ON-SITE WASTEWATER TREATMENT SYSTEMS

ON-SITE WASTEWATER TREATMENT SYSTEMS MANAGEMENT PRACTICES CATALOGUE

FOR

NONPOINT SOURCE POLLUTION PREVENTION

AND

WATER QUALITY PROTECTION

IN

NEW YORK STATE

Prepared By:

**On-site Wastewater Treatment Systems Management Practices Sub-Committee
of the
New York State Nonpoint Source Management Practices
Task Force**

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DISCLAIMER

This product is funded by the United States Environmental Protection Agency. The contents of this product do not necessarily reflect the views and policies of the Environmental Protection Agency, nor does the mention of trade names or commercial products constitute endorsement or recom-mendation for use.

This Catalogue is written and compiled by the New York State Department of Environmental Conservation to assist local municipalities in addressing On-Site Wastewater Treatment Systems as sources of nonpoint source pollution.

New York State relies on Appendix 75A of Title 10 of the New York Code of Rules and Regulations (10 NYCRR Appendix 75A) as its source of legal authority. 10 NYCRR Appendix 75A are minimum requirements, local conditions may warrant wastewater treatment practices more conservative than those listed herein, some state, county and local agencies have adopted on-site wastewater treatment requirements which differ from these practices. In those areas, the reader is advised to ascertain that all local regulations have been accounted for.

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GLOSSARY

Aerobic

An environment providing readily available (molecular) oxygen to aerobic bacteria metabolizing wastewater.

Aggregate

(1) The New York Code of Rules and Regulations, Title 10 (Health), Chapter II, Part 75, Appendix 75-A definition is washed gravel or crushed stone 3/4 - 1-1/2 inches in diameter. Larger diameter material, finer substances and run-of-bank gravel are unacceptable. **(2)** The EPA 1980 Design Manual (pg. 208-209) definition is washed crushed rock or gravel; 3/4 - 2-1/2 inches in diameter. **(3)** Soil aggregate is defined as a group of soil particles cohering so as to behave mechanically as a unit. Soil aggregate is not used as bedding material for wastewater distribution piping.

Alternative Absorption Systems

10 NYCRR Appendix 75-A recognizes four systems that assure proper treatment of sewage where site or soil conditions are not suitable for CONVEN-TIONAL ABSORPTION SYSTEMS. The Raised System, Mound System, and Intermittent Sand Filter with Downstream Mound are included in the Catalogue. The Evapo-Transpiration / E.T. Absorption System is not. See discussion in Section I.D.

Anaerobic

Septic. An environment with an absence of molecular oxygen. Anaerobic bacteria obtain their oxygen to metabolize wastewater from organic compounds and water.

BOD

Biochemical Oxygen Demand, specifically 5-day BOD, is a measure of the oxygen used by a mixed population of microorganisms to metabolize a given amount and type of organic matter over a period of five days at 20 degrees Celsius. Typical residential wastewater concentrations range between 200 and 290 mg/l. Septic tank effluent averages between 120 and 240 mg/l but can vary widely (7-480 mg/l).

Conventional Absorption Field System

Any of the following: standard absorption field system, gravelless absorption field system, deep absorption trench system, shallow absorption trench sys-tem, cut and fill (trench) system, absorption bed system, and seepage pit. See STANDARD ABSORPTION FIELD SYSTEM and 10 NYCRR Appendix 75-A and Summary Sheets for details.

Design Professional

Professional Engineer, or Registered Architect, or certain Licensed Land Surveyors (see Section 7208 of the Education Law).

Engineered Systems

Engineered systems may be allowed through the issuance of a Specific Waiver. They must be designed by a design professional. An environmental assessment form may be required. See 10 NYCRR Appendix 75-A for details.

Nitrates

Nitrate nitrogen (NO_3-N) is that form of nitrogen that results from wastewater passing through a conventional or alternative wastewater treatment system. The effluent standard is 10 mg/l based on serious health effects in infants. It is controlled by separation and setback requirements and by limiting the density of OWTSs. It is soluble in water and flows through most OWTS with a small portion taken up through plant roots. Denitrification treatment components reduce nitrate concentrations and vary in design and cost.

Pathogens

Disease-causing microorganisms. Their presence is indicated by sampling wastewater for coliform bacteria.

S.S. (Suspended Solids)

SUSPENDED SOLIDS is the matter in wastewater that would be retained by a glass-fiber filter if taken to a laboratory. Domestic wastewater averages 300-400 mg/l and septic tank effluent averages 50-150 mg/l but can vary widely (10-695 mg/l). Correct sizing of septic tanks, use of compartments, and regular pumping based on inspections will maximize S.S. settling in the septic tank and minimize absorption field clogging.

Standard Absorption Field System

The most basic subsurface soil absoption field system. Described in Appendix 75-A.8(b), it uses 24" wide trenches and requires a minimum of four feet of usable soil above bedrock and ground water with a minimum vertical separation of 2 feet to the lowest part of any trench. Design criteria, materials and construction regulations are given in the 10 NYCRR Appendix 75-A.

On-Site Wastewater Treatment Systems Management Practices For Nonpoint Source Pollution Prevention And Water Quality Protection in New York State

I. Introduction

A. Nonpoint Source Management Practice Task Force

• *Background*

The Federal Water Quality Act of 1987 placed increased attention on the development and implementation of nonpoint source control programs. Section 319 of the Act required states to prepare an Assessment Report identifying waterbodies affected by nonpoint source pollution, determining categories of nonpoint sources that are significant problems in the state and listing state programs available for the control of nonpoint source pollution. States were also required to prepare a management program that explained how they planned to deal with the source categories causing the major problems.

The New York State Department of Environmental Conservation (DEC) by virtue of its statutory authority for the management of water resources (Article 15) and control of water pollution (Article 17), has assumed the lead responsibility for control of nonpoint source pollution. One action taken by DEC to carry out its NPS responsibility was the development of a *Nonpoint Source Management Plan* in January 1990. The Management Plan outlines how DEC will identify, describe and evaluate management practices to be used to reduce nonpoint sources of pollution and make recommendations for additional control options needed to address nonpoint source pollution.

• *Candidate Management Practices*

A list of candidate management practices was developed in 1989 by the Nonpoint Source Working Group, a task force under DEC leadership, composed of federal and state agencies and groups representing a broad range of issues and source categories. The Working Group recognized that there are numerous practices with potential to control nonpoint source pollution. However, the management practices were not inventoried or evaluated for effectiveness in preventing or remediating nonpoint water quality problems. In addition, they were not catalogued in a form that facilitated their widespread use throughout the state. The original list printed in the 1990 *Nonpoint Source Management Plan* did not have any practices specifically for on-site wastewater treatment systems.

A Nonpoint Source Management Practice Task Force was created in early 1990 according to the guidelines contained in Chapter IV of the *Nonpoint Source Assessment Report.* Agencies listed in that chapter were invited to participate in a meeting of the Task Force on February 1, 1990. At that meeting there was a discussion of the process to be followed for establishing the list of management practices, and each agency was given an opportunity to identify subcommittees on which they wanted to participate.

B. On-site Wastewater Treatment Systems Management Practices Subcommittee

In August 1993, an On-Site Wastewater Treatment Systems Management Practices Subcommittee was formed under DEC leadership to address failing on-site wastewater treatment systems as a source of nonpoint source pollution. Members of the Subcommittee represented federal, state and local agencies, research institutions and wastewater treatment organizations.

The primary task of the Subcommittee was to identify and evaluate management practices for controlling nonpoint source pollution from on-site systems. As an initial step, the Subcommittee assessed the preliminary list of candidate management practices, developed by NYSDEC staff, from Appendix 75A of Title 10 of the *Official Compilation of Codes,Rules and Regulations of the State of New York* (10 NYCRR App. 75A) compiled by the Health Department and entitled *Wastewater Treatment Standards-Individual Household Systems* and from EPA's *Guidance Specifying Management Mea-sures for Sources of Nonpoint Pollution in Coastal Waters.* The management measure guidance for on-site systems includes a list of on-site systems, with brief descriptions and some ranges of cost and percent removal of pollutants.

Summary sheets of the management practices deemed to be valuable were drafted by a DEC staff member or Subcommittee member, reviewed by the Subcommittee, revised based on comments, and assembled to form the major part of the *Catalogue's* "On-Site Wastewater Treatment Systems" section.

C. NPS Pollution in New York State

- ***The NPS Assessment***

In early 1989, a process was established to enhance DEC's list of segments having water quality problems. Among the goals of this process were: to use additional data sources to identify possible nonpoint source impacts, to provide an opportunity for everyone with a knowledge of water quality problems to present this information and to expand the list to include segments that are threatened by nonpoint source pollution.

DEC, working in conjunction with the New York State Soil and Water Conservation Committee, initiated a two-phase approach to identify problem waterbodies. In the first phase, each County Soil and Water Conservation District conducted a survey of nonpoint source pollution in their county. The second phase consisted of meetings of representatives from the key agencies within each county to discuss the results of the NPS survey.

Recognition of a water quality problem was the starting point for discussion. The existence of a land use which may be associated with nonpoint source pollution was not sufficient to be considered a problem. A classified use of a surface waterbody or groundwater must be precluded, impaired, stressed or threatened to be regarded as a problem.

The Bureau of Water Quality Management (now Watershed Management) merged the information collected during the update process with the segment information contained in the Division of Water's 1988 Priority Water Problem (PWP) list and compiled it in a series of databases. Division of Water and Fisheries staff verified the degree of the problem, and the uses that are affected. In December of 1991, the Division of Water's Bureau of Monitoring and Assessment (now Watershed Assessment & Research), in conjunction with the Bureau of Water Quality Management, published the PWP List. A similar procedure was followed in 1992 and 1993. Details may be found in the *1993 PWP List Report* which was distributed in May of 1994.

According to the 1993 PWP, 1,356 waterbody segments, comprising nearly 5,000 stream-miles, over 560,000 acres, and nearly 500 shore-miles of Great Lakes, were identified as having water quality impacts from nonpoint sources of pollution. About 500 segments had their classified uses "precluded" as a result of nonpoint source pollution, with nearly 300 segments "impaired," about 400 segments "stressed," and about 200 segments "threatened". One hundred sixteen (116) segments have water quality problems due to point sources.

The 1993 assessment indicated that low pH, from acid rain, remained by far the primary nonpoint source pollutant affecting the largest number of waterbody segments reported (401), followed by sediment (297), nutrients (277), and pathogens (173). Similarly, atmospheric deposition (acid rain) was the primary source affecting the most segments (403), followed by agriculture (191), urban runoff (188), and failing on-site wastewater treatment systems (180). (**Note**: See the *1993 Priority Water Problem List* for regional and individual segment information.)

• *On-Site Wastewater Treatment Systems as a Source of Nonpoint Source Pollution*

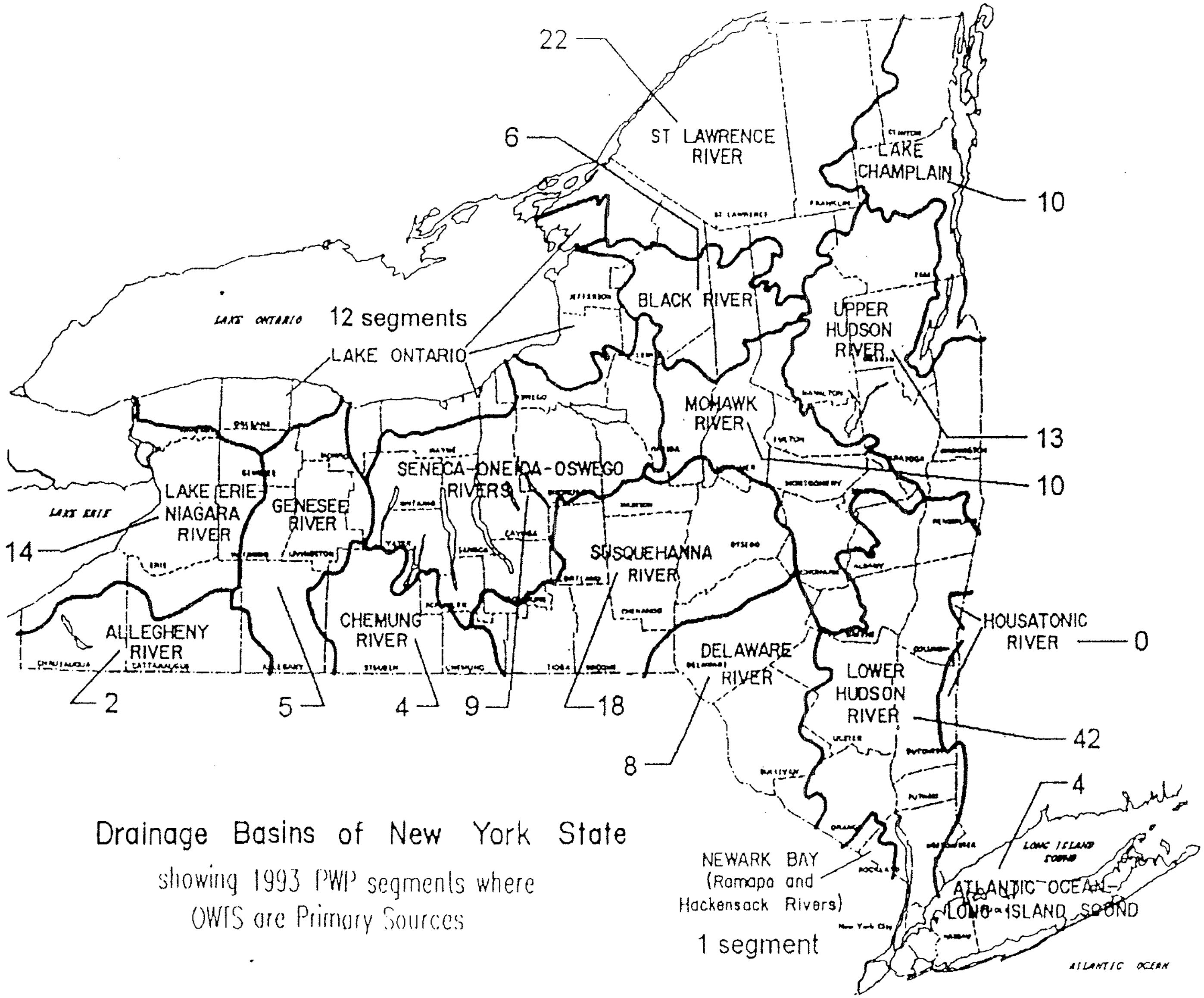
According to the 1993 PWP List, on-site wastewater treatment systems are the primary sources of water quality problems and classified water use impairments on 180 waterbodies. Two hundred eighty-one (281) miles of streams or rivers, 69 shore-miles of Great Lakes and 57,478 acres of lakes, bays and estuaries were impacted. Classified use of 8 segments was precluded; 47 impaired; 92 stressed; and 33 threatened. Figure 1 shows 24% of these segments are in the Lower Hudson River Basin, 12% are in the St. Lawrence River Basin and the remainder are throughout the state.

An additional 241 segments are affected by on-site wastewater systems as a secondary source of pollution: 123 segments are creeks or rivers and 118 are lakes, bays, estuaries or Great Lakes.

In 113 PWP List segments, nutrients were listed as the primary pollutant. Use impairment from nutrients or other pollutants can result from failing systems or cumulative effects of densely located or marginally operating systems. Other pollutants and their frequency of occurrence are: low dissolved oxygen, 6 segments; excessive pathogens, 38 segments; aesthetic impairments such as floating solids, odors, or excessive weed growth, 23 segments. Table 1 shows the distribution of segments by severity and type of primary pollutant.

Figure 1

OWTS-4



Drainage Basins of New York State

showing 1993 PWP segments where OWTS are Primary Sources

TABLE 1.

NUMBERS OF SEGMENTS IMPAIRED
(BY SEVERITY AND PRIMARY POLLUTANT)

	Nutrients	Dissolved Oxygen	Pathogens	Aesthetics
Precluded	0	0	4	4
Impaired	27	2	5	13
Stressed	63	2	21	5
Threatened	22	2	8	1

The PWP list does not document impacts on groundwater segments. There is no statewide system documenting the effects of on-site systems on groundwater resources. Proper design and installation of new systems and replacement of failing systems at the county level is the current state-of-the-art in groundwater pollution prevention in New York State. While this provides a limited amount of overall groundwater protection, municipalities near or over major aquifers may want to evaluate the use of nitrate removal systems.

The most comprehensive documents on groundwater, including the effects from and management of on-site wastewater treatment systems are the *Final Long Island Groundwater Management Program Report* (June 1986) and *Final Upstate New York Groundwater Management Program Report* (May 1987) published by NYSDEC, Division of Water.

D. What Are On-Site Wastewater Treatment Systems Management Practices?

On-site wastewater treatment systems management practices can prevent or reduce the availability, release or transport of substances that adversely affect surface and ground waters. They generally diminish the generation of pollutants from failing systems or densely located systems. While a management practice can have standards associated with its installation, operation or maintenance, such as Appendix 75A of Title 10 NYCRR, it does not impose itself as regulation. Rather, it provides an effective means of reducing or preventing the impact of nonpoint pollutants for municipal officials to investigate further or compare to other practices.

The management practices can be implemented by a private, commercial or governmental entity, and through voluntary action, financial incentives, or regulatory requirements. They can have a broad application or be highly specific to certain sites or soils.

The On-Site Wastewater Treatment Systems Management Practices Subcommittee evaluated thirty (30) practices for their effectiveness in controlling nonpoint source pollution. They are listed in Table 2. Summary sheets of the management practices follow the table and describe how each practice functions, how groundwater and surface water are impacted, and how effective each practice is for controlling certain pollutants. All practices control the same pollutants (BOD, SS, pathogens and some nutrients). Some practices have enhanced nitrate removal capabilities. Also outlined on the sheets are the practice's relative cost, its advantages and disadvantages, and its operation and maintenance requirements. Where appropriate, the references listed for each practice include sources of standards and specifications.

Proprietary information cited is not an endorsement for product use. Based upon submission of engineering research and testing data indicating that certain products, design and performance are equivalent to 10 NYCRR Appendix 75-A standards, the Commissioner of DOH may grant interim approval for the use of systems, products or procedures differing from these standards. All engineered systems must receive approval from NYSDOH or a county health department, whichever has jurisdiction.

On-site wastewater treatment systems management practices can be categorized as *operational* or *structural*, depending upon their purpose, function and design.

Operational practices are practices that involve changes in management, or design of the system. The *Proper Use and Disposal of Household Hazardous Substances, Advocating Proper Design and Construction, Conservation Measures - High Efficiency Plumbing Devices, Inspection and Pumping, Administrative Control Mechanisms,* and *Operation and Maintenance of Standard Septic Tanks and Absorption Systems* management practice summary sheets are all operational practices.

Structural practices usually require engineering design, and usually describe a treatment system. The *Septic Tank and Soil Absorption Field, Aerobic System and Soil Absorption Field, Gravelless Absorption Systems, Other Conventional Systems-Deep Absorption Trenches* management practice summary sheets are all examples of structural management practices.

The operational practices listed in the Catalogue may or may not be currently used in local municipalities. Those required by Appendix 75A of Title 10 NYCRR such as *Percolation Tests* and *Deep Hole Tests* may have local variations in how they are conducted. Those not required by the State Department of Health such as *Advocating Proper Design and Construction* or *Inspection and Pumping* may only be done by the more developed municipalities where on-site systems have been identified as significant sources of nonoint pollution or by municipalities providing for pollution prevention and protection of local water resources. These practices may also be incorporated into other programs, for example, *Proper Use and Disposal of Household Hazardous Substances* may be part of a municipality's solid waste program.

Similarly, the structural practices may or may not be currently used in New York. Most treatment systems contained in the State Department of Health's regulations in Appendix 75-A of Title 10 NYCRR are used somewhere in New York State.

TABLE 2.

MANAGEMENT PRACTICES FOR ON-SITE WASTEWATER TREATMENT SYSTEMS (OWTS)

Site and Soils

- Soil and Site Analysis
- Percolation Tests
- Deep Test Holes

Septic Tanks and Aerobic Tanks

- Septic Tanks and Standard Absorption Field
- Aerobic Tanks and Standard Absorption Field
- Septage Disposal Management

Other Conventional Absorption Systems

- Gravelless Absorption Systems
- Deep Absorption Trenches
- Shallow Absorption Trenches
- Cut and Fill Systems
- Absorption Bed Systems
- Seepage Pits

Alternative Systems

- Raised Systems
- Elevated Sand Mounds
- Intermittent Sand Filters

Administration, Operation and Maintenance

- Operation and Maintenance for Septic Tanks and Standard Absorption Systems
- Inspection and Pumping
- Administrative Control Measures

Conservation Measures

- High Efficiency Plumbing Fixtures
- Graywater Separation (also for Nitrate Removal)

Public Education

- Advocating Proper System Design and Construction
- Proper Use and Disposal of Household Hazardous Substances

Engineered Systems for Nitrate Removal

- Anaerobic Upflow Filters (AUF)
- RUCK System
- Recirculating Sand Filters
- Non-Waterborne Systems
- Constructed Wetlands

Innovative or Other Systems

- Holding Tanks for All Wastewater from Existing Systems
- Rotating Biological Contactors (RBCs)
- Trickling Filter-type Systems

Practices under the *Engineered Systems for Nitrate Removal* category are not regulated or described in Appendix 75A, aside from the requirement that all engineered systems require Health Department approval. Few of these systems are in use in New York State. They are necessary only where nitrates are identified as a health threat (> 10 ppm) to groundwater or an environmental threat to saltwater bays and estuaries. Currently, both these concerns are only being documented in areas surrounding Long Island Sound and other parts of Long Island. Since Westchester and Nassau Counties are largely sewered, these practices will be of most use in Suffolk County. Work is currently being done there to identify the best way to reduce nitrates in groundwater. Research on both economic, and pollutant removal effectiveness is needed for all *Nitrate Removal System* management practices before they will be used by most municipalities or approved by the State Department of Health. Some may be approved on an experimental basis.

Evaporation/Transpiration and Evaporation/Transpiration/Absorption Systems were not included in this Catalogue. While it is possible that one of these systems could be constructed for a limited seasonal application, the annual precipitation rate so far exceeds the annual evaporation rate as to make their use as new or replacement year-round systems impractical and unsound.

Other practices or regulations may be prescribed by other agencies as described in Appendix 75A and quoted below:

> 75-A.2. Regulation by Other Agencies. (a) Where sewage treatment systems are to be located on the watersheds or wellhead area of public water supplies, the rules and regulations enacted by the State Department of Health for the protection of these supplies must be observed. Where systems are to be located on the water-shed of any stream or body of water from which the City of New York obtains its water supply, the approval of the New York City Department of Environmental Protection, must also be obtained.
>
> A local health department may not adopt standards less stringent than the State standard unless a General Waiver has been issued by the State Commissioner of Health or his designated repre-sentative as provided in Part 75, of this Title, or the local health department is otherwise legally authorized to adopt such standards.

Tables 3 and 3A describe where the structural practices perform best. Table 3 shows the types of on-site systems likely to be used in lakeside or coastal areas or where on-site systems are being replaced in areas zoned into small lots. Actual system selection will be subject to the site criteria in Table 3A and to specifications given in the management practice summary sheets.

There may be times when economics, practical circumstances, soils or hydrogeology preclude the use of individual on-site wastewater treatment systems. Municipalities should first consider the use of cluster systems as an alternative to a municipal sewage treatment plant. Clusters of homes may be sewered and connected to some type of wastewater treatment system. Primary treatment could be accomplished at an individual home with a septic tank or other primary treatment. Septic tank or primary effluent from several homes would then be piped to a common leachfield or other secondary treatment scheme. Environmental Facilities Corporation (518/457-4100), Rural Water Resources Program ((315/734-0268), State Revolving Fund (800/882-9721), New York Rural Water Association (518/851-7642), or the ~~newly formed~~ Aerobic Waste Treatment Association (518/943-5918) may all be consulted for recommendations.

TABLE 3.

ON-SITE WASTEWATER TREATMENT MANAGEMENT PRACTICES AND APPLICABILITY TO SPECIFIC SITES

Management Practice *	Dense (1) Retrofit (Rural)	Near (2) Coast (Marine)	Near (3) Coast (Lakes)
Septic Tanks & Standard Absorption Field (SAF)			
Aerobic Tanks & SAF	●		●
Gravelless Absorption			
Deep Absorption Trench			
Shallow Absorption Trench			
Cut and Fill Trench			
Absorption Bed			
Seepage Pits	●		
ALTERNATIVE SYSTEMS			
Raised Systems			
Elevated Sand Mounds			
Intermittent Sand Filters			
ENGINEERED AND OTHER SYSTEMS (4)			
Upflow Anaerobic Filters		●	●
Holding Tank or Waterless with Graywater Separation	●	●	●
RUCK System		●	●
Constructed Wetlands and Greenhouses		●	●
Rotating Biological Contactors	●	●	●
Trickling Filter OWTS	●	●	●

* Structural practices only; operational practices are applicable for all systems. Unmarked systems may be used where site requirements are met and required approvals received. See Table 3A.

1. Marked systems indicate practices requiring less land area relative to other systems. Unmarked systems may be used with required approval(s).

2. Marked systems indicate practices designed to reduce nitrates in effluent. Unmarked systems may be used in conjunction with zoning (lot size restrictions) to reduce nitrates discharging to ground (drinking) water or nitrogen-sensitive surface waters.

3. Marked systems indicate practices that should provide higher quality effluent and/or require less land area. Some systems may require maintenance contracts or special district formation.

4. Engineered systems may be allowed through the issuance of a Specific Waiver. They must be designed by a design professional. An environmental assessment form may be required. See Appendix 75A of 10 NYCRR for details.

TABLE 3A
SITE REQUIREMENTS FOR DESIGN OF INDIVIDUAL WASTEWATER TREATMENT SYSTEMS

Method of Sub-Surface Treatment	Depth of Percolation Test Hole for System Design (inches)	Minimum Depth of In Situ Usable Soil (Feet) (Usable Soil Means Percolation Rate of 1-60 min/in Unless Otherwise Stated)	Minimum Separation Between Trench Bottom and Groundwater, Soil Mottling, Bedrock, or Impermeable Strata (Feet) [1]	Percolation Rate of Site Usable Soil (min/inch)	Allowable Slope of Site (Percent)
CONVENTIONAL SYSTEMS					
Absorption Field System	24-30	4	2	1-60	0-15
Gravelless Absorption System	24-30	4	2	1-45	0-15
Deep Absorption Trenches	At Trench Depth	4	2	1-60	0-15
Shallow Absorption Trenches	At Trench Depth [2]	2	2	1-60	0-15
Cut and Fill System	One Foot Into In Situ Usable Soil [3]	3	2	1-60	0-15
Absorption Bed System	24-30	4	2	1-30	0-8
Seepage Pits	Pit Depth and Half of Pit Depth <u>or</u> at Each Usable Soil Layer	3 Feet Below Bottom of Pit	3 Feet Below Bottom of Pit	1-60	0-15
ALTERNATIVE SYSTEMS					
Raised System	12	1	2 Feet if Dosing Devise Used [4]	1-60	0-15
Elevated Sand Mounds	12	1	2 Feet to Groundwater 3 Feet to Bedrock [5]	1-120	0-12
Intermittent Sand Filter and Downstream Mound	—	0	2	—	0-15
	6 and 12	0.5	2.5 Feet to Groundwater 4 Feet to Bedrock	1-120 at 6" Unlimited at 12"	0-12

(1) A minimum of four feet of usable soil may be necessary between the bottom of the system and bedrock in areas served by well water.
(2) A percolation test must be conducted at the depth of the bottom of the proposed trenches. If the trench bottoms will be between grade and six inches deep, conduct the test at six inch depth.
(3) A percolation test must also be conducted 24-30 inches below grade in stabilized soil (in situ or fill). The slower of the two percolation rates shall be used for design of the system.
(4) If no dosing device is used. A minimum of three feet of usable soil must be present beneath the bottom of the trenches (requires local Health Department inspection and certification program).
(5) There must be at least two feet of <u>naturally</u> occurring soil above bedrock.

E. On-Site Wastewater Treatment Systems Management Practice Summary Sheet Overview

i.	**Title**	the management practice name found in the block at the top of the summary sheet.
ii.	**Definition**	a brief statement that defines the management practice to be summarized.
iii.	**Water Quality Purpose**	states why the practice is used for NPS polllution control.
iv.	**Source Category**	in all cases, On-site Wastewater Treatment Systems is the source category for this Catalogue.
v.	**Pollutants Controlled**	the NPS pollutants controlled by the management practice.
vi.	**Where Used**	the site conditions or situations where the management practice can be applied.
vii.	**Practice Description**	the management practice in terms of its vegetative, structural and/or operational components.
viii.	**Practice Effectiveness**	the documented effectiveness for controlling the NPS pollutants identified. This information is based on national water quality research, university and agency research, water quality monitoring and water quality modeling. Practice effectiveness can be quite variable, due to location, site conditions (soils, drainage, slope, vegetative cover, rainfall, runoff, etc.), management techniques, and the contribution of additional management practices used in a best management system. This section presents practice effectiveness as a range of quantitative values, or where that information is not available, in qualitative terms. The information provided serves as a guide when estimating the effectiveness of the management practice within a specific watershed plan.
ix.	**Impact on Surface Water**	Impacts on water quality. May be defined as None (neutral), Beneficial (positive), Slight (negative), Moderate (negative), and Severe (negative).

x.	**Impact on Groundwater**	Impacts on water quality. May be defined as None (neutral), Beneficial (positive), Slight (negative), Moderate (negative), and Severe (negative). (Note: Many summary sheets include the phrase "increase in nitrates and chlorides locally." These compounds are highly soluble in water and pass through most absorption systems to increase in groundwater unless diluted by fresh infiltrating precipitation or groundwater.)
xi.	**Advantages**	selling points for the management practice. They address cost-effectiveness, additional practice benefits, and other tangible and intangible benefits.
xii.	**Disadvantages**	unfavorable conditions associated with the management practice. They address economics, operations and maintenance, and potential problems associated with the management practice.
xiii.	**Practice Lifespan**	described in quantitative or qualitative terms.
xiv.	**Cost**	described in terms of available information. Agencies involved with management practice planning and installation can provide greater detail.
xv.	**Operation and Maintenance**	the successful control of on-site wastewater pollutants depends upon conducting the re-quired O&M practices. In each case, where a management practice requires a specific course of O&M, it is detailed, or referenced in the management practice summary sheet.
xvi.	**Miscellaneous Comments**	a variety of topics, including regulatory requirements affecting installation of the management practice.
xvii.	**References**	those references used in the evaluation of the management practice are cited in this section. EPA reference manuals are nationally recognized sources of management practice evaluations and information. Every effort was made to utilize existing information from university research and agency information from New York State, most noteably Appendix 75A of Title 10 NYCRR. When that information was not available, and other states had appropriate information, it was cited. Management practice design standards and specifications are located in the references with the appropriate bold notation. Certain cited standards and specifications may only apply to components of a particular practice. Some references are for additional information. This is particularly true for the *"Proper Use and Disposal of Hazardous Household Substances"* and the *"Soil and Site Analysis"* summary sheets.

F. How to Use This Catalogue

The On-Site Wastewater Treatment Systems Management Practices Catalogue is intended to be used by those involved with educating and providing technical assistance to municipal officials. Nonpoint source pollution problems from residential on-site wastewater are addressed by the practices in this Catalogue, but its focus is primarily on providing a comparison of on-site wastewater treatment systems available for use in New York State.

Some practices have little or no history of use in New York State. This is especially true of *Nitrate Removal Systems*. The implementation of the Coastal Nonpoint Source Program (Section 6217 of the Coastal Zone Act Reauthorization Amendments) and the revised Clean Water Act may provide an impetus for the generation of effectiveness data and more opportunities for the use of those practices.

"Best" management practices (BMPs) can be selected from the Catalogue based on the application of professional judgment to solve a particular nonpoint source problem for a specific site condition or municipal situation. It should be noted that this Catalogue is neither a regulatory tool nor a design manual to be used in place of practice standards and specifications.

A well-defined municipal development plan should form the basis of nonpoint source management of on-site wastewater. Planning is key to establishing effective controls. Management practices can serve as "building blocks" and must be properly selected to provide a well-coordinated "structure" for controlling pollutants. In most situations the services of a professional engineer are needed to properly integrate the appropriate management practices with the environmental needs of the individual site and municipality.

Thorough planning will provide for proper execution of the municipal development plan. Components of the plan must be effectively communicated to each individual involved in their implementation. Management practices often include structural components that need to be installed, maintained and removed, if necessary, according to proper design. On-site assistance with the design and layout of practices is often provided by the County Soil and Water Conservation District, NYSDEC engineers or NYSDOH engineers or sanitarians.

G. Updating the On-Site Wastewater Treatment Systems Management Practices Catalogue

- ***New York Nonpoint Source Coordinating Committee***

The New York Nonpoint Source Coordinating Committee (NYNPSCC) is responsible for updating the Management Practices Catalogue. The NYNPSCC meets quarterly and at one meeting each year considers updates of the Catalogue.

The NYNPSCC is composed of academic and educational organizations and state and federal government agencies. With DEC as lead agency, the NYNPSCC is responsible for:

* Reviewing proposed additions, deletions, and revisions to the Management Practices Catalogue.

* Identifying additional categories of nonpoint source pollution that have not been adequately addressed in the list of management practices.

* Suggesting research or demonstration projects on unproven or new management practices that appear to have potential for protecting water quality.

* Periodically reviewing the state list of management practices to verify the status of each practice. This review should be based on recently published literature and new or previously unknown research or demonstration projects.

• *Conditions for Updating the Catalogue*

Any agency, organization or group may propose an addition, deletion or revision to the Catalogue. The NYNPSCC will recognize four conditions for updating the Catalogue:

* Creation of a new management practice by an agency, university, or recognized group.

* Modification of an existing management practice, either in its design requirements or operation and maintenance, requiring a modification of the practice definition, water quality purpose, practice description, practice effectiveness, impacts on surface or groundwater, advantages/disadvantages, practice lifespan, or cost.

* Emerging research data which indicates a change in management practice effectiveness and/or pollutants controlled, requiring modifications of water quality purpose, practice description, practice effectiveness, practice impacts on surface or groundwater, advantages/ disadvantages, practice lifespan, or cost.

* Revisions in state or national water quality policy that necessitate a higher level of waterbody protection, resulting in higher management practice performance standards. Policy revisions would result in additions or deletions of management practices, modifications of practice description, design requirements, operation and maintenance requirement, practice effectiveness, impacts on surface and groundwater, cost and miscellaneous comments.

• *How to Propose an Update of the Catalogue*

1. By December 31 of each year, proposed updates should be stated in writing, and submitted to the attention of the New York Nonpoint Source Coordinating Committee, NYS-DEC, Bureau of Watershed Management, 50 Wolf Road, Room 398, Albany, New York 12233-3508.

2. The Coordinating Committee will review the proposed updates at their next regularly scheduled meeting. A subcommittee of the Coordinating Committee may be formed to study the update and request input from groups not represented on the Coordinating Committee.

3. The subcommittee of the Coordinating Committee will review the proposed updates and determine if they meet the conditions for updating the Catalogue. In consultation with other interested groups, it will make a recommendation to the members of the New York Nonpoint Source Coordinating Committee by May 1 of the following year.

4. When the proposed update is approved, staff of the New York Nonpoint Source Coordinating Committee will make the appropriate changes and distribute copies of the addition to all Coordinating Committee members and holders of the current Catalogue.

II. ON-SITE WASTEWATER TREATMENT SYSTEMS MANAGEMENT PRACTICES

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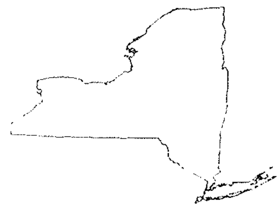


MANAGEMENT PRACTICE SUMMARY SHEET

SITE AND SOILS - Soil and Site Analysis

DEFINITION

Identifying critical soil, water and other land characteristics which determine site suitability for On-site Wastewater Treatment Systems (OWTS). (Also see Table 3A following this summary sheet.)

WATER QUALITY PURPOSE

To protect the surrounding environment to the appropriate extent by allowing informed and rational decisions regarding the type of OWTS which is most suitable for a site

SOURCE CATEGORY

On-Site Wastewater Treatment Systems (OWTS)

POLLUTANTS CONTROLLED

Those often associated with domestic sewage effluent, including suspended solids, oxygen demands, nitrogen, phosphorus, organics, pathogens. Treatment effectiveness is dependent upon the interaction of site characteristics and OWTS design.

WHERE USED

Wherever a new OWTS is planned, or an existing OWTS is upgraded or relocated.

PRACTICE DESCRIPTION

A land area is evaluated for its capacity to accept and effectively treat added wastewaters from a domestic OWTS. Site investigations can range from routine (where ordinary environmental concerns exist) to complex (where extraordinary environmental concerns exist). Level of expertise required of site evaluator increases with complexity of environmental assessment needs.

Ordinary Environmental Concerns: *NYSDOH regulations are minimum standards. At least one deep test pit and two percolation tests are required in New York State. Percolation and deep hole tests must be performed in the area (preferably upgrade) of the proposed absorption facility and future expansion area. *Deep test hole(s) allows soil profile evaluation and depth measurements to any restrictive soil features identified. Restrictive features may include water tables, bedrock, or layers of extremely slow or fast permeability. *Percolation tests are performed to determine necessary leachfield size and, to some extent, type of OWTS. Appropriate depth of perc test holes is dictated by results of soil profile evaluation, from deep test hole. *Other site characteristics are recorded, including soil slope, dominant soil texture, etc. These factors become increasingly important as housing density increases. Local regulators, advised by soil scientists, may want to require or recommend that only particular OWTS be used based on these site characteristics. *The most appropriate OWTS type is chosen for the site.

Extraordinary Environmental Concerns: *Close proximity to receiving waterbodies, aquifers, etc., that must not be degraded. *Specific pollutants of concern should be identified (nitrates, phosphates, pathogens, etc.). *More specific soil and site conditions are analyzed as they relate to pollutants of concern. *Such localities may be identified and special local regulations and/or permitting processes instituted so that appropriate OWTS siting and design modifications can occur. *Additional test holes may be needed if non-uniform site conditions are present.

PRACTICE EFFECTIVENESS

*OWTS can effectively treat domestic wastewaters if the appropriate type of OWTS is matched to site conditions. This is ensured only when adequate site analysis is performed to understand prevailing site conditions and thus allow an informed choice of OWTS type. *Building layout and design considerations should not take precedence over OWTS siting requirements. Tests should be conducted (and OWTS sited) on portions of the lot with the fewest potential limitations for waste disposal.

IMPACT ON SURFACE WATER

Beneficial, by preventing untreated sewage from entering the off-site environment. Chlorides and nitrates will usually increase slightly; impact is cumulative, increasing with housing density.

IMPACT ON GROUNDWATER

Beneficial, by preventing untreated sewage from entering the local groundwater environment. Chlorides and nitrates will usually increase slightly; impact is cumulative. Nitrates and chlorides are typically treated only by dilution to safe levels with on-site groundwater. This groundwater is continuously recharged from a portion of precipitation falling on the site, the portion available for groundwater recharge and contaminant dilution is higher on sites having more permeable soils and bedrock. Smaller building lots have less water available for contaminant dilution than larger lots. The potential for pollution increases as housing density increases and OWTS siting continues status-quo. Community sewerage, minimum lot sizes or special OWTS designs should be considered where exceedance of the nitrate standard for groundwater may be expected.

ADVANTAGES

*Ensuring maximum treatment of domestic OWTS wastewaters by choosing an OWTS design which is appropriate for each site. *Greater likelihood of ascertaining cumulative effects.

DISADVANTAGES

*Costs for accumulating the needed site information. *Contractors installing the chosen OWTS may ignore site analysis information, thus negating its effectiveness. *Planning boards issuing approvals of site plans may lack technical expertise without the added expense of contracting with soil scientists.

PRACTICE LIFESPAN

Twenty to fifty years, depending upon OWTS lifespan

COST

Usually ranges from $100 to $400 per site.

OPERATION AND MAINTENANCE

Varies with each county's health officer arrangements, level of detail expected from site analysis, level of environmental concerns, and local regulatory authorities.

MISCELLANEOUS COMMENTS

NYS Department of Health requirements are minimum standards. More stringent regulations regarding the acceptable level of site analysis can be adopted by county or municipal governments. NYCDEP has developed Policy Guidance for their water supply watersheds. Adirondack Park Agency has its own soils handbook requirements for on-site wastewater treatment systems. SCS has county soil surveys for nearly every county in New York.

REFERENCES

10 NYCRR. Appendix 75A. Wastewater Treatment Standards-Individual Household Systems. Pgs. 5-9

"Adirondack Park Agency Soils Handbook". State of New York. Executive Department. Adirondack Park Agency. August 1990. 24 pages, plus Appendices.

Delaware Soil and Water Conservation District. "Criteria for Identifying Soil Characteristics Which Restrict On-Site Wastewater Treatment Systems In Delaware County, New York." July 10, 1989. 8 pages.

"Field Office Technical Guide. Section II - Soil and Site Information". A series published by county; available for most counties in New York. U.S. Department of Agriculture, Soil Conservation Service. April 1991 (Albany County).

"Minimum Requirements for Engineering Plans for On-site Sewage Disposal Systems". State of New York. Executive Department. Adirondack Park Agency. December 1993. Pgs. 1-3.

Monroe County Environmental Management Council. "Soil Suitability For Disposal of Septic Effluent: A Classification System." March 1979. 32 pages.

Otis, R.J., Site Evaluation for On-Site Treatment and Disposal Systems. Rural Systems Engineering. Madison, WI. 1983.

"Procedures and Practices for the Approval of Septic Systems and Wastewater Treatment Plants." Policy Guidance of New York City Department of Environmental Protection. June 1993. Pgs. 12-24

USEPA. Design Manual. On-site Wastewater Treatment and Disposal Systems. U.S. Government Printing Office. 1980. Pgs. 13-49.

TABLE 3A
SITE REQUIREMENTS FOR DESIGN OF INDIVIDUAL WASTEWATER TREATMENT SYSTEMS

Method of Sub-Surface Treatment	Depth of Percolation Test Hole for System Design (inches)	Minimum Depth of In Situ Usable Soil (Feet) (Usable Soil Means Percolation Rate of 1-60 min/in Unless Otherwise Stated)	Minimum Separation Between Trench Bottom and Groundwater, Soil Mottling, Bedrock, or Impermeable Strata (Feet) [1]	Percolation Rate of Site Usable Soil (min/inch)	Allowable Slope of Site (Percent)
CONVENTIONAL SYSTEMS					
Absorption Field System	24-30	4	2	1-60	0-15
Gravelless Absorption System	24-30	4	2	1-45	0-15
Deep Absorption Trenches	At Trench Depth	4	2	1-60	0-15
Shallow Absorption Trenches	At Trench Depth [2]	2	2	1-60	0-15
Cut and Fill System	One Foot Into In Situ Usable Soil [3]	3	2	1-60	0-15
Absorption Bed System	24-30	4	2	1-30	0-8
Seepage Pits	Pit Depth and Half of Pit Depth or at Each Usable Soil Layer	3 Feet Below Bottom of Pit	3 Feet Below Bottom of Pit	1-60	0-15
ALTERNATIVE SYSTEMS					
Raised System	12	1	2 Feet if Dosing Devise Used [4]	1-60	0-15
Elevated Sand Mounds	12	1	2 Feet to Groundwater 3 Feet to Bedrock [5]	1-120	0-12
Intermittent Sand Filter and Downstream Mound	—	0	2	—	0-15
	6 and 12	0.5	2.5 Feet to Groundwater 4 Feet to Bedrock	1-120 at 6" Unlimited at 12"	0-12

(1) A minimum of four feet of usable soil may be necessary between the bottom of the system and bedrock in areas served by well water.
(2) A percolation test must be conducted at the depth of the bottom of the proposed trenches. If the trench bottoms will be between grade and six inches deep, conduct the test at six inch depth.
(3) A percolation test must also be conducted 24-30 inches below grade in stabilized soil (in situ or fill). The slower of the two percolation rates shall be used for design of the system.
(4) If no dosing device is used. A minimum of three feet of usable soil must be present beneath the bottom of the trenches (requires local Health Department inspection and certification program).
(5) There must be at least two feet of naturally occurring soil above bedrock.

MANAGEMENT PRACTICE SUMMARY SHEET

SITE AND SOILS - Percolation Tests

DEFINITION	On-site percolation tests for use in design of appropriate On-Site Wastewater Treatment Systems (OWTS).
WATER QUALITY PURPOSE	To protect the surrounding environment by ensuring that sewage effluent will be adequately treated by an OWTS designed to function in existing soil conditions.
SOURCE CATEGORY	On-Site Wastewater Treatment Systems (OWTS).
POLLUTANTS CONTROLLED	Those often associated with domestic sewage effluent, including: suspended solids, oxygen demands, nitrogen, phosphorus, organics, pathogens. Treatment effectiveness is dependent upon the interaction of soil characteristics and OWTS design.
WHERE USED	Wherever an OWTS leachfield or seepage pit is anticipated, or where an existing OWTS needs to be upgraded or relocated. The test results are related to the ability of a soil to accept sewage effluent.
PRACTICE DESCRIPTION	During the Site Analysis process, a suitable subsurface absorption system location for an OWTS is identified. Results from Deep Test Hole evaluation indicate usable soil depth, which controls the appropriate depths of percolation ("perc") test holes. A minimum of two test holes, at least 12" square or 12" in diameter, are dug for testing each leachfield area. The lower sides of the test holes are roughened to remove any smeared soil, and loose soil is removed from the bottom. One or two inches of clean pea gravel or small stones are placed on the hole bottom, and water is added to thoroughly soak and saturate the soil. Several recordings of the time required for the water level to drop from 6" to 5" in the test holes are used to determine the percolation rate (recorded as minutes per inch). Various methods are used to measure the water levels. The test is repeated one or more times until the results stabilize. The stabilized (slowest) percolation rate for each test hole is reported, for use in leachfield design.
PRACTICE EFFECTIVENESS	Variable. Although this practice is considered essential in the design of OWTS's in New York State, differences in following testing procedures, variable presoaking times, test hole depth and time of year (wet or dry seasons) can all greatly affect test results, which can directly affect OWTS design and function. The NYS Department of Health's "Individual Wastewater Treatment Design Handbook" prescribes a uniform procedure to minimize this variability.

IMPACT ON SURFACE WATER	Beneficial, to the extent that test results truly reflect soil and site conditions, allowing appropriate OWTS design. Inaccurate test results can cause premature OWTS failure: untreated sewage effluent may then enter and degrade surface waters.
IMPACT ON GROUNDWATER	Beneficial, to the extent that test results truly reflect soil and site conditions, allowing appropriate OWTS design. Inaccurate test results can cause untreated sewage effluent to enter and degrade groundwaters, or cause premature system failure.
ADVANTAGES	*Relatively simple and low cost. *Results can be directly used for sizing OWTS leachfields and seepage pits.
DISADVANTAGES	*Results can be misleading, especially if good judgement is not used regarding test hole locations and following standardized procedures.
PRACTICE LIFESPAN	Repeat test when expanding or replacing soil absorption system.
COST	Incorporated into Site Analysis costs, which usually range from $100 to $400 per site, depending upon availability as a public service of health department, etc.
OPERATION AND MAINTENANCE	Tests are conducted by whomever is recognized as a qualified professional by local health authorities.
MISCELLANEOUS COMMENTS	Percolation rate is not the same as hydraulic conductivity, which requires more controlled conditions for accurate measurement. Some states have decided to no longer accept percolation tests for OWTS designs due to their variable accuracy.

REFERENCES

Bouma, J., R. Paezold and R. Grossman. Soil Survey Investigations Report No. 38 - Measuring Hydraulic Conductivity for Use in Soil Survey. Soil Conservation Service. Washington, DC. 1982.

Canandaigua Lake Watershed Task Force. "Home Siting Handbook". Canandaigua, NY. Undated. Page 17.

Kaplan, O. Benjamin. "Septic Systems Handbook", Second Edition. Lewis Publishers, Inc. Chelsea, MI. Pgs. 61-84.

NYC Department of Environmental Protection. "Procedures and Practices for the Approval of Septic Systems and Wastewater Treatment Plants". Policy Guidance. June 1993. Pgs. 18, 19 and Appendices D and E.

NYS Department of Health. 10 NYCRR Appendix 75A.4.d. "Wastewater Treatment Standards - Individual Household Systems". Pg. 9. **Management Practice Design Standard and Specification)**

NYS Department of Health, Division of Environmental Protection. "Individual Wastewater Treatment Design Handbook". Albany. 1983. Pgs. 19-22 and 115. **(Management Practice Design Standard and Specification)**

NYS Executive Department. Adirondack Park Agency. "Adirondack Park Agency Soils Handbook" August 1990. Pgs. 9-10.

USEPA. Design Manual. On-Site Wastewater Treatment and Disposal Systems. U.S. Government Printing Office. Washington, DC. pp. 39-40. 1980.

MANAGEMENT PRACTICE SUMMARY SHEET

SITE AND SOILS - Deep Test Holes

DEFINITION

On-site soil profile evaluation for use in design of appropriate On-Site Wastewater Treatment Systems (OWTS).

WATER QUALITY PURPOSE

To protect the surrounding environment by ensuring that sewage effluent will be adequately treated by an OWTS designed to function in existing soil conditions.

SOURCE CATEGORY

On-Site Wastewater Treatment Systems (OWTS).

POLLUTANTS CONTROLLED

Those often associated with domestic sewage effluent including: suspended solids, oxygen demands, nitrogen, phosphorus, organics, pathogens. Treatment effectiveness is dependent upon the interaction of soil characteristics and OWTS design.

WHERE USED

Wherever an OWTS is anticipated, or an existing OWTS needs to be upgraded or replaced.

PRACTICE DESCRIPTION

During the Site Analysis process a suitable subsurface absorption system location for an OWTS is identified. One or more test holes are excavated to at least six feet deep, within or immediately adjacent to the proposed leachfield area.

The cutface of the pit (soil profile) is examined and careful observations made of soil characteristics and any water seepage into test pit. The primary goal is to identify any "boundary conditions", which may include bedrock, soil layers of extremely fast or slow permeability, or a water table. Wastewater treatment is not effective if these conditions exist.

The depth of native soil that is "usable" or useful for effluent treatment lies above the boundary condition that is closest to the soil surface. Once its percolation rate is determined (by percolation tests), the thickness of usable soil largely determines the type of OWTS suitable for the site.

Depth to seasonally recurring, shallow water tables can be difficult to identify, especially during the drier summer season. Experience and training in evaluating soil color patterns (mottling) is essential for reliable water table recognition. Any determination of seasonal water tables outside the normal spring high groundwater period (March 15 to June 30) should involve soil mottling/discoloration readings.

PRACTICE EFFECTIVENESS

When soils are evaluated by trained and experienced professionals this practice is highly effective for anticipating soil limitations of a site. Because conditions can vary widely between sites it is an essential step for selecting an OWTS design which will effectively treat wastewaters at each site.

IMPACT ON SURFACE WATER

Beneficial, by preventing inadequately or untreated sewage effluent from entering surface waters.

IMPACT ON GROUNDWATER	Beneficial, by preventing inadequately or untreated sewage effluent from entering groundwaters.
ADVANTAGES	*Rapid; soil evaluations usually require less than 30 minutes/test. *Ensures maximum treatment of domestic OWTS wastewaters by choosing a design which is appropriate for the soil resources at each site.
DISADVANTAGES	*Inexperienced soil evaluators can provide misleading interpretations, reducing practice effectiveness. *Excavation costs become significant on less accessible or thickly forested sites.
PRACTICE LIFESPAN	Results of the test are applicable for the life of the OWTS.
COST	Incorporated into Site Analysis costs, which usually range from $100 to $400 per site, depending upon availability as a public service of Health Department, etc.
OPERATION AND MAINTENANCE	The details of conducting these tests varies with local Health Department policy. Private services of a design professional or soil scientist may be needed. Municipalities should have a person or program to coordinate between the health department, consultants, contractors and the public to consistently apply test results.
MISCELLANEOUS COMMENTS	Despite being required by State Health Regulation and its importance for proper OWTS design, this practice is routinely ignored in some areas which lack county health departments. Soil evaluation for seepage pit design may require testing at different depths than for leachfield design. Excavations for deep hole tests may create hazards. Federal OSHA construction standards are applicable to these excavations. The Adirondack Park Agency prescribes requirements for soil test pits within the "blue line".
REFERENCES	"Adirondack Park Agency Soils Handbook". State of New York, Executive Department, Adirondack Park Agency. Pgs. 7, 8 and Appendix D. **(Management Practice Design Standard and Specification)** Individual Wastewater Treatment Design Handbook. New York State Department of Health, Division of Environmental Protection. Pgs. 13-18. New York City Department of Environmental Protection "Procedures and Practices for the Approval of Septic Systems and Wastewater Treatment Plants". Policy Guidance. June 1993. Pgs. 19 and 63. New York Public Health Law 201(1)(1). 10 NYCRR Appendix 75A.4. Wastewater Treatment Standards - Individual Household Systems. Pg. 9. **(Management Practice Design Standard and Specification)**. USEPA. 1980. Design Manual. On-Site Wastewater Treatment and Disposal Systems, US Government Printing Office, Washington, DC. Pgs. 28-49.

MANAGEMENT PRACTICE SUMMARY SHEET

SEPTIC TANKS AND STANDARD ABSORPTION FIELDS (Trenches)

DEFINITION

A large (e.g., 1,000 - 1,750 gallon) buried. watertight chamber for settling wastewater with inlet and outlet baffles to prevent discharge of solids, followed by a distribution box that diverts flow equally to two or more perforated pipes laid in gravel trenches within natural, undisturbed soil.

WATER QUALITY PURPOSE

To provide physical setting, biological treatment and equal distribution throughout the absorption field for toilet, shower, laundry, kitchen and other household wastewater. (Not stormwater or other large volumes of relatively clean water.)

SOURCE CATEGORY

On-Site Wastewater Treatment Systems (OWTS).

POLLUTANTS CONTROLLED

Settleable solids, floating solids, suspended solids, oil and grease, BOD, pathogens (bacteria and viruses), and nutrients (nitrogen and phosphorus).

WHERE USED

•Where the absorption field will not be subject to compaction from vehicles or heavy equipment. •Where proper separation distances will be maintained (see 10 NYCRR Appendix 75A). *Where adequate absorptive soils have been shown to exist (see *Soil and Site Analysis* summary sheet).

PRACTICE DESCRIPTION

Septic tanks are designed to provide 24-36 hours of quiescent detention time. Sewage bacteria break up some solids in tank. Heavy solids sink to bottom as sludge. Grease and light particles float to top as scum. Liquid flows from tank through closed pipe and distribution box to perforated pipes in trenches; flows through surrounding crushed rocks or gravel and soil to groundwater (underground water). Bacteria and oxygen in soil help purify liquid. Tank sludge and scum are pumped out periodically. Most common on-site system. Level ground or moderate slope.

PRACTICE EFFECTIVENESS

Two days in septic tank results in the following reductions: BOD: 40-50%; TSS: 50-70%; TN: 10-20%. See *Miscellaneous Comments* for removals following soil absorption trenches.

IMPACT ON SURFACE WATER

Beneficial to slight, if groundwater infiltration and treatment are effective.

IMPACT ON GROUNDWATER

Beneficial to slight. Increased nitrates and chlorides locally. Slight to severe, cumulative impact as housing density increases (see *Site and Soil Analysis* summary sheet).

ADVANTAGES

*Least expensive on-site wastewater treatment system. *Gravity operated. *Requires little maintenance. *Few problems if properly maintained. *No mechanical moving parts. *Treatment is highly effective in favorable soil and site conditions. *Favorability is determined locally, either site-by-site or based on cumulative effects of multiple sites in a development.

DISADVANTAGES

*Failure to consider soils limitations can lead to system failure and potential for ground and surface water contamination. *Offers little (20%) NO_3 removal. This becomes a concern as housing and septic system density increases and cumulative NO_3 leaches towards surface or groundwater and natural dilution from precipitation remains constant.

PRACTICE LIFESPAN

Septic Tank - 50 to 100 years. Leach Field - 10 to 20 years. (Both must be properly sited and maintained.)

COST

See *Miscellaneous Comments.*

OPERATION AND MAINTENANCE

•Chemicals to clean the system should not be added because of probable damage to distribution field and groundwater. •Harmful material should not be discharged into the tank; avoid fats, solvents, oils, coffee grounds, excessive detergents, and paper. •Septic tank scum and sludge should be inspected regularly and pumped at least once every 3 years or as inspection, or local authorities dictate. •New household appliances such as garbage disposals, spas or hot tubs should not be added to existing septic systems until the tank is checked to make sure it is adequate to handle the additional wastewater load. •Pumped out sludge should be collected and disposed of by a NYSDEC-permitted scavenger waste hauler. *Septic tank covers or extension collars should be accessible within the top 12 inches of soil.

MISCELLANEOUS COMMENTS

Table of Amounts of Pollutants Removed and System Costs

Practice	TSS (%)	BOD (%)	TN (%)	TP (%)	Path. (Logs)	Capital Cost ($1,000)	Maint. Cost ($/Year)
Conventional Septic System							
Average	72	45	28	57	3.5	$4.5	$70
Probable Range	60-70	40-55	10-45	30-80	3-4	$2.0-$8.0	$50-$100
Observed Range	54-83	30-60	0-58	9-95	3-4	$2.0-$10.0	$25-$110
No. Values Considered	7	7	13	12	2	8	4

(LOGS) Pathogenic organism removal measured in powers of ten. 3-4 = a 1,000 to 10,000 fold reduction in pathogens.

Source: EPA. Office of Water. Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters. Washington. DC. January 1993.

REFERENCES

Farm-A-Syst, Farmstead Assessment System. "Reducing the Risk of Groundwater Contamination by Improving Household Wastewater Treatment". July, 1991.

Kaplan. O. Benjamin. "Septic Systems Handbook". Second Edition. Lewis Publishers, Inc. Chelsea, MI. 1991.

Frome, Michelle. Vermont Natural Resources Council. "Rural Sewage Treatment in Vermont", Book 1: A Guide to the Alternatives". June, 1978.

Lukin, John. Rural Community Assistance Program, Rural Housing Improvement, Inc. "Understanding Septic Systems". July, 1988.

Mandel. Ross and Douglas A. Haith. Dept. of Civil and Environmental Engineering. Depts. of Agricultural and Biological Engineering. Cornell University, Ithaca, NY. "The Impact of Septic Systems on Surface Water Quality". November, 1992.

NYS Department of Health. 10 NYCRR, Appendix 75a.6-8. "Wastewater Treatment Standards - Individual Household Systems". December, 1990. Pgs. 10-18. **(Management Practice Design Standard and Specification)**

NYS Department of Health. Division of Environmental Protection. "Individual Wastewater Treatment Design Handbook". 1994.

National Association of Towns and Townships. "Treat It Right - A Local Official's Guide to Small Town Wastewater Treatment". 1989.

New York City Department of Environmental Protection. "Procedures and Practices for the Approval of Septic Systems and Wastewater Treatment Plants". Policy Guidance. June 1993. Pgs. 12-24 and 49.

New York City Department of Environmental Protection. "Proposed Regulations for the Protection from Contamination, Degradation and Pollution of the New York City Water Supply and Its Sources". September, 1990.

Scalf. M.R., et al., - EPA-Ada. Ok. "Environmental Effects of Septic Tank Systems". 1977.

USEPA. Design Manual. On-Site Wastewater Treatment and Disposal Systems. U.S. Government Printing Office. Washington, DC.1980.

USEPA. Office of Water. "Small Wastewater Systems-Alternative Systems for Small Communities and Rural Areas". January, 1980.

USEPA, Region 5, Water Division. "Rural Lakes Project Handbook". March, 1983.

Veneman. Peter L.M., Society of Soil Scientists of Southern New England. Proceedings of a Conference on On-Site Sewage Treatment and Disposal. "Principles of On-Site Sewage Disposal". November, 1990.

MANAGEMENT PRACTICE SUMMARY SHEET

AEROBIC SYSTEMS AND STANDARD ABSORPTION FIELDS

DEFINITION	A partitioned watertight compartment with a pump, air compressor or other device to inject air into the sewage in the first compartment. The next component is a settling chamber or filtering device. This is followed by solid piping to a distribution box that distributes effluent to perforated pipes in buried gravel trenches or a gravel bed for infiltration into the soil.
WATER QUALITY PURPOSE	To provide a higher quality effluent than septic tanks provide for areas where soils have limited treatment capacity.
SOURCE CATEGORY	On-Site Wastewater Treatment Systems (OWTS).
POLLUTANTS CONTROLLED	BOD, dissolved and suspended solids (SS), pathogens.
WHERE USED	*Areas where unsuitable soil or high groundwater have caused septic tank failures. *Small lots. *Sites where recommended spacing between trenches cannot be obtained.
PRACTICE DESCRIPTION	Air and wastewater are mixed in tank. Oxygen-using (aerobic) bacteria grow, digest sewage, and liquify most solids. Motors, aerators and filters make maintenance essential.
PRACTICE EFFECTIVENESS	Practice effectiveness will vary with the type of aerobic unit used, proper use, and maintenance. Generally lower BOD and suspended solids in effluent than in septic tank effluent due to filtering. The National Sanitation Foundation Class I Units effluent requirement, based on a 30-day arithmetic average, is 30 mg/l for BOD_5 and SS. There is no NSF Class I effluent requirement for nitrogen or phosphorus; aerobic units do not remove either.
IMPACT ON SURFACE WATER	Slight to moderate if directly discharged. This is prohibited for new systems in New York State. SPDES permit must be obtained for replacement units discharging to surface waters. Beneficial to slight impact if discharged through soil absorption system.
IMPACT ON GROUNDWATER	Beneficial to slight. Chlorides and nitrates may exceed drinking water standards where houses are closely spaced. Without required maintenance, bacterial concentration and resulting groundwater contamination risk is greater than that from septic tanks. With proper maintenance, less adverse impact than standard septic/soil absorption system.
ADVANTAGES	*Higher quality effluent extends life of soil absorption system. *Higher quality effluent might make surface discharge acceptable for replacement systems. *Regulating authority may allow reduced absorption system sizing for replacement systems.
DISADVANTAGES	*Requires frequent inspection and maintenance. *Susceptibility to user abuse. *May require pretreatment (i.e., trash trap upstream of aerobic tank, dosing, pre-aeration, or surge control). *Electricity required.
PRACTICE LIFESPAN	20-25 years with proper soils, siting and maintenance.

COST

- $3,500 - $7,000 for installation and capital (1994).
- $ 120 - $ 220 for annual electricity costs.
- $ 100 - $ 145 for annual maintenance costs.
- $ 90 (average) every 3 years for periodic replacement costs.

OPERATION AND MAINTENANCE

Pump out tank at least once every year (trash trap every 3 years if used). Service and repair pump as needed. Inspect semi-annually. Maintain continuous service contracts.

MISCELLANEOUS COMMENTS

All units must meet the specifications of the National Sanitation Foundation Standard Number 40, Class 1.

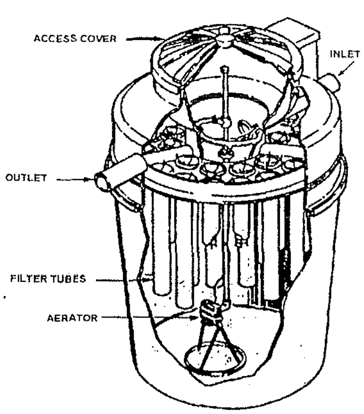
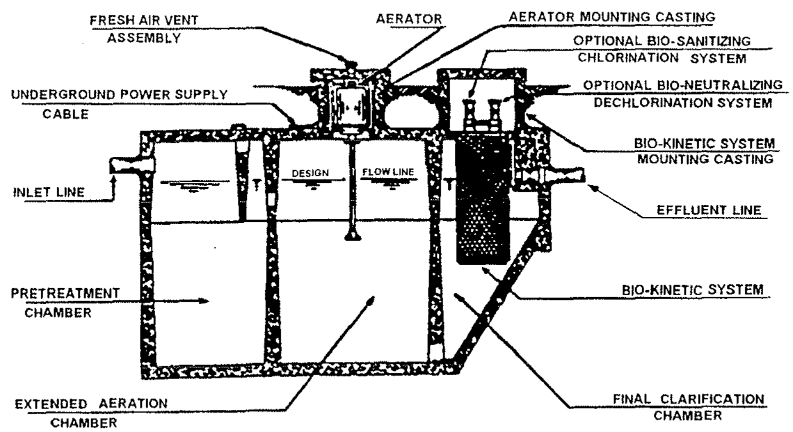


FIGURE 8A
AEROBIC UNIT

Individual Wastewater Treatment
Design Handbook
DRAFT



SECTION VIEW
FIGURE 8
AEROBIC UNIT

REFERENCES

Aerobic Waste Treatment Association, Catskill, NY. Personal letter. May,1994.

American Society of Agricultural Engineers. Proceedings of the Second National Home Sewage Treatment.Symposium. "Selected Excerpts From a Paper Entitled 'Performance of Aerobic Treatment Units', by Hutzler, N.J., Waldorf, L.E., and Fancy, J.". 1977.

Frome, Michele. Vermont Natural Resources Council. Agency of Environmental Conservation. "Rural Sewage Treatment in Vermont - Book 1: A Guide to the Alternatives". 1978.

Machmeier, Roger E., Extension Ag. Engineer, Agricultural Extension Service, University of Minnesota. "Shoreland Sewage Treatment-Recommendations for Identifying and Eliminating Nonconforming Systems". Extension Bulletin 394-Revised 1978. Page 21.

Multi-Flo Waste Treatment Systems, Inc. "Engineering and Technical Manual", 1992, and personal communication, 1994.

NYS Department of Health. 10 NYCRR, Appendix 75A. "Wastewater Treatment Standards, Individual Household Systems. December 1990. **(Management Practice Design Standard and Specifications)**

National Sanitation Foundation. "Standard 40: Individual Aerobic Wastewater Treatment Plants". July, 1990. NSF Joint Committee on Wastewater Technology. **(Management Practice Design Standard and Specifications)**

MANAGEMENT PRACTICE SUMMARY SHEET

SEPTIC AND AEROBIC TANKS - Septage Disposal Management

DEFINITION

Determining the most practical economic and publicly acceptable means of disposing of the pumped contents of septic tanks, cesspools (no longer allowed for new facilities in New York State) or other individual sewage treatment facilities that receive domestic sewage wastes.

WATER QUALITY PURPOSE

For use by septage pumping and hauling contractors to properly manage this waste to assure proper disposal.

SOURCE CATEGORY

On-Site Wastewater Treatment Systems (OWTS).

POLLUTANTS CONTROLLED

Nutrients, organics, ammonia, pathogens, oil and grease.

WHERE USED

Predominantly rural areas. Cost of constructing a septage treatment facility, transportation to a Publicly-Owned Treatment Works (POTW), storage, landfilling, land application, composting, and incineration should all be evaluated when selecting the best means of septage disposal.

PRACTICE DESCRIPTION

The primary method of septage disposal involves having Part 364 permitted waste transporter take the septage to a wastewater treatment plant. Other disposal methods used less frequently include landfilling, direct land application, composting, and incineration. Usually the easiest and least controversial method is transporting it to a POTW; however, this is not always feasible depending on the distance. Disposal at an approved landfill is a common option although diminishing as a result of landfill closures. Composting and land application are considered forms of beneficial reuse when done properly and are gaining popularity. However, facility siting and the associated costs as well as public acceptance are difficulties often encountered. Using an existing sewage sludge incinerator is an option which is not often used.

PRACTICE EFFECTIVENESS

In accordance with New York State solid waste management policy, the preferred methods of solid waste management in order are reduction, reuse, recovery, and finally, disposal. Transporting septage to a wastewater treatment plant is very effective and usually accomplished without any difficulty, provided the receiving POTW has adequate capacity. POTWs dewater sludge (i.e., solid waste reduction) and is more likely to meet standards for land application (reuse). Landfilling can be effective but is diminishing as an option, and is only disposal. Land application and composting are effective and beneficial reuses when done properly. Septage mixed with sewage sludge and incinerated is also an effective means of solid waste reduction, although not widely practiced. Composting is considered reuse if the compost product is neither landfilled nor incinerated. Land application is also considered a beneficial reuse and therefore ranks high as an option. Overall, the POTW option remains the most effective and least controversial.

IMPACT ON SURFACE WATER

No significant adverse impact provided the septage disposal facility is sited and operated properly and runoff is controlled. Beneficial to waterbodies that might otherwise be polluted by overloaded OWTS.

IMPACT ON GROUNDWATER

No significant impact provided the septage disposal facility is sited and operated properly. Land application must be done in accordance with regulations to avoid groundwater contamination. The same is true to a lesser extent for composting facilities. Beneficial to aquifers that might otherwise be polluted by overloaded OWTSs.

ADVANTAGES

*Stabilization of organic matter. *Land application and compost product constitute beneficial reuse when done properly by providing nutrients essential for plant growth. *These methods also divert wastes from landfills so that they can be more effectively utilized. *Pathogen control is also an important feature of septage treatment and disposal.

DISADVANTAGES

*Disposal areas need to be carefully monitored and inspected to ensure that the waste is being disposed of properly. *Mismanagement of sites can lead to groundwater and surface water contamination. and the potential for odors is always a concern.

PRACTICE LIFESPAN

Septage disposal management is continual. but dependent on receiving facility's capacity. Composting facilities and incinerators can operate indefinitely depending on operation and maintenance.

COST

The direct cost is borne by the homeowner when hiring a permitted waste transporter to pump out the septic tank. Permit and final disposal costs are included. A typical range is $50 to $150 per pump-out.

OPERATION AND MAINTENANCE

Land application and composting facilities need to be operated and maintained in accordance with Part 360 regulations and permit conditions.

MISCELLANEOUS COMMENTS

Septage solids removal is a necessary component of conventional, alternative, most engineered and most other innovative OWTSs.

REFERENCES

6 NYCRR Part 360 - Solid Waste Management Facilities.

6 NYCRR Part 364 - Waste Transporter Permits.

40 CFR Part 503 - Standards for the Use or Disposal of Sewage Sludge.

Domestic Septage Regulatory Guidance - A Guide to the EPA 503 Rule. September 1993. EPA 832-B-93-005.

USEPA. Design Manual On-site Wastewater Treatment and Disposal Systems. U.S. Government Printing Office. 1980. Pgs. 338-352.

OTHER CONVENTIONAL SYSTEMS - Gravelless Absorption Systems

DEFINITION

A distribution system installed without gravel-filled trenches. It receives effluent from the distribution box in the overall wastewater treatment system. Two types of systems commonly used are: (1) Chamber design (see *Miscellaneous Comments*). (2) Geotextile-wrapped corrugated plastic pipe or tubing (not shown).

WATER QUALITY PURPOSE

(1) Chamber designs seek to optimize the effluent treatment capacity of the soil by increasing the soil infiltrative area per square foot in constructed trenches. (2) Geotextile-wrapped corrugated tubing 8" (dia.) provide, approximately, the equivalent soil infiltrative area of 2 foot trench/4 inch pipe systems without the use of gravel-filled trenches.

SOURCE CATEGORY

On-Site Wastewater Treatment Systems (OWTS).

POLLUTANTS CONTROLLED

BOD, dissolved and suspended solids, pathogens, phosphorus and some nitrates.

WHERE USED

In areas where aggregate is not economically available. In New York these systems are restricted to sites that have a design percolation rate of 1 to 45 minutes per inch and a slope not exceeding 15 percent. Some can also be used in mounds, if accompanied by pressure distribution. (One has earned consideration for inclusion in an Engineered System for soils having a percolation rate of 46 to 60 minutes per inch with appropriate monitoring.)

PRACTICE DESCRIPTION

Gravelless systems can be plastic or concrete chambers of various designs, or large (8" min) diameter corrugated plastic pipes wrapped in hydrophilic geotextile material and placed in trenches or beds. Chamber systems are subsurface units designed with an unobstructed bottom to allow for an optimum effluent/soil interface and side exits to allow for lateral transmission of effluent during periods of ponding. In New York one linear foot of gravelless trench is equivalent to one linear foot of conventional absorption trench.

PRACTICE EFFECTIVENESS

Gravelless chamber systems will not improve site constraints, making an unbuildable site buildable. However, proprietary literature sites research supporting the superiority of some chamber or galley systems. These systems make maximum use of the soil's infiltrative capacity. The effectiveness of these chamber systems exceeds that of gravel and pipe trenches for both the sidewall and trench bottom. Other research shows that geotextile-wrapped corrugated pipe approximates the effectiveness of pipe and gravel trenches based on the "long-term acceptance rates" of discharged wastewater.

IMPACT ON SURFACE WATER

Beneficial to slight, if groundwater infiltration and treatment is effective.

IMPACT ON GROUNDWATER

Beneficial to slight; increased nitrates and chlorides locally. Cumulative impact slight to severe. (See *Site and Soil Analysis* summary sheet)

ADVANTAGES

*Some chamber systems exceed the unobstructed soil interface area and storage volume to pipe and gravel systems, others are equivalent. *Plastic has delivery and installation advantage over concrete chambers due to lighter weight. *Chamber systems are designed to eliminate compaction and physical obstruction from gravel. *Clogging from fines in low grade gravel and clean-up problems are eliminated. *Chamber systems protect soil interface from damage. *Inspection of chamber systems is easier than gravel trenches. *Chamber systems are typically designed to support H-10 or H-20 loadings.

DISADVANTAGES

*Since there is no a regulatory allowance for increased infiltration area, higher cost of a chamber system may be a disadvantage.

PRACTICE LIFESPAN

(1) The effectiveness of chamber or galley absorption systems may translate into lifespans longer than gravel and pipe absorption systems. (2) Available research indicates the lifespan of geotextile-wrapped plastic pipe is equal to that of pipe and gravel systems.

COST

Dependent on relative costs of plastic, concrete, gravel and associated availability and labor costs. Some chamber systems will cost more than the standard absorption trench system under current regulations in New York.

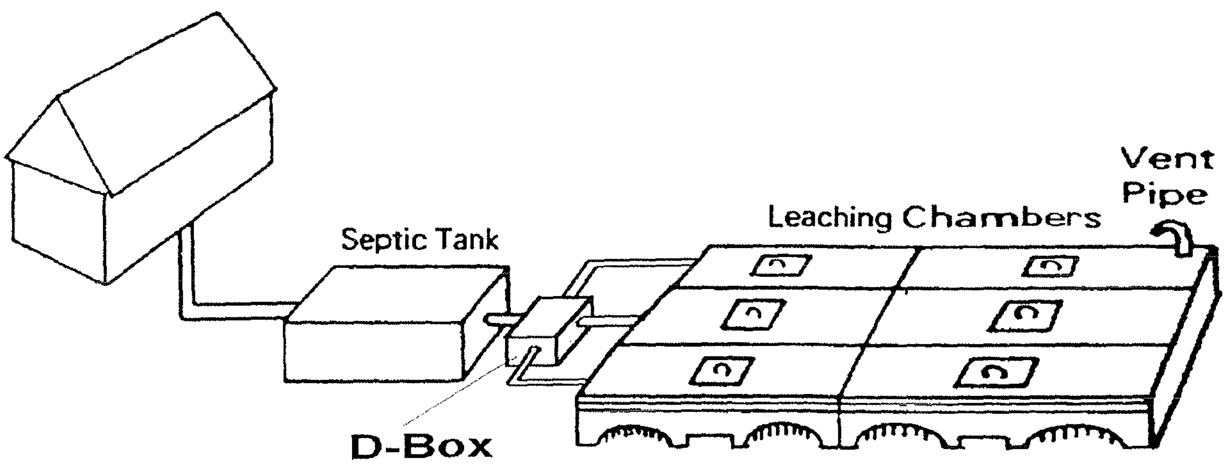
OPERATION AND MAINTENANCE

Inspection ports may be provided as part of construction. Chambers must be vented to assure adequate aeration in the leaching area. O&M same as for conventional system. (See *Operation and Maintenance* summary sheet.)

MISCELLANEOUS COMMENTS

In concept, various chamber system designs display many of the same advantages over gravel trench construction. However, evaluation of each chamber system is important, as gravel or filter fabric may be required to prevent soils intrusion through sidewall openings, with some manufactured chambers.

All gravelless systems should be sited in accordance with state and local regulations. Installation of gravelless systems should be in accordance with manufacturer's or designer's specifications.



REFERENCES

Anderson, J.L., R.E. Machmeier and M.P. Gaffron. "Evaluation and Performance of Nylon-Wrapped Corrugated Tubing in Minnesota". Agricultural Experiment Station. University of Minnesota. Paper No. 14.239. Pgs. 79-86. 1985. Abstract printed in "Proceedings of a Conference on On-site Sewage Treatment and Disposal" by Society of Soil Scientists of Southern New England. November 19-20, 1990. Printed as "Performance of Gravelless Seepage Trenches in Minnesota" by James L. Anderson.

Infiltrator Systems, Inc., "The Infiltrator Leach Field System Support Documentation". January 1991.

Lukin, John. Rural Community Assistance Program. Rural Housing Improvement, Inc. "Understanding Septic Systems". July 1988.

NYS Department of Health. 10 NYCRR, Appendix 75A. "Wastewater Treatment Standards. Individual Household Systems". December 1990. **(Management Practice Design Standard and Specification)**

NYS Department of Health. "Waste Treatment Handbook For Individual Household Systems". 1993.

OTHER CONVENTIONAL SYSTEMS - Deep Absorption Trenches

DEFINITION

A conventional soil absorption system downstream of a septic or aerobic tank. Used in sites where a thick layer of impermeable soil overlies more suitable soil (see sketch under *Miscellaneous Comments).*

WATER QUALITY PURPOSE

To provide treatment of septic or aerobic tank effluent equal to that achieved by a standard soil absorption system.

SOURCE CATEGORY

On-Site Wastewater Treatment System (OWTS).

POLLUTANTS CONTROLLED

BOD, dissolved and suspended solids, pathogens, phosphorus and some nitrates.

WHERE USED

Sites containing "at least four feet of permeable unsaturated soil (i.e., one to 60 minutes per inch percolation rate) overlain by one to five feet of impermeable soil (i.e., greater than 60 minutes per inch percolation)". Note: For sites with 1 foot or less of overlying impermeable soil a standard trench system may be used. A "Cut and Fill" system may also be used for deep trench site conditions and is recommended. Its shallower trenches "provide improved treatment and enhanced oxygenation of the infiltrative soil surface (i.e., gravel/permeable soil interface)". Deep absorption trenches should not be used within or below hydric soils or perched water table zones unless site testing indicates that these areas are isolated and limited in extent. Soil drainage systems should be used for individual lots only and generally should not be interconnected. Minimum separation distance between drainage systems and absorption fields should be established. (See Table 3A following *Soil and Site Analysis* summary sheet.)

PRACTICE DESCRIPTION

Trenches are excavated through the impermeable soil layer and at least two feet into useable (permeable) soil and backfilled with aggregate or coarse sand to a level 30" below grade. Aggregate is preferred because it provides sidewall infiltrative surfaces (i.e., better treatment). A standard absorption field system is then constructed in the upper 30" of the trenches.

PRACTICE EFFECTIVENESS

Effective where site conditions preclude use of a standard absorption trench system. Not as effective as a cut and fill system or standard trench system due to less plant root uptake of excess nutrients and less oxygen.

IMPACT ON SURFACE WATER

Beneficial to slight. Impacts to local water resources may be significant if ditches, berms, or curtain drains are used to alter natural wetland systems for sewage disposal.

IMPACT ON GROUNDWATER

Beneficial to severe. Local impact is slight due to increased nitrates and chlorides. Cumulative impact is slight to severe.

ADVANTAGES

*For thick impermeable overlying soil, it is possible to construct an absorption field with less excavation than a cut and fill system where all impermeable soil would have to be excavated. *Increased trench depths permit increased sidewall area exposure for the same amount of bottom area. *They also permit a greater depth of liquid ponding which increases the hydraulic gradient across the infiltrative surface.

DISADVANTAGES

*Failure to carefully excavate all impermeable overburden from trenches will lead to premature failure (plugging) of system. *Diversion of surface runoff around the absorption area by means of ditches or berms required uphill of all sloped sites adds to the cost, more so than shallow or standard trench systems.

PRACTICE LIFESPAN

Twenty to twenty-five years (average) for a well maintained system. Same as a standard trench system.

COST

Somewhat more than a standard trench system depending on how much extra excavation and the complexity of diverting uphill surface water around the system on a sloped site.

OPERATION AND MAINTENANCE

*Proper operation and maintenance of the septic tank or other pretreatment units is the best preventative maintenance for an absorption system. *Resting of the system is an effective method of restoring the infiltration rate. Alternating between two systems with a diversion valve can provide a means of resting the soil. *Checking and repairing of household plumbing fixtures will minimize leaks which can add substantial and unwanted amounts of water to the system. (also see *Operation and Maintenance* summary sheet).

MISCELLANEOUS COMMENTS

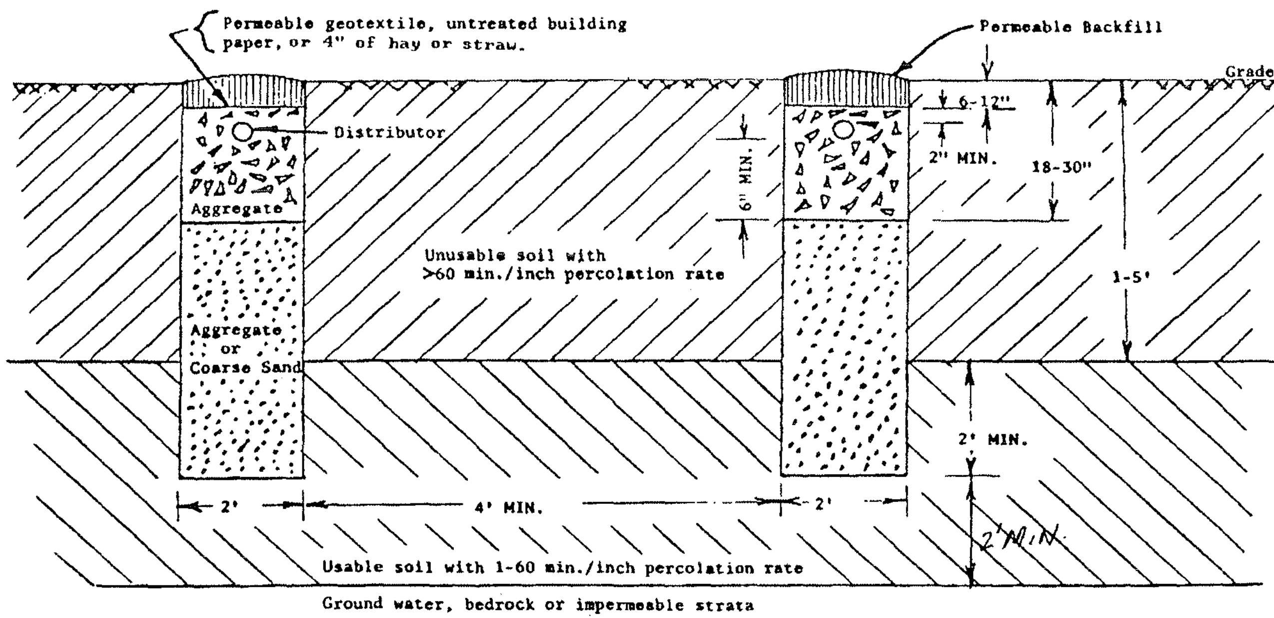


FIGURE 24
DEEP ABSORPTION TRENCHES

NOTES: On sloped sites, a diversion ditch shall be constructed uphill from the trench area to prevent surface runoff from entering the trenches.

Trench bottoms shall be level. Trenches shall be parallel to ground contours.

Coarse sand top shall be level.

Distributor shall slope 1/16 to 1/32 inch per foot.

REFERENCES

NYS Department of Health, Division of Environmental Protection. "Wastewater Treatment Handbook-Individual Household Systems". Pgs. 65-67 and 141. Albany, NY. 1994.

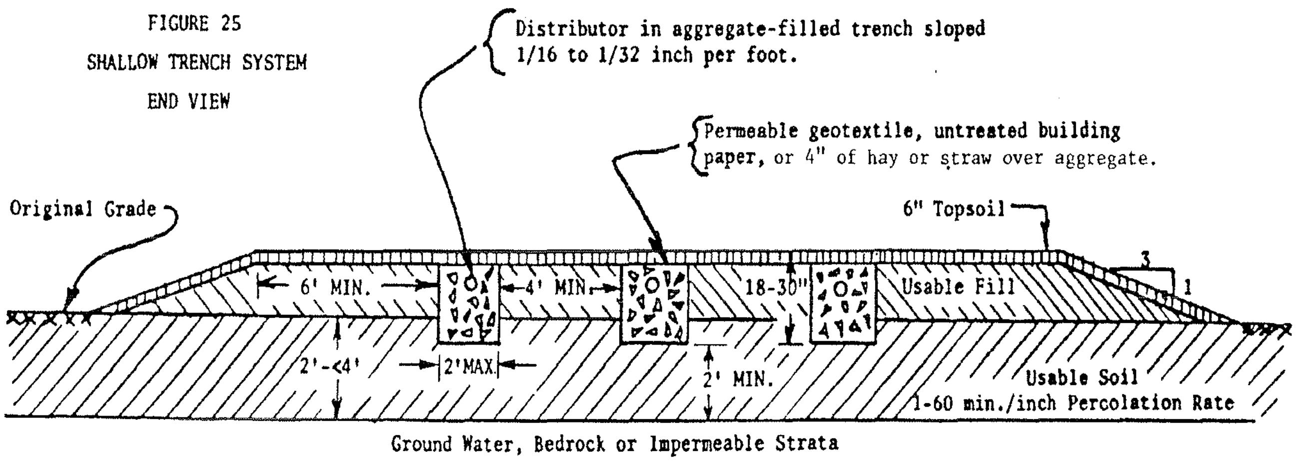
NYS Department of Health. 10 NYCRR, Appendix 75-A. "Wastewater Treatment Standards-Individual Household Systems". December 1990. Pg. 19. **(Management Practice Design Standard and Specification)**

USEPA. Office of Water Program Operations."EPA Design Manual-Onsite Wastewater Treatment and Disposal Systems". EPA Publication 625/1-80-012, Pg. 216. October 1980.

OTHER CONVENTIONAL SYSTEMS - Shallow Absorption Trenches

DEFINITION	A conventional soil absorption system downgradient of a septic or aerobic tank and having additional soil with a permeability equal to the original underlying soil used for fill (see sketch under *Miscellaneous Comments*).
WATER QUALITY PURPOSE	To provide treatment of septic or aerobic tank effluent equal to that of a standard soil absorption system.
SOURCE CATEGORY	On-Site Wastewater Treatment System (OWTS).
POLLUTANTS CONTROLLED	BOD, dissolved and suspended solids and pathogens, phosphorus and some nitrates.
WHERE USED	Sites where there is at least two feet (30 inches in the NYC water supply watersheds) but less than four feet of usable soil and/or separation to boundary conditions (i.e., fragipan, high groundwater, bedrock). If usable soil is less than 2 feet, alternative systems may be an option. (See Table 3A)
PRACTICE DESCRIPTION	The absorption trench system is constructed in the fill material, extending into the existing natural soil.
PRACTICE EFFECTIVENESS	Equal to a standard soil absorption trench system. The type (quality) of fill used becomes increasingly influential to system effectiveness when trenches are less than six inches into the in-situ soil and twelve inches or more into the fill.
IMPACT ON SURFACE WATER	Beneficial to slight, if groundwater infiltration and treatment is effective.
IMPACT ON GROUNDWATER	Beneficial to severe. Local Impact: Slight due to increased nitrates and chlorides. Cumulative impact: Slight to severe.
ADVANTAGES	*Upper soil horizons are more permeable, often due to plant and animal activity. In the growing season, transpiration will also reduce the loading on the system. (Note: These advantages are more significant when compared to a deep trench system than when compared to a standard absorption trench system.)
DISADVANTAGES	*Failure to keep heavy equipment out of the absorption area will decrease soil permeability. *Failure to add fill carefully will compact soil and decrease permeability. (Note: These are disadvantages over a standard absorption trench system because of the great amount of fill. These same problems must be overcome with absorption beds, cut and fill, raised, and mound systems.)
PRACTICE LIFESPAN	Twenty to twenty-five years (average for a well maintained system). Same as a standard absorption trench system.
COST	Somewhat more than a standard absorption trench system depending on the cost of added fill and the complexity of diverting uphill surface water around the system on sloped sites.
OPERATION AND MAINTENANCE	*Proper operation and maintenance of the septic tank or other pretreatment units is the best preventative maintenance for an absorption system. *Resting of the system is an effective method of restoring the infiltration rate. Alternating between two systems with a diversion valve can provide a means of resting the soil (also see *Operation and Maintenance* Summary Sheet).

FIGURE 25
SHALLOW TRENCH SYSTEM
END VIEW



NOTES: Bottom of all trenches shall not be above original usable soil and should preferably be at least 6" below original grade.

Usable fill shall have a percolation rate similar to but not faster than the usable soil percolation rate.

Maximum depth of usable fill plus six inches of topsoil shall not exceed 30 inches.

On sloped sites, a diversion ditch shall be constructed uphill from the fill to prevent surface runoff from entering the fill.

Fill shall extend at least six feet beyond ends of trenches before starting 1 on 3 edges of fill.

REFERENCES

NYS Department of Health, Division of Environmental Protection. Individual Wastewater Treatment Design Handbook. Pgs. 67-69 and 142. Albany, NY. 1994.

NYS Department of Health. 10 NYCRR, Appendix 75-A. "Wastewater Treatment Standards-Individual Household Systems". December 1990. Pg. 19. **(Management Practice Design Standard and Specification)**

USEPA. Office of Water Program Operations."EPA Design Manual-Onsite Wastewater Treatment and Disposal Systems". EPA Publication 625/1-80-012, Pg. 216. October 1980.

OTHER CONVENTIONAL SYSTEMS - Cut and Fill Systems

DEFINITION

A cut and fill system is a standard absorption trench system installed on sites where impermeable soil overlays a permeable or usable soil (i.e., one to 60 minutes per inch percolation rate).

WATER QUALITY PURPOSE

To provide treatment of septic or aerobic tank effluent equal to a standard soil absorption trench system.

SOURCE CATEGORY

On-Site Wastewater Treatment System (OWTS).

POLLUTANTS CONTROLLED

BOD, dissolved and suspended solids, pathogens, phosphorus and some nitrates.

WHERE USED

Sites with one to five feet of impermeable soil overlying usable soil. The usable soil layer must be at least three feet thick.

PRACTICE DESCRIPTION

The overlaying impermeable soil is removed from the proposed absorption field area (i.e., extending 5' beyond any proposed absorption trench) and replaced by permeable soil comparable to the underlying soil. A standard absorption field system (i.e., trenches with distribution lines and aggregate) is designed for the upper 18 to 30 inches of the permeable fill or underlying soil. Percolation tests of both in-situ and fill soils are taken and the lower permeability or "slower" soil is used to determine the required length of trench using tables in Appendix 75A.

PRACTICE EFFECTIVENESS

More effective than deep absorption trenches. Just as effective as a standard absorption field system provided care is taken during construction to assure that the usable underlying soil and replacement fill is not made unusable through compaction. Also, impermeable overburden must not be left in the bottom of the excavated area (i.e., on top of the permeable underlying soil).

IMPACT ON SURFACE WATER

Beneficial to slight, if the system is constructed and continues to function as designed.

IMPACT ON GROUNDWATER

Beneficial to severe. Slight increase in nitrates and chlorides locally. Slight to severe cumulative impact if constructed as designed.

ADVANTAGES

*Can also be used as part of a site modification where usable soils are overlain by unusable impermeable soils and where soils on the site percolate faster than one minute per inch. For soils with excessively high percolation rates, soil blending may be used to bring the percolation rate to within a range of 5 to 60 minutes per inch. However, in practice, direct or total exchange of soil is preferable to blending.

DISADVANTAGES

*More time and care may be needed than for a standard absorption field system: Stabilization and testing of fill requires natural settlement for at least six months including at least one freeze/thaw cycle; Alternatively, granular soils with a percolation rate of 5-30 min./in. may be placed in six-inch layers with mechanical compaction to the approximate density of the on-site soil; Fill material must be compatible with the on-site soil permeability. These factors add to construction scheduling difficulties such as weather, equipment needs and high seasonal construction demand.

PRACTICE LIFESPAN

20-25 years (average) for a well maintained system. Same as a standard absorption field system.

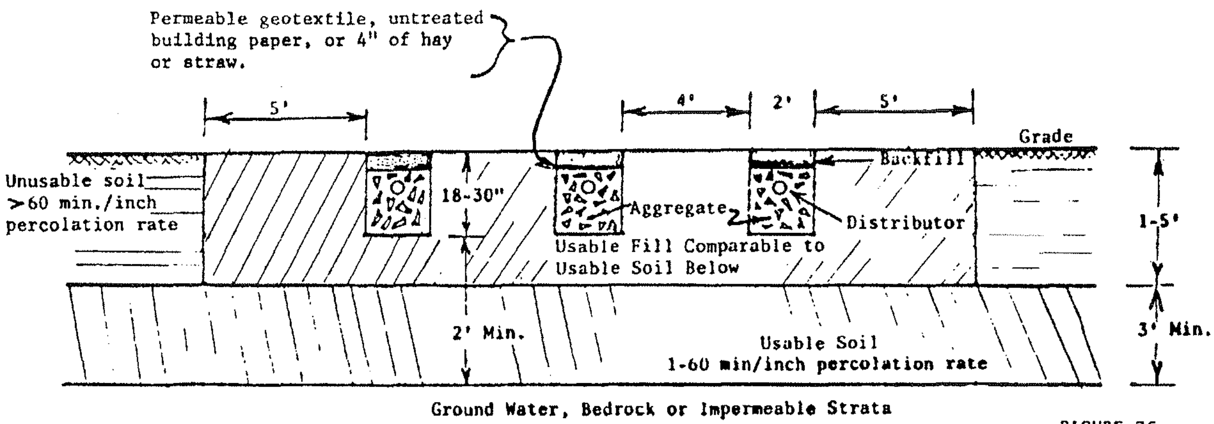
COST

Somewhat more than a standard system depending on how much extra time is required for soil stabilization, soil blending and soil compaction.

OPERATION AND MAINTENANCE

*Proper operation and maintenance of the septic tank or other pretreatment units is the best preventative maintenance for an absorption system. *Resting of the system is an effective method of restoring the infiltration rate. Alternating between two systems with a diversion valve can provide a means of resting the soil. (Also see *Operation and Maintenance* summary sheet.)

MISCELLANEOUS COMMENTS



Notes: On sloped sites, a diversion ditch shall be constructed uphill from the fill and trench area to prevent surface runoff from entering the absorption area.

FIGURE 26
CUT AND FILL SYSTEM

REFERENCES

NYS Department of Health, Division of Environmental Protection. "Individual Wastewater Treatment Design Handbook". Albany, NY. Pgs. 69-72 and 143. 1994

NYS Department of Health. 10 NYCRR, Appendix 75A. "Wastewater Treatment Standards-Individual Household Systems". Pg. 20. December 1990. **(Management Practice Design Standard and Specification)**

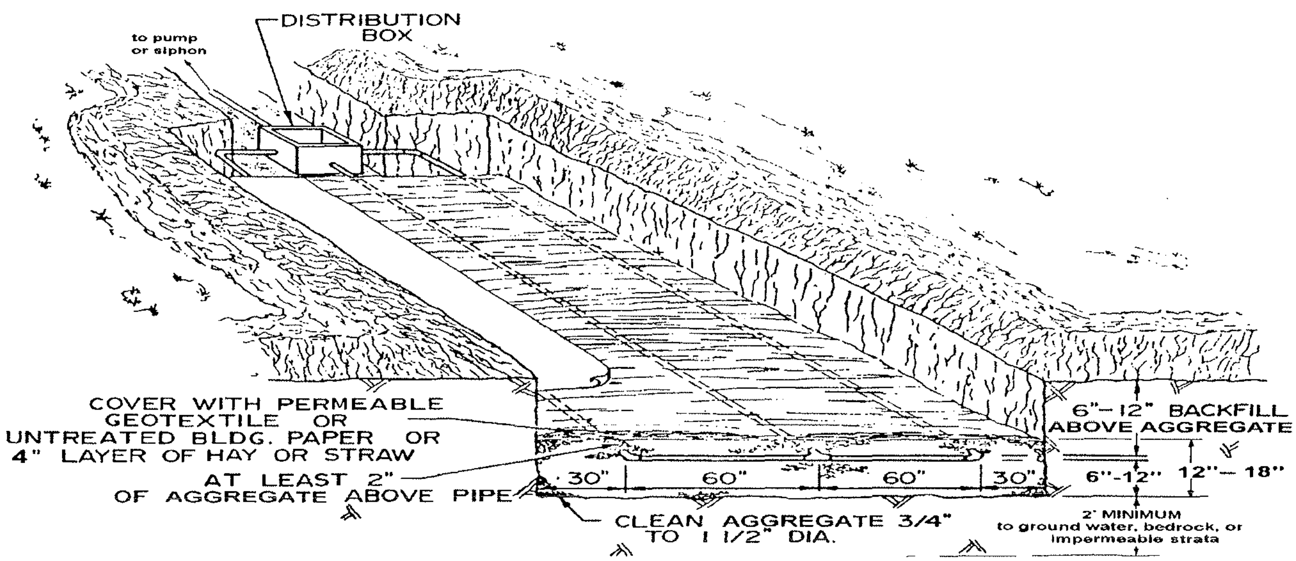
USEPA. Office of Water Program Operations. "EPA Design Manual-Onsite Wastewater Treatment and Disposal Systems". EPA Publication 625/1-80-012. Pgs. 257-259. October 1980.

OTHER CONVENTIONAL SYSTEMS - Absorption Bed Systems

DEFINITION	An absorption bed is similar to the absorption trench except that several pressure distribution laterals are installed in a single excavation rather than single laterals in several excavations.
WATER QUALITY PURPOSE	To provide treatment of septic or aerobic tank effluent equal to the standard trench soil absorption system.
SOURCE CATEGORY	On-Site Wastewater Treatment Systems (OWTS).
POLLUTANTS CONTROLLED	BOD, dissolved and suspended solids, pathogens, phosphorus and some nitrates.
WHERE USED	A bed system is used where soils are well drained, the land is relatively level but area is limited. "Useable soil at the bed site must be at least four feet deep." According to Appendix 75A of 10 NYCRR Chapter II, "A bed system may be built in soils with a percolation rate between one and 30 minutes per inch. A bed shall not be built where the soil evaluation indicated silty loam, clay loam or clay." These soil types have slow percolation rates. "Bed systems are more practical on long narrow sites with minimal slope." The natural slope of the site should not exceed 8% prior to any site modifications.
PRACTICE DESCRIPTION	The required bed area is excavated. The bottom and side walls are raked to reduce soil smearing. The bed is leveled and covered with 6 inches of aggregate (i.e., ¾ to 1½ inch washed gravel or crushed stone). The pressure distribution laterals are installed next, leveled, and aggregate is added to two inches above the top of the laterals. Geotextile is laid over the aggregate (hay or straw or untreated building paper may be used if permeable geotextile is unavailable). Next, the bed is backfilled with soil, mounded slightly (to account for settlement), and after freezing and thawing, regraded by hand.
PRACTICE EFFECTIVENESS	As effective as a standard absorption field (trench) system since the lost absorption area that would be provided by a trench system is compensated by using a decreased wastewater application rate to calculate the bed area; the requirement for pressure distribution or siphon dosing; and the requirement for using soils with lower (faster) percolation rates. The uniform application of wastewater via pressure distribution or dosing results in periodic use of the entire distribution system (i.e., all the permeable soil) rather than constant use of small areas and resultant excessive matting or porous bedrock.
IMPACT ON SURFACE WATER	Beneficial to slight, if system operates as designed with no short-circuiting to water table or fractured or porous bedrock.
IMPACT ON GROUNDWATER	Beneficial to slight, increased nitrates and chlorides on-site or locally. Slight to severe, cumulative impact depending on housing density, soil types and separation distances and the resulting dilution by infiltrating groundwater.
ADVANTAGES	*Less lawn area is needed for a bed than a trench system. *Bed can be used on lots where a standard absorption field is not possible, due to site limitations.

DISADVANTAGES	*More susceptible to overloading from surface water than standard trench systems. *It is less efficient in absorption than a trench system, so it cannot be used on as great a range of soil permeabilities. *Contractors often smear or otherwise seal the bed bottom during construction, destroying the bed's ability to absorb the effluent. *Pressure distribution requires more maintenance.
PRACTICE LIFESPAN	20-25 years (average) for a well maintained system. Same as a standard absorption field (trench) system.
COST	Somewhat more than a standard absorption (trench) system due to the capital and maintenance costs of pressure distribution or siphon dosing.
OPERATION AND MAINTENANCE	*Proper operation and maintenance of the septic tank or other pretreatment units is the best preventative maintenance for an absorption system. *Resting of the system is an effective method of restoring the infiltration rate. Alternating between two systems with a diversion valve can provide a means of resting the soil (see *Operation and Maintenance* summary sheet).

MISCELLANEOUS COMMENTS



ABSORPTION BED
adapted from 1980 EPA Design Manual

REFERENCES

Machmeier, Roger E. University of Minnesota Agricultural Extension Service. 1980. "Get To Know Your Septic Tank", Extension Folder 337. St. Paul, MN. 35108

NYS Department of Health, Division of Environmental Protection. "Individual Wastewater Treatment Design Handbook". Albany, NY. Pgs. 72-75. November 1993.

NYS Department of Health. 10 NYCRR, Appendix 75-A. "Wastewater Treatment Standards-Individual Household Systems". Pgs. 20, 22 and 144. December 1990. **(Management Practice Design Standard and Specification)**

University of Minnesota Agricultural Extension Service. Home Sewage Treatment Workshop Workbook. Department of Agricultural Engineering. St. Paul, MN. 1981.

USEPA. Office of Water Program Operations. "EPA Design Manual-Onsite Wastewater Treatment and Disposal Systems". EPA Publication 625/1-80-012, Pgs. 208-216. October 1980.

OTHER CONVENTIONAL SYSTEMS - Seepage Pits

DEFINITION

A covered pit with an open-jointed or perforated lining (either concrete. or masonry) through which septic tank effluent infiltrates into the surrounding soil. These devices are sometimes called a leaching pit. leaching pool. or dry well and are incorrectly called a cesspool.

WATER QUALITY PURPOSE

To provide treatment of septic or aerobic tank effluent. This practice is the least preferred of the conventional treatment systems in this catalogue. and is not permitted if site and soil conditions are adequate for absorption trenches.

SOURCE CATEGORY

On-Site Wastewater Treatment Systems (OWTS).

POLLUTANTS CONTROLLED

BOD. dissolved and suspended solids. pathogens. phosphorus and some nitrates.

WHERE USED

Seepage pits are generally discouraged by many local regulatory agencies in favor of trench or bed systems. However. seepage pits have been shown to be an acceptable method of disposal for small wastewater flows. Seepage pits are used where land area is too limited for trench or bed systems; and either the groundwater level is deep at all times. or the upper 3 to 4 ft. of the soil profile is underlain by a more permeable unsaturated soil material of great depth.

PRACTICE DESCRIPTION

The required number and size of seepage pits required are determined by tables in 10 NYCRR Appendix 75A. They are based on design flow rate and percolation test results of the on-site permeable soil. Pits should be as shallow as possible to enhance natural aeration of the soil infiltrative surface. A minimum 3 ft. vertical separation must exist between the bottom of any pit and the high groundwater level. bedrock, or impervious strata. (See Table 3A).

PRACTICE EFFECTIVENESS

Shallow seepage pits are as effective as a standard trench absorption system for small wastewater flows.

IMPACT ON SURFACE WATER

Beneficial to slight. if system works as designed with no short-circuiting to the water table or fractured or porous bedrock.

IMPACT ON GROUNDWATER

Beneficial to slight. Nitrate and chloride increase near system. Cumulative effects will be slight to severe depending on housing density. soil types and separation distances and the resulting dilution by cleaner infiltrating groundwater.

ADVANTAGES

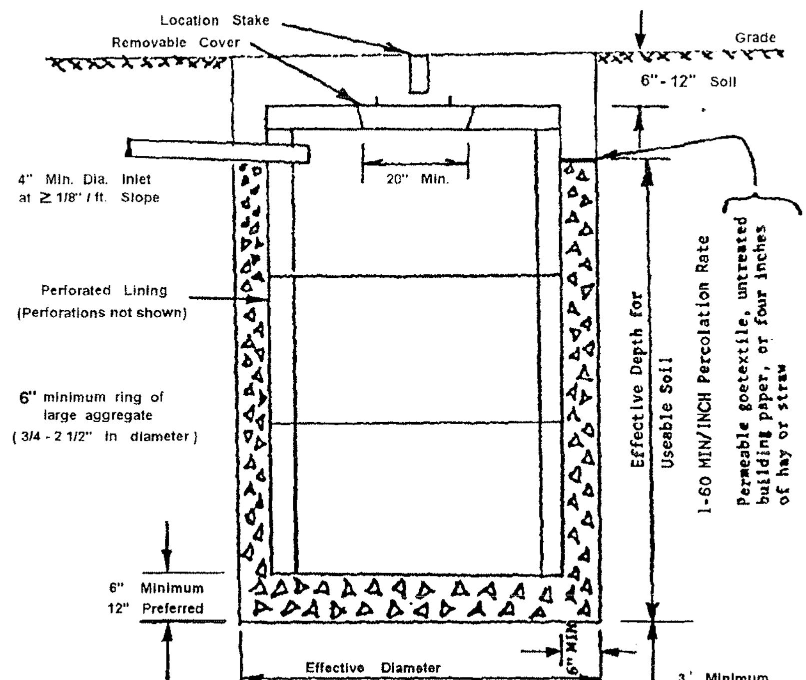
*Allows construction of an on-site system for small wastewater flows on small lots, where there is not enough room for a trench or bed system. *May allow for greater aeration than trenches for small pits and large flow variations due to the liquid level fluctuations along the biomatted wall area and greater hydrostatic pressure due to the depth.

DISADVANTAGES

*Because the range of effectiveness is for smaller design flows. seepage pits may be more susceptible to hydraulic overloading than a standard trench system. *Deeper pits provide less aeration at the wastewater/soil interface due to system depth and production of anaerobic gasses.

PRACTICE LIFESPAN	20-25 years (average) for a well maintained system. At least the same as a standard trench system, perhaps longer due to liquid level fluctuation.
COST	Less than a standard absorption (trench) system for a single seepage pit. Multiple pits with distribution box, and connecting pipes will approach the cost of a standard absorption system.
OPERATION AND MAINTENANCE	*Proper operation and maintenance of the septic tank or other pretreatment units is the best preventative maintenance for an absorption system. *Resting of the system is an effective method of restoring the infiltration rate. Alternating between two systems with a diversion valve can provide a means of resting the soil (see *Operation and Maintenance of Standard Septic Tank and Soil Absorption System* summary sheet).

MISCELLANEOUS COMMENTS



Page 145
INDIVIDUAL
WASTEWATER TREATMENT
DESIGN HANDBOOK

Section View
FIGURE 28
TYPICAL SEEPAGE PIT DETAIL

REFERENCES

Kaplan, O. Benjamin. "Septic Systems Handbook", Second Edition. Lewis Publishers. Chelsea, MI. 1991.

NYS Department of Health, Division of Environmental Protection. "Individual Wastewater Treatment Design Handbook. Albany, NY. January 1994. Pgs. 76-81 and 145.

NYS Department of Health. 10 NYCRR, Appendix 75A. "Wastewater Treatment Standards-Individual Household Systems". December 1990. Pg. 22-24. **(Management Practice Design Standard and Specification)**

USEPA. Office of Water Program Operations. "EPA Design Manual-Onsite Wastewater Treatment and Disposal Systems". EPA Publication 625/1-80-012, Pgs. 235-239. October 1980. Includes following reference: Bendizen, T.W., R.E. Thomas, and J.B. Coulter. Report of a Study to Develop Practical Design Criteria for Seepage Pits as a Method for Disposal of Septic Tank Effluents. Robert A. Taft Sanitary Engineering Ctr., Cincinnati, Ohio. 1963. 252 pp.

ALTERNATIVE SYSTEMS - Raised Systems

DEFINITION

A raised system is a conventional absorption trench system constructed in stabilized (in place for at least six months and one freeze/thaw cycle) permeable fill placed above the original ground surface on a building lot. (Note: Granular soils with a percolation rate of 5-30 min/inch do not require stabilization.)

WATER QUALITY PURPOSE

To provide treatment equal to a conventional absorption system on sites where site or soil conditions preclude the use of a conventional system.

SOURCE CATEGORY

On-Site Wastewater Treatment Systems (OWTS).

POLLUTANTS CONTROLLED

BOD, dissolved and suspended solids, pathogens, phosphorus and some nitrates.

WHERE USED

On sites not suitable for conventional systems due to inability to meet horizontal or vertical separation distances to boundary conditions. Site requirements include: (1) Original soil must be at least one foot deep but less than two feet and have a percolation rate between one and 60 minutes per inch; (2) Slope of the site, including sufficient area to allow for 50% expansion must be less than or equal to 15%. If accomplished through site modification, the original ground slope may not exceed 20% and the modified site must undergo stabilization prior to additional soil tests; and (3) Completed system must provide all necessary separation distances.

PRACTICE DESCRIPTION

Site is prepared by cutting of vegetation (trees, stumps, brush, vines, weeds and grass) at grade. Vegetation is removed but root structure below grade is not removed. The underlying soil shall be undisturbed although the surface may be plowed to a depth of 7-8 inches with a double-bottomed plow turning furrows upslope. Heavy construction equipment must not be allowed in the area of the system.

After clearing and plowing, all traffic should be excluded. Stabilized fill should be placed as soon as possible and spread from the uphill side with a track-type bulldozer or from the sides with front end loader. Six inches of fill should be between the track and natural soil at all times.

A standard trench absorption system is constructed entirely in the fill and the entire surface of the system including the tapered edges are covered with six inches of topsoil, mounded to enhance precipitation runoff and seeded to grass.

PRACTICE EFFECTIVENESS

Effectiveness is enhanced by the NYSDOH requirement for dosing or pressure distribution of the effluent unless the system is installed under the review of a local health department with construction inspection and certification, and a minimum of two feet of fill material with a five to 30 minute per inch percolation rate is maintained between the trench and bottom and original ground surface. (see 10 NYCRR Appendix 75-A for further details).

IMPACT ON SURFACE WATER

Beneficial to slight, if system functions as designed.

IMPACT ON GROUNDWATER

Beneficial to slight, an increase in chlorides and nitrates locally. Slight to severe cumulative impact depending on dilution by fresh groundwater.

ADVANTAGES

*Allows a standard trench absorption system in adequate fill where the existing soil is of inadequate depth. *Does not require the soil specification of a mound system.

DISADVANTAGES

*May require a larger land area than a mound system. *Some soils require a six-month stabilization period. Alternatively, granular soils (5-30 min/in) may be placed in six-inch layers with mechanical compaction to the approximate density of the in-situ soil. *Landscaping needs to incorporate elevation change of system.

PRACTICE LIFESPAN

20-25 years (average) for a well-designed, constructed and maintained system. Same as a standard trench absorption system.

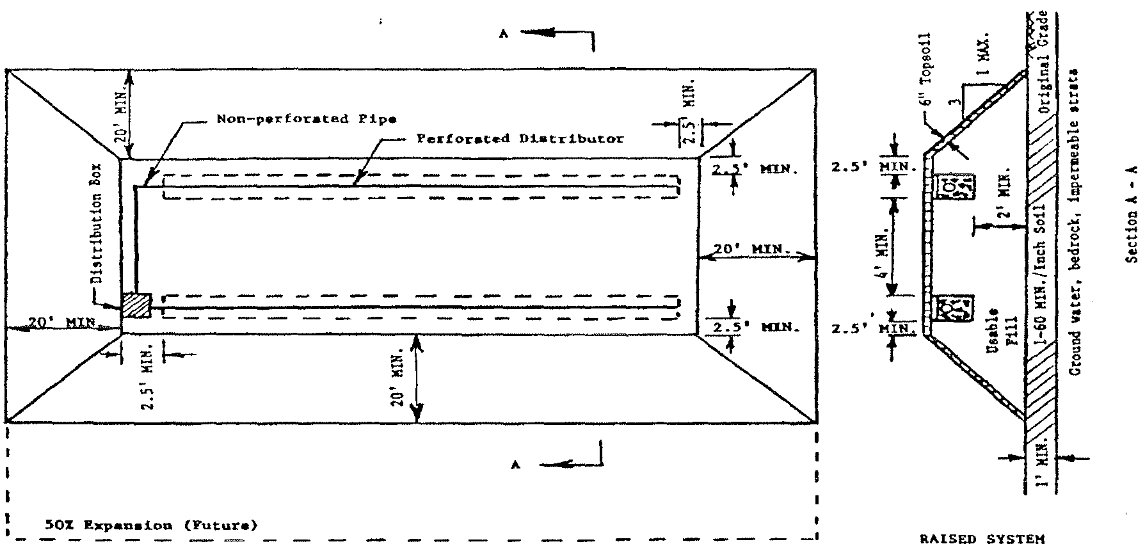
COST

Somewhat less than a mound system and more than a standard trench system. Cost above a trench system depends on soil availability, stabilization time and compaction time and equipment.

OPERATION AND MAINTENANCE

•Pump, if used, should be inspected annually and appropriately maintained. •Proper operation and maintenance of the septic tank or other pretreatment units is the best preventative maintenance for an absorption system. •Resting of the system is an effective method of restoring the infiltration rate. Alternating between two systems with a diversion valve can provide a means of resting the soil. (Also see *Operation and Maintenance* summary sheet.)

MISCELLANEOUS COMMENTS



Top View

RAISED SYSTEM
FIGURE 29

REFERENCES

Myers, Jennie. Director, Lands Management Protection. Draft Management measures for On-Site Sewage Disposal Systems in Coastal Areas, Coastal Zone Management Act Amendments. Pg. 59. April 8, 1991.

NYS Department of Health, Division of Environmental Protection. "Individual Wastewater Treatment Design Handbook". Albany, NY. Pgs. 83-88 and 146-147. 1994.

NYS Department of Health. 10 NYCRR, Appendix 75-A. "Wastewater Treatment Standards-Individual Household Systems". Pgs. 24-26. December 1990. **(Management Practice Design Standard and Specification)**

Ulster County Health Department. Environmental Sanitation Division. "Recommendations for a Small Sewage Disposal System" and notes and details of a "Run-of-Bank Fill System". Undated. Revised 1993. Ulster County Health Department. Kingston, NY.

USEPA. Office of Water Program Operations. "EPA Design Manual-Onsite Wastewater Treatment and Disposal Systems". EPA Publication 625/1-80-012, Pgs. 219 and 257 and following. October 1980.

ALTERNATIVE SYSTEMS - Elevated Sand Mounds

DEFINITION	A mound system is a pressure-dosed absorption system that is elevated above the original soil surface in a sand fill. The system consists of a septic tank (or aerobic tank), dosing chamber and the elevated sand mound.
WATER QUALITY PURPOSE	To achieve more effective wastewater treatment by providing better distribution of effluent within the system and greater distance of unsaturated flow. To provide some denitrification at the interface of the sand and original topsoil.
SOURCE CATEGORY	On-site Wastewater Treatment Systems (OWTS).
POLLUTANTS CONTROLLED	BOD, pathogens, dissolved and suspended solids, phosphorus and some nitrates, other contaminants through filtering and biological oxidation.
WHERE USED	Where native subsoils have a very low ability to transmit water (e.g., compact tills, fragipans, compact clays and silts). Also where there is insufficient depth of permeable soil above high groundwater or creviced or porous bedrock. These systems are not acceptable within the watersheds of New York City's water supply.
PRACTICE DESCRIPTION	Liquid wastewater is pumped in controlled doses (usually via a pump or possibly a siphon) from the dosing chamber to perforated plastic distribution pipe in a sand mound that covers the original topsoil. Wastewater flows from the pipe perforations, into the gravel trenches, through the sand mound, and into the natural soil. The mound is also covered with a clay cap and a few inches of topsoil to maintain a vegetative cover.
PRACTICE EFFECTIVENESS	Comparable to conventional system removals, possibly greater nitrate removal (see *Miscellaneous Comments).*
IMPACT ON SURFACE WATER	Beneficial to slight if system functions as designed and with effective groundwater infiltration and treatment prior to reaching surface water.
IMPACT ON GROUNDWATER	Beneficial to slight. Increase in chlorides and nitrates locally. Slight to severe cumulative impact depending on dilution by fresh groundwater, soil types, separation distances and housing density.
ADVANTAGES	*The primary advantage of this system is that the presence of the mound of fill increases the distance that wastewater percolates before reaching a restrictive soil horizon or groundwater.

DISADVANTAGES

*Pump maintenance and electrical power is required. *Requires that suitable fill materials are located within a reasonable distance of the site. *May be difficult to landscape. *If mound permeability and loading rate are high, there may be leaking at toe of mound. *Higher design and construction costs than for conventional system.

PRACTICE LIFESPAN

Twenty to twenty-five years depending on quality of design, construction and materials.

COST

See table below.

OPERATION AND MAINTENANCE

Regular inspection and maintenance of pump or dosing chamber is required. Septic tank should be pumped at least once every three years or as inspections or local regulations dictate. This system should include an appropriate alarm device that indicates pump failure. (see *Operation and Maintenance* summary sheet.)

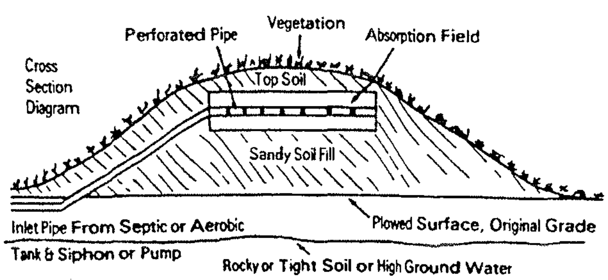
MISCELLANEOUS COMMENTS

Percent Removal of Contaminants

Mound Systems[1]	% TSS	% BOD	% TN	% TP	Path (LOGS)	Capital Cost ($1,000)	O&M Per Year
Average	NA	NA	44	NA	NA	$8.3	$180
Probable Range	60-70	40-55	10-45	30-80	3-4	$7.0 - $10.0	$100 - $300
Observed Range	NA	NA	NA	NA	NA	$6.8 - $11.0	$90 - $310
No. Values Considered	0	0	0	0	0	4	4

(LOGS) Pathogenic organism removal measured in powers of ten. 3-4 = a 1,000 to 10,000 fold reduction in pathogens.

1 EPA, Office of Water. Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters. Washington, DC. January 1993.



REFERENCES

NYS Department of Health, Division of Environmental Protection. Individual Wastewater Treatment Design Handbook. Albany, NY. 1994. Pages 88-96, 148-152 and Appendix A.

NYS Department of Health. 10 NYCRR, Appendix 75-A. "Wastewater Treatment Standards, Individual Household Systems". December 1990. **(Management Practice Design Standard and Specifications)** Pgs. 24 and 26-28.

Myers, Jennie. Director, Land Management Project. Draft Management Measures for On-Site Sewage Disposal Systems in Coastal Areas, Coastal Zone Management Act Amendments. April 8, 1991. Pgs. 59 and 60.

USEPA. Office of Water Program Operations. "EPA Design Manual-On-site Wastewater Treatment and Disposal Systems". EPA Publication 625/1-80-012. Pgs. 278-296. October 1980.

ALTERNATIVE SYSTEMS - Intermittent Sand Filters

DEFINITION	A biological and physical treatment process consisting of a bed of sand receiving periodic doses of wastewater from the septic tank. The liquid passing through the sand filter is then discharged to a mound absorption system. This practice is called a Buried Sand Filter in some literature.
WATER QUALITY PURPOSE	To provide wastewater treatment equal to or greater than a conventional system.
SOURCE CATEGORY	On-Site Wastewater Treatment Systems (OWTS).
POLLUTANTS CONTROLLED	BOD, dissolved and suspended solids, pathogens, phosphorus and some nitrates.
WHERE USED	Where the site has shallow soil, slowly permeable soil or a high water table: conditions that do not permit a conventional system. Intermittent sand filters and downstream absorption mound systems should only be used on large lots. These systems are not intended for use when the surface soil/rock is impermeable since a downstream mound would exhibit continuous weeping. The downstream absorption mound should be located where at least six inches of permeable (i.e., 1-120 min/in) soil exists to absorb the double filtered wastewater (i.e., by the sand filter and downstream mound). Since the downstream absorption mound may still exhibit some weeping during the wet season, the mound should be located distant from the residence and at least 100 feet from any property line. These systems will generally not be approved for use within the watershed of the New York City water supply system.
PRACTICE DESCRIPTION	Septic tank or aerobic unit effluent is intermittently spread across the surface of a bed of sand via perforated distribution lines in aggregate. Collector pipes in aggregate beneath the sand and a 3-inch layer of ⅛ or ¼ inch diameter crushed stone or washed gravel collect filtered wastewater for additional treatment.
PRACTICE EFFECTIVENESS	Generally greater removals of BOD, total suspended solids, total nitrogen and total phosphorus than conventional systems. USEPA observed a range of removals for a limited sampling of intermittent sand filters (no downstream mound). Removals were as follows: Total S.S. - 70-99% for seven systems; BOD - 80-99% for ten systems; Total Nitrogen - 40-75% for seven systems; Total Phosphorus - 70-90% for two systems; Pathogens - 100-10,000 fold decrease for six systems.
IMPACT ON SURFACE WATER	Discharge of sand filter effluent to surface water is not permitted in New York. The impact therefore would be beneficial to slight if both the sand filter and downstream absorption mound are operating as designed.
IMPACT ON GROUNDWATER	Beneficial to slight due to the double filtration of the sand filter and downstream mound.
ADVANTAGES	*Can work on sites with shallow or low permeability soil.

DISADVANTAGES

*Expensive because it involves double filtering (sand filter and mound absorption system). *Biological activity in the sand filter is temperature dependent.

PRACTICE LIFESPAN

The sand media may have to be replaced after 20 to 25 years.

COST

Approximately twice that of a conventional system since it must be used in conjunction with a mound system. The USEPA found a range of costs for seven systems (intermittent sand filter only) to be $2,300 to $10,000. The maintenance costs for five systems ranged between $100 and $440 per year.

OPERATION AND MAINTENANCE

*Proper operation and maintenance of the septic tank or other pretreatment units is the best preventative maintenance for an absorption system. *Sand filters are especially prone to clogging by excess solids passing through an overloaded septic tank. *Resting of the system is an effective method of restoring the infiltration rate. Alternating between two systems with a diversion valve can provide a means of resting the soil. *Inspection of all components of the dosing chamber every three months is recommended.

MISCELLANEOUS COMMENTS

Other sand filter systems can be designed. They are subject to approval in New York as "Engineered Systems".

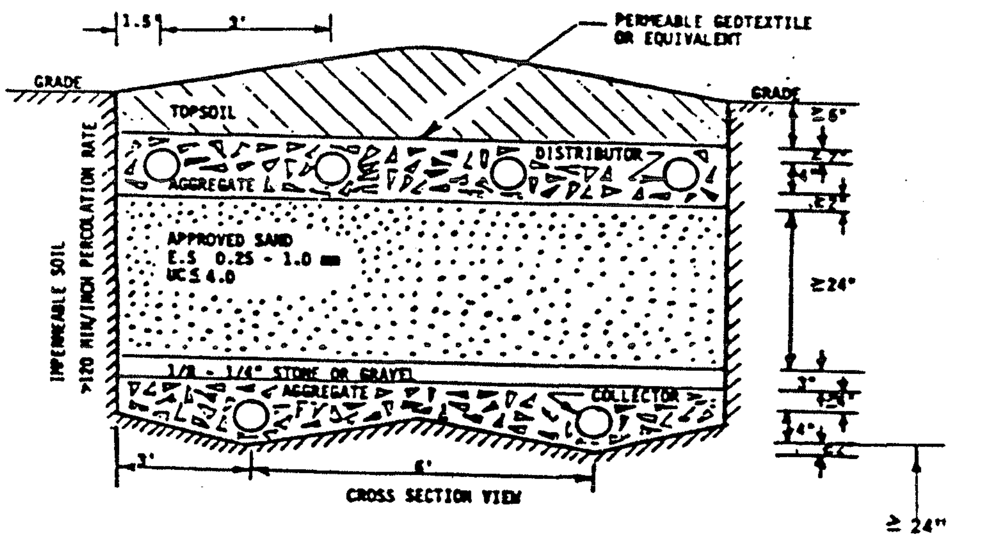


Figure 34
Typical Buried Intermittent Sand Filter with Gravity Distribution

REFERENCES

Braem, Lee and Marian Mlay. USEPA. Office of Groundwater Protection. "Septic Systems and Groundwater Protection: A Program Manager's Guide and Reference Book". July 1986. Pg. A-4.

Frome, Michele. Vermont Natural Resources Council. "Rural Sewage Treatment in Vermont, Book 1: A Guide to the Alternatives". June 1978. Pg. 59.

Myers, Jennie. Director. Land Management Project Draft Management Measures for On-Site Sewage Disposal Systems in Coastal Areas, Coastal Zone Management Act Amendments. April 8, 1991. Pgs. 66-67.

NYS Department of Health, Division of Environmental Protection. Individual Wastewater Treatment Design Handbook. Albany, NY. January 1994. Pgs. 96-104 and 153-155.

NYS Department of Health. 10 NYCRR, Appendix 75A."Wastewater Treatment Standards, Individual Household Systems". December 1990. Pgs. 28 and 32. **(Management Practice Design Standard and Specifications)**

National Association of Towns and Townships. "Treat It Right-A Local Official's Guide to Small Town Wastewater Treatment". 1989. Pg. 18.

USEPA. Design Manual. On-site Wastewater Treatment and Disposal Systems. U.S. Government Printing Office.1980. Pgs. 113-140.

USEPA. Office of Water. Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters. Washington, DC. January 1993. Pgs. 4-104 -- 4-107.

OPERATION AND MAINTENANCE FOR SEPTIC TANKS AND STANDARD ABSORPTION SYSTEMS

DEFINITION

Tasks that the user or a municipal agent must perform to prevent premature failure of a septic system and to assure the longest possible lifespan and optimum performance.

WATER QUALITY PURPOSE

To provide for the proper treatment and disposal of household wastewater where community-based treatment works are not available. Sewage treatment systems that are properly designed, installed, well maintained and operated will prevent septic odors, sewage overflows, water pollution and other environmental insults from occurring.

SOURCE CATEGORY

On-Site Wastewater Treatment Systems (OWTS).

POLLUTANTS CONTROLLED

Settleable and floatable solids, BOD, pathogens and other contaminants are treated through wastewater clarification, anaerobic and aerobic bacterial action, and absorption of the treated wastewater into suitable soils.

WHERE USED

Statewide.

PRACTICE DESCRIPTION

Septic tanks and absorption systems should be inspected annually (see *Inspection and Pumping summary sheet).*

New owners of homes should be given a map showing the location of the on-site system and information on how to maintain the system (i.e., Cornell's file folder and fact sheets).

Garbage grinders substantially increase the accumulation of solids in the septic tank, as well as the solids entering the absorption facility. They are not recommended for households on septic systems. If used the tank size must be increased and the outlet baffle must be equipped with a gas deflection device. Solids retention can be enhanced further by installing a septic tank outlet filter.

Avoid the disposal of cigarette butts, disposable diapers, feminine hygiene products, plastic, trash, hazardous substances, etc. into household systems (see *Proper Use and Disposal of Household Hazardous Substances* summary sheet).

Septic tank additives are unnecessary, and may harm proper system functions and/or the environment. Waste brine from water softeners can be discharged to the septic tank, except where the absorption field consists of structured clay soil. If it does, a separate absorption field or seepage pit should be properly installed and used for the brine discharge.

Discharges from large volume fixtures and appliances (i.e., hot tubs, pool filter backwash water, whirlpool baths, etc.) should be limited to five gallons per minute. This will prevent solids from being washed out of the septic tank and into the absorption field.

Keep swimming pools (above or inground) away from the absorption field. Never permit heavy equipment and vehicles to pass over the absorption field. Never pave over an absorption field. All roof, cellar and footing drainage, as well as surface water must be excluded from this system. Roof downspouts and rain runoff should drain away from absorption facilities.

The lifespan of household wastewater treatment systems can be prolonged by practicing water conservation. Check for leaky fixtures and defective toilet valves on a regular basis.

PRACTICE EFFECTIVENESS

Proper operation and maintenance of individual household wastewater treatment systems increases system lifespan, optimizes wastewater treatment and helps to prevent system failures.

IMPACT ON SURFACE WATER

Beneficial.

IMPACT ON GROUNDWATER

Beneficial.

ADVANTAGES

*The use of proper operation and maintenance practices will protect the environment. Lifetime system costs can be reduced.

DISADVANTAGES

None.

PRACTICE LIFESPAN

These practices should be routinely performed over the typical lifespan of the system.

COST

There are no costs associated with annual homeowner inspections. Failure to maintain system may cause premature failure and lead to higher costs.

OPERATION AND MAINTENANCE

Requires Homeowner Education programs for effective execution.

MISCELLANEOUS COMMENTS

None.

REFERENCES

NYS Department of Health, Division of Environmental Protection, "Wastewater Treatment Handbook-Individual Household Systems." Albany, NY. November, 1993.

"EPA Design Manual, On-site Wastewater Treatment and Disposal Systems," Publication EPA 625/1-80-012, October, 1980.

"EPA Septic Systems and Ground Water Protection, A Program Manager's Guide and Reference Book," GPO Document No. 055-000-00256-8, July, 1986.

"EPA Septic Systems and Ground Water Protection, An Executive's Guide," GPO Document No. 055-000-00256-6, July, 1986.

"EPA Septic Tank Siting to Minimize the Contamination of Ground Water by Microorganisms," EPA Publication 440/6-87-007, June, 1987.

"Design Standards for Wastewater Treatment Works, Intermediate Sized Sewerage Facilities," New York State Department of Environmental Conservation, 1988.

MANAGEMENT PRACTICE SUMMARY SHEET

ADMINISTRATION, OPERATION AND MAINTENANCE: Inspection and Pumping

DEFINITION

Periodic (e.g., yearly) septic system inspections and routine pumping of the septic tank

WATER QUALITY PURPOSE

To prevent overflow of solids into distribution network and consequential failure of downstream treatment facilities.

SOURCE CATEGORY

On-Site Wastewater Treatment Systems (OWTS).

POLLUTANTS CONTROLLED

BOD, suspended solids, nitrogen, phosphorus, chloride, metals, organic contaminants and pathogens.

WHERE USED

In communities where private residences have the potential to contaminate ground and surface water (i.e., all areas with OWTS).

PRACTICE DESCRIPTION

Tanks:

- Solids that do not decompose remain in the tank, requiring periodic pumping (see Frequency Table under *Miscellaneous Comments*). Septic tanks should be pumped out only by NYSDEC authorized septage haulers.
- Septic tanks may have one or two compartments, pump both.
- Tees (baffles) are provided at the tank's inlet and outlet pipes. The inlet tee slows the incoming wastes and reduces disturbance of the settled sludge. The outlet tee retains the solids or scum in the tank. Pumping contractor should check integrity of inlet and outlet tees, tank walls and floor.
- All tanks should have inspection ports for checking the condition of the baffles and access hole for pumping tank contents.

Absorption Field:

- Drainfield receives septic tank effluent and distributes it through its network of perforated pipes. Inspect distribution box to see if equal distribution is being maintained. Distribution box "speed levelers" to correct unequal flow distribution are recommended devices.
- Pipes are in gravel-filled trenches or beds in the soil. Wastewater trickles out of the pipes, through the gravel layer, and into the soil. Inspect field for wet spots, surfacing wastewater or sludge, and lush or dead spots in lawn, and deeply rooting vegetation.

PRACTICE EFFECTIVENESS

Clogged drainfield pipes are often the major symptom of septic system failure. Clogging of the pipes and gravel trench caused by a complete lack of pumping and resulting overflow of solids keeps effluent from penetrating soil. Inspection and pumping prevents the buildup and overflow of excessive waste particles in the tank.

Natural, beneficial clogging also develops along the trench walls and bottom. This gradual buildup is called a biological mat and is formed by sticky secretions from bacteria. Mats form as a result of normal flow. Inspection and pumping are effective in preventing excessive organic loading to the absorption field which accelerates matting.

Roots can interfere with the proper function of a drainfield trench. Seeking moisture, roots enter the pipe and cause clogging, or wrap around a pipe and dislodge it. Checking for and removing deep rooted plants from the absorption field is the most effective preventive practice. Grass and shallow-rooted plants are beneficial and should be cultivated.

IMPACT ON SURFACE WATER

Beneficial.

IMPACT ON GROUNDWATER

Beneficial.

ADVANTAGES

*Biggest advantage is that the system operates efficiently for many years. *Homeowner saves money with proper maintenance.

DISADVANTAGES

*Administrative problems regarding scheduling, record-keeping, etc. *Final septage disposal may be limited or costly.

PRACTICE LIFESPAN

Duration of the life of the septic system.

COST

Maintenance costs are lower than system replacement costs, when averaged over the life of the system. Septage haulers charge a fee to inspect and pump out a septic tank ($100 and up is not unusual).

OPERATION AND MAINTENANCE

Homeowner should follow guidelines in *Practice Description* section for maintenance (see *Operation and Maintenance* summary sheet).

MISCELLANEOUS COMMENTS

The table below shows estimated septic tank pumping frequencies in years for year-round residences. (Note: More frequent pumping is needed if garbage grinder is used.)

Tank size	Household size (number of people)									
(gallons)	1	2	3	4	5	6	7	8	9	10
500	5.8	2.6	1.5	1.0	0.7	0.4	0.3	0.2	0.1	--
750	9.1	4.2	2.6	1.8	1.3	1.0	0.7	0.6	0.4	0.3
900	11.0	5.2	3.3	2.3	1.7	1.3	1.0	0.8	0.7	0.5
1000	12.4	5.9	3.7	2.6	2.0	1.5	1.2	1.0	0.8	0.7
1250	15.6	7.5	4.8	3.4	2.6	2.0	1.7	1.4	1.2	1.0
1500	18.9	9.1	5.9	4.2	3.3	2.6	2.1	1.8	1.5	1.3
1750	22.1	10.7	6.9	5.0	3.9	3.1	2.6	2.2	1.9	1.6
2000	25.4	12.4	8.0	5.0	4.5	3.7	3.1	2.6	2.2	2.0
2250	28.6	14.0	9.1	6.7	5.2	4.2	3.5	3.0	2.6	2.3
2500	31.9	15.6	10.2	7.5	5.9	4.8	4.0	4.0	3.0	2.6

MF-947, COOPERATIVE EXTENTION SERVICE, MANHATTAN, KANSAS, MARCH 1990

REFERENCES

Cornell Cooperative Extension. "Your Septic System". Publication FS-1. Distribution Center. 8 Research Park. Cornell University. Ithaca, NY. 14850.

Hammond, C. and T. Tyson. Cooperative Extension Service. University of Georgia College of Agriculture and Environmental Sciences. Circular 819-2 1991.

Laak, Rein. "Wastewater Engineering Design for Unsewered Areas". Technomic Publishing Co., Inc. Lancaster, PA. 17604. 1986.

Lomax, Ken M. "Home Septic Systems: Proper Care and Maintenance". Extension Bulletin 126. Department of Agricultural Engineering. University of Delaware. Newark, DE. 19711.

Mancl, Karen. "Septic System Failure". Bulletin SW-41. Pennsylvania State University. College of Agriculture. Cooperative Extension Svc. University Park, PA.

North Carolina Cooperative Extension Service. "Septic Systems: What You Need to Know". North Carolina State University. College of Agriculture & Life Sciences. Bulletin WM-1. 1991.

Siegrist, R.L., T. Woltanski, L.E. Waldorf. "Water Conservation and Wastewater Disposal". IN Proceedings of the Second National Home Sewage Treatment Symposium. Chicago, IL. 1977.

Minnesota Extension Service. "Onsite Sewage Treatment Manual". Department of Agricultural Engineering. St. Paul, MN 55108. 1992.

ADMINISTRATION, OPERATION AND MAINTENANCE:
Administrative Control Measures

DEFINITION

Regulations, permit processes, and other controls available to local units of government for reducing nonpoint source pollution.

WATER QUALITY PURPOSE

To require the use of nonpoint source pollution management practices at certain times and/or in certain geographic areas.

SOURCE CATEGORY

On-Site Wastewater Treatment Systems (OWTS).

POLLUTANTS CONTROLLED

Nitrogen, phosphorus, BOD, pathogens and suspended solids are controlled indirectly by adoption of various administrative control measures.

WHERE USED

Statewide.

PRACTICE DESCRIPTION

Administrative control measures include NYS Health Department regulation addendums, septic surveys, property/home sale contingencies, subdivision rules and regulations, site review and zoning regulations. Measures can be adopted statewide, countywide, townwide, or for specially designated areas such as wastewater disposal or sewer districts, watershed protection districts or lake associations. Common components of OWTS control measures include a sound, legal framework; financial guarantees or bonds; inspection, enforcement, and penalty provisions; and a public education program. Administrative control measures may be tied to state or federal legislation. Watershed Rules and Regulations can be adopted by water purveyors; and Wellhead Protection measures adopted by localities.

PRACTICE EFFECTIVENESS

Administrative control measures reduce nonpoint source pollution best when they are based on a systematic assessment of the problem, are provided with adequate statutory jurisdiction, and rely upon clear and enforceable standards. For local regulations to work well, they must be supported by adequate resources from the governing body. These mechanisms are most effective when they: (1) define procedures to minimize pollutants discharged to OWTS; (2) minimize flow to OWTS through water conservation, and (3) minimize discharge of pollutants from OWTS by appropriate design and siting.

IMPACT ON SURFACE WATER

Beneficial.

IMPACT ON GROUNDWATER

Beneficial.

ADVANTAGES

*Assures communities that OWTS pollution will be addressed systematically. *Cost of prevention is usually less than cost of remediation. *If failed systems are replaced with publicly-owned systems (on-site or cluster), the local government project may be eligible for a State Revolving Fund loan.

DISADVANTAGES

*Additional costs for OWTS installation and maintenance to finance improved designs, fund septage or maintenance districts, or pay for improved record keeping or other local regulatory program. *Additional workload for code enforcement officers, planners, or other administering agencies. *Possible liability for corrective costs if failure due, in part, to failure of municipality to properly approve.

PRACTICE LIFESPAN

Normally long-term, with amendments as needed.

COST

Costs to implement control will vary. Least costly when administered concurrently with other regulatory programs.

OPERATION AND MAINTENANCE

Requires adequate staffing for review, inspection, and enforcement phases. Technical training should be provided to maintain staff capabilities. Regulations and standards need periodic assessing and updating.

MISCELLANEOUS COMMENTS

Administrative control measures need to be based on sound principles of natural resource management and nonpoint source pollution control. Local interagency cooperation can reduce administrative costs and is most effective when structured through formal memoranda of understanding.

REFERENCES

Albany County Department of Health. Addendum to New York State Department of Health. 10 NYCRR Part 75. Appendix 75-A. Albany County Health Department. 50 Ferry & Greene Streets, Albany, NY. 12203. **(Management Practice Design Standard and Specifications)**

Great Lakes-Upper Mississippi River Board of State Sanitary Engineers. Ground Disposal of Wastewaters. Appendix of Recommended Standards for Sewage Works. Health Education Services. Inc. Albany. NY. 1978. **(Management Practice Design Standard and Specifications)**

Myers. Jennie. Director. Lands Management Protection. Draft Management Measures for On-site Sewage Disposal Systems in Coastal Areas. Coastal Zone Management Act Amendments. April 8, 1991.

New England Interstate Water Pollution Control Commission. "Criteria for Regulation of On-site Sewage Treatment and Disposal Systems". Wilmington, MA. 40 pages. 1992.

NYS Department of Environmental Conservation. Water Pollution Control and Enforcement Laws: Article 17 and Related Portions of Articles 71 and 72 - Environmental Conservation Law. State of New York. June 1990.

NYS Department of Environmental Conservation. Division of Water. Design Standards for Wastewater Treatment Works-Intermediate-Sized Sewage Facilities. Bureau of Wastewater Facilities Design. 50 Wolf Road. Rm. 318, Albany, NY 12233-3505. 1988. **(Management Practice Design Standard and Specifications)**

NYS Department of Health. 10 NYCRR, Appendix 75-A. "Wastewater Treatment Standards, Individual Household Systems". December 1990. **(Management Practice Design Standard and Specifications)**

USEPA. Office of Water Program Operations. "EPA Design Manual - On-Site Wastewater Treatment and Disposal Systems". EPA Publication 625/1-80-012. pgs. 353-366. October 1980.

USEPA. Office of Water. Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters. Washington. DC. January 1993.

CONSERVATION MEASURES -- High Efficiency Plumbing Fixtures

DEFINITION

Enforcing the use of high efficiency plumbing devices for new systems and promoting their use as a contingency for the approval of a replacement system or upgraded system.

WATER QUALITY PURPOSE

To reduce hydraulic loading and promote an unsaturated, aerobic condition in the leachfield.

SOURCE CATEGORY

On-Site Wastewater Treatment Systems (OWTS).

POLLUTANTS CONTROLLED

None directly by devices. All indirectly by the resulting improved soil treatment.

WHERE USED

(1) Where a system has failed due to hydraulic overloading and the replacement system cannot be sufficiently expanded. (2) Where environmental conditions or neighboring system failures suggest hydraulic overloading. (3) Wherever water conservation is being promoted.

PRACTICE DESCRIPTION

Municipality promotes use of plumbing fixtures that use less water as part of their procedure for approving replacement and new systems. The 1984 Pennsylvania State University Study by Sharpe, et al., concluded: "Hydraulic load reduction with water conservation devices seems to be a viable method of alleviating failed septic tank soil absorption systems where the cause of failure is slowly permeable soil or organic clogging of soils with otherwise acceptable porosity. .The results of this study also suggest that a combination of inexpensive water conservation devices and alternate absorption system construction is an effective method of correcting malfunctions".

PRACTICE EFFECTIVENESS

Between 60% and 80% of indoor residential water use comes from the kitchen and bathroom. This component can be reduced by up to 50% by using high efficiency plumbing fixtures.

IMPACT ON SURFACE WATER

Beneficial by preventing saturated conditions in groundwater that is hydrologically connected to surface water.

IMPACT ON GROUNDWATER

Beneficial by preventing saturated conditions and the resulting increased distances that pollutants are carried through the ground.

ADVANTAGES

*Conserves water. *Prolongs system life. *For new OWTS, reduces size and resulting cost.

DISADVANTAGES

*Some fixtures may have a poor consumer-acceptance history that may be difficult to reverse.

PRACTICE LIFESPAN

Promoting or requiring of these devices would be continual.

COST

The cost of replacing fixtures is much less than that of replacing the OWTS. Some water companies offer free replacements.

OPERATION AND MAINTENANCE

The operation and maintenance of this practice consists of public education and possibly changes in regulations. Operation and maintenance of the plumbing fixtures is the same as normal flow fixtures.

MISCELLANEOUS COMMENTS

Summary of Indoor Residential Water Use Per Person Per Day

	Non-Conserving				Conserving [1]					
	Gals/Use	Units	Total Gals	% of Total	Gals/Use	Units	Total Gals	% of Total	Gals Saved	% Saved
Toilets [2]	5.5	4.0	22.0	28.4	1.6	4.0	6.4	14.7	15.6	70.9
Showers (gals/min) [2]	3.4	4.8	16.3	21.1	1.8	4.5	8.1	18.6	8.2	50.4
Faucets [2]			9.0	11.6			8.0	18.4	1.0	11.1
Clothes Washers [3]	55.0	0.30	16.5	21.3	42.0	0.30	12.6	28.9	3.9	23.6
Dish Washers [3]	14.0	0.17	2.4	3.1	8.5	0.17	1.4	3.3	0.9	39.3
Toilet Leaks	24.0	20%	4.3	5.5	0.0		0.0	0.0	4.3	100.0
Baths	50.0	0.14	7.0	9.0	50.0	0.14	7.0	16.1	0.0	0.0
TOTAL INDOOR			77.5				43.5		34.0	43.8

1 Categories represent new construction with fixtures meeting minimum state plumbing standards, and with typical modern washing machines and dishwashers. Note that 20% of toilets in existing housing are estimated to leak.

2 1.6 gallon per use toilets are the legal maximum. Figures for showers and faucets are typical, new low-flow products that exceed legal specifications.

3 Clothes washers and dishwashers are not covered by the law; estimates for more efficient products are given here.

(W. Nechamen, NYSDEC)

REFERENCES

Brown and Caldwell. Walnut Creek, California. "Residential Water Conservation Projects: Summary Report". U.S. Department of Housing and Urban Development. June 1984..

Maddaus, William O. "Water Conservation". American Water Works Association, Denver. CA. 1987.

McKinney's Consolidated Laws of New York. Environmental Conservation Law, Section 15-0314.

Microphor. "Flow Reduction: The Key to Septic Tank Life". Harrow Corporation. Undated.

Microphor. "Flow Reduction". Harrow Corporation. Undated.

Sharpe, William E., Charles A. Cole, and Daniel F. Fritton. "Restoration of Failing On-site Wastewater Disposal Systems Using Water Conservation". Institute for Research on Land and Water Resources. Reprint Series No. 179. The Pennsylvania State University. University Park, PA. pg. 865 July 1984.

CONSERVATION MEASURES - Graywater Separation

DEFINITION

Separating toilet water from the wastewater stream and retaining and treating the resulting graywater on-site. Several alternatives are used to treat toilet wastes (blackwater).

WATER QUALITY PURPOSE

To reduce the pollutant loading to the On-Site Wastewater Treatment System and the environment.

SOURCE CATEGORY

On-Site Wastewater Treatment Systems (OWTS).

POLLUTANTS CONTROLLED

BOD, suspended solids, nitrogen and phosphorus.

WHERE USED

•Where systems are failing and there is no room for an adequate replacement system. •Where cumulative effects of numerous systems are threatening local environments, especially from increased concentrations of nitrates. •Where a RUCK system is used to reduce nitrates (see *RUCK System* summary sheet). •Where non-waterborne toilets are used (see *Non-waterborne Systems* summary sheet). •Where underground holding tanks are used to store blackwater for off-site treatment. (Note: Holding tanks are not permitted in New York State for new residential constructions.)

PRACTICE DESCRIPTION

The municipality promotes or prescribes by regulation when and where graywater separation could or should be used. Graywater must be treated by a conventional system or alternative system although it will be designed for a lower flow, and, therefore, cost less. The separated blackwater must be treated with a second treatment scheme, transported to a municipal wastewater treatment plant, or eliminated through use of a non-waterborne system. If blackwater is stored for transport to a municipal facility, holding tanks are required to be 1,000 gallons minimum in New York. However, even when receiving only blackwater, a larger tank should be recommended. A 2,000 gallon tank would provide about 3 months storage for a 4-person family averaging 3.5 flushes per person per day and using 1.6 gallon low flow toilets required in New York for new construction. Existing homes are not required to have fixtures retrofitted (see *Septage Disposal Management* summary sheet).

Graywater systems are designed upon a flow of 75 gallons per day per bedroom in accordance with 10 NYCRR, Appendix 75A and discharged to groundwater. Adoption of graywater separation should normally be accompanied by a water conservation and plumbing retrofit program.

PRACTICE EFFECTIVENESS

Eliminating blackwater or toilet wastes reduces the flow, total phosphorus and BOD loading by about 35% each, suspended solids, total nitrogen by about 50% and 80%, respectively.

IMPACT ON SURFACE WATER

Beneficial. The lower hydraulic loading of the soil absorption system helps to prevent saturation of the soil. Once nitrates enter saturated soil (groundwater) they will be delivered to any hydrologically connected surface water reduced in concentration only by fresh groundwater infiltration or plant root uptake. Where lot density is high, fresh groundwater infiltration may be negligible.

IMPACT ON GROUNDWATER

Beneficial. The lower nitrogen concentration delivered to the soil absorption system will infiltrate to groundwater and drinking water sources in much lesser concentrations due to plant uptake and fresh groundwater infiltration.

ADVANTAGES

*Local environmental and private drinking will benefit due to displacement of blackwater to a wastewater treatment plant, advanced treatment system, or alternate medium (i.e., compost). *The lower hydraulic and organic loading from the graywater septic tank would allow a smaller area for the soil absorption system. *New nitrogen loading to sensitive waterbodies is immediately reduced by 80%.

DISADVANTAGES

*Creates two waste streams that must be treated. *Frequent pumping of holding tank wastes may be objectionable to homeowner. *Retrofitting of separate plumbing systems may be difficult.

PRACTICE LIFESPAN

Indefinite. Holding tanks are usually temporary but may be indefinite for a replacement system.

COST

The combined cost of graywater and blackwater treatment will most likely exceed that of a septic tank/soil absorption system. For a holding tank, average costs according to several sources, range from $1,200 to $6,600 including separate plumbing costs. Graywater may be treated in existing septic tank and absorption system if approved by regulating agency. If new graywater system is required, cost will be in the upper end of this range (see *RUCK System* and *Non-waterborne Systems* for additional cost information).

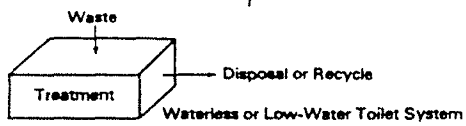
OPERATION AND MAINTENANCE

For a holding tank, pump and haul holding tank contents every 2-4 months. Remove septage from graywater septic tank every 5-10 years. Annual costs for O&M range from $100 - $2,000 (see *Operation and Maintenance* for *Septic Tank and Soil Absorption System* summary sheet).

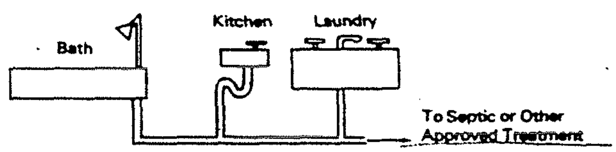
MISCELLANEOUS COMMENTS

Depending on how blackwater will be treated, the municipality may want to require maintenance contracts as a condition for system approval. Alternatively, municipality may want to create septic system maintenance districts.

(A) Blackwater (Toilet Wastes)



(B) Graywater (Other Household Wastewater)



REFERENCES

Frome, Michelle. Vermont Natural Resources Council. "Rural Sewage Treatment in Vermont. Book 1: A Guide to the Alternatives". June 1978. Pg. 53.

Great Lakes/Upper Mississippi River Board of State Sanitary Engineers. "Policy Statement on Pump and Haul Procedures" contained in "Recommended Standards for Individual Sewage Systems". 1980. Pg. 49.

NYS Department of Health. 10 NYCRR, Appendix 75A. "Wastewater Treatment Standards-Individual Household Systems". Pg. 31. December 1990 **(Management Practice Design Standard and Specification)**

NYS Department of Health. Division of Environmental Protection. "Individual Wastewater Treatment Design Handbook". Albany, NY. Pgs. 108-109. January 1994.

Owen Ayers & Associates, Inc. "Onsite Nitrogen Removal Systems Research/Demonstration Project-Phase I Report - "Nitrogen Removal from Domestic Unsewered Areas". Wisconsin Dept. of Industry. Labor and Human Relations. June 1991. Appendix: Fact Sheets.

USEPA Office of Water "Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters". Washington, DC. Pgs. 4-100 and 4-108. January 1993.

USEPA Office of Water "Small Wastewater Systems-Alternative Systems for Small Communities and Rural Areas". January 1980.

USEPA Office of Water Program Operations. "EPA Design Manual-Onsite Wastewater Treatment and Disposal Systems". EPA Publication 625/1-80-012. Pgs. 58, 88, 186, 197 and 339. October 1980.

USEPA. Region 5 Water Division. "Rural Lakes Project Handbook". March 1983. Pgs. 21, 30-33.

PUBLIC EDUCATION:
Advocating Proper System Design and Construction

DEFINITION

Preventing future on-site wastewater treatment system failure by promoting professional designer, installer and homeowner education on the design and construction of On-Site Wastewater Treatment Systems (OWTS).

WATER QUALITY PURPOSE

To prevent pollutants found in household wastewater from contaminating ground and surface water (see *Operation and Maintenance for Standard Septic Tanks and Soil Absorption Systems* summary sheet.).

SOURCE CATEGORY

On-Site Wastewater Treatment Systems (OWTS).

POLLUTANTS CONTROLLED

BOD, suspended solids, nitrogen, phosphorus, chloride, metals, organic contaminants and pathogens.

WHERE USED

In communities where private residences as well as large community systems have the potential to contaminate ground and surface water.

PRACTICE DESCRIPTION

•Provide education on the need to design system to accommodate the largest size to which the household will grow. An estimate of 250 gallons of volume and seven square feet of liquid surface area per bedroom is used when sizing a septic tank:

Number of Bedrooms	Septic Tank Minimum	Minimum Liquid Surface Area ($ft.^2$)
1,2,3	1,000	27
4	1,250	34
5	1,500	40
6	1,750	47

If hot tubs, spas or garbage grinders are expected or planned, septic tank capacity should be increased by 250 gallons and sewage surface area in the tank should be increased by 7 square feet to handle the additional loading of each unit. Multiple compartment tanks must be provided when garbage grinders are used to provide additional areas for the solids to settle. •The size of the absorption area or the length of the absorption trenches needed to handle wastewater is also important. Trench dimensions are determined by soil conditions and expected daily water use. Soil absorption capacity through deep hole and percolation tests should be made in an on-site evaluation. •Promote the need for equal distribution to all parts of the soil absorption system for proper operation. Provide means for homeowners to choose a reputable company for sewage system construction. Some county health departments certify installation. •Provide access to soil scientists. Soil conditions are important factors, as coarse soils may not provide adequate treatment, and fine soil may not allow wastewater to pass through. Soil can restrict water flow and cause system failure even if all other aspects of the system are satisfactory. •Promote advantages of larger septic tanks: for better separation of scum and solids; to prevent solids from entering the absorption field; to require less frequent pumping; and to allow for expansion. •Freezing and thawing may result in a need for re-leveling of the distribution system. •Provide homeowner, installer and professional designer education for this and other installation precautions.

PRACTICE EFFECTIVENESS

Prevention is more effective than fixture correction or replacement.

IMPACT ON SURFACE WATER

Beneficial.

IMPACT ON GROUNDWATER

Beneficial.

ADVANTAGES

*Minimum cost for upgrading a system when remodeling (adding bedroom or converting other rooms to bedrooms), if original OWTS design accounted for future expansion.

DISADVANTAGES

*May require more follow-up with contractor/installer to oversee proper installation.

PRACTICE LIFESPAN

Prior to design and through to end of construction.

COST

Homeowner: Initial system cost may be higher.
Municipality: Increased time for design approval.

OPERATION AND MAINTENANCE

Inform homeowners that system should be inspected once a year and pumped on a regular basis (see *Inspection and Pumping* and *Operation and Maintenance* summary sheets.).

MISCELLANEOUS COMMENTS

•Care should be taken to not drive over the septic system as compaction of soil will result; shifting soils and crushing lines. Tree roots can be another source of physical damage to the system. •Soil in absorption field subject to "smearing" upon construction. Soil trenches should be raked to open pores and accommodate percolation of wastewater. •Incorrectly run percolation and deep hole tests can result in an undersized soil absorption system. This can lead to system overloading and eventual failure (see *Soil and Site Analysis, Percolation Test* and *Deep Test Holes* summary sheets).

REFERENCES

Cornell Cooperative Extension. "Your Septic System". Publication PS-1. Distribution Center. 8 Research Park. Cornell University. Ithaca. NY. 14850.

Laak, Rein. "Wastewater Engineering Design for Unsewered Areas". Technomic Publishing Company, Inc. Lancaster. PA. 17604. 1986.

Lomax, Ken M. "Home Septic Systems: Proper Care and Maintenance". Extension Bulletin 126. Department of Agricultural Engineering. University of Delaware. Newark, DE. 19711.

Mancl, Karen. "Septic System Failure". Bulletin SW-41. Pennsylvania State University. College of Agriculture. Cooperative Extension Service. University Park, PA.

Minnesota Extension Service. "On-Site Sewage Treatment Manual". Department of Agricultural Engineering. St. Paul, MN. 55108. 1992.

NYS Department of Health. 10 NYCRR, Appendix 75A. "Wastewater Treatment Standards-Individual Household Systems". Pg. 11. December 1990. **(Management Practice Design Standard and Specification)**

Siegrist, R.L., T. Woltanski, L.E. Waldorf. Water Conservation and Wastewater Disposal. In Proceedings of the Second National Home Sewage Treatment Symposium. Chicago, IL. 1977.

PUBLIC EDUCATION:
Proper Use and Disposal of Household Hazardous Substances

DEFINITION

The appropriate use and disposal of household hazardous substances.

WATER QUALITY PURPOSE

To reduce or prevent hazardous substances from entering surface waterbodies or groundwater or causing premature failure of septic tanks, leach fields, or soil contamination.

SOURCE CATEGORY

On-Site Wastewater Treatment Systems (OWTS).

POLLUTANTS CONTROLLED

Acids, bases, organic solvents, chlorine, bactericides, other toxic products.

WHERE USED

In all communities, where household hazardous substances have the potential to contaminate surface waterbodies or groundwater, or destroy beneficial organisms in septic systems.

PRACTICE DESCRIPTION

Household hazardous substances are any products used in the house which are flammable, toxic, corrosive or reactive. Common examples include: oil-based paint, wood preservatives, pesticides, solvent-based cleaning products, thinners, strippers and other solvents, swimming pool chemicals, automotive fluids, batteries and hobby chemicals. In order to reduce the use and disposal of household hazardous substances:

- consider substituting a less hazardous product; some products have less toxic, biodegradable or non-toxic alternatives.
- before you buy a product, read the label to make sure the product will perform the job you want done.
- buy only as much product as you need.
- once you purchase a product, follow label directions for proper use.
- don't use more of a product than the directions/label recommend.
- share leftover hazardous products with someone who can use them, but leave in original container with label intact.
- recycle household hazardous waste fluids (motor oil, paint, etc.) and products (automotive batteries) at approved recycling facilities.
- store hazardous substances destined for collection in cool, dry, weather-proof places.
- Never pour hazardous substances down the sink, drain, into a storm drain, driveway, street or back yard. The only exception being small amounts of product that would go down the drain during normal use. These should be disposed by pouring down the drain slowly with a lot of water.

PRACTICE EFFECTIVENESS

There is no research to document a correlation between proper use and disposal of hazardous household substances and water quality improvements. However, common sense dictates prudent use and a switch, when possible, to alternative products or control practices. This process is likely to be effective to the extent that consumers refrain from improper use and disposal of household hazardous products and waste. Increasing consumer awareness, the availability of proper disposal situations (e.g., "collection days") and resultant changes in behavior determine practice effectiveness.

IMPACT ON SURFACE WATER	Beneficial. Reduces concentration of hazardous substances leaching from absorption fields to hydrologically connected surface water. Reduces direct dumping.
IMPACT ON GROUNDWATER	Beneficial. Reduces concentration of hazardous substances leaching from absorption fields beyond separation distances and in range of drinking water recharge areas.
ADVANTAGES	*Provides heightened consumer awareness about hazardous substances used in the home. *Reduces the availability of synthetic organics and toxic substances as nonpoint source pollutants. *Little homeowner cost involved in performing this practice. *Prolongs septic system lifespan.
DISADVANTAGES	*No direct correlation has been documented between practice performance and water quality improvements. *Collection programs require considerable planning, substantial public education and promotion.
PRACTICE LIFESPAN	Continual. This practice must be performed prior to selection, use and disposal of the household hazardous substance. Collection programs should be held regularly to remain effective.
COST	Consumer costs associated with the proper use and disposal of household hazardous substances are minimal. Less or non-toxic products can be more expensive than the replaced product. Car batteries and used motor oil can be recycled for free at retailers, service stations and recycling facilities as long as consumers do not exceed the daily or monthly product limits. Consumers do pay for collection days through local taxes. Permitted facilities may have dedicated funding through solid waste disposal fees. State assistance is available to defray costs.
OPERATION AND MAINTENANCE	Handle hazardous products according to label directions, store products in their original labeled containers, keep products out of the reach of children and pets, store away from sources of heat and use safety precautions to prevent accidental spills. Dispose of properly.
MISCELLANEOUS COMMENTS	Disposal techniques for household hazardous products are specific to each product. Follow disposal instructions on the product label or refer to the DEC Household Hazardous Waste Tip Strip listed in the References section of this summary sheet. The Division of Solid and Hazardous Materials provides technical and financial assistance to local governments who want to establish a Household Hazardous Waste collection program. Information on grants program and publications is available by calling (518) 457-7337.

REFERENCES

Cornell Cooperative Extension. NYS College of Human Ecology. Disposal of Household Hazardous Waste. Ithaca, NY. January 1989.

Cornell University. Personal communication with Ann Lemley, Assistant Professor. NYS College of Human Ecology. Ithaca, NY. September 1993.

League of Women Voters of Albany County. Household Hazards: A Guide to Detoxifying Your Home. Albany, NY. 1990.

NYS Department of Environmental Conservation. 6NYCRR Subpart 373-4 Facility Standards for Collection of Household Hazardous Waste and Hazardous Waste from Conditionally Exempt Small Quantity Generators (7/29/95).

NYS Department of Environmental Conservation. Managing and Disposing of Household Hazardous Waste (6/93).

NYS Department of Environmental Conservation. Household Hazardous Waste: Reduce Your Use. Albany, NY (1/98).

NYS Department of Environmental Conservation. Household Hazardous Waste TIP STRIPS: •Automotive Products Disposal; •Paint Disposal; •Pesticide Disposal; •Solvent Disposal; •Cleaning and Maintenance Product Disposal.

Water Pollution Control Federation. Household Hazardous Waste: What You Should & Shouldn't Do. Alexandria, VA.

ENGINEERED SYSTEMS FOR NITRATE REMOVAL: Anaerobic Upflow Filters (AUF)

DEFINITION

A component of an OWTS consisting of a 500-2,500 gallon tank (or sand filter underdrain system of equal capacity) containing gravel or rock. The unit is continually submerged in septic tank or sand filter effluent to maintain an anaerobic environment.

WATER QUALITY PURPOSE

To provide an anaerobic environment for denitrification of wastewater, to reduce nitrate concentrations in receiving groundwater and, ultimately, surface water.

SOURCE CATEGORY

On-Site Wastewater Treatment Systems (OWTS).

POLLUTANTS CONTROLLED

Nitrates, BOD, suspended solids, pathogens, and phosphorus

WHERE USED

•Coastal areas. •Near surface waters receiving nutrient-rich runoff or subject to accelerated eutrophication. •Where housing density and resultant wastewater flows threaten increased nitrate levels in wellwater. •Where nitrate concentrations currently exceed drinking water standards.

PRACTICE DESCRIPTION

One treatment scheme is shown under *Miscellaneous Comments*. In this scheme, the AUF receives a mixture of septic tank effluent and recirculated effluent from the sand filter. Effluent from the AUF discharges to a sand filter via a recirculation tank. Effluent from the sand filter is recirculated back to the AUF less a portion discharged to the subsurface soil absorption system or a permitted surface discharge (surface discharges are discouraged in New York for replacement system, prohibited for new systems). The filter media is a substrate for microorganisms not a physical straining filter. Variations include alternative filter media, buried or gravel-covered sand filters; additional recirculation tanks to control recirculation ratios or to store and control dosing of the sand filter; downflow anaerobic filters; and added carbon sources to sustain denitrifying bacteria in the AUF following their consumption by nitrifying bacteria in the sand filter.

PRACTICE EFFECTIVENESS

Total nitrogen removal averages 70%. Both nitrification and denitrification are temperature dependent: above 50°F nitrification rates range from 70% to 100%. Below 50°F nitrification rates decrease to 20% to 25%, so most units are buried or use recirculation to retain heat. Denitrification converts from 90-100% of the nitrified nitrogen. BOD and TSS removal rates can range from 46% - 84% and 24%-89%, respectively, with effluent quality up to 5 mg/l for both.

IMPACT ON SURFACE WATER

Beneficial. Improved BOD, total suspended solids and nitrogen removals over conventional systems. Systems with added carbon sources have achieved nearly 100% nitrogen removal.

IMPACT ON GROUNDWATER

Beneficial. Reduced nitrate concentrations in aquifer recharge zones.

ADVANTAGES

*Lower organic loading to soil absorption system may allow a reduction in surface area required by health department. *Where sand filter follows AUF, sand filter area may be reduced by a factor of 8 to 20 subject to reviewing agency approval.

DISADVANTAGES

*Requires greater land area than a conventional system. *Service contracts may be required. *Electrical power is required for pumps. *If OWTS is not used for weeks or months, depending on the prevailing temperature, denitrifying bacteria will die as the temperature in the unit drops below 50°F.

PRACTICE LIFESPAN

Soil absorption field lifespan is dependent on the effluent it receives. Lighter organic and hydraulic loading extends lifespan.

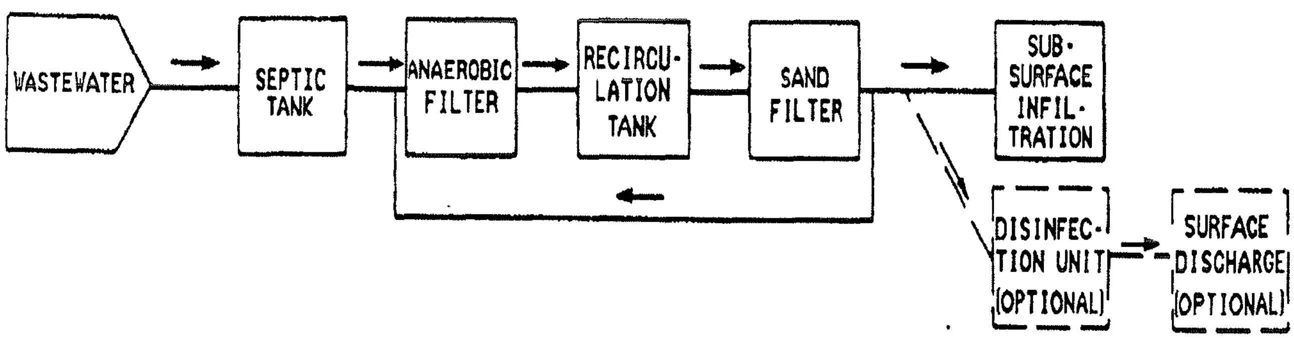
COST

Literature lists cost in range of $3.000 to $9.300; with variations over $12.000. Annual operation and maintenance costs range from $150 - $500; with variations over $500/year.

OPERATION AND MAINTENANCE

•Pumping of septic and recirculation tanks. •Readjustment of rates. •Checking operability of pumps. •Backflushing of Anaerobic Upflow Filter. •Replacement of sand media may be needed at some point (sources conflict on how long); designs are based on controlling loading and/or raking the sand bed semi-annually and removing weeds and debris.

MISCELLANEOUS COMMENTS



"ONSITE NITROGEN REMOVAL SYSTEMS RESEARCH DEMONSTRATION PROJECT"

SURFACE DISCHARGE NOT PERMITTED IN NY STATE

REFERENCES

NYS Department of Health, Division of Environmental Protection. "Individual Wastewater Treatment Design Handbook". Albany, NY. Pg. 105. January 1994.

NYS Department of Health. 10 NYCRR, Appendix 75-A. "Wastewater Treatment Standards-Individual Household Systems". Pg. 32. December 1990. **(Management Practice Design Standard and Specification)**

Owen Ayres and Associates, Inc. "On-Site Nitrogen Removal Systems Research/Demonstration Project-Phase I Report-Nitrogen Removal from Domestic Wastewater in Unsewered Areas". Wisconsin Department of Industry, Labor and Human Relations. June, 1991. Appendix: Fact Sheets.

USEPA. Office of Water Program Operations. "EPA Design Manual-Onsite Wastewater Treatment and Disposal Systems". EPA Publication 625/1-80-012, pg. 185-191. October 1980.

USEPA. Office of Water. "Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters". Washington, DC. pg. 4-104 and 4-107. January 1993.

ENGINEERED SYSTEMS FOR NITRATE REMOVAL: RUCK System

DEFINITION	The RUCK System is a blackwater/graywater separation and treatment system. It uses two septic tanks, a 3-stage sand filter, and a standard or custom-designed soil absorption system.
WATER QUALITY PURPOSE	To achieve high nitrate removal.
SOURCE CATEGORY	On-Site Wastewater Treatment Systems (OWTS).
POLLUTANTS CONTROLLED	Nitrates, BOD, suspended solids, phosphorus, volatile organics and pathogens.
WHERE USED	Coastal areas; near other nitrate sensitive waters; in areas where lots are small and systems are failing or cumulative nitrate concentrations are exceeding health department standards. Also in new developments where small lots are being planned.
PRACTICE DESCRIPTION	Raw toilet wastes flow to a septic tank where light and heavy solids separate and rise or settle. Effluent discharges to a passively vented, 3-stage sand filter for nitrification, and removal of organic compounds, pathogens and phosphorus. The sand filter effluent mixes with the effluent from the graywater septic tank and flows to the absorption field.
PRACTICE EFFECTIVENESS	Average nitrogen removals have been 70% for residential systems. Depending on design, final effluent total nitrogen concentrations have been below 5 mg/l. System is buried to insulate from temperatures below 50°F but has operated equally well with wastewater temperatures from 41°F to 59°F. BOD and suspended solids average 20 mg/l and 30 mg/l, respectively, in the final effluent. Final effluent concentrations are those delivered to the soil absorption field, where further pollutant reduction is affected. The RUCK System can be designed to meet specific effluent requirements.
IMPACT ON SURFACE WATER	Beneficial. Reduced nitrate concentrations delivered to hydrologically connected groundwater.
IMPACT ON GROUNDWATER	Beneficial. Reduced nitrate concentrations in aquifer recharge zones of drinking water wells.
ADVANTAGES	*Inexpensive concrete sand can be used. *Sand filter loading rates preclude need for regular surface raking. *Lower organic loading and custom in-drains have allowed 80% reduction in the subsurface drainfield in other states, subject to approval by regulating agency in New York. *Gravity driven system. *O&M skill level is equivalent to that needed for a conventional septic tank/absorption field system.
DISADVANTAGES	*Installation of sand filter must be at a depth sufficient to maintain 10°C (50°F) for optimum performance. *Retrofitting separate plumbing may be difficult and may require building code enforcement agency approval. (Alternative designs are used for retrofitting.)

PRACTICE LIFESPAN

Insufficient data to state authoritatively. First systems were installed in late 1970s. Reduced organic loading of the absorption field increases its life an indeterminate amount. RUCK System is designed for the Long-Term Acceptance Rate of the soil for an indefinite life.

COST

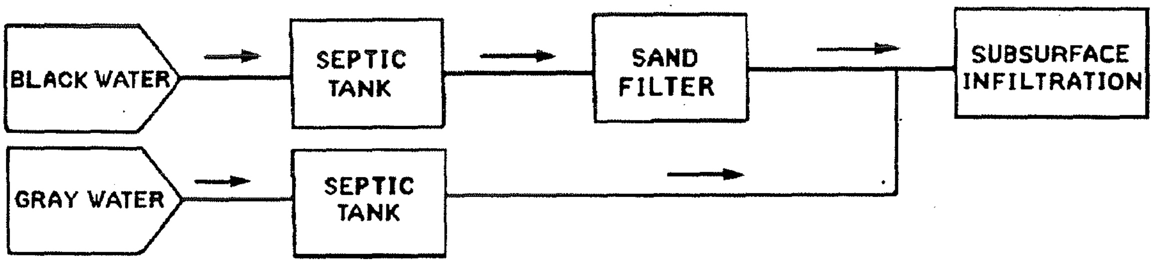
Average 1991 costs for construction totaled $10.300 with pumping and an anaerobic upflow filter (AUF) according to one source. If gravity is sufficient to drive the system and the AUF is not required, the construction costs average $7.300. 1994 ECO-RUCK System costs $5.100. Annual O&M costs are $20 without pumping; $55 with pumping. The system can be custom-designed to minimize costs. The AUF was eliminated from RUCK system designs in 1992.

OPERATION AND MAINTENANCE

•Septic tank inspection and pumping. •pH testing of sand filter effluent. •Replacement of media as required.

MISCELLANEOUS COMMENTS

The sand filter and subsurface infiltration field have been combined in the ECO-RUCK System.



REFERENCES

Laak, Rein. Performance of RUCK System. A paper written for a demonstration project proposal. Unpublished. January 1994.

Laak, Rein. Society of Soil Scientists of Southern New England. Proceedings of a Conference on On-Site Sewage Treatment Disposal. "The RUCK System". November 1990. Pg. 56.

Laak, Rein. "The RUCK System". Proceedings of a Symposium on Individual On-Site Wastewater Treatment and Disposal Systems". The Society of Soil Scientists of Southern New England. 1986. Pg. 31.

Mandal, Ross and Douglas A. Haith. Dept. of Civil and Environmental Engineering. Dept. of Agricultural and Biological Engineering. Cornell University, Ithaca, NY. "The Impact of Septic Systems on Surface Water Quality". November 1992. Pg. 128.

Myers, Jennie. Director, Lands Management Protection.Draft Management Measures for On-Site Sewage Disposal Systems in Coastal Areas. Coastal Zone Management Act Amendments. April 8, 1991. Pg. 67.

NYS Department of Health. 10 NYCRR, Appendix 75A. "Wastewater Treatment Standards-Individual Household Systems". Pg. 20. December 1990 **(Management Practice Design Standard and Specification)**

NYS Department of Health. Division of Environmental Protection. "Individual Wastewater Treatment Design Handbook". Albany, NY. Pg. 111. January 1994.

Owen Ayres & Associates, Inc. "Onsite Nitrogen Removal Systems Research/Demonstration Project-Phase I Report-Nitrogen Removal from Domestic Wastewater in Unsewered Areas". Wisconsin Department of Industry, Labor and Human Relations. June 1991. Appendix: Fact Sheets.

USEPA. Office of Water Program Operations. "EPA Design Manual-On-Site Wastewater Treatment and Disposal Systems". EPA Publication 625/1-80-012. Pg. 257. October 1980.

ENGINEERED SYSTEMS FOR NITRATE REMOVAL: Recirculating Sand Filters

DEFINITION

A modified intermittent sand filter in which sand filter effluent is mixed with septic tank effluent and recirculated through the sand filter. A portion of the filtered effluent is discharged to the soil absorption system.

WATER QUALITY PURPOSE

To reduce nitrates in the effluent to the soil absorption system, thus protecting groundwater aquifers and hydrologically connected surface waters.

SOURCE CATEGORY

On-Site Wastewater Treatment Systems (OWTS).

POLLUTANTS CONTROLLED

Nitrates, BOD, suspended solids (SS), pathogens and phosphorus.

WHERE USED

Where the site has shallow soil, slowly permeable soil or a high water table (i.e., conditions that do not permit a conventional system). Also small lots or sites near nutrient-rich surface waters or groundwaters not meeting drinking water standards for nitrates. For replacement systems, a surface water discharge may be allowed with an NPDES/SPDES permit from NYSDEC.

PRACTICE DESCRIPTION

Raw sewage is pretreated in a septic tank to remove floatable and settleable solids.

Effluent from the septic tank is discharged to the sandfilter or to the recirculation tank and then to the sand filter.

The sand filter effluent may be recirculated to the septic tank, mixed with septic effluent in a recirculation tank (500 gal.), or discharged to an absorption field.

As wastewater passes through the filter, some organic matter is physically immobilized and reduced forms of nitrogen nitrified. Some denitrification is achieved in the system, however, the location of occurrence and processes involved are unknown.

PRACTICE EFFECTIVENESS

Generally greater removals of BOD, total suspended solids, total nitrogen and total phosphorus than conventional systems, and greater nitrogen removal than the intermittent sand filter system.

USEPA observed a range of removals for a limited sampling of recirculating sand filters. Removals were as follows: Total SS-70-98% for twelve systems; BOD-75-98% for 15 systems; Total Nitrogen-60-85% for 13 systems; Total Phosphorus-70-90% for 2 systems; Pathogens-100-10,000 fold decrease for 8 systems.

IMPACT ON SURFACE WATER

Beneficial to slight. Reduced nutrients discharged.

IMPACT ON GROUNDWATER

Beneficial to slight. Reduced nitrates in aquifer recharge zones.

ADVANTAGES	*Can work where an intermittent sand filter will work with greater removal of pollutants. *The lower organic content of the effluent may allow reduction of the area requirements for the soil absorption system, subject to approval.
DISADVANTAGES	*Semi-annual raking of the sand filter is necessary to prevent formation of a dense biomat. Removal of weeds and debris removal may also be necessary. *Sand media must be replaced when raking reduces filter depth by four inches. *Maintenance contracts with a professional operator will usually be necessary to ensure acceptable performance. *Electrical power is required for pump operation.
PRACTICE LIFESPAN	Twenty to twenty-five years, if properly designed, installed and maintained.
COST	The U.S. Environmental Protection Agency (USEPA) found a range of costs for five systems to be $1,850 to $9,200. A Wisconsin consultant calculated a total system cost of $8,300 including septic tank, recirculation tank, sand filter and soil absorption system.
OPERATION AND MAINTENANCE	Annual operation and maintenance costs for the five systems above ranged from $15 - $410. The consultant estimated $140/year. Tasks include: •Pumping of septic tank and recirculation tank solids. •Adjustment of recirculation rates to optimize filter performance. •Checking pumps and controls. •Sand filter raking and cleaning.
MISCELLANEOUS COMMENTS	As engineered systems, recirculating sand filters are subject to an environmental assessment process, require design and installation supervision by a design professional, the issuance of a Specific Waiver, and homeowner notification of reliability and potential problems. Monitoring may also be required.

REFERENCES

Myers, Jennie. Director. Lands Management Protection. Draft Management Measures for On-site Sewage Disposal Systems in Coastal Areas. Coastal Zone Management Act Amendments. April 8, 1991. Pgs. 66-67.

NYS Department of Health. 10 NYCRR, Appendix 75A. "Wastewater Treatment Standards - Individual Household Systems". December 1990. Pg. 32. **(Management Practice Design Standard and Specification)**

NYS Department of Health. Division of Environmental Protection. "Individual Wastewater Treatment Design Handbook". Albany, NY. Pgs. 111-112. 1994.

Owen Ayers & Associates, Inc. "Onsite Nitrogen Removal Systems Research/Demonstration Project-Phase I Report - "Nitrogen Removal from Domestic Unsewered Areas". Wisconsin Dept. of Industry. Labor and Human Relations. June 1991. Appendix: Fact sheets and pgs. 27-29.

USEPA. Office of Water. "Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters". Washington, DC. Pgs. 4-105 and 4-107. January 1993.

USEPA. Office of Water Program Operations. "EPA Design Manual-Onsite Wastewater Treatment and Disposal Systems". EPA Publication 625/1-80-012. Pgs. 123-139. October 1980.

Whitmyer, R.W., R.A. Apfel, R.J. Otis, R.L. Myer. "Overview of Individual Onsite Nitrogen Removal Systems". In On-Site Wastewater Proceedings of the Sixth National Symposium on Individual and Small Community Sewage Systems. Chicago, IL. December 1991.

MANAGEMENT PRACTICE SUMMARY SHEET

ENGINEERED SYSTEMS FOR NITRATE REMOVAL:
Non-Waterborne Systems

DEFINITION

Elimination of toilet (blackwater) waste from the soil absorption system by use of a solid waste disposal unit. (Note: Remaining sewage (graywater) must be treated soil absorption system designed for 75 gpd per bedroom.)

WATER QUALITY PURPOSE

To protect nitrogen sensitive waters from 80% of the nitrogen normally delivered to the absorption system from blackwater (toilet waste). To provide a 40% reduction in the hydraulic loading.

SOURCE CATEGORY

On-Site Wastewater Treatment Systems (OWTS).

POLLUTANTS CONTROLLED

Nitrogen, BOD, suspended solids, pathogens and phosphorus.

WHERE USED

In one- and two-family dwellings, subject to approval by the regulating authority having jurisdiction. Generally wet plumbing is required by the building code. In remote, island or mountainous park or recreation areas where soil or site conditions preclude use of a conventional system. Where a lack of water precludes use of a conventional system. Where a restricted discharge area for nitrogen is needed. Some waterless units can be used where no electricity is available.

PRACTICE DESCRIPTION

Waterless toilets include vault or pit privies (outhouses), composting toilets (large basement (bi-level) unit, small heat-assisted bathroom unit), incinerator toilets, chemical toilets, oil recirculating toilets. Alternatively, blackwater can be separately plumbed to a holding tank. This accomplishes the same nitrogen reduction with wet plumbing.

PRACTICE EFFECTIVENESS

These systems are immediately effective at reducing the nitrogen and hydraulic loading. The trade-off is expense, required homeowner attention to operation details, or service contracts for some units.

IMPACT ON SURFACE WATER

Beneficial. Reduced pollutant loadings for all pollutants. Less clean water used for flushing.

IMPACT ON GROUNDWATER

Beneficial. Reduced pollutant loadings. Less clean water used for flushing.

ADVANTAGES

*Pit or vault privies are inexpensive, use and maintenance is low-tech, require no water or electricity, and may be attached to the house. *Incinerators require no water, are small units, easy to install and produce a low volume of waste for final disposal. *Large bi-level composting toilets require no water (and electricity only for optional fan), have low-tech operation and maintenance chores and produce a humus material that can be used as fertilizer. *Small heat-assisted composting toilets also have low-tech operation and maintenance chores, is easy to install, and takes the same amount space as a conventional flush toilet. *Both the chemical- and oil-recirculating toilets require very little water and produce a low volume of solid waste requiring only annual pumping. *A holding tank is easy to install, use and maintain, requires no energy with gravity-flow and standard bathroom fixtures are used.

DISADVANTAGES

*Privies (outhouses), incinerating and composting toilets can have problems with insects, rodents, odors or liquid build-up -- during start-up for the composters, and under poor maintenance or operating conditions. *All units can be expensive to install, operate or maintain except the outhouse. *All are more inconvenient than the flush toilet due to added chores that must be done weekly, daily or after each use. *The additional cost of a graywater system.

PRACTICE LIFESPAN

Indefinite when operated and maintained correctly including timely replacement of mechanical parts, or parts exposed to weathering or corrosion.

COST

COSTS TABLE				
ELEMENT	PURCHASE	CONSTRUCTION/INSTALLATION	OPERATION AND MAINTENANCE	VARIES ACCORDING TO:
Privy		$150-$400	Minimal	Design complexity
Incinerator	$600-$1,000+	• Vent pipe • Minimal	• $24-$170 per year • ¼ lb. gas or 0.08 kwh of electricity per cycle	• Price of fuel • Frequency of use
Composting (large)	$2,000-$5,000	Varies with size of cellar, crawlspace	Electricy for fan (Optional)	• Design complexity • Added capacity
Composting (small)	$900-$2,200	Minimal	$30-$114 per year for electricity	Design complexity
Chemical (small)	$50	Minimal (Indoor port-a-potty)	Minimal	Chemical Disposal Cost
Chemical (large)	$2,500-$3,500	Varies with size of cellar	Electricity chemicals service	(Bi-level system similar to oil-recirculating)
Oil - Recirculation	$3,000-$5,000	Varies with size of cellar or crawl space	Electricity, oil, chemicals; service contract	Design complexity
Holding Tank	$2,000 for a 2,000 gal. tank	Included in purchase	Monthly pumping	• Size of tank • Size of family

OPERATION AND MAINTENANCE

See Costs Table.

MISCELLANEOUS COMMENTS

None.

REFERENCES

Frome, Michele. Vermont Natural Resources Council. "Rural Sewage Treatment in Vermont, Book 1: A Guide the Alternatives". June 1978. pgs. 63-80.

Kulik, Anthony and H. Stevan Logsdon. "Alternative Sewage Disposal Methods (Waterless)". Information Pamphlet No. 4. New England Rural Community Assistance Program, Inc. September 1980.

New York State Building Code. Section 900.2(b) of Subtitle S, Title 9, of the Official Compilation of Codes, Rules and Regulations of the State of New York.

NYS Department of Health. 10 NYCRR, Appendix 75A. Wastewater Treatment Standards - Individual Household Systems. pgs. 31-32.

NYS Department of Health. Division of Environmental Protection. Individual Wastewater Treatment Design Handbook. Albany, NY. January 1994. pgs. 107-111.

Oswego County Environmental Management Council. "Alternatives for Onsite Wastewater Disposal". Environmental Management Series Publication No. 1. Second Printing. July 1985. pgs. 9-14.

August 1994

ENGINEERED SYSTEMS FOR NITRATE REMOVAL: Constructed Wetlands

DEFINITION	An aquatic plant/microbial filter constructed in a gravel bed or gravel trenches. It may be constructed downgradient from the septic or aerobic tank and followed by an absorption field. It may also be constructed downgradient from an elevated sand mound for effluent polishing. It is a component of a complete wastewater treatment system.
WATER QUALITY PURPOSE	To provide further treatment of effluent from individual or clustered homes with poorly performing septic tank/absorption field systems. To provide denitrification of the nitrified effluent from elevated sand mound systems. To meet EPA secondary standards of 30 mg/l for BOD and suspended solids and provide nutrient removal.
SOURCE CATEGORY	On-Site Wastewater Treatment Systems (OWTS).
POLLUTANTS CONTROLLED	BOD, suspended solids, pathogens, ammonia-nitrogen, nitrate-nitrogen and phosphorus.
WHERE USED	Wherever septic tank/absorption trench systems would adversely affect the surface and groundwater without further treatment.
PRACTICE DESCRIPTION	Areal requirements in Mississippi for up to a 3 bedroom house are 300 sq. ft. for 18-inch trenches and 600 sq. ft. for 12-inch trenches. For 4 bedroom houses, or larger, the areas increase to 400 and 800 sq. ft., respectively. Work is currently being done in Ontario, Canada, to develop engineering criteria for year-round cold weather use. The mound/constructed wetland design varies from the NYS Department of Health mound design in that the mound is constructed over an impervious liner sloped toward the wetland. The wetland is a subsurface flow wetland of gravel-filled cells planted with hydrophilic plant species, such as cattail and common reed (see *Elevated Sand Mound* summary sheet).
PRACTICE EFFECTIVENESS	Studies published in 1989 recommended 400 sq. ft. of washed gravel filter for a single home of 2-3 people using a 12- to 18-inch ditch, three feet wide. Ninety percent removals of BOD from the settled septic tank effluent was reported. A 85% reduction in ammonia-nitrogen and 97% reduction in fecal coliform colonies were also reported. Cold weather performance has been successful at a mountainous western Virginia location. The municipal system has operated since 1987 with temperatures as low as 30°F. A 1987 publication by EPA reported effluent concentrations of 7 mg/l BOD, 9 mg/l SS, and 6 mg/l Total N for a Canadian, year-round municipal system. In 1993, EPA reported average percent reductions of 19 systems: BOD, 81%; suspended solids, 80%; total nitrogen, 90%; and pathogens, 10,000 fold reduction. Systems can be designed to meet site-specific effluent standards, from secondary to advanced standard permit limits. As engineered systems, they are subject to an environmental assessment process, require design and installation supervision by a design professional, the issuance of a Specific Waiver, and homeowner notification of reliability and potential problems. Monitoring may also be required to document effectiveness.
IMPACT ON SURFACE WATER	Beneficial to slight. Monitoring may be required.

IMPACT ON GROUNDWATER	Beneficial to slight. Monitoring may be required.
ADVANTAGES	*Can produce usable vegetation (non-food crops). *Lower organic loading of constructed wetland loading would allow smaller soil absorption system. *Aesthetically pleasing flowers and ornamental shrubs can be grown.
DISADVANTAGES	*Constructed wetlands generally do not perform as well in cold weather. Nitrification may drop from 70-100% N removal in summer to as low as 25% in winter. Denitrification converts only nitrified nitrogen and so is dependent on the nitrification process occurring first. *Large land area requirements.
PRACTICE LIFESPAN	No information was available for the mound/constructed wetland system. Designed to be a permanent sustainable system.
COST	Depends on the level of treatment required, volume of septic tank effluent and the resulting size of the system. As a cluster or municipal system, it can be 50% to as low as 3% of the cost of a mechanical/chemical sewage treatment plant. Sources cited by EPA in a 1993 had price ranges of $1,000-$3,000 (probable); and $50-$350 (observed) based on 19 systems. The average cost of the 19 systems was $710.
OPERATION AND MAINTENANCE	Harvest excess growth as needed. Yearly maintenance for constructed wetland only was $25, based on one ystem.
MISCELLANEOUS COMMENTS	In New York State, the mound/wetland system or constructed wetland system are considered "engineered systems". As an engineered system, it is subject to an environmental assessment process, requires design and installation supervision by a design professional, the issuance of a Specific Waiver, and homeowner notification of reliability and potential problems.

REFERENCES

Myers, Jennie. Director. Lands Management Protection. Draft Management Measures for On-site Sewage Disposal Systems in Coastal Areas. Coastal Zone Management Act Amendments. April 8, 1991. Pg. 68.

NYS Department of Environmental Conservation. Division of Water. Design Standards for Wastewater Treatment Works-Intermediate-sized Sewage Facilities. Bureau of Wastewater Facilities Design. 50 Wolf Road. Rm. 318. Albany, NY. 12233-3505. 1988.

NYS Department of Health. Division of Environmental Protection. "Individual Wastewater Treatment Design Handbook". Albany, NY. Pgs. 111-112. 1994.

NYS Department of Health. 10 NYCRR, Appendix 75A. "Wastewater Treatment Standards-Individual Household Systems". Pg. 32. December 1990. **(Management Practice Design Standard and Specification)**

Owen Ayers and Associates, Inc. "On-Site Nitrogen Removal Systems Research/Demonstration Project-Phase I Report-Nitrogen Removal from Domestic Wastewater in Unsewered Areas". Wisconsin Department of Industry. Labor and Human Relations.June 1991. Appendix: Fact sheets and pgs. 27-29.

Steiner, Gerald R., P.E., and James T. Watson, P.E. "General Design, Construction, and Operation Guidelines - Constructed Wetlands Wastewater Treatment Systems for Small Users Including Individual Residences. Second Edition. Tennessee Valley Authority. Resource Group, Water Management. TVA/WM--93/10. Chattanooga, TN. May 1993

USEPA. "Natural Systems for Wastewater Treatment in Cold Climates". Text by Sherwood C. Reed. USACOE. Hanover, NH. September 1987. 8 panel brochure.

USEPA. Office of Water "Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters". Washington, DC. Pgs. 4-105 and 4-108. January 1993.

Whitmyer, R.W., R.A. Apfel, R.J. Otis, R.L. Myer. "Overview of Individual Onsite Nitrogen Removal Systems". In On-Site Wastewater Treatment Proceedings of the Sixth National Symposium on Individual and Small Community Sewage Systems. Chicago, IL. December 1991. Pgs. 5, 8 and 9.

Wolverton, Bill C. "Aquatic Plant/Microbial Filters for Treating Septic Tank Effluent" in Constructed Wetlands for Wastewater Treatment. Edited by Donald Hammer. Lewis Publishers. 1989.

INNOVATIVE OR OTHER SYSTEMS: Holding Tanks for All Wastewater

DEFINITION

Underground storage tanks are used to retain all wastewater generated by the household.

WATER QUALITY PURPOSE

To prevent the discharge of untreated or inadequately treated wastewater to the ground surface or into the groundwater.

SOURCE CATEGORY

On-Site Wastewater Treatment Systems (OWTS).

POLLUTANTS CONTROLLED

BOD, suspended solids (SS), pathogens, organics, grease, oil, nitrogen and phosphorus.

WHERE USED

Acceptable only as a temporary means of wastewater handling for existing homes where weather conditions, impending sanitary sewers or other conditions make installation of on-site treatment system impossible or impractical.

Holding tanks may also be considered as a means of abating a public health hazard created by the discharge of sewage, either through installation of new tanks or by sealing the outlet of existing tanks.

PRACTICE DESCRIPTION

Holding tank size shall be based upon five days design flow or 1,000 gallons, whichever is greater and meet the same construction standards as a septic tank except that the holding tank shall not have an outlet. A larger holding tank is preferable since a family of four may fill a 1,000 gallon tank in as little as 3 days if all conservation measures are not practiced. Holding tank wastes must be transported by waste haulers permitted by the NYS Department of Environmental Conservation and must be disposed of at approved wastewater treatment plants.

PRACTICE EFFECTIVENESS

Temporary use of holding tanks is an effective means of controlling discharge of pollutants and preventing or abating health hazards. However, the effectiveness is limited by how conscientious the homeowner is in having the tank pumped, the availability of the waste scavenger and in the regulatory agencies' ability to monitor the system.

IMPACT ON SURFACE WATER

Beneficial. Results in the discharge of no contaminants.

IMPACT ON GROUNDWATER

Beneficial. Results in the discharge of no contaminants.

ADVANTAGES

*Utilizing a holding tank can facilitate immediate occupancy of a dwelling before an on-site treatment system or public sewers are available. It results in the discharge of no pollutants. Short-term use of a holding tank at an installation such as a construction field office can result in economic savings. *Holding tanks can be beneficial for abating health hazards by immediately terminating all discharges to the environment.

DISADVANTAGES

*The proper use of a holding tank relies heavily upon how conscientious the homeowner is at having it pumped regularly. *Failure to pump holding tanks when needed can result in the backup of sewage into the residence or the discharge of raw sewage onto the ground. *Use of a holding tank can also be expensive. It may cost $60-$100 to pump a holding tank, which may be required each three days or even more often, depending on water conservation measures and occupancy.

PRACTICE LIFESPAN

Should be temporary. Can be indefinite.

COST

The initial installation cost of a holding tank can be low, perhaps $500-$1,000 and the holding tank may later be a component of an on-site system. However, the maintenance (pumping) of the holding tank could exceed $800 per month (pumping twice a week at $100).

OPERATION AND MAINTENANCE

Pump and haul holding tank contents as needed.

MISCELLANEOUS COMMENTS

Permits should be required for holding tanks as a means of regulating the installation, duration of use and proper termination. In issuing a permit, the regulatory agency should consider the size, location, etc., of the tank with regard to it becoming part of an on-site system. Regulatory inspections are desirable, but manpower intensive. Therefore, holding tank permits should be issued judiciously. Municipal maintenance districts should be considered if conditions result in any number of holding tanks in an area.

REFERENCES

NYS Department of Health. 10 NYCRR, Appendix 75A. "Wastewater Treatment Standards - Individual Household Systems". December 1990. Pg. 31. **(Management Practice Design Standard and Specification)**

Frome, Michelle. Vermont Natural Resources Council. "Rural Sewage Treatment in Vermont. Book 1: A Guide to the Alternatives". June 1978. Pg. 53.

Great Lakes/Upper Mississippi River Board of State Sanitary Engineers. "Policy Statement on Pump and Haul Procedures" contained in "Recommended Standards for Individual Sewage Systems". 1980. Pg. 49.

NYS Department of Health. Division of Environmental Protection. "Individual Wastewater Treatment Design Handbook". Albany, NY. Pgs. 108-109. January 1994.

Owen Ayers & Associates, Inc. "Onsite Nitrogen Removal Systems Research/Demonstration Project-Phase I Report - "Nitrogen Removal from Domestic Unsewered Areas". Wisconsin Dept. of Industry. Labor and Human Relations. June 1991. Appendix: Fact Sheets.

USEPA. Office of Water. "Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters". Washington, DC. Pgs. 4-100 and 4-108. January 1993.

USEPA. Office of Water. "Small Wastewater Systems-Alternative Systems for Small Communities and Rural Areas". January 1980.

USEPA. Office of Water Program Operations. "EPA Design Manual-Onsite Wastewater Treatment and Disposal Systems". EPA Publication 625/1-80-012. Pgs. 58, 88, 186, 197 and 339. October 1980.

USEPA. Region 5. Water Division. "Rural Lakes Project Handbook". March 1983. Pgs. 21, 30-33.

INNOVATIVE OR OTHER SYSTEMS: Rotating Biological Contactors

DEFINITION

A type of aerobic wastewater treatment system inclusive of primary clarifier with extended detention times and sludge holding capacity for a minimum period of 200 days. The Rotating Biological Contactor (RBC) module rotates through the stored solids which are used as a biological food source, even in no flow or low flow periods. A constant attenuation device returns high DO (dissolved oxygen) to the primary clarifier to draw down the ADL (applied disc load). The flow enters a secondary settlement tank for capture of sloughed biomass.

If there is a requirement for tertiary quality effluent (BOD-5 mg/L; S.S-10 mg/L; NH_3-N-2 mg/L), then an upflow filter system can be incorporated and a solids return system added to the treatment process above. An ultraviolet disinfection system for fecal kill would be used before direct discharge.

If the requirement is for secondary effluent (BOD-20 mg/L, S.S-20 mg/L), then the flow is directed to the leach field or effluent distribution system through perforated pipes in buried trenches or gravel beds for infiltration into the soil.

WATER QUALITY PURPOSE

To provide a high quality effluent where there are limiting site conditions. The effluent from this system will met NYSDEC standards for surface water discharge (BOD-5 mg/L; S.S.-10 mg/L; NH_3-N-1.25 mg/L; total fecal kill).

SOURCE CATEGORY

On-Site Wastewater Treatment Systems (OWTS).

POLLUTANTS CONTROLLED

BOD, suspended solids (S.S.), NH_3-N and pathogens.

WHERE USED

Where conventional systems are not feasible due to inadequate separation distances, shallow soil, slowly permeable soil or a high water table. For replacement systems, a surface water discharge may be allowed with an NPDES/SPDES permit from the NYS Department of Environmental Conservaiton (NYSDEC).

PRACTICE DESCRIPTION

With the circulating movement of the discs (biological support media) in and out of the wastewater and the interaction between the oxygen (air) and the food source (pollutant), the oxygen (aerobic) utilizing bacteria propagate, break down the pollutant into an acceptable by-product to be discharged to either a water course (after filtration and disinfection) or to an absorption field where further treatment is done. Uses the same disposal method as septic tank. Maintenance is essential. Ninety percent of the system can be underground.

PRACTICE EFFECTIVENESS

Practice effectiveness will vary with the type of aerobic unit used, proper use, and maintenance. Effluent will have a 60% lower BOD and 60% greater SS removal than would be expected from a septic tank.

IMPACT ON SURFACE WATER

Slight, if directly discharged. SPDES permit must be obtained for replacement units discharging to surface waters.

IMPACT ON GROUNDWATER

Slight. Nitrates and bacteria if secondary quality effluent is discharged.

ADVANTAGES

*Higher quality effluent extends life of soil absorption system. *Higher quality effluent might make surface discharge acceptable for replacement systems. *Low maintenance. *Ten percent lower power costs than aerator-type aerobic systems.

DISADVANTAGES

*Requires a continuous series of service contracts. *Susceptibility to user abuse.

PRACTICE LIFESPAN

Twenty to twenty-five years, with proper soils, siting and maintenance.

COST

Secondary:	$ 6,400 + Absorption Field
Tertiary:	$10,000 + Absorption Field

$50-$200 for periodic equipment replacement; $275-$715 for annualized costs of above plus power and maintenance. Annualization based on interest rate of 10%, 25-year life for tank and 10-year life for equipment.

OPERATION AND MAINTENANCE

Pump out tanks at least twice a year. Inspect semi-annually. Maintenance and operation do's and don't's provided in writing to homeowners.

MISCELLANEOUS COMMENTS

All units may meet the specifications of the National Sanitation Foundation Standard Number 40, Class 1.

REFERENCES

Brovetto, Ronald. Personal communication, March 1994, with assistance from Michael Croston, Amicros Company, Inc.

NYS Department of Health. 10 NYCRR, Appendix 75A. "Wastewater Treatment Standards - Individual Household Systems". December 1990. Pg. 32. **(Management Practice Design Standard and Specification)**

NYS Department of Health. Division of Environmental Protection. "Individual Wastewater Treatment Design Handbook". Albany, NY. Pgs. 111-112. 1994.

Myers, Jennie. Director. Lands Management Protection. Draft Management Measures for On-site Sewage Disposal Systems in Coastal AReas. Coastal Zone Management Act. Amendments. April 8, 1991. Pg. 68.

USEPA. Office of Water. "Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters". Washington, DC. Pg. 4-109. January 1993.

USEPA. Office of Water Program Operations. "EPA Design Manual-Onsite Wastewater Treatment and Disposal Systems". EPA Publication 625/1-80-012. Pgs. 155-157. October 1980.

MANAGEMENT PRACTICE SUMMARY SHEET

INNOVATIVE OR OTHER SYSTEMS: Trickling Filter-type Systems

DEFINITION

A package plant relying on both aerobic and anaerobic bacteria, providing secondary treatment. It receives influent from a septic or aerobic tank and its effluent discharges to a soil absorption system.

WATER QUALITY PURPOSE

To provide advanced secondary treatment: nitrification and denitrification of sanitary wastewater.

SOURCE CATEGORY

On-Site Wastewater Treatment Systems (OWTS).

POLLUTANTS CONTROLLED

BOD, total suspended solids, oil, grease, pathogens, nitrogen and phosphorus.

WHERE USED

Varies with proprietary device. The Bioclere system originated in Finland and has been used in Western Europe and the Middle East since the 1970's. Currently there are installations in Massachusetts, Rhode Island, Maryland, Delaware and with pending approval in Connecticut. The Clearwater Ecological Unit is available commercially in Pacific Northwest and Alaska.

More generally, where conventional systems are inadequate due to inadequate separation distances or where enhanced nutrient removal is required. In New York, both units are considered as "new products" and as "engineered systems". As engineered systems, they are subject to an environmental assessment process, require design and installation supervision by a design professional, the issuance of a Specific Waiver, and homeowner notification of reliability and potential problems. As a new product, they must be shown to be equivalent to 10 NYCRR standards based on submission of engineering research and testing data.

PRACTICE DESCRIPTION

Wastewater from the septic or aerobic tank discharges by gravity into a lower compartment of the unit. A pump distributes the wastewater over synthetic media for aerobic treatment. As the biomass thickens on the media micro-organisms nearest the surface of the media slough off and settle in the sump. Anaerobic conditions prevail in the sump and excess solids are pumped to the primary (septic or aerobic) tanks. Clarified wastewater with high dissolved oxygen discharges to the soil absorption system. Details regarding pumps, distribution methods, and performance during power failure varies with the proprietary unit.

PRACTICE EFFECTIVENESS

•Can be designed to meet site-specific effluent standards. However, this may be attained with multiple units in series. •One study of the Clearwater Ecological Unit cited 45-50% nitrogen removal and BOD/TSS unit effluent concentrations of 80 and 10 mg/L, respectively. •One Bioclere study cited an 83% reduction in groundwater nitrate at one installation. •Both are approved by the National Sanitation Foundation under NSF standard 40. •Bioclere's NSF results for BOD_5 and TSS ranged between 9-17 mg/l and 9-23 mg/l (30-day arithmetic mean).

IMPACT ON SURFACE WATER

Beneficial. Nutrient reduction greater than that from conventional systems.

IMPACT ON GROUNDWATER

Beneficial. Nitrate reduction greater than that from conventional systems.

ADVANTAGES

*Levels of secondary treatment (BOD and SS reduction) and nutrient removal can be designed. *Fixed film process is generally considered one of the most stable forms of wastewater treatment. *Lower organic loading and high dissolved oxygen levels in effluent may allow reduction in size of soil absorption system.

DISADVANTAGES

*May require more frequent pumping of solids within primary (septic or aerobic) tank. *Requires a service contract for periodic maintenance and service.

PRACTICE LIFESPAN

- Bioclere systems: 25-30 years.
- Clearwater Ecological systems: No information.

COST

Bioclere units $4,600: as a complete engineered system $6,000-$6,500. Clearwater Ecological Unit $8,500: as a complete engineered system $11,000 to $12,000. Both systems can be used as apart of a clustered treatment system at considerable cost savings (50% or greater per home). Septic tank and absorption field are additional.

OPERATION AND MAINTENANCE

Routine maintenance for pumps, valves, computer controller (Clearwater Ecological Unit only), fans, electrical connections, etc., is required. Effluent monitoring is required by both proprietors and NYS Department of Health. Service contracts are recommended and may be required by municipality or agency having jurisdiction.

MISCELLANEOUS COMMENTS

Frequency of visits by a professional operator or service representative for both cluster and individual systems will vary with system type, effluent quality, performance, and is likely to be more frequent during start-up phase.

REFERENCES

NYS Department of Health. Division of Environmental Protection. "Individual Wastewater Treatment Design Handbook". Albany, NY. Pgs. 111-112. 1994.

NYS Department of Health. 10 NYCRR, Appendix 75A. "Wastewater Treatment Standards-Individual Household Systems". Pg. 32. December 1990. **(Management Practice Design Standard and Specification)**

National Sanitation Foundation. "Standard 40: Individual Aerobic Wastewaer Treatment Plants". July 1990. NSF Joint Committee on Wastewater Technology. **(Management Practice Design Standard and Specification)**

Owen Ayres and Associates, Inc. "On-Site Nitrogen Removal Systems Research/Demonstration Project-Phase I Report-Nitrogen Removal from Domestic Wastewater in Unsewered Areas". Wisconsin Department of Industry, Labor and Human Relations. June 1991. Appendix: Fact sheets and pgs. 27-29.

USEPA. Office of Program Operations. "EPA Design Manual-Onsite Wastewater Treatment and Disposal Systems". EPA Publication 625/1-80-012. Pgs. 155-162. October 1980.

USEPA. Office of Water. "Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters". Washington, DC. Pg. 4-109. January 1993.

Wardell, Charles. Edited by Sandy Fritz. "Help for Septic Systems". Popular Science. June 1993. Pg. 40.

Whitmyer, R.W., R.A. Apfel, R.J. Otis, R.L. Meyer. "Overview of Individual Onsite Nitrogen Removal Systems". In On-Site Wastewater Treatment Proceedings of the Sixth National Symposium on Individual and Small Community Sewage Systems. Chicago, IL. December 1991.

APPENDIX A

Appendix A
Other References

References are from **"Where to Find Information on Nonpoint Source Pollution in New York State"**, a directory compiled by the New York Nonpoint Source Coordinating Committee. The directory is available at no charge from NYS Department of Environmental Conservation, Bureau of Program and Regulatory Activities, Public Participation Section, 50 Wolf Road, Albany, NY, 12233-3502, Phone No.: (518) 457-0669.

Design Standards for Wastewater Treatment Works in the Lake George Basin - NYS Department of Environmental Conservation, Division of Water, BTSR.

It's Your Choice - A Guidebook for Local Officials on Small Community Wastewater Management Options - Environmental Protection Agency. Small Flows Clearinghouse. FMBKGNO1. $4.00

The Impact of Septic Systems on the Marine Environment - Schneider, T.R. New York Sea Grant Extension.

Natural Wastewater Treatment Systems for Small Northern Communities - McIlwane, S. Rural Housing Improvement, Inc. Free with request letter.

On-site Domestic Sewage Disposal - MWPS-24. $6.00.

On-site Sewage Treatment and Disposal Conference Proceedings - Soc. Soil Scientists. Small Flows Clearinghouse. L2747. $6.00.

Terminology for On-site Sewage Treatment Systems - Cornell Cooperative Extension. Cornell University. 329FS9. $1.00.

Understanding Septic Systems, 1991 - Rural Water Resources Program. Rural Housing Improvement, Inc. 1-3 Free, other $3.00 ea.

Septic Systems, Soils and Groundwater Protection - Cornell Cooperative Extension, Cornell University. 174IB230. $2.75.

Your Septic System - Cornell Cooperative Extension. Cornell University. 174FSSET. $3.00