governments is dependent upon local circumstances, the implementing authority, the make-up of the regulated community, the use of conventional technology and techniques, and the stringency of an enforceable standard. While establishing a program focusing on strict enforceable standards may, in the abstract, help ensure protection of human health and the environment, the program must not be so strict as to promote non-compliance or overtax the capability of the implementing authority. The crux of the matter is the need to ensure that system users will comply with the standards that are established. The more a program relies on strict controls and prohibitions, rather than on other management techniques, the more compliance needs to be ensured through some form of enforcement activity. The importance of compliance cannot be overemphasized: a regulatory program without compliance is as ineffective as no program at all. This section describes several approaches to foster compliance used by existing septic system management programs.

State and local agencies include a variety of licensing and permitting requirements or controls within their septic system regulations or ordinances. These requirements relate to virtually all aspects of septic system use, including siting, design, installation, operation, and maintenance by:

- Requiring qualified engineers or sanitarians to design the systems;
- Requiring site inspections by soil scientists and/or geologists as a condition for issuance of an installation permit;
- Requiring licensed contractors to install or supervise installation of all septic systems;
- Requiring inspections before issuing occupancy permits that allow homeowners to use the systems;
- Monitoring operation and maintenance of all systems through periodic inspections;
- Making builders and/or installers responsible for the performance of new systems for a specified period of time following installation;
- Requiring mail-in certifications to ensure that systems are regularly inspected and pumped by licensed septage handlers; and
- Requiring pre-sale or mortgage approval inspections.

The general sanctions that many governments use to ensure compliance with these septic system controls include:

- Fines for non-compliance; and
- Ordering violators of septic system regulations to take corrective action.

A number of states, including Washington, Maine, and Idaho, already have enacted strong compliance and enforcement provisions. In each case, local governments may choose to implement more strict methods. Examples of these methods are discussed in earlier sections of this publication (see sections 3.5, 3.6, 3.7, and 3.8). Nevertheless, no matter how strict the state or local methods for ensuring compliance may be, the effectiveness of any program depends on the ability of local officials to implement the controls. Without the active involvement of regulatory personnel in the enforcement process, code provisions will become meaningless.

Maine has established an effective compliance and enforcement program through the combination of sound regulatory requirements and strong local implementation. Enforcement provisions of the Maine Subsurface Wastewater Disposal Rules (10-144 Code of Maine Regulations, 7/1/80) call for construction and installation oversight. The site evaluator's permit application is referred to the local plumbing inspector, who issues the permit if it is determined that the system complies with the rules. The local plumbing inspector must also inspect the installed tank system before it can be covered. The rules specify that "any system covered or concealed before being inspected shall be required to be uncovered for inspection by the Local Plumbing Inspector."

To successfully implement Maine's Subsurface Wastewater Disposal Rules, staff involvement at both state and local levels is required. Key local staff include plumbing inspectors and site evaluators. There are approximately 250 certified plumbing inspectors in Maine. To become certified, an inspector must take written exams, but need not be a professional engineer or plumber. Local governments may employ a plumbing inspector as a full-time staff member, but the inspectors are more commonly retained as part-time consultants. They are paid each time they perform an inspection. Usually, the municipality gives the plumbing inspector a portion of the fee the applicant pays when submitting a permit request.

There are over 100 licensed site evaluators in Maine. To become licensed as a site evaluator, the applicant must be a professional geologist, soil scientist, or engineer, and must successfully complete a written and field exam. Site evaluators generally work as private consultants, and are hired by homeowners, developers, or builders who want to install septic systems.

Maine's Department of Human Services has five full-time engineers assigned to oversee and implement the Subsurface Wastewater Disposal Rules. One of the full-time positions is devoted to issuing variances and prosecuting Rule violators. Historically, Maine had used fines to penalize violators of the Subsurface Wastewater Disposal Rules. In 1983, the Maine Legislature enacted Chapter 796, which authorizes the District Courts to order violators of Maine's land-use laws (which includes plumbing and subsurface wastewater disposal rules) to both pay fines and to stop or correct violations.

The State of Washington has developed a program that combines strong regulatory language at the State level with effective local enforcement.

Compliance provisions of Washington's On-Site Sewage Disposal Systems Rules and Regulations include:

- *Site Evaluation Oversight.* All sites must be evaluated by, or under the direct supervision of, a health officer, registered sanitarian, professional engineer, registered soil scientist, or certified designer having knowledge and experience in the areas of soil and wastewater treatment and disposal.

- *Performance Monitoring of Alternative Systems.* The regulations require performance monitoring of alternative systems. Costs of monitoring are collected as part of applicants' permit fees.

- *Design of Septic Systems.* The regulations require that all designs for on-site sewage systems must be completed by or under the supervision of a professional engineer, registered sanitarian, or certified designer. However, a health officer may permit a resident owner to design his or her own system.

Local governments in Washington are responsible for enforcing the on-site sewage disposal program. The State performs routine reviews of local health departments and recommends ways of strengthening the programs. Approximately 90 full-time employees throughout Washington's 39 county health departments implement the septic system management regulations.

Several counties in Maryland, as well as other jurisdictions around the country, require the issuance of an occupancy permit before a septic system can be used. These permits ensure that the septic systems are inspected *when the property is sold.* The State of Rhode Island requires that any "newly constructed, altered, or rebuilt individual sewage disposal system" must receive a "Certificate of Conformance" from the State before the building serviced by the system can be sold or occupied. The Certificate of Conformance also must be received before local jurisdictions can grant a Certificate of Occupancy.

The State of Minnesota also has sought to ensure that the existing septic systems on riparian lots are functioning properly. To accomplish this task, Minnesota promoted a state-wide inspection of the existing systems. The inspections were conducted primarily by local county officials. As a result of the survey 18,000 nonconforming systems in Minnesota were brought up to standard by 1983. However, the Minnesota Department of Natural Resources estimates that this represents only one-third to one-half of the total number of nonconforming systems.

Massachusetts and New York require that large septic systems or systems that treat and dispose of potentially hazardous compounds must receive a ground-water discharge permit. The conditions associated with these permits require that the permit holder adhere to strict performance standards that limit the introduction of contaminants into the ground water. In addition, commercial and industrial discharges are generally required to monitor the effluent from the systems, institute recordkeeping procedures, and report on system performance to the regulatory authority (see Section 3.8.1).

Idaho uses a "mortgage survey" system to ensure that septic systems are adequately maintained. Under this system, homeowners applying for mortgages or mortgage renewals must provide the Regional Health District with verification that their septic systems have been inspected. (This approach was discussed more fully in Section 3.5.)

Each of these techniques has advantages and disadvantages. Using inspectors to oversee siting, design, construction, installation, and use of septic systems can help to ensure that systems will function properly. However, retaining inspectors may be a financial burden to government agencies, especially local governments. Inspectors may either be hired as full-time staff, or paid a stipend each time they perform an inspection (essentially, acting as part-time staff). Some jurisdictions have chosen to pool their resources on a region-wide basis and hire a consultant to work for several municipalities on a joint-use basis. Additional expenses are involved in licensing inspectors. The community must establish a licensing procedure that includes developing an exam, providing accompanying study materials, advertising and holding the exam at regular intervals (e.g., once or twice a year), grading the exams, and notifying the applicants of the outcomes. The costs of these activities can be recovered through licensing, examination, and registration fees.

Areas that use sanctions to enforce their septic system management programs have found that a combination of fines and corrective action requirements is most effective. Fines alone are frequently not a strong enough sanction, because they generally only amount to a few hundred dollars per violation. However, if property owners know ahead of time that they will be required to correct any violations, they will be much more likely to comply with the regulations. Officials in Maine, for instance, have found their new enforcement provisions, which call for fines and require system repairs, are very effective. Marion County, Indiana, also has incorporated language into its local code that allows health officials to serve notices to property owners who own or operate septic systems that may damage the health of the general public. These notices include schedules for the property owner to take remedial action to upgrade or repair the septic system (see Appendix B). If the repair deadline in the schedule is not met, the property owner may be fined up to $1,000.

All of the above-mentioned measures provide for a more effective septic system management program by ensuring that appropriate control practices are followed.

4. TECHNICAL INFORMATION

This chapter provides a list of references that may be consulted for further information concerning septic system design and operation and the management and control topics addressed in Chapter 3. The following sections provide a listing and brief description of numerous comprehensive technical references on septic systems; references for the Chapter 3 subjects; and information concerning other sources of reference material. Copies of the reference materials should be obtained from the listed sources. Fees may be charged for some of these documents, which may be of limited availability.

4.1 Comprehensive Technical Documents

Various technical documents are available to aid in understanding how a septic system operates and how septic systems can lead to ground-water contamination. A few of these documents, and information on how to obtain copies, are listed below.

> U.S. EPA. 1980. *Design Manual: On-Site Wastewater Treatment and Disposal Systems*. Office of Research and Development, Cincinnati, Ohio. EPA 625/1-80-012.

This manual (known as "the Purple Book") provides information on various types of on-site wastewater treatment and disposal systems. The publication is intended to be used by individuals involved in the design, construction, operation, and maintenance of on-site systems. The publication, in particular, discusses the on-site system and its relation to ground- and surface-water contamination. Copies can be obtained by contacting the U.S. EPA, Center for Environmental Research Information, 26 West St. Clair, Cincinnati, Ohio, 45268, (513) 569-7562.

> Bicki, T.J., R.B. Brown, M.E. Collins, R.S. Mansell, and D.F. Rothwell. 1984. *Impact of On-Site Sewage Disposal Systems on Surface and Ground Water Quality*. Report to the Florida Department of Health by the Institute of Food and Agricultural Sciences, University of Florida, Gainesville.

This report is divided into sections that include a general description of on-site sewage disposal systems, wastewater and effluent characterization, and how to site septic systems to obtain maximum treatment. It is written in both a technical and non-technical way and contains an excellent reference list, should any further information on septic systems be desired. The report can be obtained through the Small Flows Clearinghouse (see section 4.3).

> Cantor, L. and R.C. Knox. 1984. *Septic Tank System Effects on Ground Water Quality*. Lewis Publishers, Inc., Chelsea, Michigan.

This report provides a comprehensive literature survey on septic systems and their effects on ground-water quality. It includes information on how a septic system works, how ground-water contamination can occur from septic systems, and how to apply computer models to evaluate septic systems. The report is available through Lewis Publishers, Inc., 121 South Main Street, Chelsea, Michigan, 48118, (800) 525-7894.

Midwest Plan Service. 1982. *On-Site Sewage Disposal Handbook.* Midwest Plan Service, Ames, Iowa.

The handbook contains detailed, technical information designed to help the homeowner plan, design, install, and maintain a private sewage treatment and disposal system. Although information in this handbook is highly technical in nature, it is written in a manner which makes it easy and practical to use. It concentrates primarily on septic systems but also contains information on other types of on-site sewage disposal. There is a $5.00 fee for the document, and it may be obtained by contacting Deborah Geisert at the Midwest Plan Service, Iowa State University, Ames, Iowa 50011. It can also be obtained by contacting the Extension Agricultural Engineer at state universities in Illinois, Indiana, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.

Minnesota Pollution Control Agency. 1984. *High Rate Soil Absorption System (HRSA); Task Force Final Report.*

This report was produced by the Minnesota Pollution Control Agency to address possible ground-water quality problems that could result from "large" septic systems (multi-unit systems that receive up to 100,000 gallons per day). It contains information on technical analyses done on large systems. This report is quite technical in nature and, although it looks at only large systems, many of the techniques can be applied to septic systems of any size. This document can be obtained by writing the Minnesota Pollution Control Agency, Division of Water Quality, 1935 West County Road B2, Roseville, MN, 55113, (612) 296-7389.

Otis, R.J., W.C. Boyle, J.C. Converse, and E.J. Terry. 1977. *On-Site Disposal of Small Wastewater Flows.*

This report provides information on how to locate a septic system in order to obtain maximum treatment from the soil. It presents test results on soil percolation rates and concentrations of various contaminants associated with septic systems located in a variety of soil types. Information from the report can be used to determine such things as septic system loading rates and the size of the drain field required for a particular type of system in a particular soil type. Copies can be obtained by contacting the College of Agriculture and Life Sciences, 240 Agriculture Hall, University of Wisconsin, Madison, Wisconsin, 53706, (608)262-6969. There is a $2.50 fee for each copy of the report.

Scalf, M.R., W.J. Dunlap, and J.F. Kreissl. 1977. *Environmental Effects of Septic Tank Systems.* Report by the Kerr Environmental Research Laboratory, Ada, Oklahoma.

This document discusses, in general, possible impacts of septic systems on ground water and other environmental media. It can be obtained through NTIS, 5825 Port Royal Road, Springfield, Virginia, 22161. Report number PB-272 702/2ST (EPA 600/3-77/096).

Waltz, J.P. 1975. *A System for Geologic Evaluation of Pollution Potential at Mountain Dwelling Sites.* Report by Colorado State University Department of Earth Resources, Ft. Collins, Colorado.

This report addresses the significant problem of properly siting septic systems in areas with thin or absent soils. It is available through NTIS (see above), Report number PB-240 810/2ST.

Thomson, M., et al. 1984. *Characterization of Soil Disposal System Leachates.* U.S. EPA Report No. EPA 600/2-84/101. NTIS Report No. PB84-196229.

This paper discusses 22 trace-level toxic organics that were traced from distribution trenches of large soil absorption systems to underlying ground water at 10 sites around the U.S. It is available from NTIS.

4.2 References Pertaining to Specific Topics

In this section, literature citations, publications, state regulations, and contacts are listed for the topics discussed in Chapter 3.

4.2.1 Overview of Regulatory Programs

Olivieri, Adam W., Robert J. Roche, and Griffith L. Johnston. 1981. "Guidelines for Control of Septic Tank Systems." *J. Env. Eng. ASCE.* 107(5):1025-1033.

Urban Systems Research and Engineering, Inc. 1983. *Managing Small and Alternative Wastewater Systems.* Cambridge, Mass.

U.S. Environmental Protection Agency. 1980. *Planning Wastewater Management Facilities for Small Communities.* Municipal Environmental Research Laboratory, Cincinnati, Ohio. EPA-600/8-80-030.

U.S. Environmental Protection Agency. 1982. *Management of On-Site and Small Community Wastewater Systems.* Municipal Environmental Research Laboratory, Cincinnati, Ohio. EPA-600/8-82-009.

4.2.2 Requiring Site Evaluations

Alley, T. and K. Thompson. 1981. *The Hydrogeologic Mapping of Unincorporated Gunn County, Missouri to Identify Areas Where Sinkholes, Flooding and Serious Ground-Water Contamination Could Result from Land Development.* Section 208 Summary Report, 6/81.

Bauman, B.J. and W.M. Schafer. 1985. "Estimating Ground-Water Quality Impacts from On-Site Sewage Treatment Systems," in *Proceedings of the Fourth National Symposium on Individual and Small Community Sewage Systems,* American Society of Agricultural Engineers Publication 07-85, St. Joseph, Michigan.

Bouwer, H. 1978. *Groundwater Hydrology.* McGraw-Hill Inc., New York.

Childs, K.E., S.B. Upchurch, and B. Ellis. 1974. "Sampling of Variable Waste-Migration Patterns in Ground Water," *Ground Water* 12(6).

Gardner, Walter H. 1979. "How Water Moves in the Soil," (Reprints available from *Crops and Soils Magazine,* by the American Society of Agronomy, Inc., 677 S. Sigal Road, Madison, WI 53711).

Healy, K.A. and R. Laak. 1974. "Site Evaluation and Design of Seepage Fields," *J. Env. Eng., ASCE.* 100(5).

Healy, K.A., and R. May. 1982. "Seepage and Pollutant Renovation Analysis for Land Treatment, Sewage Disposal Systems," Connecticut Department of Environmental Protection.

Hensel, John E., ed. Minnesota Pollution Control Agency. 1984. *High Rate Soil Absorption System: HRSA Task Force Final Report.* Roseville, MN.

Jaynes, D.B. and E.J. Tyler. 1985. "Two Simple Methods for Estimating the Unsaturated Hydraulic Conductivity for Septic System Absorption Beds," in *Proceedings of the Fourth National Symposium on Individual and Small Community Sewage Systems*, American Society of Agricultural Engineers Publication 07-85, St. Joseph, Michigan.

Magner, J.A., P.R. Book, and E.C. Alexander, Jr. 1986. "A Waste Treatment/ Disposal Site Evaluation Process for Areas Underlain by Carbonate Aquifers". *Ground Water Monitoring Review*. Spring, 1986.

Nelson, J.D., and R.C. Ward. 1982. "Ground Water Monitoring Strategies for On-Site Sewage Disposal Systems," in *Proceedings of the Third National Symposium on Individual and Small Community Sewerage Systems.* American Society of Agricultural Engineers Publication 1-82, St. Joseph, Michigan.

Otis, Richard J., William C. Boyle, James C. Converse, and E. Jerry Tyler. 1977. *On-Site Disposal of Small Wastewater Flows.* Environmental Protection Agency Technology Transfer. University of Wisconsin, Madison, Wisconsin.

Soil Survey Manual: Soil Survey Staff, May 1981 Edition. USDA Soil Conservation Service. St. Paul, MN 55101.

Tennessee Valley Authority. 1985. *Technical Report Series: Conceptual On-site Wastewater Management Plan for Residential Developments Along Cedar Creek Reservoir.* TVA/ON RED/AWR-85/4.

Todd, D.K. 1978. *Groundwater Hydrology.* John Wiley & Sons, New York.

U.S. Environmental Protection Agency. 1978. *Management of Small Waste Flows.* Muncipal Environmental Research Laboratory, Cincinnati, Ohio, EPA-600/2-78-173.

Local soil and water conservation district offices are a good source for unpublished soils information.

4.2.3 Making Regulatory Programs More Comprehensive

Connecticut Department of Environmental Protection, Connecticut Cooperative Extension Service, *Septic Systems Manual: A Guide to On-Site Subsurface Sewage Disposal for Local Land-Use Officials*, University of Connecticut, Storrs.

Idaho Panhandle Health District I Board of Health. 1977. *Rules and Regulations Governing Sewage Disposal on the Rathdrum Prairie in Kootenai County, Idaho,* March 29.

Kreissl, J.F. 1982. "Evolution of State Codes and Their Implications," in *Proceedings of the Fourth Northwest On-Site Wastewater Disposal Short Course*, Seattle, Washington, September 1982.

Lash, James E., and Randy May. 1982. *Community Sewerage Systems, A Primer for Developers and Local Officials*, prepared by the Connecticut Department of Environmental Protection.

Lustig, Kenneth W., Larry M. Belmont, and David E. Burmaster. 1986. *A Case Study of Innovative Subsurface Sewage Management Over the Rathdrum Prairie Aquifer, Idaho*, prepared under contract for Regulatory Reform Staff (PM-223), U.S. Environmental Protection Agency, Washington, D.C.

State of Maine, *Subsurface Wastewater Disposal Rules*, 10-144A-CMR-241, Published by the Department of Human Services, Division of Health Engineering, Augusta, Maine. July 1980.

State of Oregon, Administrative Rules, Chapter 340, Divisions 71, 72, 73, Promulgated by the Department of Environmental Quality, May 29, 1984.

Stewart, David E., "*Alternative Methods of Regulating Onsite Domestic Sewerage Systems*," presented at the Third National Conference on Individual Onsite Wastewater Systems, November 16-18, 1976, Ann Arbor, Michigan. (Part of the Small Scale Waste Management Project, University of Wisconsin-Madison.)

U.S. Environmental Protection Agency. 1983. *Wastewater Management in Rural Lake Areas: Final - Generic Environmental Impact Statement*. Region V, Waste Division, Chicago, Illinois.

State of Washington, *On-Site Sewage Disposal Systems: Rules and Regulations of the State Board of Health*, Chapter 248-96 WAC, Department of Social and Health Services, Office of Environmental Health Programs, Olympia, Washington. July 1983.

4.2.4 Allowing Innovative and Alternative Technologies

Bennett, E.R., and K.D. Linstedt, 1978. *Sewage Disposal by Evaporation Transpiration*. Municipal Environmental Research Laboratory, Cincinnati, Ohio. EPA 600/2-78-163.

Converse, J.C., B.L. Carlisle, and G.W. Peterson. 1977. "Mounds for the Treatment and Disposal of Septic Tank Effluent." in *Home Sewage Disposal, Proceedings of the 2nd National Symposium*. American Society of Agricultural Engineers Pub. 5-77, St. Joseph, Michigan.

Converse, J.C. 1978. *Design and Construction Manual for Wisconsin Mounds*. Small Scale Waste Management Project. 240 Ag. Hall, U. of Wisconsin Madison.

Dix, Stephen P. 1986. *Case Studies of Innovative and Alternative Technologies for Sewage Collection and Treatment*. Case Study Number Four: Crystal Lakes Colorado. EPA National Small Flows Clearinghouse. Morgantown, West VA.

Eastburn, R.P., and W.F. Ritter. 1985. "Denitrification in On-Site Wastewater Treatment Systems - A Review." in *Proceedings of the Fourth National Symposium on Individual and Small Community Sewage Systems*. American Society of Agricultural Engineers Publication 07-85, St. Joseph, Michigan.

Effert, David, and Craig Beer. 1985. "An Extended Study of Absorption from Two Electro-Osmosis Soil Absorption Fields." in *Proceedings of the Fourth National Symposium on Individual and Small Community Sewage Systems*. American Society of Agricultural Engineers Publication 07-85, St. Joseph, Michigan.

Laak, Rein. 1980. "Multichamber Septic Tanks." *J. Env. Eng. Div., ASCE.* 106(EE3):539–516.

Loudon, T.L., et al. 1985. "Cold Climate Performance of Recirculating Sand Filters." in *Proceedings of the Fourth National Symposium on Individual and Small Community Sewage Systems.* American Society of Agricultural Engineers Publication 07–85, St. Joseph, Michigan.

Midwest Plan Service. 1982. *On-site Domestic Sewage Disposal Manual.* Iowa State University, Ames, Iowa.

State of Minnesota, Pollution Control Agency, "Individual Sewage Treatment Systems Standards," M.R. Chapter 7080.0180 and Appendix A.

Oregon Department of Environmental Quality. 1982. *Final Report: Oregon On-Site Experimental Systems Program.*

Otis, R.J., W.C. Boyle, J.C. Converse, and E.J. Tyler. 1977. *On-Site Disposal of Small Wastewater Flows.* Environmental Protection Agency Technology Transfer. University of Wisconsin, Madison, Wisconsin.

Otis, Richard J. 1982. "Pressure Distribution Design for Septic Tank Systems." *J. Env. Eng. Div., ASCE.* 108(EE1):123–140.

U.S. Environmental Protection Agency. 1978. *Innovative and Alternative Technology Assessment Manual.* Program Operations (WH-547), Washington, D.C. EPA-430/9-78-009.

U.S. Environmental Protection Agency. 1978. *Management of Small Waste Flows.* Municipal Environmental Research Laboratory, Cincinnati, Ohio. EPA-600/2-78-173. NTIS No. PB 286560/AS.

U.S. Environmental Protection Agency. 1980. *Design Manual: On-Site Wastewater Treatment and Disposal Systems.* Office of Water Program Operations, Municipal Environmental Research Laboratory, Cincinnati, Ohio. EPA 625/1-80-012.

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Washington State Department of Social and Health Services, Office of Environmental Health Programs. Technical Review Committee Guidelines:

- *Guidelines for Alternating and Dosing Systems*, January 1985.
- *Guidelines for the Use of Pressure Distribution Systems*, September 1984.
- *Guidelines Governing the Use of Experimental On-Site Sewage Systems*, September 1984.
- *Interim Guidelines Governing the Design, Application, and Operation of Incineration Toilets*, July 1984.
- *Guidelines for the Use of Composting Toilets*, July 1984.
- *Guidelines Governing the Design, Application, and Operation of Aerobic Treatment Devices*, July 1984.

- *Interim Guidelines for Sand Filters*, October 1981.

- *Guidelines Governing the Design, Application, and Operation of Fill or Mound Systems*, May 1980.

  Contact: Washington State Department
  of Social and Health Services
  LD-11
  Olympia, Washington 98504

4.2.5 Educational Programs: For General Audiences

Agricultural Extension Service Offices are an excellent source of educational material for general audiences. Contact Extension personnel at their state offices.

The Health Departments of Acton, MA, and Fairfax County, VA, can provide information on the public education programs offered in conjunction with septic system management programs.

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Tennessee Valley Authority. *Groundwater: A Vital Resource. Student Activities.* Cedar Creek Learning Center. Knoxville, Tenn.

U.S. EPA Region V. *Introduction to Wastewater Management in Unsewered Communities: A Slide Presentation.* Environmental Impact Section, Chicago, Illinois, 60604.

U.S. EPA Region V. *Needs Documentation in Unsewered Communities: A Slide Presentation.* Environmental Impact Section, Chicago, Illinois, 60604.

U.S. EPA Region V. *Small Waste Flows Technologies: A Slide Presentation.* Environmental Impact Section, Chicago, Illinois, 60604.

U.S. EPA Region V. *Small Waste Flows Management: A Slide Presentation.* Environmental Impact Section, Chicago, Illinois, 60604.

U.S. EPA Region V. *Land Use Planning and Small Waste Flows: A Slide Presentation.* Environmental Impact Section, Chicago, Illinois, 60604.

U.S. Environmental Protection Agency. 1979. *Municipal Wastewater Management: Public Involvement Activities Guide.* Office of Water Program Operations, U.S. EPA

4.2.6 Educational Programs: For Technical Audiences

Agricultural Extension Service, University of Minnesota, and Minnesota Pollution Control Agency. 1986. *On-Site Sewage Treatment Manual.* Includes Workshop Agenda, codes, and comprehensive technical background and guidance. For copies and workshop registration, contact:

Office of Special Programs
Minnesota Pollution Control Agency
1935 West County Road B2
Roseville, MN 55113
612/625-2722

Wisconsin Department of Industry, Labor and Human Relations, Safety and Buildings Division. *Private Sewage*, Parts 1 and 2 and math volume; *Plumbing Inspector*, Parts 1 and 2. These training manuals may be obtained from:

Bureau of Plumbing
P.O. Box 7969
Madison, Wisconsin 53707

There is a $10.00 charge for each volume.

4.2.7 Promoting Water Conservation

Bauer, David H., E.T. Conrad, and Donald G. Sherman. 1981. *Evaluation of On-Site Treatment and Disposal Options.* Municipal Environmental Research Laboratory, Cincinnati, Ohio, EPA 600/52-81-178. NTIS No. PB 82-101635.

Hampton, Mark J., and Don D. Jones. 1985. "Water Conservation and Residential Wastewater Quality." in *Proceedings of the Fourth National Symposium on Individual and Small Community Sewage Systems.* American Society of Agricultural Engineers Publication 07-85, St. Joseph, Michigan.

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Siegrist, Robert L. 1977. "Waste Segregation to Facilitate Onsite Wastewater Disposal Alternatives" in *Home Sewage Treatment, Proceedings of the Second National Home Sewage Treatment Symposium.* American Society of Agricultural Engineers Publication 5-77, St. Joseph, Michigan.

U.S. Environmental Protection Agency. 1978. *Management of Small Waste Flows.* Municipal Environmental Research Laboratory, Cincinnati, Ohio. EPA-600/2-78-173. NTIS No. PB 286560/AS.

U.S. Environmental Protection Agency. 1983. *Wastewater Management in Rural Lake Areas: Final-Generic Environmental Impact Statement.* Region V, Waste Division, Chicago, Illinois.

4.2.8 Assuring Proper Operation and Maintenance

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Dix, Stephen P. 1986. *Case Studies of Innovative and Alternative Technologies for Sewage Collection and Treatment.* Case Study Number Four: Crystal Lakes Colorado. EPA National Small Flows Clearinghouse. Morgantown, West VA.

Gross, Mark, and David Thrasher. 1985. "Causes, Correction and Prevention of Septic Tank Soil Absorption System Malfunctions." in *Proceedings of the Fourth National Symposium on Individual and Small Community Sewage Systems.* American Society of Agricultural Engineers Publication 07-85, St. Joseph, Michigan.

Huang, Jerry Y.C. 1983. "Management of On-site Disposal Systems: Case Study." *J. Env. Eng., ASCE.* 109(4):845-858.

Koppelman, L.E., E. Tanenbaum, and C. Swick (eds.). 1984. *Non-Point Source Management Handbook.* Long Island Regional Planning Board, Hauppauge, New York. 22-139. 10/84.

Contact: Lee Koppelman
Long Island Regional Planning Board
H. Lee Dennison Executive Office Building
Veterans Memorial Highway
Hauppauge, NY 11788
(516) 360-5189

Lustig, Kenneth W., Larry M. Belmont, and David E. Burmaster. 1986. *A Case Study of Innovative Subsurface Sewage Management Over the Rathdrum Prairie Aquifer, Idaho,* prepared under contract for Regulatory Reform Staff (PM-223), U.S. Environmental Protection Agency, Washington, D.C.

Michigan State University Cooperative Extension Service. 1981. *Maintaining Your Septic System.* E-1521 File 28.2812.

Contact: Michigan State University Bulletin Office
Cooperative Extension Service
P.O. Box 6640
East Lansing, MI 48823-6640

Olivieri, Adam W., Robert J. Roche, and Griffith L. Johnson. 1981. "Guidelines for Control of Septic Tank Systems." *J. Env. Eng. Div., ASCE.* 107(EE5): 1025-1033.

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4.2.9 Controlling Septage Disposal

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Kolega, John, Bruce L. Morton, Warren Heizig, Brian Curtis, and Elizabeth A. Cunningham. 1982. "Groundwater Quality Studies at Connecticut Land Septage Disposal Facilities," in *Proceedings of the Third National Symposium on Individual and Small Community Sewage Treatment.* American Society of Agricultural Engineers Publication 01-82, St. Joseph, Michigan.

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Contact: Randy May
Water Compliance Unit
Department of Environmental Protection
165 Capitol Avenue
Hartford, CT 06106
(203) 566-7139

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Contact: Aldo Andreoli, Director of Environmental Health
Department of Health Services
Suffolk County
225 Rabro Drive East
Hauppauge, NY 11788

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Contact: Julie Shepard
Maine Municipal Association
Community Drive
Augusta, Maine 04330
Phone: (207) 623-8428

4.3 Other Information Sources

In addition to various publications and reports which provide information on septic systems, other groups, organizations, and institutions are able to provide useful information on septic systems and on ground-water quality in general.

Probably the best and most easily accessible sources of information are state agricultural extension services which are usually associated with state colleges and universities. State extension services are not only able to provide information on septic systems in general, but also information on area soil types, including their permeabilities, which is critical to the proper siting of septic systems.

The Small Flows Clearinghouse provides an up-to-date data base containing bibliographic citations to all types of literature on on-site disposal systems. Information which can be obtained ranges from how to site your septic system to what diseases can be caused by septic systems. Access to the data base can be obtained by contacting:

Small Flows Clearinghouse
258 Stewart Street
West Virginia University
Morgantown, West Virginia 26506
(308) 293-4191

The National Water Well Association (NWWA) is a major national organization devoted to the study and use of ground water. Among services available from NWWA are a computer data base with up-to-date state ground-water legislation and trade publications provided for well drillers and septic system installers. Contact the NWWA at:

National Water Well Association
6375 Riverside Drive
Dublin, Ohio 43017
(614) 761-1711

The American Society of Agricultural Engineers (ASAE) periodically sponsors national conferences on on-site sewage disposal. Proceedings have been published from these conferences which contain excellent papers on topics ranging from economic considerations when using septic systems to determining proper septic system loading rates. Contact ASAE at:

American Society of Agricultural Engineers
2950 Niles Road
St. Joseph, Michigan 49085
(616) 983-6521

The U.S. Environmental Protection Agency maintains libraries at its Washington, D.C., Headquarters and at Regional Offices. These libraries maintain various types of data and publications related to septic systems and ground water in general. Addresses and phone numbers of EPA libraries are listed below:

Water Engineering Research Laboratory
(formerly MERL)
Cincinnati, OH 45268
(513) 569-7703

Headquarters
401 M Street, S.W.
Washington, D.C. 20460
(202) 382-5922

Region I
JFK Federal Building
Room 2100-B
Boston, Massachusetts 02203
(617) 223-5791

Region II
26 Federal Plaza
New York, New York 10278
(212) 264-2881

Region III
Curtis Building
3PM24
6th and Walnut Streets
Philadelphia, Pennsylvania 19106
(215) 597-0580

Region IV
345 Courtland NE
Atlanta, Georgia 30365
(404) 347-4216

Region V
230 South Dearborn Street
Room 1420
Chicago, Illinois 60604
(312) 353-2022

Region VI
1201 Elm Street
First International Building
Dallas, Texas 75270
(214) 767-7341

Region VII
324 East 11th Street
Kansas City, Missouri 64106
(816) 374-3497

Region VIII
1860 Lincoln Street
Denver, Colorado 80295
(303) 327-2560

Region IX
215 Fremont Street
San Francisco, California 94105
(415) 454-8255

Region X
1200 Sixth Avenue
Seattle, Washington 98101
(206) 399-1289

APPENDIX A
GLOSSARY OF TECHNICAL TERMS

Adsorption – The adhesion of a compound (e.g., waste constituents, such as metals or synthetic organics) to the surface of a solid body (e.g., a soil particle).

Aeration – The process by which wastewater is exposed to air or by which air is caused to circulate through wastewater. Aeration may be passive (as when waste is exposed to air) or active (as when a mixing or bubbling device is used to introduce air).

Aerobic Treatment – Process by which microorganisms decompose complex organic compounds in the presence of oxygen and use the liberated energy for reproduction and growth. Process types include extended aeration, trickling filtration, and rotating biological contactors.

Alternating and Dosing System – An on-site disposal system that uses tanks, automatic siphons, pumps, or other mechanisms to control the passage of waste effluent from the septic tank to the drain field. The system allows for dose and rest cycles that improve waste assimilation in the drain field.

Alternative System – Any septic system design that modifies the conventional treatment and disposal pratices, which include a septic tank and a subsurface soil absorption field. Examples of alternative systems include mound systems and sand filtration.

Anaerobic Treatment – Process by which microorganisms decompose complex organic compounds in the absence of oxygen and use the liberated energy for reproduction and growth.

Aquifer – A geologic formation that contains sufficient saturated, permeable material to yield significant amounts of water to wells or springs.

Attenuation – The process by which a compound is reduced in concentration over time, through adsorption, degradation, dilution, and/or transformation.

Bacteria – Single-celled microorganisms that feed upon and consequently degrade organic matter in wastewater. Pathogenic bacteria are capable of causing diseases in humans or animals.

Biodegrade – To decompose as a result of the action of microorganisms.

Blackwater – Wastewater containing human body waste, apart from other waste sources from a household.

Closed-Loop Recycling – Reclaiming or reusing wastewater for non-potable purposes in an enclosed process.

Cluster System – A collection process in which wastes from numerous homes or other sources are conveyed to a central treatment and disposal facility. Systems generally consist of small collection pipes attached to individual homes that transfer the wastes to the central treatment facility.

Commercial Waste – Any waste that is generated and disposed by a commercial establishment such as a gas station, restaurant, or dry cleaner. These wastes often contain hazardous constituents which may require special treatment.

Composting Toilet - Any device that is designed to store and decompose human waste by aerobic digestion. These usually require special venting, plumbing, electrical, and mechanical components, and regular, periodic maintenance.

Conventional System - On-site waste disposal system that uses septic tanks for treatment and subsurface soil absorption for final disposal.

Domestic Waste - Waste that is generated by a residence. These wastes generally consist of human wastes and wastewater from washing machines, toilets, showers, and dishwashers.

Effluent - Treated wastewater that flows from a septic system or any other treatment process.

Evapotranspiration System - An on-site treatment system in which waste flow from a septic tank or other device is disposed of through evaporation from the soil surface or transpiration from plants. This process is most useful in areas with year-round high evaporation rates which exceed rainfall rates.

Experimental System - An on-site waste disposal system that does not rely on conventional septic system design concepts and has not been tested, installed, and operated by a significant number of users. These systems use new, largely untried designs.

Filtration - The physical removal of suspended particles from effluent by soil or sand particles.

gpd - Gallons per day. A measure of water or effluent flow rate.

Geology - The structure of the earth in a given region or area, including soil, rocks, and water.

Greywater - Wastewater generated by fixtures such as washing machines, dishwashers, and showers. Greywater does not contain any significant amount of human waste (as differentiated from blackwater).

Ground Water - Water found in cracks, fissures, and pore spaces in the subsurface below the water table.

Ground-Water Recharge - Water which flows from the surface, through soil, and into the subsurface saturated zone to replenish ground-water sources.

Hydraulic Conductivity - The ability of soil to transmit liquids through pore spaces in a specified direction, e.g., horizontally or vertically.

Hydraulic Potential - Also called hydraulic capacity or long-term acceptance rate. The ability of a soil to accept and dispose of a volume of waste effluent over time. It is used as a measure of the proper size for a soil absorption field.

Hydrogeologic Characteristics - Characteristics that describe the hydrology (the distribution of water on the surface and below the ground) and the geology (the structure and content of the earth) at a site. Hydrogeologic characteristics include soil type, depth to ground water, soil permeability, and ground-water recharge rate. These properties control the entrance of water to the subsurface and the capacity to hold, transmit, and deliver water.

Hydrology - Surface- and ground- water conditions at a site.

Homogeneous hydrogeology - Condition in which hydrogeologic characteristics are relatively continuous over an area or region.

I&A – "Innovative and Alternative" on-site disposal systems; see "Alternative System."

Industrial Wastes – Any waste that results from manufacturing or other industrial processes. These wastes often contain hazardous chemicals which require special treatment processes.

Innovative System – See "Experimental System."

Licensed Professional Engineer – An engineer who has been certified or approved by a state or local authority.

Lineament Analysis – An analytical technique that uses aerial photographs to detect linear features in the landscape that are indicative of solution zones in karst terrain.

Long-term Acceptance Rate – See "Hydraulic Potential."

Monitoring Well – Wells used to collect ground-water samples for the purpose of physical, chemical, or biological analysis. They are generally installed where ground-water contamination exists or has a potential to exist.

Mound System – Also called a fill system. An alternative system design in which fill material, generally sand, is laid on top of plowed soils that are unsuitable for waste treatment. These systems are generally used where there is an inadequate thickness of acceptable soil to support a conventional soil absorption system. The soil absorption system is placed within the fill material.

Nitrate (NO_3) – The most oxidized form of inorganic nitrogen and a contaminant commonly associated with septic systems. High concentrations of nitrate and nitrite (NO_2) in drinking water are known to cause methemoglobinemia (a poisoning similar to that caused by cyanide) in infants.

Non-Functional Water Use – Excessive water use that is a result of malfunctioning or poorly maintained plumbing, high water pressure, or wasteful water-use habits.

Pathogens – Microorganisms potentially harmful to humans or animals, including parasites, bacteria, and viruses.

Perched Water-Table – A discontinuous, saturated area of soil which exists in the unsaturated zone (above the normal water table) as a result of a low permeability layer. Often occurs after heavy rain.

Percolation – The movement of water downward and radially through the interstitial spaces (or pores) between the particles in soil.

Percolation Test – A test used to estimate the percolation rates of water through soils. It is required by many states in conjunction with other measurements of site suitability when installing septic systems.

Performance Standard – A standard is used to judge whether predetermined requirements have been met, such as the necessary level of treatment for a waste stream, after the completion or initiation of operation. Performance standards generally are in the form of a pre-determined level or concentration of a particular compound or constituent that is allowed in a waste effluent.

Permeability – The rate at which liquids pass through soil in a specified direction.

Physical and Chemical Treatment – Processes generally used in large-scale wastewater treatment facilities. Physical processes may involve air-stripping or filtration. Chemical treatment includes coagulation, chlorination, or ozone addition.

Ponding – The accumulation of septic tank discharge in soil absorption drainfields (See "Surfacing").

Pressure Distribution – A system that uses a pump and special piping to evenly distribute waste flow from a septic tank over a drain field. The system can improve upon gravity flow by distributing the effluent over a wider area and by permitting resting cycles.

Rotating Biological Contactor – A device used in an aerobic process which encourages the growth of organisms that aerobically decompose wastes. The organisms are grown on surfaces of the contactors, often constructed as large disks, which are rotated to come in contact with the waste flow and with air. The process seeks to optimize organism growth by exposing them to an ideal combination of wastes and oxygen.

Sand Filters – A biological and physical treatment process consisting of a bed of sand to which pretreated waste from the septic tank is discharged. Liquid passing through the filter may be discharged to a soil absorption system or to surface water (after disinfection).

Saturated Zone – The area below the water table where the soil pores are fully saturated with water.

Scum – A layer of light solids (such as hair, grease, and soap) which accumulates at the surface of the wastewater in a septic tank.

Septage – An anaerobic slurry of solid wastes, including the scum, sludge, and liquid contents of a septic tank at the time of pumping. The septage must be periodically pumped from the septic tank. Also called scavenger waste or septic tank pumpings.

Septic System – An on-site waste disposal system. Septic systems are constructed using conventional, alternative, or experimental system designs.

Septic Tank – A treatment receptacle that receives wastewater and is designed and constructed to separate the liquid and solids in the waste. In addition, organisms in the tank anaerobically treat and digest organic matter prior to discharge, generally to a subsurface disposal system.

Sludge – A layer of heavy solids that settles from septic tank influent or raw wastes to the bottom of the septic tank.

Soil Absorption System – A system consisting of trenches (although beds and pits have been historically used as well), together with piping or gravel, installed in appropriate soils for the purpose of receiving waste flow from a septic tank or other treatment device and transmitting it into soil for final treatment and disposal.

Soil Borings – Soil samples taken where the septic tank or soil absorption system is to be located. Samples may be tested for various soil characteristics (see below).

Soil Characteristics – Relevant properties of soil, including its clay content, texture, particle size, classification, structure, permeability, and other relevant properties.

Soil Texture – A relative description of the soil in terms of various soil components, including sands, silts, and clays, that make up the soil layers at a site. Soil textural analysis can be used to determine a soil's ability to treat and dispose of septic tank effluent and in sizing the soil absorption system.

Sole-Source Aquifer – A ground-water aquifer which is the sole or principal drinking water source for an area and which, if contaminated, would create a significant hazard to public health.

Sorption - Process by which suspended and colloidal particles in waste effluent become attached to soil particles. In general, soils high in clay or organic content have high sorptive capacities.

Surfacing - Excess ponding resulting in introduction of partially treated effluent to the soil surface above a soil absorption system. There is potential for disease transmission through contact with the surfaced effluent (See "Ponding").

Synthetic Organic Chemicals - Man-made organic chemicals often found in industrial and, to a lesser extent, domestic wastes. These chemicals include pesticides and solvents. Many chemicals are dangerous to human health and may require special treatment methods.

Topography - The general shape of the ground surface at a site (i.e., hilly, rolling, level).

Trickling Filter - A filter used in wastewater treatment that consists of an artificial bed of coarse material, usually broken stone or slate. Wastewater is applied evenly to the bed as droplets, film, or spray, and trickles through the bed to underdrains. As the waste trickles through the filter, the bacterial slime that coats the bed material biodegrades the organic material in the wastewater.

Unsaturated Zone - The area above the water table where the soil pores are not fully saturated, although some water may be present. Also called the vadose zone.

Water Table - The dividing line between the soil's saturated and unsaturated zones.

Waterless Toilets - Any one of a number of types of toilets that do not use water, including composting toilets.

APPENDIX B
REPRESENTATIVE REGULATORY LANGUAGE

1) State of Minnesota Pollution Control Agency, 6 MCAR 4.8040, Section D.

   - guidelines for site evaluations.

2) State of Washington, Rules and Regulations of the State Board of Health: On-Site Sewage Disposal Systems, Chapter 248-96 WAC-080, -090, and -094.

   - rules for permit review, land area requirements, and site characteristic evaluation

3) State of Maine, Subsurface Wastewater Disposal Rules, 10-144A CMR 241, Section 3.

   - rules for permit application, evaluation, and issuance.

4) State of Maryland, Department of Health and Mental Hygiene, 10.17.02 Sewage Disposal Systems for Homes and Other Establishments in the Counties of Maryland where a Public Sewage System is not Available, Section C.

   - standards for conventional on-site sewage disposal

   - provisions for county ground-water protection reports

5) State of Washington, Rules and Regulations of the State Board of Health: On-Site Sewage Disposal Systems, Chapter 248-96 WAC-046 and -047.

   - rules and guidelines for designing alternative and experimental septic systems.

6) State of Minnesota Pollution Control Agency, 6 MCAR §4.8040, Appendix A.

   - standards for design, location, installation, use, and maintenance of alternative sewage treatment systems.

7) State of Idaho Department of Health and Welfare, Regulations for Individual Subsurface Sewage Disposal Systems, Title I, Chapter 15.

   - regulations governing the cleaning of septic tanks.

8) State of Connecticut Public Health Code, Section 19-13-B103d, e, and f.

   - septic tank maintenance and sludge disposal guidelines.

9) Commonwealth of Massachusetts, Division of Water Pollution Control, 314 CMR 5.0 and 6.0

   - ground-water discharge permit program.

   - ground-water quality standards.

10) Suffolk County, NY, Sanitary Code, Article 7, Sections 703P, 705, and 706.

- restrictions on the disposal of toxic or hazardous substances.
- protection of sensitive ground-water recharge areas.

11) State of Oregon Department of Environmental Quality, Oregon Administrative Rules, Chapter 340, Division 71-520.

- rules for the design and construction of large septic systems.

12) Nassau County, NY Department of Health, Manual of On-Site Sewage Disposal, Section 4.

- specific requirements for commercial, industrial, and food service establishments.

13) State of Illinois, P.A. 80-1371, Section 1401-1404.

- statutory authority for creation of municipal wastewater disposal zones.

14) Idaho Panhandle Health District I, Board of Health, Sewage Management Agreement with Dalton Gardens, Idaho.

- negotiated contract to implement regulations through comprehensive management plan tailored to community needs.

15) Marion County, Indiana, Private Sewage Disposal Ordinance, Chapter 14, Articles 11 and 12.

- powers for inspections, enforcement, service of notices and orders, and hearings
- appeal procedures.

D. Site evaluation.

1. All proposed sites for individual sewage treatment systems shall be evaluated as to:

a. Depth to the highest known or calculated ground water table or bedrock;

b. Soil conditions, properties and permeability;

c. Slope;

d. The existence of lowlands, local surface depressions, and rock outcrops;

e. All legal setback requirements from: existing and proposed buildings; property lines; sewage tanks; soil treatment systems; water supply wells; buried water pipes and utility lines; the ordinary high water mark of lakes, rivers, streams, flowages; and the location of all soil treatment systems and water supply wells on adjoining lots within 150 feet of the proposed soil treatment system, sewage tank and water supply well;

f. Surface water flooding probability.

2. A preliminary evaluation shall be made of publicly available, existing data. If this evaluation, in the opinion of the permitting authority, yields enough information that the site is suitable, approval may be given for the installation of a standard system as specified in section H. 2. If a preliminary evaluation does not produce sufficient information, a field evaluation shall be made to determine the necessary information as specified in section D. 1.

3. Procedures for soil borings and percolation tests.

a. Soil borings. Where soil borings are required, they shall be made as follows:

(1) Each boring or excavation shall be made to a depth at least three feet deeper than the bottom of the proposed system or until bedrock or a water table is encountered, whichever is less.

(2) A soil texture description shall be recorded by depth and notations made where texture changes occur.

(3) Particular effort shall be made to determine the highest known water table by recording the first occurrence of mottling observed in the hole, or if mottling is not encountered, the open holes in clay or loam soils shall be observed after standing undisturbed a minimum of 16 hours, and depth to standing water, if present, shall be measured.

b. Percolation tests. Where percolation tests are required, they shall be made as follows:

(1) Test hole dimensions and locations:

(a) Each test hole shall be six to eight inches in diameter, have vertical sides, and be bored or dug to the depth of the bottom of the proposed individual sewage treatment system.

(b) Soil texture descriptions shall be recorded noting depths where texture changes occur.

(2) Preparation of the test hole:

(a) The bottom and sides of the hole shall be carefully scratched to remove any smearing and to provide a natural soil surface into which water may penetrate.

(b) All loose material shall be removed from the bottom of the test hole and two inches of one-fourth to three-fourths inch gravel shall be added to protect the bottom from scouring.

(3) Soil saturation and swelling:

(a) The hole shall be carefully filled with clear water to a minimum depth of 12 inches over the soil at the bottom of the test hole and maintained for no less than four hours.

(b) The soil shall then be allowed to swell for at least 16, but no more than 30 hours. In sandy soils, the saturation and swelling procedure shall not be required and the test may proceed if one filling of the hole has seeped away in less than ten minutes.

(4) Percolation rate measurement:

(a) In sandy soils adjust the water depth to eight inches over the soil at the bottom of the test hole. From a fixed reference point, the drop in water level shall be measured in inches to the nearest one-eighth inch at approximately ten minute intervals. A measurement can also be made by determining the time it takes for the water level to drop one inch from an eight-inch reference point. If eight inches of water seeps away in less than ten minutes, a shorter interval between measurements shall be used, but in no case shall the water depth exceed eight inches. The test shall continue until three consecutive percolation rate measurements vary by a range of no more than ten percent.

(b) In other soils, adjust the water depth to eight inches over the soil at the bottom of the test hole. From a fixed reference point, the drop in water level shall be measured in inches to the nearest one-eighth inch at approximately 30 minute intervals, refilling between measurements to maintain an eight-inch starting head. The test shall continue until three consecutive percolation rate measurements vary by a range of no more than ten percent. The percolation rate can also be made by observing the time it takes the water level to drop one inch from an eight-inch reference point if a constant water depth of at least eight inches has been maintained for at least four hours prior to the measurement.

(5) Calculating the percolation rate:

(a) Divide the time interval by the drop in water level to obtain the percolation rate in minutes per inch.

(b) Percolation rates determined for each test hole shall be averaged to determine the final soil treatment system design.

(6) For reporting the percolation rate, worksheets showing all calculations and measurements shall be submitted.

(7) A percolation test shall not be run where frost exists below the depth of the proposed soil treatment system.

E. Building sewers. The design, construction, and location of, and the materials for use in building sewers are presently governed by the Minnesota Building Code which, in Minn. Reg. SBC 8701, incorporates by reference the Minnesota Plumbing Code, Minn. Reg. MHD 120-135, and by specific provisions of the Minnesota Water Well Construction Code, Minn. Reg. MHD 217 (c)(1)(dd), (ee) and (ff). Relevant portions of the Minnesota Plumbing Code, as of the date of enactment of this rule, are reproduced in Appendix C. Minn. Reg. MHD 217(c)(1)(dd), (ee) and (ff), as of the date of enactment of this rule, is reproduced in Appendix D.

F. Sewage tanks.

1. General.

a. All tanks, regardless of material or method of construction shall be:

(1) Watertight.

(2) So designed and constructed as to withstand all lateral earth pressures under saturated soil conditions with the tank empty.

(3) So designed and constructed as to withstand a minimum of seven feet of saturated earth cover above the tank top.

(4) Not subject to excessive corrosion or decay.

b. Any tank not having an integrally cast bottom shall not be installed when the water table is closer than three inches to the bottom of the excavation at the time of construction.

248-96-080 Permit.

(1) No person shall install or cause to be installed a new on-site sewage system, nor perform any alterations, extensions or relocations or connections to an existing system without a valid permit issued by the health officer. Larger on-site sewage systems approved by the department are exempt from permit requirements. Permits for alterations or repairs shall be so identified. Application for such permit shall be made in writing in a manner prescribed by the health officer. Each permit application shall include a reminder of

the applicant's right of appeal. The authority to issue permits shall not be delegated by the health officer.

(2) When applying for a permit to install an on-site sewage system, a construction plan of the proposed system is required. The construction plan shall contain information as required by the health officer in sufficient detail and to a scale which will permit a proper evaluation of the application. Such information shall contain the following as a minimum:
   (a) Name of applicant and legal description of site.
   (b) Soil evaluation as required by the health officer.
   (c) Percolation test data where required or if obtained.
   (d) Maximum seasonal ground water table.
   (e) General topography of the site and site drainage characteristics.
   (f) Distances of proposed system to water supply distribution lines and sources, surface water, banks or cuts, boundaries of property and structures or other improvements.
   (g) Distance to public sewer system.
   (h) Source of potable water supply.
   (i) Known encumbrances affecting system placement and/or operation.

(3) For any on-site sewage system proposed to serve a structure requiring a flood control zone permit under the provisions of chapter 86.16 RCW and chapter 508-60 WAC, the installation permit shall not be issued until a flood control zone permit has been issued. [Statutory Authority: RCW 43.20.050. 83-13-014 (Order 259), § 248-96-080, filed 6/3/83. Statutory Authority: RCW 43.20.050. 80-04-038 (Order 196), § 248-96-080, filed 3/20/80; Order 101, § 248-96-080, filed 6/10/74.]

248-96-090 Minimum land area requirement.

(1) For any development approved after June 30, 1984, including but not limited to subdivisions, mobile home parks, multifamily housing, and commercial establishments, where an on-site sewage system is proposed, one of the following methods for determining minimum gross land area requirements shall be used. The minimum gross land area shall exist for each unit volume of sewage (450 gallons per day) or for each single family residence.

(a) METHOD I. Table I notes the minimum gross land area required per unit volume or single family residence based upon soil type and the type of water supply.

TABLE I
MINIMUM GROSS LAND AREA REQUIRED PER UNIT VOLUME OF SEWAGE OR SINGLE FAMILY RESIDENCE

TYPE OF WATER SUPPLY	SOIL TYPE[1] 1	2	3	4	5	6
Public	1 acre	12,500 sq.ft.	15,000 sq.ft.	18,000 sq.ft.	20,000 sq.ft.	22,000 sq.ft.
Individual—Each Lot	2 acres	1 acre	1 acre	1 acre	2 acres	2 acres

Soil types are defined in WAC 248-96-094 (Determination of site characteristics).

(b) METHOD II.
(i) On-site sewage systems shall be installed on lots, parcels, or tracts that have a sufficient amount of area with proper soils in which sewage can be retained and treated properly on-site. Justification demonstrating the development has sufficient area with proper soils to adequately retain and treat sewage on-site shall be provided in a report. The report shall fully support the conclusions reached by the proper analysis of all needed data. All such data shall be contained or referenced. This justification shall be sufficient to enable the health officer to establish minimum gross land area requirements. The minimum gross land area requirement for each unit volume of sewage or for each single family residence shall be twelve thousand five hundred square feet. Application of this will result in a maximum single family residence density of 3.5 units per acre or for other development a maximum flow density of one thousand five hundred seventy gallons of sewage per acre per day. Factors that must be considered in the report shall include but not be limited to the following:
(A) Soil type and depth.
(B) Area drainage, development and/or lot drainage.

(C) Public health impact on ground and surface water quality.
(D) Setbacks from property lines, water supplies, etc.
(E) Source of domestic water.
(F) Topography, geology, and ground cover.
(G) Climatic conditions.
(H) Availability of public sewers.
(I) Activity or land use, present, and anticipated.
(J) Growth patterns.
(K) Reserve areas for additional subsurface disposal.
(L) Anticipated sewage volume.
(M) Compliance with zoning and other requirements.
(N) Possible use of alternative systems or designs.
(O) Other justification submitted by the developer.

(ii) If the report required in section (1)(b)(i) of this subsection identifies type 1 soils, the health officer may allow a reduction below the requirements noted in Table 1. The health officers and the department shall develop guidelines to be applied when such reductions are considered by July 1, 1984. Until guidelines have been developed, the health officer may permit such reductions only when an alternative system will be used. The alternative system shall provide a degree of treatment to the sewage, before the sewage enters the original, undisturbed soil, equal to or greater than the treatment provided by a mound or sand filter. Mounds and sand filters are defined and the design criteria specified in the appropriate technical review committee guidelines. Until the guidelines have been developed, the resulting gross land area per unit volume of sewage or single family residence shall not be less than one-half acre.

(2) The health officer may reduce land area requirements in this section if the proposed on-site sewage systems are to be located within the boundaries of a recognized sewer utility and where the assessment roll has been finalized. [Statutory Authority: RCW 43.20-.050. 83-13-014 (Order 259), § 248-96-090, filed 6/3/83; Order 101, § 248-96-090, filed 6/10/74.]

248-96-094 Determination of site characteristics.

(1) Site characteristics shall be determined in accordance with chapter 3 and Appendix A of Design Manual: On-site Wastewater Treatment and Disposal Systems, United States Environmental Protection Agency, Report No. EPA-625/1-80-012, October, 1980, except where modified or in conflict with these regulations.

(2) The textural classification of a soil shall be determined by using normal laboratory and/or field procedures such as particle size analyses and percolation tests. Following are the specific soil textural classifications and soil type designations. The soil textures in Table 7-2 of the design manual referenced in subsection (1) of this section are amended as follows:

Soil Type	Soil Textural Classifications[1]
1[2]	Coarse sands or coarser
2	Medium sand
3	Fine sand, loamy sand
4	Sandy loam, loam
5	Porous, well-developed structure in silt and silt loams
6	Other silt loams, silty clay loams, and clay loams.

[1] According to the United States Department of Agriculture, soil conservation service's soil classification system.
[2] Includes other soils and/or conditions where the treatment potential is ineffective in retaining and/or removing substances of public health significance to underground sources of drinking water.

(3) All site evaluations shall be performed by or under the direct supervision of the health officer, a registered sanitarian, professional engineer, registered soil scientist (American registry of certified professionals in agronomy, crops and soils), or certified designer having knowledge and experience in the areas of soil and wastewater treatment and disposal.

(4) All soil tests shall be conducted using uniform procedures and terminology as set forth in chapter 3 and Appendix A of the manual referred to in WAC 248-96-094(1).

(5) If sufficient information is not available concerning water table conditions, the health officer or department may require that the soils analysis be performed during the months of suspected high-water table conditions. [Statutory Authority: RCW 43.20.050. 83-13-014 (Order 259), § 248-96-094, filed 6/3/83.]

248-96-095 Subdivision and individual site review.

(1) Subdivisions - preliminary tests for subdivisions utilizing individual on-site sewage systems shall include at least one representative soil log per acre or tract or more as required by the health officer. A reduced number of soil logs may be allowed if adequate soils information is available.

(2) Individual sites - at least one soil log shall be performed at the site of each disposal area. This requirement may be waived by the health officer if adequate soils information is available. Additional soil logs may be required where the soil characteristics vary.

3. PERMIT FOR SYSTEM

A. Permit Required.

A permit shall be required prior to construction/installation of a system or those components of a system listed in Table 3-1.

B. Permit Not Required.

A permit shall not be required for the maintenance of a pump, siphon or accessory equipment, the clearance of a stoppage, or the sealing of a leak in a treatment tank, building sewer or effluent line.

C. Application for Permit Required.

An Application shall be completed by a Site Evaluator, except as otherwise authorized in Section 6.E.

D. Application for Permit Not Required.

An Application is not required for a replacement treatment tank or the installation of an alternative toilet with the exception of a pit privy.

E. Issuance of Permit.

The LPI shall issue a permit if it has been determined that the system is in compliance with the Rules, and has received payment of the required permit fee.

F. Permit Fee.

Permit fees for the construction of systems are listed in Table 3-1.

TABLE 3-1 PERMIT FEE SCHEDULE	
Complete Systems	
Non-engineered System	$ 40.00
Primitive Disposal System	$ 40.00
Engineered System.	$ 150.00
System Components [installed separately]	
Treatment Tank.	$ 20.00
Holding Tank.	$ 40.00
Alternative Toilet.	$ 20.00
Disposal Area	$ 30.00
Engineered Disposal Area.	$ 80.00
Separated Laundry Disposal System	$ 20.00
Other	
Seasonal Conversion Permit.	$ 20.00

G. Late Permit Fee.

A person who starts construction without first obtaining a permit shall pay double the permit fee indicated in Table 3-1.

H. Restrictions.

[1] A permit is valid only for the named applicant and is non-transferrable.

[2] A permit shall become void if construction has not been started within six [6] months from the date of issue.

[3] The issuance of a permit shall not be construed to give authority to violate the provisions of the Rules and shall not prevent the LPI from requiring a correction of an error in the Application or from stopping construction when it is in violation of the Rules.

I. Denial and Revocation of Permit.

[1] A request for a permit shall be denied, or a previously issued permit shall be revoked by the LPI when one or more of the following conditions exist:

[a] The proposed system is in noncompliance with the Rules.

[b] The Application has not been properly completed.

[c] The Application is unclear.

[d] The site fails to meet the requirements of:

[i] Minimum Lot Size Law [12 MRSA §4807]

[ii] Local Mandatory Shoreland Zoning wastewater disposal requirements.

[iii] Land Use Regulation Commission building permit requirements [12 MRSA § 685], where applicable.

[2] The reasons for denial or revocation of a permit shall be indicated on the Application and forwarded to the property owner or applicant.

J. Records.

All completed Applications, Permits, Certificates of Approval, Variances and other applicable records shall be sent to the Department by the Municipality. The Municipality shall retain copies for their record and the LPI shall furnish a copy to the applicant.

K. Connection to private/public system.

[1] When a Plumbing permit has been obtained to connect an existing building or existing work to a new disposal facility, back filling of wastewater disposal facilities abandoned subsequent to such connection is included in the Permit. 6-1-82

State of Maryland, Department of Health and Mental Hygiene, 10.17.02 Sewage Disposal Systems ..., Section C.

C. Conventional On-Site Sewage Disposal Systems

(1) Conventional on-site sewage disposal systems may not be approved where there is less than 4 feet unsaturated, unconsolidated material sufficient to attenuate effluent below the bottom of the on-site sewage disposal system.

(2) In the coastal plain province where 4 feet of unsaturated, unconsolidated material sufficient to attenuate effluent below the bottom of the on-site sewage disposal system is not available, the Approving Authority may identify areas where on-site sewage disposal systems using less than 4 feet of unsaturated soil may be allowed, if:

(a) The aquifer had been designated as Type III (other than Type I or Type II), pursuant to COMAR 10.50.01; or

(b) The aquifer has limited potential to serve as a drinking water source. These aquifers shall meet one or more of the following conditions:

(i) Insufficient potable water to serve as a year-round supply due to seasonally fluctuating water tables.

(ii) Interconnection with tidewater such that if pumped for water supply, brackish water or saltwater intrusion into the aquifer has or would occur.

(iii) Evidence the aquifer has already been polluted by, or is in imminent danger of being polluted by, activities in the area.

(3) The following conditions are required for all areas in which aquifers have been designated, pursuant to Subsection C(1) or C(2), for installation of on-site sewage disposal systems using less than 4 feet of unsaturated soil below the bottom of the sewage disposal field or pit:

(a) These areas shall be delineated in a ground water protection report prepared by the County Government or their representative and approved by the county health department and the report shall be included in the appropriate county water and sewer plan and approved by the Office of Environmental Programs of the Department of Health and Mental Hygiene. The report shall set density, design, and construction requirements to minimize degradation of aquifers designated for discharge. The report will be submitted to the Office of Environmental Programs within six months of the effective date of this regulation. Requests for disposal systems using less than 4 feet of unsaturated soil will not be approved until the County's report is submitted and approved by OEP. Until the reports are approved, the Approving Authority may issue permits for on-site disposal systems using less than 4 feet unsaturated soil for lots in Talbot, Dorchester, Wicomico, Worcester and Somerset which were previously approved by the Approving Authority and meet all other requirements of this regulation.

(b) A quantitatively and qualitatively superior potable water supply is available from one or more deeper confined aquifers which are separated from the disposal aquifer by a confining aquiclude.

(c) Steps are taken by the county health department to ensure that the aquifer designated for waste disposal is not currently and will not be used for a potable water supply.

(d) Discharge to a surficial aquifer will not contaminate a deeper aquifer of Type I or II, pursuant to COMAR 10.50.01, or any aquifer used for water supply.

(e) Water supply wells tapping confined aquifers beneath the disposal aquifer shall be grouted through the disposal aquifer.

(f) The on-site sewage disposal system and recovery area is located 100 feet from any well in a confined aquifer.

(g) Unimproved lots served by these on-site sewage disposal systems shall be not less than 2 acres in size.

248-96-046 Alternative systems.

(1) The health officer may issue permits for alternative systems only after the requirements of subsections (2) and (3) of this section have been completed.

(2) The department shall establish and maintain a technical review committee. The committee shall be composed of a maximum of seven members and consist of qualified representatives. Representatives may be selected from local health departments; consumer organizations; engineering firms; the department of ecology; a public sewer utility; land sales, subdivision and building industries; and other interested organizations. The functions of the committee are to review and evaluate alternative systems and establish guidelines for use. Such guidelines may include national standards including, but not limited to, guidelines of the national sanitation foundation.

(3) Once guidelines for an alternative system have been established by the technical review committee, that system can be permitted for use. However, before a proprietary device or method can be permitted, certification in a manner prescribed by the department must be provided to the department that all criteria in the appropriate guidelines have been satisfied.

(4) The health officer shall require monitoring of the performance of any alternative system installed for which guidelines have been developed. The frequency and duration of monitoring shall be in accordance with guidelines developed by the technical review committee. Costs for monitoring and/or reporting may be included as an addition to the permit fee. Procedures for monitoring and reporting shall be developed by the technical review committee. Copies of any records of such performance evaluation shall be submitted to the department. [Statutory Authority: RCW 43.20.050. 83-13-014 (Order 259), § 248-96-046, filed 6/3/83; Order 101, § 248-96-046, filed 6/10/74.]

248-96-047 Experimental systems.

(1) If supportive theory and/or applied research exists, a limited number of specific experimental systems may be permitted. Prior to the installation of such a system, an experimental system permit shall be obtained from the local health officer. Costs for monitoring and reporting may be included as part of the experimental system permit fee.

(2) The use of an experimental system may be considered when:

   (a) The experimental system proposed is attempting to correct a failing system and other conventional or alternative systems are not feasible.

   (b) The experimental system proposed is for new construction where it has been determined that an on-site sewage system meeting the requirements of these rules and regulations could be installed in the event of failure of the experiment. A recorded agreement shall exist stating that, in the event of unsatisfactory performance or a failure to adequately monitor the system and submit the records to the health officer, the health officer may direct that use of the experimental system be discontinued and a new system meeting the requirements of these regulations be installed.

(3) General guidelines for the use of experimental systems shall be developed by the technical review committee.

(4) The health officer shall require monitoring of the performance of experimental systems in a manner and with a frequency as established by the technical review committee guideline. [Statutory Authority: RCW 43.20.050. 83-13-014 (Order 259), § 248-96-047, filed 6/3/83; 248-96-047, filed 6/3/83.]

Appendix A
Alternative Systems

A. General. The intent of this appendix is to provide standards for the design, location, installation, use and maintenance of alternative sewage treatment systems in areas of limiting soil characteristics, or where a standard system cannot be installed or is not the most suitable treatment. Where such systems are employed, they shall comply with all local codes and ordinances, and be subject to timely inspections to assure adherance to specifications.

B. Adoption and use.

1. Where 6 MCAR § 4.8040 is administered by a local unit of government, those local units of government may adopt this appendix, in whose or in part, as part of a local code or ordinance. Nothin in 6 MCAR § 4.8040 or this appendix, however, shall require the adoption of any part of this appendix as a local ordinance or code. Further, nothing in 6 MCAR § 4.8040 or this appendix shall require local units of government to allow the installation of any system in this appendix.

2. This appendix defines the minimum requirements for alternative systems serving establishments or facilities licensed or otherwise regulated by the State of Minnesota or this Agency pursuant to section C. 1. a.

C. Class I alternatives–modified standard systems.

1. Extreme caution and careful planning shall be employed wherever limiting characteristics including, but not limited to water table or bedrock, exist within two feet of the original ground surface.

2. Fluctuating ground water.

a. Where natural drainage will not provide three feet of separation between the bottom of the soil treatment area and the highest known or calculated level of the water table, agricultural drain tile may be used to intercept or lower the seasonal high water table, except within shorelands of public waters. There shall be at least ten feet of undisturbed soil between the sidewall of the soil treatment unit and the agricultural drain tile.

b. Within shorelands of public waters, agricultural drain tile may be used to intercept the seasonal high water table provided the ground water table has a slope of at least two feet per hundred feet toward the public water and provided the drain tile are installed upslope of the soil treatment system. There shall be at least 20 feet of undisturbed soil between the sidewall of the soil treatment unit and the agricultural drain tile.

c. In all cases the greatest practicable vertical separation distance from the water table shall be provided.

3. Bedrock proximity. In no case shall filter material of the soil treatment system be placed closer than three feet to creviced bedrock or to consolidated permeable bedrock. When all horizons of the original soil profile have percolation rates slower than 60 minutes per inch, filter material of the soil treatment system shall be placed no closer than seven feet to consolidated impermeable bedrock. A maximum depth of 24 inches of sand may be used under the filter material. Where additional fill is required to achieve the required separation distance, a soil having a percolation rate between five and 45 minutes per inch (loamy sand to silt loam) 12 months after placement shall be used. If it is not possible to allow the soil to settle for 12 months after placement, mechanical methods may be used to settle the fill to within ten percent of its "in situ" density.

4. Slowly permeable soils.

a. In no case shall excavation for the purpose of constructing a soil treatment system be made in any soil layer having a percolation rate slower than 120 minutes per inch.

b. In no case shall excavation for the purpose of constructing a soil treatment system be made in a soil layer having a percolation rate slower than 60 minutes per inch unless the moisture content is lower than the plastic limit of the soil.

c. In no case shall filter material be placed in contact with original soil having a percolation rate slower than 60 minutes per inch.

d. Where the percolation rate of the original soil is slower than 60 minutes per inch, at least six inches but no more than 12 inches of fill material having a percolation rate of between five and 30 minutes per inch (loamy sands and loams) after placement shall be placed between the filter material and the original soil along the excavation bottom and sidewalls.

e. In no case shall construction equipment, wheels or tracks be placed in contact with the bottom of the excavation during the construction of a soil treatment system in soils having a percolation rate slower than 15 minutes per inch.

f. The size of soil treatment system shall be based on the required treatment area for a soil having a percolation rate of 60 minutes per inch as specified in Table III set forth in section H. 2. a. (4).

5. Rapidly permeable soils.

a. Filter material for a soil treatment unit shall not be placed in contact with original soil having a percolation rate faster than one-tenth minute per inch.

b. For coarse soils having a percolation rate faster than one-tenth minute per inch, at least six inches of sandy loam textured soil having a percolation rate between five and 15 minutes per inch after placement (loamy sand to sandy loam) shall be placed between the filter material and the coarse soil along the excavation bottom and sidewalls.

c. For soils with percolation rates between one-tenth and five minutes per inch at least one of the following treatment techniques shall be used:

(1) Provide at least six inches of sandy loam textured soil with a percolation rate between five and 15 minutes per inch after placement between the filter material and the coarse soil.

(2) Distribution of sewage tank effluent by pressure flow over the treatment area as specified in section G. 1. b.

(3) Divide the total soil treatment area into at least four equal parts connected serially.

6. Flood plain areas.

a. The soil treatment area shall be a trench system with at least 12 inches of filter material below the distribution pipe. There shall be no pipe or other installed opening between the filter material and the soil surface.

b. The trench system shall be located on the highest feasible area of the lot and shall have location preference over all other improvements except the water supply well. The bottom of the trench shall be at least as high as the elevation of the ten year flood. The sewage tank may be located so as to provide gravity flow to the soil treatment area.

c. If a pumping station is used to move effluent from the sewage tank to the drainfield, provisions shall be made to prevent the pump from operating when inundated with flood waters.

d. When fill is needed to raise the elevation of the soil treatment area, a mound system may be used with the following additional requirement: The elevation of the mound shall be such that the elevation of the bottom of the rock layer shall be at least one-half foot above the ten year flood elevation. Inspection wells shall not be installed unless the top of the mound is above the elevation of the regional flood.

e. When the top of the sewage tank is inundated, the dwelling must cease discharging sewage into it. This may be accomplished by either temporarily evacuating the structure until the system again becomes functional, or by diverting the sewage into a holding tank sized and installed according to the requirements below.

f. The building sewer shall be designed to prevent backflow of liquid into the building when the system is inundated. If a holding tank is utilized, the building sewer shall be designed to permit rapid diversion of sewage into the holding tank when the system is inundated.

g. If a holding tank is utilized for a dwelling, its liquid capacity shall be equal to 100 gallons times the number of bedrooms times the number of days between the ten year stage on the rising limb of the regional flood hydrograph and the ten year stage on the falling limb of the hydrograph, or 1,000 gallons, whichever is greater. For other establishments see Appendix A, section F.

h. Whenever the water level has reached a stage above the top of the sewage tank, the tank shall be pumped to remove all solids and liquids after the flood has receded before use of the system is resumed.

D. Class II alternatives—reduced area systems.

1. Aerobic tanks. No additional reduction in soil treatment area shall be allowed with the use of an aerobic treatment tank.

2. Separate toilet waste and greywater systems.

a. General.

(1) A toilet waste treatment device shall be used in conjunction with a greywater system.

(2) In all cases, only toilet wastes shall be discharged to toilet waste treatment devices. Greywater or garbage shall not be discharged to the device except as specifically recommended by a manufacturer.

b. Toilet waste treatment devices.

(1) Toilet waste treatment devices shall be considered as one of two types: I—privies; and II—other devices, including, but not limited to, incinerating, composting, biological, chemical, recirculating or holding toilets.

(2) Type I—privies.

(a) Pit privies shall not be installed where the bottom of the pit is less than three feet above the water table. A vault privy shall be used in areas of high ground water. The vault of a vault privy shall be constructed in the same manner as a septic tank. See section F. 1.

(b) Privies shall be set back from surface waters the same distance as required for buildings and from property lines and water supply wells the same distance as required for soil treatment areas.

(c) Pits or vaults shall be of sufficient capacity for the residence they serve, but shall have at least 50 cubic feet of capacity.

(d) The sides of the pit shall be curbed to prevent cave-in.

(e) The superstructure shall be constructed so as to be easily cleaned, and it shall be insect proof. The door and seat shall be self closing. All openings including vent openings, shall be screened.

(f) Privies shall be adequately vented.

(g) When the pit is filled to within one foot of the top the solids shall be removed or a new pit shall be constructed. The abandoned pit shall be filled with clean earth and slightly mounded to allow for settling. Removed solids shall be disposed of by land application in accordance with Agency guidelines for septage disposal and all local ordinances and codes.

(h) All liquids and solids removed from a vault privy shall be treated and disposed of by application in accordance with the Agency's septage disposal guidelines.

(3) Type II—other devices.

(a) Other devices may be used where reasonable assurance of performance is provided.

(b) All Type II devices shall be vented.

(c) All electric, gas and water connections to a Type II device shall conform to all local ordinances and codes.

(d) Operation and maintenance of all Type II devices shall follow the manufacturer's recommendations.

(4) All materials removed from a Type I or II toilet waste treatment device, including but not limited to ashes, compost and all solids and liquids shall be disposed of in a public sewage system or by land application in accordance with the Agency's septage disposal guidelines and all local ordinances and codes.

c. Greywater system.

(1) Plumbing.

(a) The drainage system in new systems shall be based on a pipe diameter of two inches to prevent installation of a water flush toilet. There shall be no openings or connections to the drainage system, including floor drains, larger than two inches in diameter. For repair or replacement of an existing system, the existing drainage system may be used.

(b) Toilets or urinals of any kind shall not be connected to the drainage system. Toilet waste or garbage shall not be discharged to the drainage system.

(c) Garbage grinders shall not be connected to the drainage system.

(2) Building sewer. The building sewer shall meet all requirements of section E. except that the building sewer for a greywater system shall be at least two inches in diameter.

(3) Sewage tank.

(a) Greywater septic tanks shall meet all requirements of section F. 1., except that the liquid capacity of a greywater septic tank serving a dwelling shall be based on the number of bedrooms contemplated in the dwelling served and shall be at least as large as the capacities given below (see sections B. 6. and C. 2. e.):

TABLE A-1

Number of Bedrooms	Tank Liquid Capacity (gallons)
2 or less or hand pump	300
3 or 4	500
5 or 6	750
7, 8 or 9	1,000

(b) For ten or more bedrooms or other establishments, the greywater septic tank shall be sized as for an other establishment (see section F. 2. 6. (2)) except that the minimum liquid capacity shall be at least 300 gallons.

(c) Greywater aerobic tanks shall meet all requirements of section F. 3.

(4) Distribution and dosing. Distribution and dosing of greywater shall meet all requirements of section G.

(5) Final treatment and disposal.

(a) Standard system. A standard greywater system shall meet all requirements of sections H. 1. and 2.

(b) Alternative system. A greywater mound system shall meet all requirements of Appendix A, section E. 1.

3. Seasonal use.

a. Where a commercial establishment is occupied or used for less than 180 days per year and less than 120 days consecutively, the maximum daily sewage flow shall be determined and the average daily sewage flow shall be computed by dividing the total annual estimated or measured sewage flow by 365 days. The size of the soil treatment system shall be based on the average daily sewage flow and the areas specified in Table III set forth in section H. 2. a. (4). All other requirements of soil treatment system construction shall be followed.

b. The maximum daily sewage flow shall be used to determine sewage tank size for other establishments. There shall be no reduction in the size of sewage tanks for seasonal use.

c. In no case shall a seasonal use establishment be converted to full-time use until the soil treatment system meets the size requirements of Table III set forth in section II. 2. a. (4).

E. Class III—alternatives—advanced alternative system.

1. Mounds.

a. Mounds may be constructed on soils having the site or soil conditions specified in Appendix A, section C.

b. The soil percolation rate in all layers of the natural or fill soil to a depth of at least 24 inches below the sand, as specified in Appendix A, section E. 1. 1., shall be faster than 120 minutes per inch.

c. Below the sand layer there shall be at least one layer of soil, either natural or fill, at least 12 inches thick, which has a percolation rate slower than five minutes per inch (loamy sand).

d. Wherever possible, mounds shall be located on flat areas or crests of slopes. Mounds shall not be located on natural slopes of more than three percent if the percolation rate is slower than 60 minutes per inch to a depth of at least 24 inches below the sand layer.

e. Mounds shall not be located on slopes exceeding six percent if the soil percolation rate is slower than 30 minutes per inch to a depth of at least 24 inches below the sand layer.

f. Mounds shall not be located on natural slopes exceeding 12 percent under any soil percolation rate conditions.

g. The bottom area of the filter material shall be sized on the basis of 0.83 square feet per gallon of waste per day.

h. In no case shall the width of the filter material in a single bed exceed ten feet.

i. A rubber tired tractor may be used for plowing or discing but in no case shall a rubber tired tractor be used after the surface preparation is completed where the soil is slower than 15 minutes per inch. A crawler or track type tractor shall be used for mound construction where the soil is slower than 15 minutes per inch.

j. The discharge pipe from the pump to the mound area shall be installed prior to soil surface preparation. The trench shall be carefully backfilled and compacted to prevent seepage of effluent.

k. Soil surface preparation.

(1) The total area selected for the mound, including the dikes

shall be plowed to a depth of at least eight inches or the sod layer broken and roughened by backhoe teeth. Furrows shall be thrown uphill and there shall be no deadfurrow under the mound. The soil shall be plowed only when the moisture content of a fragment eight inches below the surface is below the plastic limit.

(2) In soils having percolation rates faster than 15 minutes per inch (sandy loam) in the top eight-inch depth, disking may be used for surface preparation as a substitute for plowing.

(3) Mound construction shall proceed immediately after surface preparation is completed.

l. A minimum of twelve inches of soil defined as sand shall be placed where the filter material is to be located. A crawler tractor with a blade shall be used to move the sand into place. At least six inches of sand shall be kept beneath equipment to minimize compaction of the plowed layer. The sand layer upon which the filter material is placed shall be level.

m. A depth of at least nine inches of filter material shall be placed over the bed area below the distribution pipe.

n. Distribution of effluent over the filter material shall be either by four-inch distribution pipes with gravity flow from a distribution box or by perforated pipe under pressure from a manifold.

o. Gravity distribution.

(1) The four-inch distribution pipes shall be rigid plastic with holes at least one-half inch diameter spaced no further than 36 inches. One row of holes shall be laid at the bottom of the pipe.

(2) The distribution pipe shall slope downward two inches per 100 feet away from the distribution box.

(3) The far ends of the distribution pipe shall be connected.

(4) The distribution pipes shall be spaced no further than five feet apart and no further than 30 inches from the edge of the filter material.

(5) The distribution pipes shall connect to the outlets of a distribution box.

(6) The quantity of effluent per pump dose shall be at least 25 percent of the estimated or measured daily sewage flow.

p. Pressure distribution.

(1) Perforation holes shall be as set forth in Table I set forth in

section G. 1. b. (4). Holes shall be drilled straight into the pipe and not at an angle.

(2) The perforated pipe laterals shall be connected to a two-inch diameter manifold pipe with the ends capped. The laterals shall be spaced no further than 40 inches on center and no further than 20 inches from the edge of the filter material.

(3) The perforated pipe laterals shall be installed level with the perforations downward.

(4) The manifold pipe shall be connected to the supply pipe from the pump. The manifold shall be sloped toward the supply pipe from the pump.

q. At least two inches of filter material shall be placed over the lateral or distribution pipes.

r. Straw or marsh hay to an uncompacted depth of three to four inches shall be placed over the filter material.

s. Construction vehicles shall not be allowed on the filter material until backfill is placed.

t. Sandy loam soil shall be placed on the filter material to a depth of one foot in the center of the mound and to a depth of six inches at the sides.

u. A maximum of two ten-foot wide beds may be installed side by side in a single mound if the soil percolation rate is between five and 60 minutes per inch to a depth of at least 24 inches below the sand layer. The beds shall be separated by four feet of sand.

v. When two beds are installed side by side the sandy loam fill at the center of the mound shall be 18 inches deep and six inches deep at the sides.

w. Six inches of topsoil shall be placed on the fill material over the entire area of the mound.

x. A grass cover shall be established over the entire area of the mound.

y. No shrubs shall be planted on the top of the mound. Shrubs may be placed at the foot and side slopes of the mound.

z. The side slopes on the mound shall be no steeper than three to one.

aa. Whenever mounds are located on slopes, a diversion shall be constructed immediately upslope from the mound to intercept and direct runoff.

bb. A pump shall be used as specified in section G. 2. c.

2. Collector systems.

a. General.

(1) Where site or soil conditions do not allow for final treatment and disposal on an individual lot, a system whereby a soil treatment system is located on another lot or lots may be employed, where approved by the local unit of government.

(2) Plans and specifications shall comply with local ordinances on such issues as zoning, joint ownership of land, joint maintenance responsibilities, easements, and other considerations and shall be approved by the local unit of government.

b. Design.

(1) Common soil treatment system. The size of common soil treatment systems shall be based on the sum of the areas required for each residence.

(2) Sewage tanks. The system shall be designed with each residence having a sewage tank or with a common sewage tank. In the case of a common tank, the capacity of the tank shall be sized according to section F. 2. b. (2) except that the minimum capacity shall be at least 3,000 gallons, and shall be compartmented if in a single tank.

(3) Sewers.

(a) Sewer systems shall be designed on an estimated average daily flow for dwellings based on Table II, set forth in section H. 2. a. (2), plus estimated flows from other establishments.

(b) The sewer for systems with common sewage tanks shall be so constructed to give mean velocities, when flowing full, of not less than two feet per second. The sewer for systems with individual sewage tanks shall be so constructed and designed to hydraulically conduct the flow for which they were designed. In no case shall a gravity sewer be less than four inches in diameter.

(c) Infiltration or exfiltration shall not exceed 200 gallons per inch of pipe diameter per mile per day.

(d) Cleanouts, brought flush with or above finished grade, shall be provided wherever a common sewer joins an individual building sewer or piping from an individual sewage tank, or every 100 feet, whichever is less, unless manhole access is provided.

(e) There shall be no physical connection between sewers and water supply systems. Sewers shall be set back from water supply systems and piping as required for building sewers. See section E. 3. Where it is not possible to obtain proper separation distances, the sewer connections shall be watertight and pressure tested as in section E. 3.

(4) Pumps and pump stations.

(a) Pump stations shall be watertight.

(b) Pump stations shall have manholes flush with or above finished grade for cleaning and maintenance.

(c) Manhole covers shall be so constructed as to prevent unauthorized entry.

(d) Pumps and pump stations shall be sized to handle peak flows.

(e) An alarm system shall be provided for all pumping stations to warn of pump failure, overflow or other malfunction.

c. Maintenance. All persons using a common drainfield system shall assure, by contract with maintenance personnel or other equivalent means, that the system will be adequately maintained throughout its useful life. The system so maintained includes, but is not limited to, common drainfields, common sewage tanks, common pumps, common pump stations, common sewers and all individual tanks connected to the common system.

3. Sewage osmosis.

a. The Electroosmosis System (a proprietary installation process under U. S. and Canadian patents) may be permitted as an alternative system in clay soils having percolation rates slower than 60 minutes per inch.

b. Standards and criteria for approval.

(1) Installation shall comply with all applicable requirements for standard systems contained in these regulations as pertain to system location, water table and bedrock separation distances, septic tanks, pumping stations, distribution or drop boxes, and materials.

(2) Conditions for installation and reporting of performance shall be subject to the provisions in Appendix A, section E. 5.

4. Seepage pits.

a. Seepage pits may be used for disposal of sewage tank effluent only when it can be clearly demonstrated that a standard drainfield system or mound system is not feasible on the particular site in question and when such use is indicated by favorable conditions of soil, ground water level or topog-

raphy and where such use does not reduce the safety of surrounding ground water supplies. In areas where limestone or any geological formation characterized by similar fault patterns is covered by less than 50 feet of earth, seepage pits shall not be installed. The pit excavation shall terminate at least three feet above the highest known or calculated ground water table. The depth of the excavation shall not exceed 50 percent of the depth of any well casing in the area or ten feet, whichever is least.

b. When two or more seepage pits are used, a distribution box constructed in accordance with section G. 1. a. (2) (b) shall be used if the inlet inverts of the seepage pits have no more than one foot difference in elevation. If the difference in elevation between the inlet inverts is greater than one foot, the seepage pits shall be connected in series.

c. Seepage pits, in addition to the general provisions specified in Table IV following section H. 2. d. (3) shall be set back not less than the stated minimum distances from the following:

(1) Wells less than 50 feet in depth and not encountering at least 10 feet of impervious material . . . . 150 ft.

(2) Any water supply well or buried water suction pipe . . 75 ft.

(3) Buildings . . . . 20 ft.

(4) Property lines and buried pipe distributing water under pressure . . . . 10 ft.

(5) Other seepage pits . . . . three times the diameter of the largest pit (edge to edge).

d. Effective soil treatment area of a seepage pit shall be calculated as the sidewall area below the inlet, exclusive of any hardpan, rock or clay formations. The sidewall area shall be based on the outer diameter of the pit lining plus 12 inches of rock in the annular space.

(1) Required treatment area shall be determined by the percolation test described in section D. and from Tables II and III, set forth in sections H. 2. a. (2) and (4), with no reduction for increased filter material below or around the pit. In no case shall a seepage pit be installed in soils where the percolation rate of any stratum is faster than one-tenth minute per inch (coarse sand). A percolation test shall be made in each vertical stratum penetrated by the seepage pit, and the weighted average of the results, exclusive of results from soil strata in which the percolation rate is slower than 30 minutes per inch, shall be computed and applied to the seepage bed column of Table III as indicated.

(2) A minimum of four feet composite depth of porous formation for each installation shall be provided in one or more pits.

(3) All pits shall have an inside diameter of at least five feet.

e. Construction of all seepage pits shall conform to the following requirements:

(1) To prevent cave-in, the pit shall be precast concrete or lined with brick, stone or block at least four inches thick, laid in a radial arch to support the pit walls.

(2) The brick, stone or block shall be laid watertight above the inlet and with open joints below the inlet to provide adequate passage of liquids.

(3) A minimum annular space of 12 inches between the pit lining and excavation wall shall be filled with crushed rock or gravel.

(4) The seepage pit shall be so constructed at the top as to be capable of supporting the overburden of earth and any reasonable load to which it is subjected. Access to the pit shall be provided by means of a manhole or inspection hole equipped with a watertight cover. The seepage pit may terminate in a conventional manhole top, frame and cover to a point within 12 inches, but no closer than six inches below finished grade. The manhole cover shall be covered with at least six inches of earth. The top of the seepage pit shall be not less than 12 inches below the ground surface. The top shall be provided with an inspection pipe of not less than four-inch diameter extending through the cover to a point flush with finished ground level. The top of the inspection pipe shall be provided with a readily removable watertight cap.

5. Other systems. Where unusual conditions exist, special systems of treatment and disposal other than those specifically mentioned in Appendix A, sections E. 1. to E. 4. above, may be employed provided:

a. reasonable assurance of performance of such system is presented to the permitting authority;

b. the engineering design of such system is first approved by the permitting authority;

c. there is no discharge to the ground surface or to surface waters;

d. treatment and disposal of wastes is in such a manner so as to protect the public health and general welfare;

e. such systems comply with all applicable requirements of these standards and with all local codes and ordinances.

F Class IV alternatives–holding tanks.

1. General. Holding tanks may be allowed only as replacements for

existing non-conforming systems or on existing parcels or lots as of the date of the enactment of these standards and only where it can conclusively be shown that a standard, Class I, Class II or mound system cannot be feasibly installed.

2. Construction. A holding tank shall be constructed of the same materials and by the same procedures as those specified for watertight septic tanks.

3. Access. A cleanout pipe of at least six inches diameter shall extend to the ground surface and be provided with seals to prevent odor and to exclude insects and vermin. A manhole of at least 20 inches least dimension shall extend through the cover to a point within 12 inches, but no closer than six inches below finished grade. The manhole cover shall be covered with at least six inches of earth.

4. Depth of bury. The tank shall be protected against flotation under high water table conditions. This shall be achieved by weight of tank, earth anchors or shallow bury depths.

5. Capacity.

a. For a dwelling the size shall be 1,000 gallons, or 400 gallons times the number of bedrooms, whichever is greater.

b. For permanent structures other than dwellings, the capacity shall be based on measured flow rates or estimated flow rates. The tank capacity shall be at least five times the daily flow rate.

6. Location. Holding tanks shall be located:

a. In an area readily accessible to the pump truck under all weather conditions.

b. As specified for septic tanks in Table IV, set forth following section H. 2. d. (3).

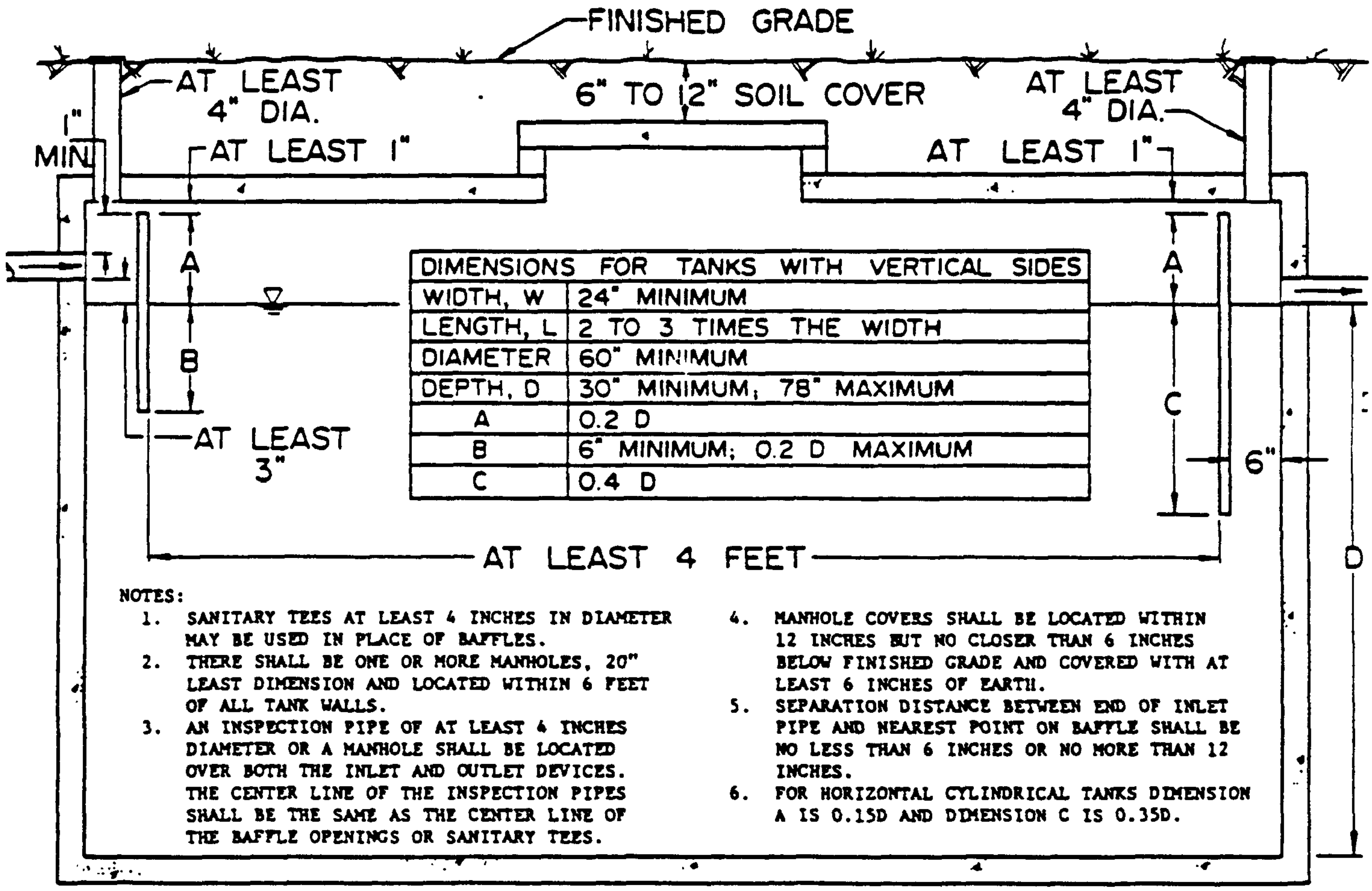
c. Where accidental spillage during pumping will not create a nuisance.

7. Contract. A contract for disposal and treatment of the sewage wastes shall be maintained by the owner with a pumper, municipality, agency or firm established for that purpose.

8. Accidental overflow. Holding tanks shall be monitored to minimize the chance of accidental sewage overflows. Techniques such as visual observation, warning lights or bells, or regularly scheduled pumping shall be used For other establishments, a positive warning system shall be installed which allows 25 percent reserve capacity after actuation.

FIGURE 1

VERTICAL SIDEWALL SEPTIC TANK



DIMENSIONS FOR TANKS WITH VERTICAL SIDES	
WIDTH, W	24" MINIMUM
LENGTH, L	2 TO 3 TIMES THE WIDTH
DIAMETER	60" MINIMUM
DEPTH, D	30" MINIMUM; 78" MAXIMUM
A	0.2 D
B	6" MINIMUM; 0.2 D MAXIMUM
C	0.4 D

NOTES:

1. SANITARY TEES AT LEAST 4 INCHES IN DIAMETER MAY BE USED IN PLACE OF BAFFLES.
2. THERE SHALL BE ONE OR MORE MANHOLES, 20" LEAST DIMENSION AND LOCATED WITHIN 6 FEET OF ALL TANK WALLS.
3. AN INSPECTION PIPE OF AT LEAST 4 INCHES DIAMETER OR A MANHOLE SHALL BE LOCATED OVER BOTH THE INLET AND OUTLET DEVICES. THE CENTER LINE OF THE INSPECTION PIPES SHALL BE THE SAME AS THE CENTER LINE OF THE BAFFLE OPENINGS OR SANITARY TEES.
4. MANHOLE COVERS SHALL BE LOCATED WITHIN 12 INCHES BUT NO CLOSER THAN 6 INCHES BELOW FINISHED GRADE AND COVERED WITH AT LEAST 6 INCHES OF EARTH.
5. SEPARATION DISTANCE BETWEEN END OF INLET PIPE AND NEAREST POINT ON BAFFLE SHALL BE NO LESS THAN 6 INCHES OR NO MORE THAN 12 INCHES.
6. FOR HORIZONTAL CYLINDRICAL TANKS DIMENSION A IS 0.15D AND DIMENSION C IS 0.35D.

FIGURE 2

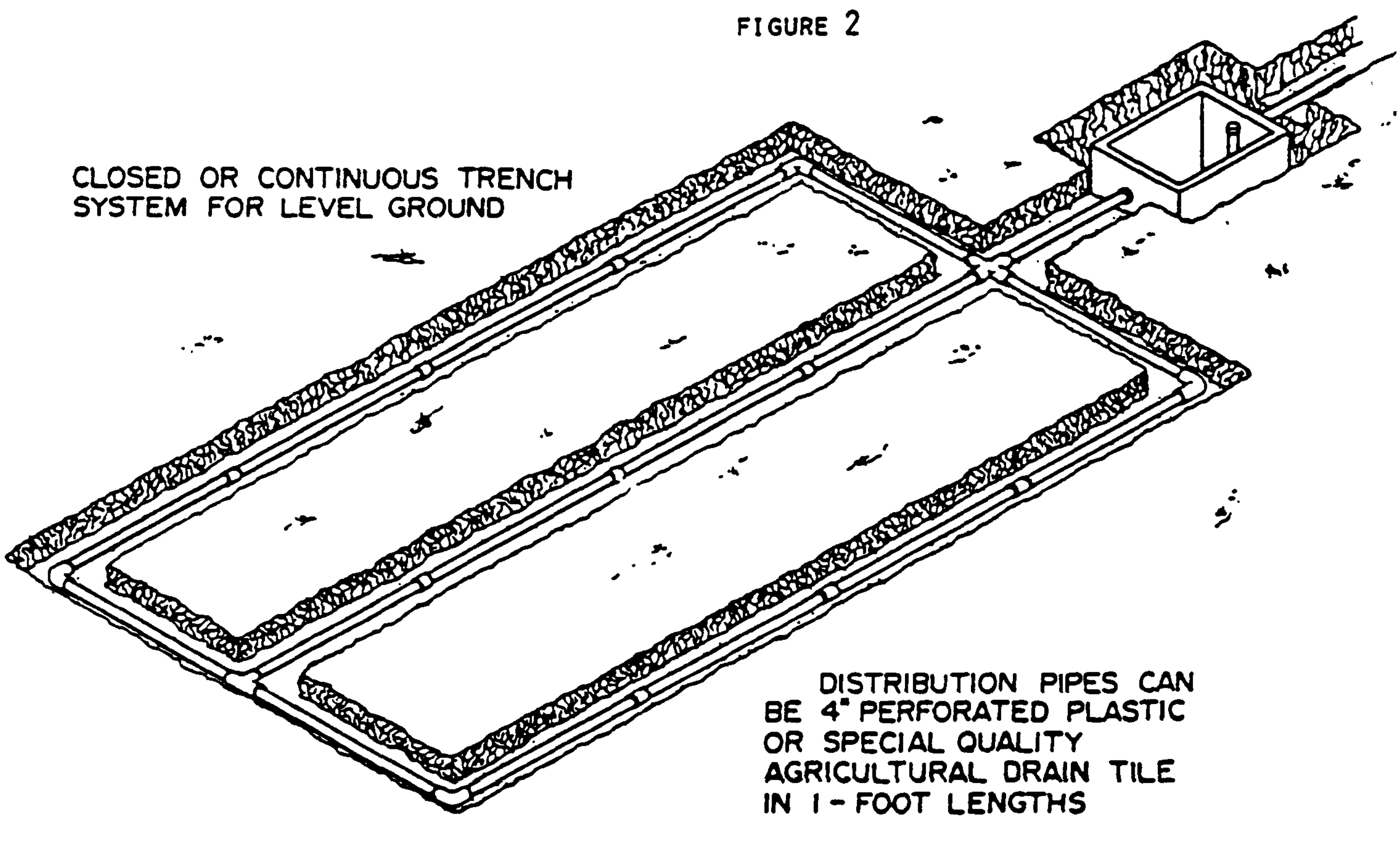
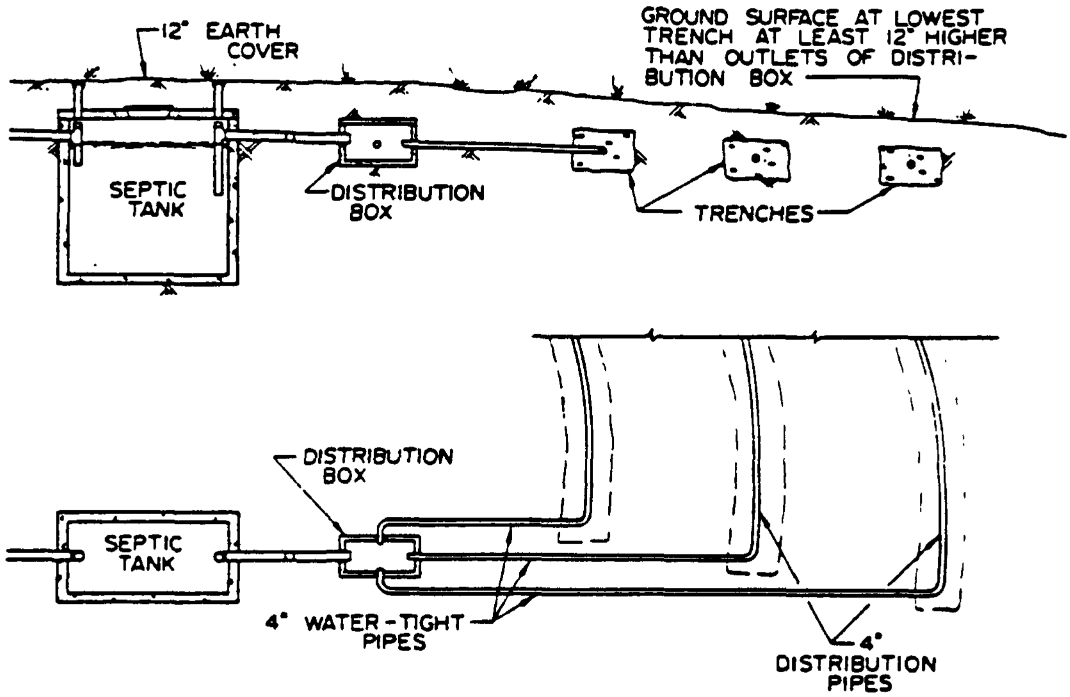


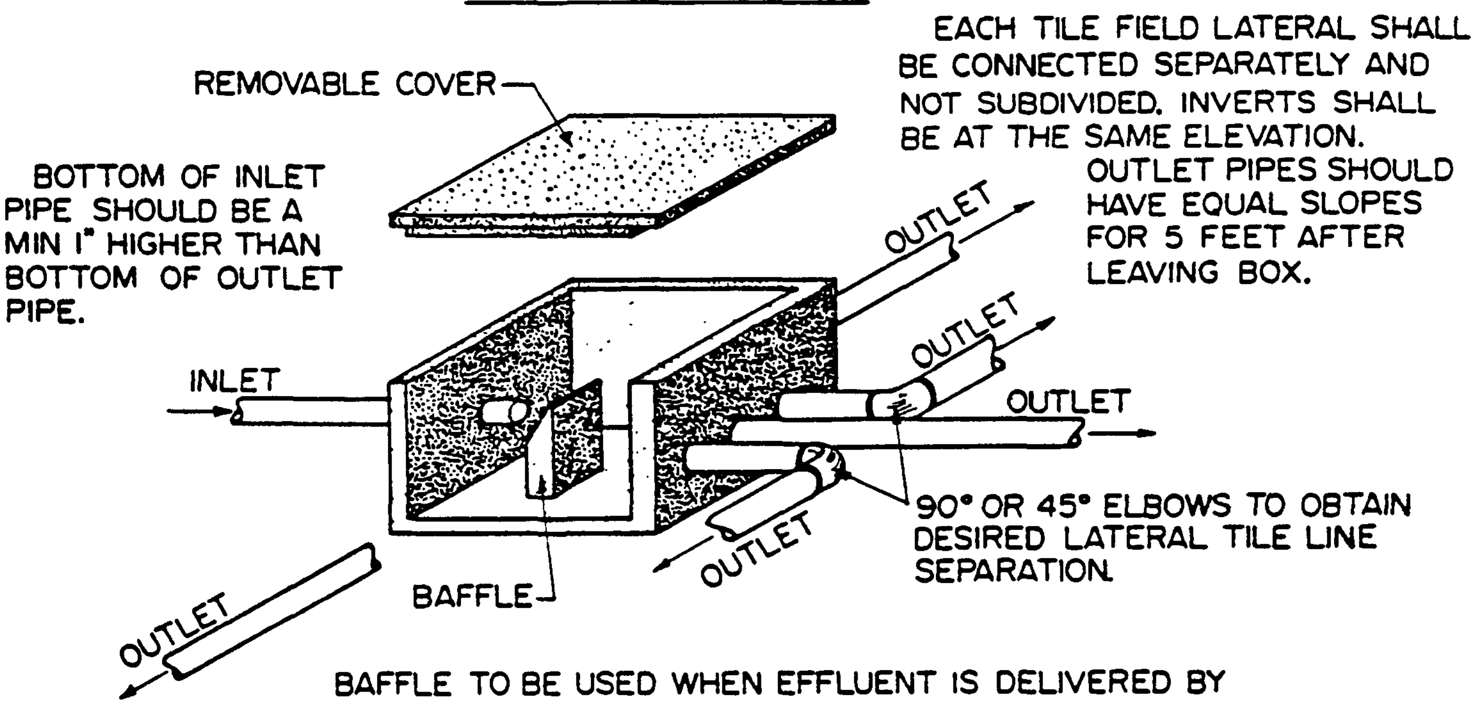
FIGURE 3



SEWAGE TREATMENT SYSTEM WITH DISTRIBUTION BOX

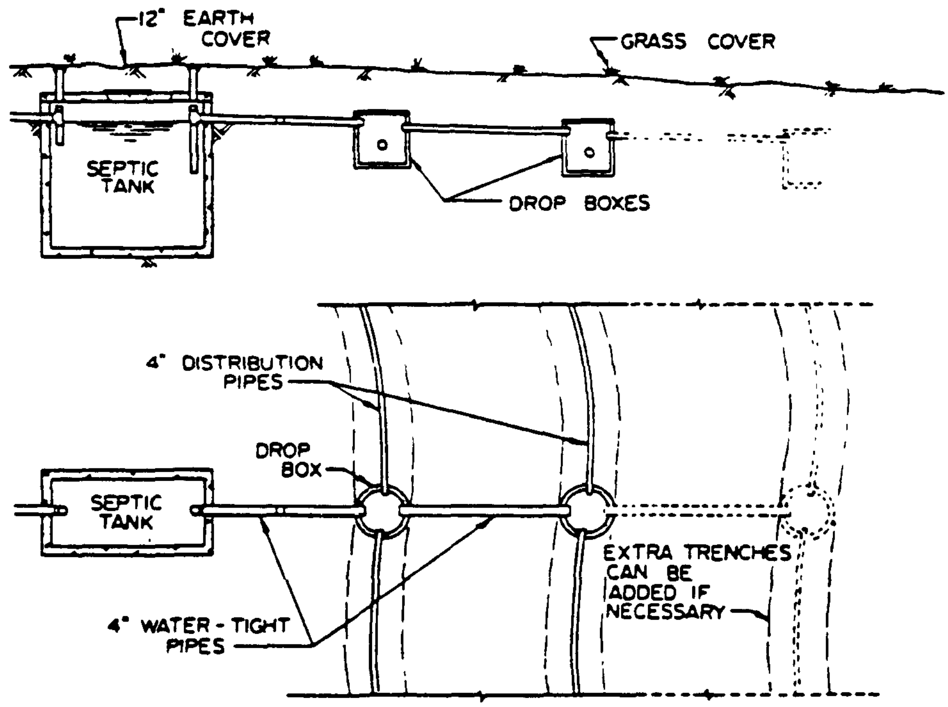
FIGURE 4

DISTRIBUTION BOX



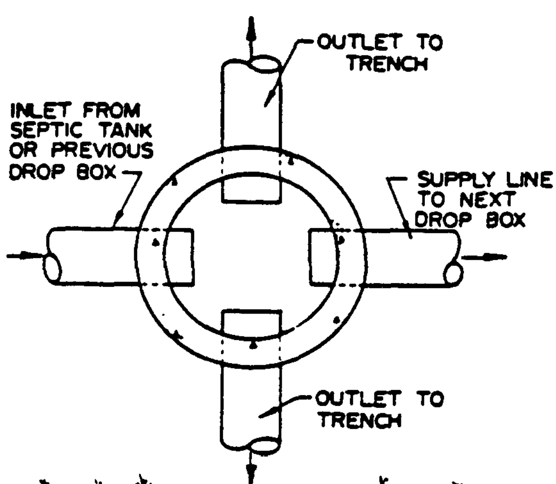
BAFFLE TO BE USED WHEN EFFLUENT IS DELIVERED BY PUMP OR SIPHON, OR THE SLOPE OF THE INLET LINE IS SUCH THAT UNEVEN DISTRIBUTION COULD OCCUR. TOP OF THE BAFFLE AT LEAST LEVEL WITH THE CROWN OF THE INLET PIPE.

FIGURE 5



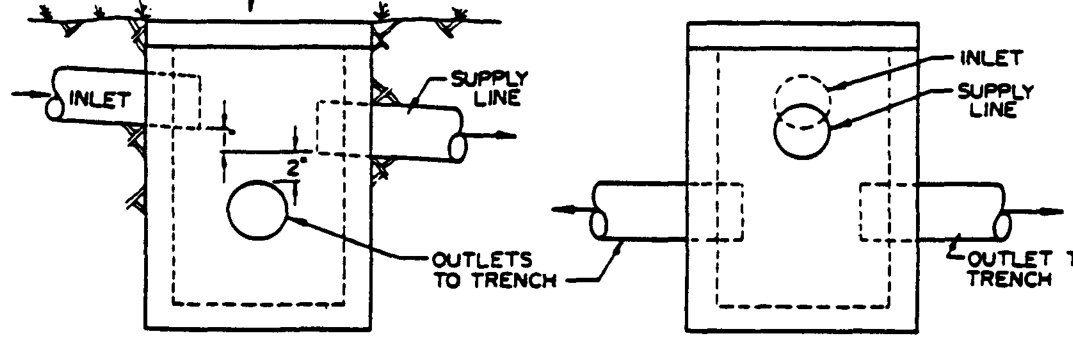
SEWAGE TREATMENT SYSTEM WITH DROP BOXES

FIGURE 6



NOTES

1. ALL PIPES SHOULD BE AT LEAST 4-INCH DIAMETER
2. ELEVATION OF INLET AND SUPPLY LINE TO NEXT DROP BOX MAY BE ADJUSTED UP OR DOWN FOR DESIRED EFFLUENT LEVEL IN TRENCH
3. SUGGESTED TRENCH LIQUID LEVEL IS 2" ABOVE TOP OF OUTLET PIPE
4. INVERT OF INLET MUST BE AT LEAST ONE INCH HIGHER THAN INVERT OF SUPPLY PIPE TO NEXT DROP BOX
5 TRENCHES MAY OUTLET ONE SIDE OR BOTH SIDES OF DROP BOX



DROP BOX

FIGURE 7

LAYOUT OF PERFORATED PIPE LATERALS FOR PRESSURE DISTRIBUTION

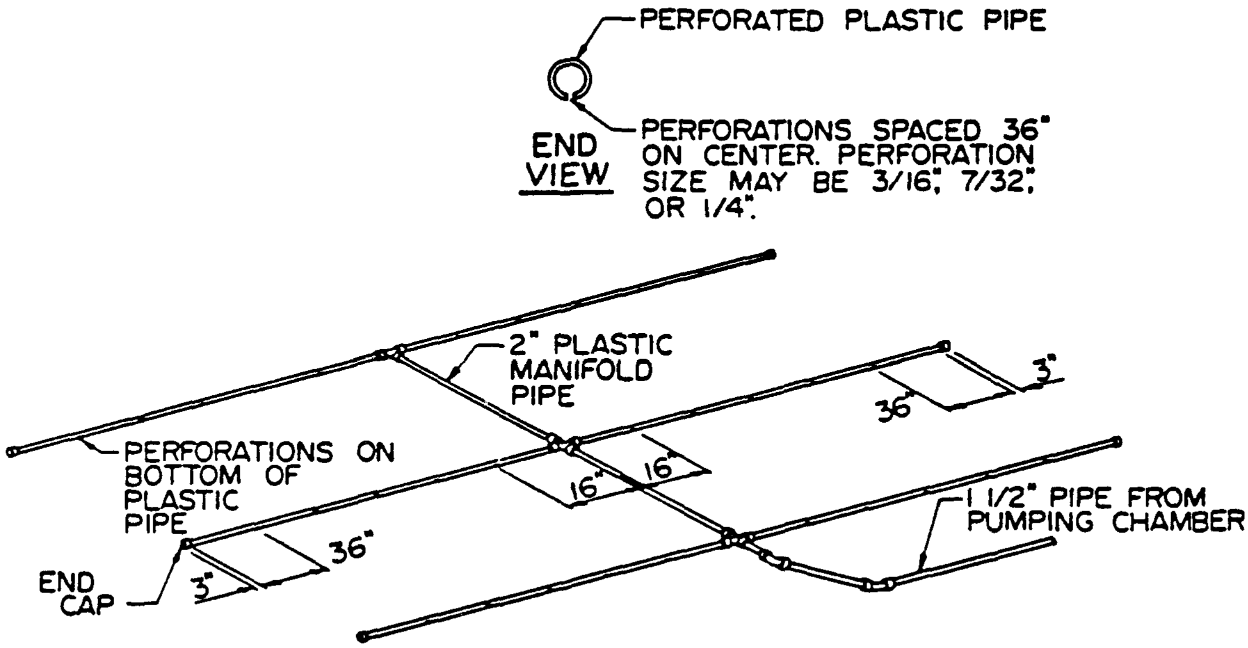
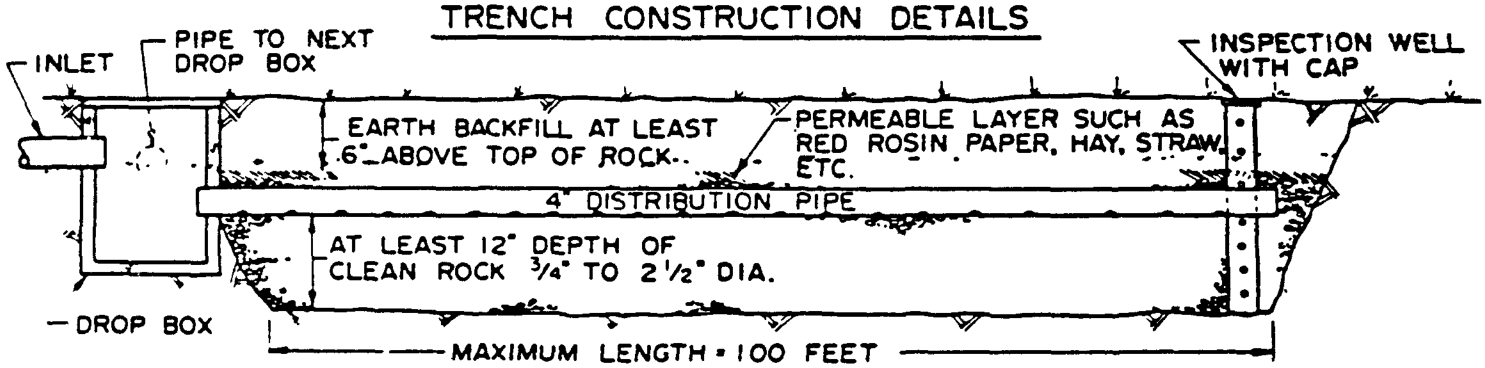


FIGURE 8

TRENCH CONSTRUCTION DETAILS



NOTE : 1. BOTTOM OF TRENCH MUST BE FLAT ALONG LENGTH

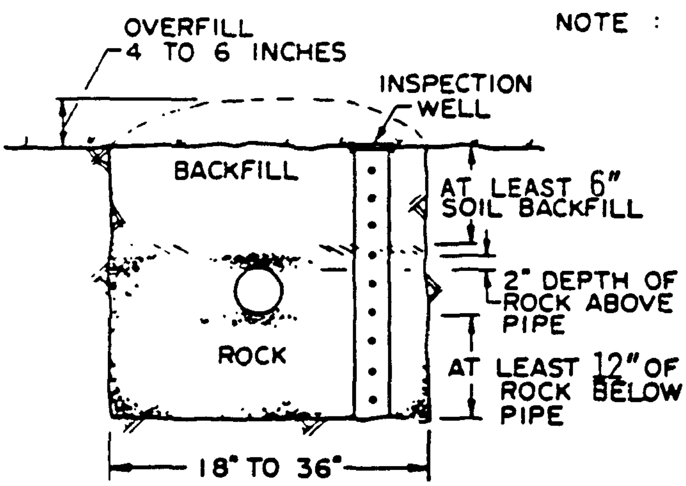
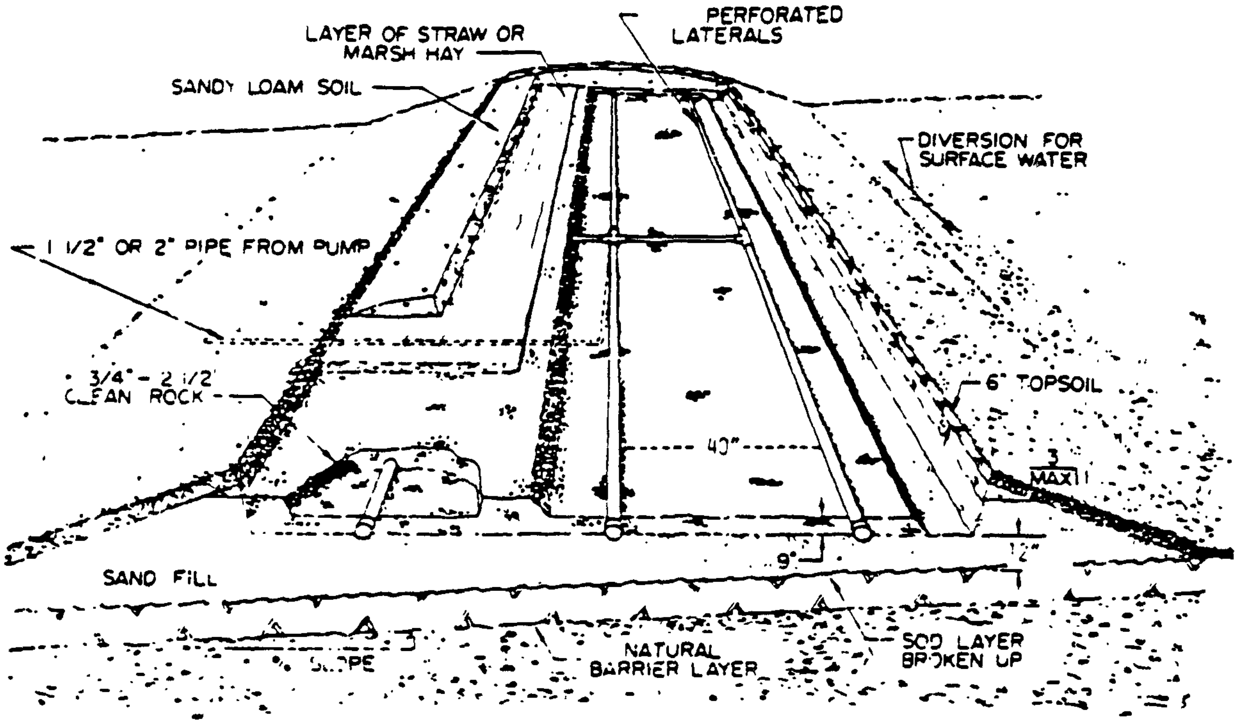


FIGURE 9



SEWAGE TREATMENT MOUND (PRESSURE DISTRIBUTION)

1-15003 GENERAL REQUIREMENTS. All persons, firms or corporations operating any tank truck or any other device or equipment used or intended to be used for the purpose of pumping or cleaning septic tanks and/or transporting or disposing of human excrement, shall conform with the following requirements. (3-1-60)

.01 Equipment to be Watertight. The tank or transporting equipment shall be watertight and so constructed as to prevent spilling or leaking while being loaded, transported and/or unloaded. (3-1-60)

.02 Equipment to be Cleanable. The tank or transporting equipment shall be constructed in such a manner that every portion of the interior and exterior can be easily cleaned and maintained in a clean condition at all times while not in actual use. (3-1-60)

.03 Disposal Methods. Disposal of excrement from septic tanks shall be by the following methods only: (3-1-60)

(a) Discharging to a public sewer; (3-1-60)

(b) Discharging to a sewage treatment plant; (3-1-60)

(d) All material removed from any septic tank, privy, sewer, subsurface sewage disposal system, sewage holding tank, toilet or sewage plumbing system shall be transported in water-tight vehicles or containers in such a manner that no nuisance or public health hazard is presented. All vehicles used for the transportation of such material shall bear the name of the company or licensee and shall be maintained in a clean exterior condition at all time. No defective or leaking equipment shall be used in cleaning operations. All vehicles or equipment shall be stored in a clean condition when not in use. Water used for rinsing such vehicles or equipment shall be considered sewage and shall be disposed of in a sanitary manner approved by the local director of health.

(e) Septic tanks shall be cleaned by first lowering the liquid level sufficiently below the outlet to prevent sludge or scum from overflowing to the leaching system where it could cause clogging and otherwise damage the system. Substantially all of the sludge and scum accumulation shall be removed whenever possible, and the inlet and outlet baffles shall be inspected for damage or clogging. Cleaners shall use all reasonable precaution to prevent damaging the sewage disposal system with their vehicle or equipment. Accidental spillages of sewage, sludge or scum shall be promptly removed or otherwise abated so as to prevent a nuisance or public health hazard.

(f) No sewage shall be allowed to discharge or flow into any storm drain, gutter, street, roadway or public place, nor shall such material discharge onto any private property so as to create a nuisance or condition detrimental to health. Whenever it is brought to the attention of the local director of health that such a condition exists on any property, he shall investigate and cause the abatement of this condition.

Commonwealth of Massachusetts Division of Water Pollution Control, 314 CMR 5.03 - 5.10 and 6.06 - 6.10.

5.03: Discharges Requiring a Permit

(1) No person shall discharge pollutants to ground waters of the Commonwealth without a currently valid permit from the Director pursuant to M.G.L. c. 21, s. 43 and 314 CMR 5.00, unless exempted in 314 CMR 5.05. No person shall construct, install, modify, operate or maintain an outlet for such a discharge or any treatment works required to treat such discharge without having first obtained a discharge permit in accordance with 314 CMR 5.03(1) and written approval from the Department for such activity. Any person who discharges or proposes to discharge to ground waters of the Commonwealth may obtain a permit by filing the appropriate application forms in accordance with 314 CMR 5.00 and 2.00.

(2) Activities which constitute discharges of pollutants requiring a permit under 314 CMR 5.03 (1) include, but are not limited to:

(a) Any facility which discharges a liquid effluent onto or below the land surface;

(b) Any facility which discharges a liquid effluent to a percolation pit, pond, or lagoon;

(c) Any facility which discharges a liquid effluent via subsurface leaching facilities including but not limited to: leaching pits, galleries, chambers, trenches, fields and pipes;

(d) Any facility which discharges a liquid effluent into a Class V injection well as defined in 310 CMR 27.00; or

(e) Any facility with an associated unlined pit, pond, lagoon, or surface impoundment in which wastewaters or sludges are collected, stored, treated, or disposed and from which a liquid portion seeps into the ground.

5.04: Other Activities Requiring a Permit

(1) No person shall engage in any other activity, other than those described in 314 CMR 5.03, which may reasonably result, directly or indirectly, in the discharge of pollutants into ground waters of the Commonwealth, without a currently valid permit from the Director, pursuant to 314 CMR 5.00 and 2.00, unless exempted in 314 CMR 5.05. Any person who engages or proposes to engage in such activities may obtain a permit by filing the appropriate application forms in accordance with 314 CMR 5.00 and 2.00.

(2) Such other activities shall specifically include, but not be limited to:

(a) Storm Water Discharges to the ground as defined herein.

"Storm water discharges" means a conveyance or system of conveyances (including pipes, conduits, ditches and channels) primarily used for collecting and conveying storm water runoff, but not including combined municipal sewer systems, and which:

1. Discharges storm water runoff contaminated by contact with process wastes, raw materials, toxic pollutants, hazardous substances, or oil and grease to a leaching facility, or percolation pit, pond, or lagoon; or

2. Is designated under 314 CMR 5.04(2)(b).

Such discharges shall include, but not be limited to, any "storm water discharge" which is located in an industrial plant or in plant associated areas, if there is a potential for significant discharge of storm water contaminated by contact with process wastes, raw materials, toxic pollutants or hazardous substances. "Plant associated areas" means industrial plant yards, immediate access roads, drainage ponds, refuse piles, storage piles or areas, and material or product loading and unloading areas. The term excludes areas located on plant lands separated from the plant's industrial activities, such as office buildings and accompanying parking lots.

(b) Case-by case designation of storm water discharges to the ground. The Director may designate a conveyance or system of conveyances primarily used for collecting and conveying storm water runoff as a storm water discharge to the ground. This designation may be made when the Director determines that a storm water discharge is or may be a significant contributor of pollution to the ground waters of the Commonwealth. In making this determination, the Director shall consider the following factors:

1. The location of the discharge with respect to ground waters of the Commonwealth.

2. The size of the discharge.

3. The quantity and nature of the pollutants reaching ground waters of the Commonwealth and the Massachusetts water quality standards applicable to such waters; and

4. Other relevant factors.

(3) Any person owning, operating or maintaining a "storm water discharge" is subject to the requirements of 314 CMR 5.04(1).

(4) Any person owning, operating or maintaining a conveyance or system of conveyances operated primarily for the purpose of collecting and conveying storm water runoff which does not constitute a "storm water discharge" is subject to the provisions of 314 CMR 5.05(8).

The following activities are exempt from the need to obtain a permit pursuant to M.G.L. c. 21, s. 43 and 314 CMR 5.00:

(1) Any facility which discharges a liquid effluent as a result of the treatment of sewage at a treatment works which is designed to receive and receives 15,000 gallons per day or less provided that such facility was designed, approved, constructed and is maintained in accordance with 310 CMR 15.00, "The State Environmental Code, Title 5, Minimum Requirements for the Subsurface Disposal of Sanitary Sewage".

(2) Any recharge well used exclusively to replenish the water in an aquifer with uncontaminated water.

(3) Any discharge in compliance with the written instructions of an On-Scene Coordinator pursuant to 40 CFR Part 1510 (The National Oil and Hazardous Substances Pollution Plan) or 33 CFR 153.10(e) (Pollution by Oil and Hazardous Substances) or if approved in writing by the Director, the Commissioner, or their designees, as necessary to abate an imminent hazard to the public health or safety.

(4) Any salt water intrusion barrier well used to inject uncontaminated water into a fresh water aquifer to prevent the intrusion of salt water into the fresh water.

(5) Any facility used to return to the ground the waters used for heating or cooling energy in a heat exchanger provided the flow does not exceed 15,000 gallons per day.

(6) Any facility used to discharge non-contact cooling waters provided the flow does not exceed 2,000 gallons per day and the temperature of the wastewater does not exceed 40 degrees Celsius.

(7) Any facility that recirculates sanitary landfill leachate on top of the sanitary landfill over an area that has been specifically designed with a liner and collection system for the purpose of recycling the leachate.

(8) Any conveyance or system of conveyances operated primarily for the purpose of collecting and conveying storm water runoff which does not constitute a "storm water discharge".

(9) Any introduction of pollutants from non point source agricultural, silvicultural, land management or right-of-way maintenance activities including runoff from orchards, cultivated crops, pastures, range lands, forest lands and rights-of-way, but not including point source discharges from concentrated animal feeding operations, discharges of silvicultural process water or any "storm water discharges [as defined in 314 CMR 5.04(2)].

(10) Any landfill approved by the Department pursuant to 310 CMR 19.00 provided that. such facility is not a point source and does not result in a discharge which causes a violation of applicable water quality standards or result in a threat to public health, safety or welfare.

(11) Any land application of sewage sludge provided it is performed in accordance with a plan approved by the Department.

(12) Any treatment works and discharge therefrom with interim permit status pursuant to 314 CMR 5.17(3).

Any exemption in accordance with the provisions of 314 CMR 5.05 does not relieve the discharger of his responsibilities under other state regulations including, but not limited to 310 CMR 27.00 "Under-ground Water Source Protection".

5.06: Restrictions on the Issuance of a Permit

The Director shall not issue a permit pursuant to 314 CMR 5.00:

(1) When the discharge will cause or contribute to a condition in contravention of standards for classified waters of the Commonwealth, pursuant to 314 CMR 4.00 and 6.00;

(2) For the discharge of any radiological, chemical, or biological warfare agent or high-level radioactive waste; or

(3) Where a sewer system is reasonably accessible in the opinion of the Director and where permission to enter such a sewer system can be obtained from the authority having jurisdiction over it, in accorance with 310 CMR 15.02(12) and M.G.L. c. 83, s. 11.

5.07: Effect of a Permit

Issuance of a permit under 314 CMR 5.00 and 2.00 shall be deemed to allow, to the extent specified in the permit and 314 CMR 5.07, the permittee to discharge pollutants to ground waters of the Commonwealth, to construct, install, modify, operate and maintain an outlet for such discharge, together with any treatment works required to meet effluent limitations specified in the permit for such discharge in accordance with plans and specifications approved in writing by the Department. Issuance of a permit under 314 CMR 5.00 and 2.00 shall not relieve the discharger of any responsibilities under 310 CMR 27.00 (the Massachusetts U.I.C. program).

5.08: Continuation of an Expiring Permit

(1) The conditions of a permit continue in force under M.G.L. c. 30A, s. 13 beyond the expiration date if:
(a) the permittee has made timely application for renewal of a new permit pursuant to 314 CMR 5.09(3) which is a complete application under 314 CMR 5.09(4); and
(b) the Director does not renew or issue a new permit with an effective date under 314 CMR 2.08 on or before the expiration date of the previous permit.

(2) Permits continued under 314 CMR 5.08 remain fully effective and enforceable.

5.09: Application for a Permit

(1) Duty to apply. Any person required to obtain a permit pursuant to 314 CMR 5.03 or 5.04 shall complete and submit the application form contained in 314 CMR 5.20, and, if applicable, the appropriate application form contained in 314 CMR 5.22, 5.24, 5.26 and 8.20.

(2) Who must apply. The owner of the treatment works or activity resulting in a discharge of pollutants shall apply for a permit.

(3) Time to apply.
(a) Any person required to obtain a permit pursuant to 314 CMR 5.03 or 5.04, and who does not have a currently effective permit shall submit an application at least one hundred and eighty (180) days before the date on which the discharge is to commence, unless permission for a later date has been granted by the Director. Persons proposing a new discharge are encouraged to submit their applications well in advance of the one hundred and eighty (180) day requirement to avoid delay.
(b) Any person with a currently effective permit shall submit a new application at least one hundred and eighty (180) days before the expiration date of the existing permit, unless permission for a later date has been granted by the Director.

5.09: continued

(4) Completeness. The Director shall not issue a permit before receiving a complete application as required under 314 CMR 2.03(2).

5.10: Permit Conditions

(1) General Conditions. The conditions in 314 CMR 5.19 apply to every permit issued under 314 CMR 5.00, whether or not expressly incorporated into the permit.

(2) Special Conditions.

(a) In addition to conditions applicable to all permits [314 CMR 5.10(1) and 5.19], the Director shall establish special conditions, as required on a case-by-case basis, to provide for and assure compliance with all applicable requirements of the State Act and regulations adopted thereunder. These conditions shall establish effluent limitations, and applicable requirements [314 CMR 5.10(3), and (4)]; the duration of the permit [314 CMR 5.10(5)]; monitoring, recordkeeping and reporting requirements [314 CMR 5.10(6)]; and, where applicable, schedules of compliance [314 CMR 5.10(7)] and other conditions [314 CMR 5.10(8)]. An applicable requirement is a state statutory or regulatory requirement which takes effect prior to issuance of the permit. These requirements will be identified in the fact sheet or statement of basis prepared under 314 CMR 2.05.

(b) Effuluent Limitations. In establishing effluent limitations, the Director shall apply the more stringent of the following:

1. Water quality based effluent limitations under 314 CMR 5.10(3); or
2. Technology based effluent limitations under 314 CMR 5.10(4).

(3) Water quality based effluent limitations. All permits contain limitations which are adequate to assure the attainment and maintenance of the water quality standards of the receiving waters as assigned in the Massachusetts Ground Water Quality Standards (314 CMR 6.00). Toward this end, the following effluent limitations shall apply to any discharge from a point source or outlet:

(a) Primary effluent limitations for Class I and Class II ground waters. The effluent limitations listed below apply to any discharge from a point source or outlet which enters the saturated zone of, or the unsaturated zone above, Class I and Class II ground waters.

Parameter	Limit
1. Coliform Bacteria	Shall not be discharged in amounts sufficient to render ground waters detrimental to public health, safety or welfare, or impair the ground water for use as a source of potable water.
2. Arsenic	Shall not exceed 0.05 mg/l
3. Barium	Shall not exceed 1.0 mg/l
4. Cadmium	Shall not exceed 0.01 mg/l
5. Chromium	Shall not exceed 0.05 mg/l
6. Fluoride	Shall not exceed 2.4 mg/l
7. Lead	Shall not exceed 0.05 mg/l
8. Mercury	Shall not exceed 0.002 mg/l
9. Total Trihalomethanes	Shall not exceed 0.1 mg/l
10. Selenium	Shall not exceed 0.01 mg/l
11. Silver	Shall not exceed 0.05 mg/l
12. Endrin (1,2,3,4,10, 10-hexachloro-1,7-epoxy-1, 4,4a,5,6,7,8,9a-octahydro-1, 4-endo,endo-5,8-dimethano naphthalene)	Shall not exceed 0.0002 mg/l

Parameter	Limit
13. Lindane (1,2,3,4,5, 6-hexachlorocyclohexane, gamma isomer)	Shall not exceed 0.004 mg/l
14. Methoxychlor [1,1,1-Trichloro-2, 2-bis (p-methoxyphenyl) ethane]	Shall not exceed 0.1 mg/l
15. Toxaphene ($C_{10}H_{10}Cl_8$, Technical Chlorinated Camphene, 67-69 percent chlorine)	Shall not exceed 0.005 mg/l
16. Chlorophenoxys:	
2,4-D,(2,4-Dichlorophenoxyacetic acid)	Shall not exceed 0.1 mg/l
2,4,5-TP Silvex (2,4, 5-Trichlorophenoxy-propionic acid)	Shall not exceed 0.01 mg/l
17. Radioactivity	Shall not exceed the maximum radionuclide contaminant levels as stated in the National Interim Primary Drinking Water Standards.
18. Toxic pollutants (other than those listed above)	Shall not exceed "Health Advisories" which have been adopted by the Department and/or EPA. A toxic pollutant for which there is no available "Health Advisory" and for which there is not sufficient data available to the Department for the establishment of a "Health Advisory" will be prohibited from discharge.

(b) Secondary effluent limitations for Class I and Class II ground waters. In addition to the effluent limitations in 314 CMR 5.10(3)(a), the following limitations shall also apply to any discharge from a point source or outlet which enters the saturated zone of, or the unsaturated zone above, Class I and Class II ground waters.

Parameter	Limit
1. Copper	Shall not exceed 1.0 mg/l
2. Foaming Agents	Shall not exceed 1.0 mg/l
3. Iron	Shall not exceed 0.3 mg/l
4. Manganese	Shall not exceed 0.05 mg/l
5. Oil and Grease	Shall not exceed 15 mg/l
6. pH	Shall be in the range of 6.5 to 8.5 standard units
7. Sulfate	Shall not exceed 250 mg/l
8. Zinc	Shall not exceed 5.0 mg/l
9. All other pollutants	None in such concentrations which in the opinion of the Director would impair the ground water for use as a source of potable water or cause or contribute to a condition in contravention of standards for other classified waters of the Commonwealth.

(c) <u>Additional effluent limitations for Class I and Class II ground waters</u>. In addition to the effluent limitations listed in 314 CMR 5.10(3)(a) and (b), the following limitations shall apply to treatment works designed to treat wastewater at flows in excess of 150,000 gallons per day:

Parameter	Limit
1. Nitrate Nitrogen (as Nitrogen)	Shall not exceed 10.0 mg/l
2. Total Nitrogen (as Nitrogen)	Shall not exceed 10.0 mg/l

(d) <u>Additional effluent limitations for Class I ground waters</u>. In addition to the effluent limitations in 314 CMR 5.10(3)(a)(b) and (c) the following limitations shall apply to treatment works discharging to Class I ground waters:

Parameter	Limit
1. Chlorides	Shall not exceed 250 mg/l
2. Total Dissolved Solids	Shall not exceed 1000 mg/l

(e) <u>Effluent limitations for Class III ground waters</u>. The effluent limitations listed below apply to any discharge from a point source or outlet which enters the saturated zone of, or the unsaturated zone above, Class III ground waters.

Parameter	Limit
1. Radioactivity	Shall not exceed the maximum radionuclide contaminant levels as stated in the National Interim Primary Drinking Water Standards.
2. All Other Pollutants	None in concentrations or combinations which upon exposure to humans will cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions or physical deformations or cause any significant adverse effects to the environment, or which would exceed the recommended limits on the most sensitive ground water use.

(4) <u>Technology based effluent limitations</u>.

(a) <u>Technology based effluent limitations for POTW's</u>. Except as provided in 314 CMR 5.10(9) technology based limitations for discharges from POTW's with design flows greater than 15,000 gallons per day shall be as follows:

1. For discharges to Class I and Class II ground waters the technology based limitations shall be secondary treatment, which is defined as that process or group of processes capable of removing from untreated wastewater a minimum of 85% of the five (5) day biochemical oxygen demand and suspended solids, and virtually all floating and settleable solids, followed by disinfection. Disinfection of treated effluent may be discontinued at the discretion of the Director. Limitations defining secondary treatment may be expressed in terms of concentration as well as mass.

2. For discharges to Class III ground waters the technology based limitations shall be primary treatment, which is defined as that process or group of processes capable of removing from untreated wastewater a minimum of 25% of the five (5) day biochemical oxygen demand, 55% of the suspended solids, and 85% of the floating and settleable solids.

(b) Technology based effluent limitations for non-POTW's. Technology based limitations for discharges from non-POTWs shall be the most stringent of the following:

1. Limitations and standards for the applicable industrial category promulgated by EPA pursuant to Sections 304, 306, 307, 316, and 405 of the Federal Act to comply with the requirements of Section 301 of that Act.

2. Limitations developed on a case-by-case basis which, in the Director's best professional judgment, define the appropriate level of control set forth in the Federal Act for the category of discharger or class of pollutants discharged. In defining the appropriate level of control hereunder, the Director will consider any draft or promulgated EPA effluent limitation guidelines, draft or proposed EPA development documents or guidance, any available state guidance, or any technology or process which has been demonstrated to be achievable in the experience of the Division for the class or category of discharger.

3. In the case of reissued permits, limitations which are at least as stringent as those of the previous permit, unless the effluent limitations imposed by the previously issued permit are more stringent than subsequently promulgated effluent guidelines and one or more of the following conditions applies:

a. The discharger has installed the treatment facilities required to meet the effluent limitations in the previous permit and has properly operated and maintained the facilities but has nevertheless been unable to achieve the previous effluent limitations. In this case the limitations in the renewed or reissued permit may reflect the level of pollutant control actually achieved (but shall not be less stringent than required by the subsequently promulgated effluent limitation guidelines).

b. The circumstances on which the previous permit was based have materially and substantially changed since the time the permit was issued and would constitute cause for permit modification or revocation and reissuance under 314 CMR 5.12.

(5) Duration of permits. Permits shall be effective for a fixed term not to exceed five (5) years. The Director may issue any permit for a lesser duration.

(6) Monitoring, recordkeeping and reporting requirements.

(a) Each permit shall contain monitoring requirements to assure compliance with permit limitations and conditions, including the installation of monitoring wells. The number, location, dimensions, method of construction, and method of sampling of monitoring wells shall be approved by the Division in accordance with 314 CMR 6.08. The type, intervals, and frequency of monitoring shall be sufficient to yield data which are representative of the monitored activity including, when appropriate, continuous monitoring. Monitoring requirements may include the mass (or other measurement specified in the permit) for each pollutant limited in the permit, the volume of effluent discharged from each facility, and other measurements as appropriate (including biological monitoring methods when appropriate). Monitoring shall be conducted in accordance with the provisions of 314 CMR 5.19(10) and 6.08. Permittees shall maintain records of all monitoring activities in accordance with 314 CMR 5.19(11).

(b) Each permit shall contain requirements to report monitoring results with a frequency dependent on the nature and effect of the discharge, but in no case less than once a year. Pollutants for which the permittee must report violations of maximum daily discharge limitations under 314 CMR 5.19(20)(e) shall be listed in the permit.

(7) Schedule of Compliance.
(a) A permit may, when appropriate, specify a schedule leading to compliance with the State Act and regulations adopted thereunder. Any such schedule shall require compliance as soon as possible.
Each schedule shall set forth dates to accomplish interim requirements leading toward compliance. Beginning with the date of permit issuance, the time between interim dates shall not exceed one (1) year. If the time necessary for completion of any interim requirement is more than one (1) year and is not readily divisible into stages for completion, the permit shall specify interim dates for the submission of reports of progress toward completion of the interim requirements and indicate a projected completion date.
(b) The first permit issued for a discharge which commences after the effective date of 314 CMR 5.00 shall not contain a schedule of compliance. No new or recommencing discharge shall commence operations or discharge prior to installation and operation of all treatment works necessary to comply with the effluent limitations established in the permit.

(8) Other Conditions. In addition to the conditions established under 314 CMR 5.10(1) through (7), a permit may include special conditions as follows:
(a) Requirements for POTWs to comply with pretreatment provisions under 314 CMR 12.00; including:
1. The identification, in terms of character and volume of pollutants, of any significant indirect discharge into the POTW subject to the prohibitions and standards of 314 CMR 12.08;
2. The establishment of a POTW pretreatment program in accordance with 314 CMR 12.09, including any necessary schedule of compliance for adoption of the program;
3. The incorporation of an approved POTW pretreatment program in the permit; and
4. The submittal by a POTW of the reports required by 314 CMR 12.09(3).
(b) Requirements applicable to the management of hazardous wastes for treatment works subject to the provisions of 314 CMR 8.00.
(c) Requirements to control or abate the discharge of pollutants through the application of best management practices when:
1. Authorized under Section 304(e) of the Federal Act for the control of toxic pollutants and hazardous substances from ancillary and industrial activities;
2. Numerical effluent limitations are infeasible; or
3. The practices are reasonably necessary to achieve effluent limitations and standards or to carry out the purposes and intent of State Act.
(d) Requirements to monitor, record, and report the quality of water at upgradient and downgradient monitoring wells to determine that the discharge does not result in a violation of the Massachusetts Ground Water Quality Standards (314 CMR 6.00).
(e) Requirements to prepare and submit monthly operating reports under 314 CMR 12.07.
(f) Requirements imposed in grants made by EPA or the Director to POTW's under Section 201 and 204 of the Federal Act or Section 30A of the State Act which are reasonably necessary for the achievement of effluent limitations.
(g) Requirements governing the disposal of sludge from treatment works.

6.06: Minimum Ground Water Quality Criteria

(1) Class I and Class II Ground Waters. The following minimum criteria are applicable to all Class I and Class II ground waters:

Parameter	Criteria
(a) Pathogenic Organisms	Shall not be in amounts sufficient to render the ground waters detrimental to public health and welfare or impair the ground water for use as source of potable water.
(b) Coliform Bacteria	Shall not exceed the maximum contaminant level as stated in the National Interim Primary Drinking Water Standards.
(c) Arsenic	Shall not exceed 0.05 mg/l
(d) Barium	Shall not exceed 1.0 mg/l
(e) Cadmium	Shall not exceed 0.01 mg/l
(f) Chromium	Shall not exceed 0.05 mg/l
(g) Copper	Shall not exceed 1.0 mg/l
(h) Fluoride	Shall not exceed 2.4 mg/l
(i) Foaming Agents	Shall not exceed 0.5 mg/l
(j) Iron	Shall not exceed 0.3 mg/l
(k) Lead	Shall not exceed 0.05 mg/l
(l) Manganese	Shall not exceed 0.05 mg/l
(m) Mercury	Shall not exceed 0.002 mg/l
(n) Nitrate Nitrogen (as Nitrogen)	Shall not exceed 10.0 mg/l
(o) Total Trihalomethanes	Shall not exceed 0.1 mg/l
(p) Selenium	Shall not exceed 0.01 mg/l
(q) Silver	Shall not exceed 0.05 mg/l
(r) Sulfate	Shall not exceed 250 mg/l
(s) Zinc	Shall not exceed 5.0 mg/l
(t) Endrin (1,2,3,4,10, 10-hexachloro-1,7-epoxy-1, 4,4a,5,6,7,8,9a-octahydro-1,4-endo,endo-5,8-dimethano naphthalene)	Shall not exceed 0.0002 mg/l
(u) Lindane (1,2,3,4,5, 6-hexachlorocyclohexane, gamma isomer)	Shall not exceed 0.004 mg/l
(v) Methoxychlor (1,1,1-Trichloro-2, 2-bis (p-methoxyphenyl) ethane)	Shall not exceed 0.1 mg/l
(w) Toxaphene ($C_{10}H_{10}Cl_8$, Technical Chlorinated Camphene, 67-69 percent chlorine)	Shall not exceed 0.005 mg/l
(x) Chlorophenoxys:	
2,4-D,(2,4-Dichlorophenoxyacetic acid)	Shall not exceed 0.1 mg/l
2,4,5-TP Silvex (2,4, 5-Trichlorophenoxypropionic acid)	Shall not exceed 0.01 mg/l
(y) Radioactivity	Shall not exceed the maximum radionuclide contaminant levels as stated in the National Interim Primary Drinking Water Standards.

6.06: continued

Parameter	Criteria
(z) pH	Shall be in the range of 6.5-8.5 standard units or not more than 0.2 units outside of the naturally occurring range.
(aa) All Other Pollutants	None in such concentrations which in the opinion of the Director would impair the waters for use as a source of potable water or to cause or contribute to a condition in contravention of standards for other classified waters of the Commonwealth.

(2) Class III Ground Waters. The following minimum criteria are applicable to all Class III ground waters:

Parameter	Criteria
(a) Pathegenic Organisms	Shall not be in amounts sufficient to render the ground waters detrimental to public health, safety or welfare.
(b) Radioactivity	Shall not exceed the maximum radionuclide contaminant levels as stated in the National Interim Primary Drinking Water Standards.
(c) All Other Pollutants	None in concentrations or combinations which upon exposure to humans will cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions or physical deformations or cause any significant adverse effects to the environment, or which would exceed the recommended limits on the most sensitive ground water use.

6.07: Application of Standards

(1) Ground Water Discharge Permits. No person shall make or permit an outlet for the discharge of sewage or industrial waste or other wastes or the effluent therefrom, into any ground water of the Commonwealth without first obtaining a permit from the Director of the Division of Water Pollution Control pursuant to 314 CMR 5.00. Said permit shall be issued subject to such conditions as the Director may deem necessary to insure compliance with the standards established in 314 CMR 6.06. Applications for ground water discharge permits shall be submitted within times and on forms prescribed by the Director and shall contain such information as he may require.

(2) Establishment of Discharge Limits. In regulating discharges of pollutants to ground waters of the Commonwealth, the Division shall limit or prohibit such discharges to insure that the quality standards of the receiving waters will be maintained or attained. The determina-

tion by the Division of the applicable level of treatment for an individual discharger will be made in the establishment of discharge limits in the individual ground water discharge permit. In establishing effluent limitations in the individual permits, the Division must consider natural background conditions, must protect existing adjacent and downgradient uses and must not interfere with the maintenance and attainment of beneficial uses in adjacent and downgradient waters. Toward this end, the Division may provide a reasonable margin of safety to account for any lack of knowledge concerning the relationship between the pollutants being discharged and their impact on the quality of the ground waters.

(3) For purposes of determining compliance with 314 CMR 6.06(1)(aa) for toxic pollutants in Class I and Class II ground waters, the Division shall use Health Advisories which have been adopted by the Department or EPA. Generally, the level of a toxic pollutant which may result in one additional incident of cancer in 100,000 given a lifetime exposure (10^{-5} Excess Lifetime Cancer Risk) will be used in determining compliance with that section of the regulations.

(4) Coordination with Federal Criteria. The Division may use available published water quality criteria documents as guidance in establishing case-by-case discharge limits on specific pollutants to ground waters including but not limited to EPA guidance published in accordance with Section 304(b) of the Federal Act.

6.08: Monitoring

(1) Collection of Samples. The determination of compliance or non-compliance of sewage, industrial waste or other waste discharges with the requirements of 314 CMR 6.00 shall be made through tests or analytical determinations of ground water or effluent samples collected, transported and stored in such manner as is approved by the Division. The location at which ground water samples are collected shall be determined by the Division. In selecting or approving such locations, the Division shall consider all relevant facts including, but not limited to:

(a) The mobility of pollutants in the unsaturated zone and the pollutant attenuation mechanisms in this zone.
(b) Attenuation mechanisms which may remove potential pollutants in passage through the soil.
(c) The relative thickness of the unsaturated zone.
(d) Attenuation of pollutant concentrations with distance which may occur in the saturated zone, as a result of attenuation processes occurring below the water table.

The location at which effluent samples are collected shall be at a point where the effluent emerges from a treatment works, disposal system, outlet or point source and prior to being discharged to the ground.

(2) Number of Monitoring Wells. The Division shall determine the number of observation and and monitoring wells necessary for the determination of compliance with 314 CMR 6.00.

(3) Tests or Analytical Determinations. Test or analytical determinations to determine compliance or non-compliance with standards shall be made in accordance with:

(a) the latest edition of Standard Methods for the Examination of Water and Wastewater prepared by the Ammerican Public Health Association, American Water Works Association, and Water Pollution Control Federation;
(b) the latest edition of Methods for Chemical Analysis of Water and Wastes prepared by the Environmental Protection Agency;

6.08: continued

(c) the latest edition of Water Standards of The American Society for Testing and Materials; or
(d) other methods approved by the Director as giving results equal to or superior to methods listed above.

(314 CMR 6.09: Reserved)

6.10: Interim Provisions

(1) Ground water classifications will be assigned state-wide by the Division on or after June 1, 1985. Any person desiring an initial assignment of a specific classification for particular ground waters as part of the state-wide classifications should submit the information specified in 314 CMR 6.04 to the Division prior to January 1, 1985. All ground waters for which no petition for consideration of a specific classification is filed with the Division prior to January 1, 1985 will be proposed by the Division for assignment as Class I. The Division may consider individual petitions for Class III assignment on a case-by-case basis at any time, such petitions shall comply with the provisions of 314 CMR 6.04.

(2) In the absence of a classification all ground waters will be protected for the most sensitive of the uses designated in 314 CMR 6.03, that is as a source of potable water supply. All ground water discharge permits issued after October 1, 1983, but prior to the classification of the ground waters receiving the discharge, shall contain such special conditions necessary to protect the ground waters for use as a source of potable water supply, including but not limited to the applicable Class I effluent limitations contained in 314 CMR 5.10(3).

REGULATORY AUTHORITY

314 CMR 6.00: M.G.L. c. 21, ss. 27(5) and 28(12).

Suffolk County, NY Sanitary Code, Article 7, Sections 703 P, 705, and 706.

Section 705. General Restrictions and Prohibitions

A. Construction of a Disposal System

1. It shall be unlawful for any person to construct, reconstruct, install or substantially modify any disposal system without first having obtained a permit therefor issued by or acceptable to the commissioner.

2. Section 705.A.1 does not apply to stormwater disposal systems unless there is an actual or potential discharge into the system of industrial wastes, toxic or hazardous materials, or sewage.

B. Discharge

1. It shall be unlawful for any person to discharge sewage, industrial wastes, offensive materials, toxic or hazardous materials or other wastes to any surface waters or groundwaters, to the surface of the ground or to a disposal system unless such discharge is specifically in accordance with a State Pollutant Discharge Elimination System (SPDES) Permit or other permit issued by or acceptable to the commissioner for that purpose.

2. No permits, as stipulated in Section 705.B.1, are required for the following types of discharges:

a. discharge of sewage from an existing residential structure to a private or individual sewage disposal system, or from any residential structure, houseboat or housebarge to a communal sewage system or municipal sewage system that does not contravene standards or result in a public health nuisance;

b. discharge of sewage from a commercial or industrial facility to a communal sewage system or municipal sewage system;

c. discharge of stormwater to a disposal system unless there is an actual or potential discharge into the system of industrial wastes or toxic or hazardous materials or sewage.

3. For existing discharges not prohibited by law prior to the effective date of this article, a permit shall be obtained within the time limits provided in Section 707.

C. Construction or Operation of a Treatment System

1. It shall be unlawful for any person to construct, modify or operate a treatment system without first obtaining a permit therefor issued by or acceptable to the commissioner.

D. Commingling

1. It shall be unlawful for any person to commingle stormwater runoff, cooling water, sewage or industrial wastes in any disposal system not approved for that purpose pursuant to this article.

E. Stormwater Discharges

1. It shall be unlawful for any person to develop or use land in such a manner as to cause stormwater runoff from that land to become contaminated and discharged in contravention of the other provisions of this article.

Section 706. Deep Recharge Areas and Water Supply Sensitive Areas

The following additional restrictions and prohibitions shall apply in deep recharge areas and water supply sensitive areas.

A. It shall be unlawful for any person to discharge any restricted toxic or hazardous materials or to discharge industrial wastes from processes containing restricted toxic or hazardous materials to the groundwaters, to the surface of the ground, beneath the surface of the ground, to a municipal or communal sewage system, or to a disposal system except as follows:

1. application of fertilizers, pesticides or other agricultural chemicals approved for that purpose by the appropriate state and federal agencies; or

2. application of road surfacing or road construction materials or deicing salts to roadways, walkways, and parking areas; or

3. discharge from an establishment to a municipal or communal sewage system with effluent disposal to marine surface waters or recharge outside of the deep recharge areas and water supply sensitive areas, and the following minimum requirements are satisfied pursuant to a permit issued by or acceptable to the commissioner:

a. Dual plumbing systems shall be installed, one for the sanitary wastes and one for industrial wastes.

b. Sampling access approved by the administrative head of the municipal or communal sewage system and the Department shall be provided for both the sanitary and industrial waste systems.

c. The administrative head of the municipal or communal sewage system, with approval of the Department, shall determine which industrial wastes are acceptable to "hold and haul" and which require pretreatment prior to discharge to the collection system in order to assure compliance with the applicable sewer use ordinance.

d. Personnel authorized by the administrative head of the municipal or communal sewage system or other individual(s) acceptable to the commissioner, shall operate at each establishment its pretreatment facility for industrial wastes prior to discharge to the collection system.

e. Only batch pretreatment of industrial wastes will be permitted. Batch facilities and facilities for storage of drums containing toxic or hazardous wastes shall be located in an area accessible at all times by district personnel, in or adjacent to the industrial building, with heat and power provided by the owner.

f. Personnel authorized by the administrative head of the municipal or communal sewage system or other individual(s) acceptable to the commissioner, will be responsible for collection and disposal of pretreatment sludges, and other "hold and haul" materials.

g. The owner shall allow the personnel authorized by the administrative head of the municipal or communal sewage system or other individual(s) acceptable to the commissioner, access, from time to time, to wet process areas to perform their duties and inspections.

h. Industrial process-area floors shall be provided with adequate means to contain any spill of restricted toxic or hazardous materials. The design of containment facilities shall be subject to the approval of the commissioner.

i. A minimum of four (4) groundwater monitoring wells shall be installed at the owner's expense.

j. Financial assurance shall be provided to pay for cleanup of spills. This cost shall be entered as a judgment upon notice against the owner, occupant, tenant, or lessee responsible for such spill or spills.

B. It shall be unlawful to use or store any restricted toxic or hazardous materials on any premises except as follows:

1. a. the intended use of the product stored is solely for on-site heating, or intermittent stationary power production such as stand-by electricity generation or irrigation pump power; and

b. the facility for such storage is intended solely for the storage of kerosene, number 2 fuel oil, number 4 fuel oil, number 6 fuel oil, diesel oil or lubricating oil; and

c. the facility for such storage is constructed in accordance with the construction standards of Article 12 of the Suffolk County Sanitary Code for non-petroleum hazardous materials; and

d. the materials so stored are not industrial wastes from processes containing restricted toxic or hazardous materials; and

e. the materials stored are not intended for resale; or

2. a. the materials so stored are in containers where the total liquid capacity stored at any time does not exceed 250 gallons and where the dry storage in bags, bulk or small containers does not exceed 2,000 pounds; or

3. a. the materials so stored are intended solely for for treatment or disinfection of water or sewage in treatment processes located at the site; or

4. a. the materials are stored solely incident to retail sales on premises and are not processed, pumped, packaged, or repackaged at the site; or

5. a. the materials are stored at a service station or similar installation solely incident to the distribution of gasoline, kerosene, diesel oil or other petroleum products for motor vehicular uses and repair; and

b. the facility for such storage is constructed in accordance with construction and monitoring standards of Article 12 of the Suffolk County Sanitary Code for non-petroleum hazardous materials; or

6. a. the materials are stored at an establishment for which a permit has been secured in accordance with Section 706.A.3, and a permit for such storage has been granted by the Department.

7. a. the materials are stored on a farm site solely incident to on-premises use, and consist of fertilizers, pesticides, or other agricultural chemicals to be applied in accordance with the provisions of Section 706.A.1.

C. The provisions of Sections 706.A and 706.B of this article shall be applicable:

1. immediately for all non-residential facilities which have not been approved, constructed, or put into operation prior to the effective date of this article; and

2. immediately for all non-residential facilities which were approved, constructed, or put into operation prior to the effective date of this article upon:

a. any change in use or process which results in an increase of mass loading in the discharge of restricted toxic or hazardous materials, or introduces a toxic or hazardous material not previously discharged; or

b. any change in use or process which results in an increase of the storage or change of type of restricted toxic or hazardous materials.

D. When upgraded in accordance with the time schedule specified in Article 12, existing facilities, including those for petroleum products, not otherwise covered by items 706.A, 706.B or 706.C, above, shall conform to the standards of Article 12 for non-petroleum hazardous materials. These requirements do not apply to facilities upgraded in accordance with Article 12 prior to the effective date of this article.

P. **Restricted Toxic or Hazardous Materials** shall mean the following toxic or hazardous chemicals that have been or could be expected to be detected in the groundwater, or in discharges to the groundwater, of Suffolk County. This definition applies to these substances alone or in combination, solution or mixture with other substances, or chemically compounded with other elements or compounds.

Arsenic	Freon 113
Barium	Lead
Benzene	Mercury
Bromobenzene	Methylene Chloride
Bromodichloromethane	Nickel
Bromoform	Pesticides
Cadmium	Petroleum Distillates
Carbon Tetrachloride	Phenols
Chlorobenzene	Phthalates
Chlorodibromomethane	Roadway Deicing Salt
Chloroform	Silver
Chlorotoluene	Styrene
Chromium	Tetrachloroethylene
Cis 1,2 Dichloroethylene	1,2,4,5 Tetramethylbenzene
Creosotes	Toluene
Cyanide	1,2,3 Trichlorobenzene
Dichlorobenzene	1,2,4 Trichlorobenzene
1,1 Dichloroethane	1,1,1 Trichloroethane
1,2 Dichloroethane	1,1,2 Trichloroethane
1,1 Dichloroethylene	1,1,2 Trichloroethylene
1,2 Dichloropropane	1,2,3 Trichloropropane
p-Diethylbenzene	1,2,4 Trimethylbenzene
Ethylbenzene	1,3,5 Trimethylbenzene
p-Ethyltoluene	Vinyl Chloride
Fluoride	Xylenes

All other halogenated hydrocarbon compounds.

State of Oregon Department of Environmental Quality, Oregon Administrative Rules, Chapter 340, Division 71 - 520.

340-71-520 LARGE SYSTEMS.

(1) For the purpose of these rules "large system" means any system with a projected daily sewage flow greater than two thousand five hundred (2,500) gallons.

(2) Special Design Requirements. Unless otherwise authorized by the Department, large systems shall comply with the following requirements:

(a) Large system absorption facilities shall be designed with pressure distribution.

(b) The disposal area shall be divided into relatively equal units. Each unit shall receive no more than thirteen hundred (1300) gallons of effluent per day.

(c) The replacement (repair) disposal area shall be divided into relatively equal units, with a replacement disposal area unit located adjacent to an initial disposal area unit.

(d) Effluent distribution shall alternate between the disposal area units.

(e) Each system shall have at least two (2) pumps or siphons.

(f) The applicant shall provide a written assessment of the impact of the proposed system upon the quality of public waters and public health.

(3) Plans and specifications for large systems shall be prepared by any competent professional with education or experience in the specific technical field involved. The professional may accept an assignment requiring education or experience outside of his/her own field of competence provided he/she retains competent and legally qualified services to perform that part of the assignment outside his/her own field of competence, his/her client or employer approves this procedure, and he/she retains responsibility to his/her client or employer for the competent performance of the whole assignment.

(4) Construction Requirements:

(a) Construction shall be in substantial conformance with approved plans and specifications and any terms of the permit issued by the Agent.

(b) After completion of the system the professional shall certify that the system was installed in accordance with approved plans and specifications.

Nassau County, NY Department of Health, Manual of On-Site Sewage Disposal, Section 4.

SECTION 4 - MISCELLANEOUS REQUIREMENTS

1. Requirements of Food Serving Establishments

If a food serving facility is to be located in an existing building, it must have adequate and satisfactory sewage disposal facilities. If the existing structure was formerly a "dry" store (one which does not utilize large quantities of water), or contained a smaller food serving establishment, it is required that a new or modified sewage disposal system be installed to serve the new occupancy. If the owner (or operator) feels the existing sewage disposal system is adequate, he must demonstrate, to the satisfaction of the Nassau County Department of Health, that the existing sewage disposal system can accommodate the projected design flow of the new establishment. In general, any leaching pool with 75% or more of the effective pool depth filled with sewage is considered to have failed and shall not be considered in assessing the apparent leaching capacity of an existing sanitary system.

It should be noted that in addition to the above-referenced approval, other permits may be needed in order to operate a food-serving establishment. The Bureau of Food and Beverage Control of the Nassau County Department of Health should be contacted for further information.

II. Commercial or Industrial Projects

It is required that the owner of a commercial or industrial building operation which could contain manufacturing, warehousing, packaging operations, submit as part of the project's SPDES application, the following statement on the company's letterhead:

"I, ______________________________, hereby certify that
(name of applicant)
there will not be any industrial or other non-sanitary waste discharged from the facility for which this permit is applied. This facility ____________________________
(fully describe the name, location and proposed function of the business at the facility)

Should any changes be contemplated in the waste to be discharged from this facility, all required permits will be obtained before any such waste is discharged."

____
Signature

____
Title

MUNICIPAL WASTEWATER DISPOSAL ZONES

AN ACT to provide for the creation of municipal wastewater disposal zones. P.A. 80-1371, approved and eff. Aug. 14, 1978.

1401. Definitions

§ 1. When used in this Act,

"Corporate authorities" means the governing authority of a municipality.

"On-site wastewater disposal system" means any of several works, facilities, devices, or other mechanisms used to collect, treat, reclaim, or dispose of wastewater on, or immediately adjacent to, the property from which the wastewater is disposed.

"Zone" means an on-site wastewater disposal zone formed pursuant to this Act.

"Real property" means both land and improvements to land which is located within the zone.

"Wastewater" means sewage, industrial waste or other waste, or any combination of these, whether treated or untreated plus any admixed land run-off.

"Municipality" means the city, village or incorporated town forming a zone.

1402. On-site wastewater disposal zones—Formation

§ 2. The corporate authorities of any city, village or incorporated town may form on-site wastewater disposal zones to protect the public health, to prevent and abate nuisances, to protect existing and future beneficial water use, to achieve compliance with regulations of the Pollution Control Board and to achieve compliance with any other statutes or requirements regarding public health or environmental protection. Whenever an on-site wastewater disposal zone has been formed pursuant to this Act, the municipality shall have the powers set forth in this Act, which powers shall be in addition to any other powers provided by law.

1403. Purposes of formation

§ 3. An on-site wastewater disposal zone may be formed for the following purposes:

(a) to collect, treat, reclaim, or dispose of wastewater;

(b) to acquire, design, own, construct, install, operate, monitor, regulate, inspect, rehabilitate, modify and maintain existing and new on-site wastewater disposal systems, within the zone in a manner which will promote environmental quality, prevent the pollution, waste, and contamination of water, abate nuisances, and protect public health;

(c) to conduct investigations, make analyses, and monitor conditions with regard to water quality within the zone;

(d) to apply for, obtain and utilize federal and State funds for any of the purposes specified in this Act;

(e) to adopt and enforce reasonable rules and regulations necessary to implement the purposes of the zone. Such rules and regulations may be adopted only after the corporate authorities conduct a public hearing after giving public notice in a newspaper of general circulation within the municipality;

(f) to contract for the exercise of any of the aforementioned powers even if any such contract shall extend for longer than one year; and

(g) to impose a tax upon all real property located in the zone for the purpose of retiring bonds issued pursuant to Section 6 of this Act,[1] paying the costs of construction, operation and maintenance of the wastewater disposal system, and to impose a user charge to defray the costs of routine operation and maintenance.

[1] Paragraph 1406 of this chapter.

1404. Powers and duties

§ 4. The corporate authorities shall have the following powers and duties:

(a) to exclude any territory proposed to be included in a zone if it finds that the territory will not be benefited by becoming a part of the zone; and

(b) to include any additional territory in a proposed zone if it finds that the territory will be benefited by becoming a part of the zone.

1405. Ordinances—Wastewater disposal zones

§ 5. Whenever the corporate authorities deem it necessary to form an on-site wastewater disposal zone in all or a portion of the municipality, it shall by ordinance declare that it intends to form such a zone. The ordinance shall include:

(a) a description of the boundaries of the territory proposed to be included within the zone, which description may be accompanied by a map describing the boundaries.

(b) the public benefit to be derived from the establishment of such a zone;

(c) a description of the proposed types of on-site wastewater disposal systems and a proposed plan for wastewater disposal;

(d) the number of residential units and commercial users in the proposed zone which the municipality proposes to serve;

(e) the proposed means of financing the operations of the zone;

(f) the time and place for a public hearing on the question of the formation and extent of the proposed zone, and on the question of the number and type of the residential units and commercial units that are to be served in the proposed zone; and

(g) a statement that at such time and place any interested persons will be heard.

Reproduction of Sewage Waste Management Agreement (SMA) for Dalton Gardens, Idaho.

This AGREEMENT made this 1st day of May, 1986, between the City of Dalton Gardens, a municipal corporation organized under the laws of the State of Idaho and situated in the County of Kootenai, State of Idaho, hereinafter referred to as "MUNICIPALITY" and Panhandle Health District I, a health district organized under Title 39, Chapter 4, Idaho Code, with its principal office in the City of Coeur d'Alene, County of Kootenai, State of Idaho, hereinafter referred to as "HEALTH DISTRICT."

WHEREAS, the Health District has legal responsibility for the protection and preservation of the public health under Idaho Code 39-414 and the protection of the Rathdrum Prairie Aquifer from contamination;

WHEREAS, the parties hereto desire to maintain orderly population growth in such a manner as to prevent possible contamination to the Rathdrum Prairie Aquifer from septic tank effluent;

WHEREAS, the Municipality has the responsibility to protect the health and welfare of its citizens. The Municipality is obligated to meet all applicable local, State of Idaho, and federal laws, rules, regulations, and standards to realize this responsibility.

WHEREAS, the Panhandle Health District has adopted effective October 11, 1977, Rules and Regulations governing Sewage Disposal on the Rathdrum Prairie;

WHEREAS, Section 41.1.10 (iii) of the Rules and Regulations Governing Sewage Disposal on the Rathdrum Prairie provides for adoption of a "sewage management plan";

NOW, THEREFORE, in consideration of the foregoing and of the mutual covenants and undertaking herein set forth, the parties covenant and agree as follows:

1. The Municipality shall assume responsibility for the aggregate effect of all the subsurface sewage disposal systems within its legal boundaries. In particular, the Municipality agrees to fulfill this responsibility in accordance with the provisions of APPENDIX A.

2. The Municipality agrees to report to the Health District all failed subsurface systems within the Municipality's legal boundaries.

3. The Municipality shall not issue any building permit to an applicant until such application is first submitted to the Health District for its approval and is so approved by the Health District. The approval shall be given by the Health District when the application complies with the Rules and Regulations for Individual and Subsurface Sewage Disposal Systems.

4. In consideration of the foregoing, the Health District agrees to refrain from taking any action in law or equity against the Municipality to enforce Section 41.1.4a of the Environmental Health Code. In the event the Municipality fails to perform any of its obligations under this AGREEMENT, the Health District may proceed promptly in any court of jurisdiction to seek enforcement against the Municipality.

5. The Parties agree to meet at least every third year and upon written request of either party, through duly authorized representatives to reexamine this AGREEMENT and made recommendations to the governing board of each party as to any modification in the AGREEMENT which would be in the public interest.

6. Each of the Parties heretofore mentioned recognizes its governmental agencies are regulated by the statutes of the State of Idaho. None of the sections are designed to exceed the powers intended; nor shall any particular section be binding if the same is determined to be invalid.

7. This instrument, including APPENDIX A, contains the entire AGREEMENT between the Parties, and no statement, promise, or inducement made by either Party or Agent of either Party that is not contained in this written contract, including APPENDIX A, shall be valid or binding; this contract may

not be enlarged, modified, or altered except in writing signed by the parties and endorsed hereon.

IN WITNESS WHEREOF, the Parties have executed this **AGREEMENT** the day and year first above written.

____
MAYOR
City of Dalton Gardens, Idaho

____
CHAIRPERSON
Panhandle Health District I

ATTEST:

____
City Clerk

APPENDIX A

The City of Dalton Gardens shall maintain, in effect, an ordinance concerning the operation and maintenance of subsurface sewage disposal systems within its legal boundaries.

The ordinance shall include, but is not limited to the following:

1. No subsurface sewage system (residential, commercial, or industrial) shall be installed or allowed to continue in operation if the effluent loading exceeds that of the equivalent of one house to the acre.

2. All new subsurface systems must have the following:

    a. Septic tanks with manhole risers to within six inches of the ground surface and an inspection riser to ground surface.

    b. Date of installation, location, size, and type of all components in system recorded at the City Hall with lot size.

3. An annual notice should be sent to all property owners reminding them to pump their sewage systems every five years.

4. When an existing system is pumped, a manhole riser to within six inches of the surface and an inspection riser to the surface should be installed.

5. All septic pumpers doing business in Dalton Gardens should report to the City the condition, location, size, and type of tank and disposal system, and date of pumping.

6. The City shall annually report the number of systems installed or repaired to the Health District.

Marion County, Indiana, Private Sewage Disposal Ordinance, Chapter 14, Articles 11 and 12.

ARTICLE 11: POWERS FOR INSPECTION-ENFORCEMENT-SERVICE OF NOTICES AND ORDERS-HEARINGS

Sec. 14-1101 The Health Officer or his agent bearing proper credentials and identification shall be permitted to enter upon all properties at the proper time for the purposes of inspection, observation, measurement, sampling, and testing necessary to carry out the provisions of this ordinance.

Sec. 14-1102 Whenever the Health Officer determines that there are reasonable grounds to believe that there has been a violation of any provision of this ordinance which affects the health of the occupants of any dwelling, dwelling unit or rooming unit or the health of the general public, the Health Officer shall give notice of such alleged violation to the person or persons responsible therefore, and to any known agent of such person, as hereinafter provided. Such notice shall:

(a) Be put in writing.

(b) Include a statement of the reasons why it is being issued.

(c) Allow a reasonable time for the performance of any act it requires.

(d) Be served upon the owner or his agent, or the occupant, as the case may require; provided that such notice shall be deemed to be properly served upon such owner or agent, or upon such occupant, if a copy thereof is served upon him personally, or if a copy is sent by registered mail to his last known address, or if a copy thereof is posted in a conspicuous place in or about the dwelling affected by the notice, or if he is served with such notice by any other method authorized or required under the laws of this state.

(e) Such notice must contain an outline of remedial action which, if taken, will effect compliance with the provisions of this ordinance.

Sec. 14-1103 Any person affected by any such notice issued by the Health Officer may request and shall be granted a hearing on the matter before the Health Officer, provided that such person shall file in the office of the Health Officer, within ten (10) days after service of the notice, a written petition requesting such hearing and setting forth a brief statement of the grounds therefor. Upon receipt of such petition, the Health Officer shall arrange a time and place for such hearing and shall give the petitioner written notice thereof. Such hearing shall be held as soon as practicable after the receipt of request therefor. At such hearing the petitioner shall be given an opportunity to be heard and to show cause why such notice should not be complied with.

Sec. 14-1104 After such hearing the respective Board shall sustain, modify, or withdraw the notice, depending upon its findings as to whether the provisions of this ordinance have been complied with. If the Board shall sustain or modify such notice, it shall be deemed to be an order. Any notice served pursuant to Article 1102 of this ordinance shall automatically become an order if a written petition for a hearing is not filed in the office of the Health Officer within ten (10) days after such notice is served. After a hearing in the case of any notice suspending any permit required by this ordinance, when such notice has been sustained by the Board, the permit shall be deemed to have been revoked. Any such permit which has been suspended by a notice shall be deemed to be automatically revoked if a petition for hearing is not filed in the office of the Health Officer within ten (10) days after such notice is served.

Sec. 14-1105 The proceeding at such hearing, including the findings and decision of the Health Officer or in his absence the Chief of the Bureau of Environmental Health, shall be summarized, reduced to writing, and entered as a matter of public record in the offices of the Board. Such record shall also include a copy of every notice or order issued in connection with the matter. Any person aggrieved by the decision of the Board may seek relief therefrom in any court of competent jurisdiction, as provided by the laws of this state.

Sec. 14-1106 Whenever the Health Officer finds that an emergency exists which requires immediate action to protect the public health he may, without notice or hearing, issue an order citing the existence of such an emergency and requiring that such action be taken as he deems necessary to meet the emergency. Notwithstanding the other provisions of this ordinance, such order shall be effective immediately. Any person to whom such an order is directed shall comply therewith immediately, but upon petition to the Health Officer shall be afforded a hearing as soon as possible, in the manner provided in Article 1103. After such hearing, depending upon the finding as the whether the provisions of this ordinance have been complied with, the Board shall continue such order in effect, or modify it, or revoke it.

Sec. 14-1107 Any person found to be violating any provision of this ordinance except Article 1001, shall be served by the Health Officer with a written order stating the nature of the violation and providing a time limit for satisfactory correction thereof. Any person found to be violating Article 1001 immediately shall be subject to prosecution therefor and, upon conviction, shall be subject to the penalties set forth in Article 1108.

Sec. 14-1108 Any person who shall continue any violation of this ordinance beyond the time limit provided for in Article 1001 of this ordinance shall be guilty of a misdemeanor. On conviction the violator shall be punished for the first offense by a fine of not more than Five Hundred Dollars ($500.00); for the second offense by a fine of no more than One Thousand Dollar ($1000.00); and for the third and each subsequent offense by a fine of not more than One Thousand Dollars Dollars ($1000.00), and each day after the expiration of the time limit for abating insanitary conditions and completing improvements to abate such conditions as ordered by the Director of Public Health shall constitute a distinct and separate offense.

Sec. 14-1109 Any person violating any of the provisions of this ordinance shall become liable to The Health and Hospital Corporation of Marion County, Indiana, for any expense, loss, or damage occasioned such corporation by reason of such violation.

<u>ARTICLE 12:</u> APPEAL PROCEDURES.

Sec. 14-1201 If an applicant is refused a permit, the Health Officer shall, upon request, afford the applicants a fair hearing.

Sec. 14-1202 The Health Officer may, after reasonable opportunity for fair hearing, revoke a permit authorizing the construction of a sewage disposal system if it finds that the holder of the permit has failed to comply with any provision of this regulation.