SEPTIC SYSTEMS

AND YOUR LAKE

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This septic system brochure was prepared by volunteers and members of the Lake Cochituate Watershed Association. Major contributors were:

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THE MASSACHUSETTS CONGRESS OF LAKES AND PONDS ASSOCIATIONS, INC.

The Massachusetts Congress of Lakes and Ponds Associations, Inc. (MCOLAPA) is an active organization working to vigorously support legislation to clean up lakes and ponds in the Commonwealth. The Congress provides citizen leadership in designing efforts to curb pollution in Massachusetts waters.

In September of 1979, the newly formed state-wide Massachusetts Congress of Lakes and Ponds Association, Inc. held an annual meeting at Worcester Polytechnical Institute. During the meeting, an Executive Committee was elected and project priorities were determined.

The Massachusetts Congress of Lakes and Ponds Associations, Inc. has two purposes as stated in its by-laws:

(1) To perform all acts appropriate to a non-profit, scientific, literary, and educational organization dedicated to the promotion and development of environmental quality standards essential for satisfactory life styles and conditions in the natural community, and

(2) To preserve the aesthetic, recreational, and commercial values of lakes and properties through the maintenance and improvement of such environmental factors as watershed ecology, water quality, lake water levels, shoreline, woodland management, agricultural soils practices, recreational and residential building standards, and related influences, such as water and boating safety.

Membership in the Congress is welcome and viewed as essential in assuring that the water quality issues on lakes and ponds are addressed on a state-wide as well as an individual level. More detailed information on the Massachusetts Congress of Lakes and Ponds Associations, Inc. is available by contacting Mr. Carl Peterson, President, P.O. Box 312, Westminster, MA 01473.

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PURPOSE AND USE OF THIS BROCHURE

This brochure addresses the proper management of septic systems and problems associated with malfunctioning septic systems, briefly presents alternatives to these systems and suggests techniques which may be employed by the homeowner to restore or repair systems which are not functioning properly and may be polluting the lake or which may constitute a general health hazard.

Don't be turned off by the size of the brochure. We have attempted to organize it in such a way that anyone can get as much out of it as they wish with the least amount of time and effort. The casually interested person may wish to read only the Summary section. Those with a greater interest, who are lake abuttors, or who are presently experiencing problems with their septic systems, may wish to read further. It is not necessary to read every section in order to get some value out of this brochure.

SUMMARY

On-lot septic systems provide many households with an economical and efficient means of sanitary waste disposal. These systems, if properly built, operated and maintained, can work well for many years removing most of the solids and pollutants from household wastes and returning treated wastewater to the ground.

HOW SEPTIC SYSTEMS WORK

It is useful to know how septic systems function in order to understand how they may be operated and maintained to provide long-term sanitary waste disposal.

A septic system consists of a septic tank and leaching area (bed, trench, pit, etc.) which are buried underground adjacent to a building. Household sewage (everything which goes down the drain in bathrooms, kitchen, and laundry) flows by gravity into the septic tank, where solid particles settle to the bottom and form a layer of sludge. Greases and oils float to the surface creating a scum layer. Sludge and scum are retained in the septic tank, and only the remaining conditioned wastewater is permitted to flow into the leaching area. There, a network of perforated pipes or a perforated concrete chamber allows the wastewater to trickle into a surrounding stone-filled area and then into the soil.

The soil filters out many of the small particles, which can cause disease or groundwater pollution. Unfortunately, the soil is unable to remove all pollutants, and a limited amount unavoidably reaches the groundwater.

It is, therefore, important that homeowners use extreme care in assuring that only regular domestic sewage is allowed to flow into the septic system. Because soil types vary greatly, the design and subsequent performance of septic systems are dependent upon this and several related natural features of the site. Some of the sludge and scum, stored in the septic tank, are reduced to liquid by bacteria which live in the tank, but the rest of that material must be pumped out at regular intervals to prevent it from overflowing the tank and entering the leaching area.

If the sludge and scum are permitted to enter the leaching area, they will clog the soil, and the system may fail. At this point, it might become necessary to build a new leaching area.

MAINTENANCE MAKES SENSE

It makes sense to maintain your septic system. A failing system can cause household plumbing to back up and raw sewage to overflow into the yard. In addition to creating an unpleasant nuisance, a failing system may allow pollutants to wash into surface waters, thereby creating a public health hazard. A new septic system costs from $1,000 to $3,500 to install. If it should become clogged and fail, it can cost as much or more to repair the system or build a new leaching field. On the other hand, a routine pump-out costs only $45-$75. By putting it off, the cost of even "normal" service will rise significantly and further complications become likely. That's a pretty small price to pay every few years for preventive maintenance that can extend the life of your septic system and preserve the quality of water in your lake.

WARNING SIGNS

Although septic systems generally give little warning that they are about to fail, the homeowner can look for certain symptoms which indicate that the leaching area is becoming clogged. These include:

- sewage odor near the septic tank or leaching area
- slow-running drains and toilets
- patch of bright green grass above the leaching area
- area of melted snow above the leaching area in winter
- formation of water puddles above the leaching area following heavy water usage, i.e., washing machine

PREVENTING FAILURES

A few simple preventative measures can keep your septic system from malfunctioning:

- Pump it regularly - at least once every three years - or have it inspected for signs that it may fail.

- Conserve water in the home. Excess water use can overload the septic system. Also, minor investments in water-saving plumbing fittings and habits can provide major savings in water and energy bills.

- Whenever possible, keep slow-to-decompose and toxic substances out of your drains and septic systems, such as: vegetable trimmings, eggshells, cigarette filters, ground garbage, coffee grounds, sanitary napkins, fats, oils, pesticides, disinfectants, acids, medicines, paint, paint thinner and plastic packaging materials. Garbage disposals should be avoided in homes with septic systems.

- Keep heavy vehicles off the leaching area where they can crush underground pipes and compact the soil.

- Don't plant deep-rooted trees, bushes, or shrubs over the leaching area.

where the roots may clog or dislocate pipes. It is a good practice to mark the boundaries of the leach area.

CASE STUDY: THE LAKE COCHITUATE WATERSHED

The Lake Cochituate Watershed area (all of the land which drains downhill into the lake) contains about 17.4 square miles in parts of Natick, Framingham, Wayland, Sherborn, and Ashland. The lake itself, located in Framingham, Natick, and Wayland covers over 600 acres.

Lake Cochituate consists of three major ponds (North, Middle, and South) separated by the Mass. Pike to the north and Route 135 at the southern extremity. From 1848 to 1931, this beautiful, sprawling lake provided Metropolitan Boston with drinking water through a complex eighteen-mile aqueduct system. In 1931, the Metropolitan District Commission (MDC) made Lake Cochituate a stand-by reservoir, by then a small supplement to the newer Wachusett and later Quabbin Reservoir systems. Finally, in 1947, the MDC transferred Lake Cochituate to what was then called the Massachusetts Conservation Department, freeing the shoreline and waters for general recreational use.

Since 1947, Lake Cochituate's wooded shoreline and attractive setting have drawn growing numbers of visitors from the Metropolitan Boston area, and elsewhere in eastern Massachusetts. The caretaker agency, the Forest and Parks Division of the Department of Environmental Management, has recognized Cochituate State Park as its most complex and heavily used State Park.

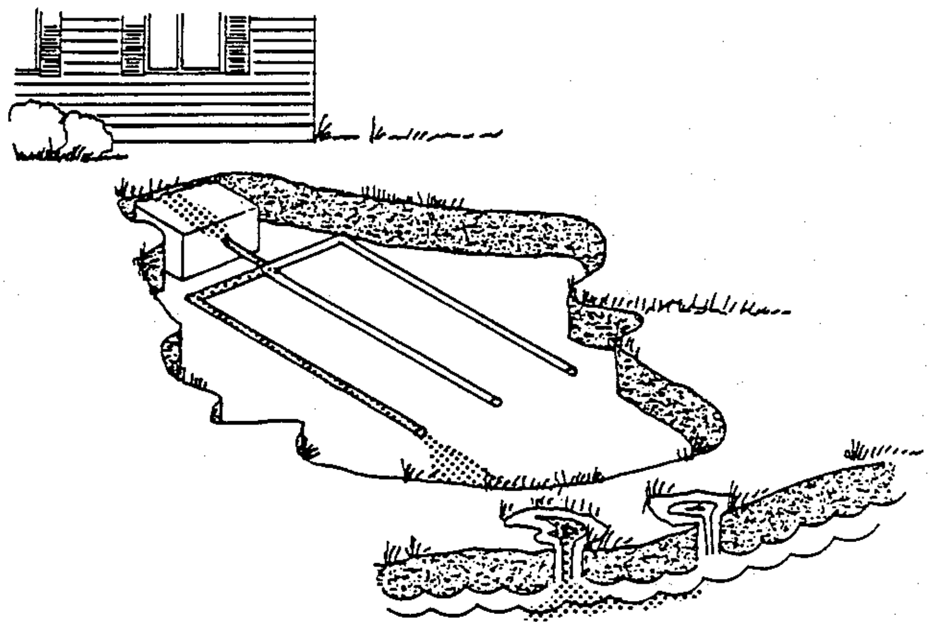
As a result of a century of water supply usage, the lake's immediate shoreline has been protected from development. The 27 miles of sand and gravel shoreline, which are backed with thickly wooded stands of pine, oak, birch, and maple, are, however, deceiving. Behind this narrow screen of green is the major reason for concern for the lake's future: heavy development of land for residential and commercial uses.

The post World War II population density of the Lake Cochituate watershed area is very high. Industrial growth of the Route 128 area and an improved transportation network have led to tremendous growth of the suburban towns of Natick and Framingham. Housing development adjacent to the lake in these two towns poses the greatest threat for harmful pollution when septic systems malfunction or fail. Past development near the lake generally consisted of residential lots of less than one-half acre (about 20,000 square feet). Sherborn and Wayland, which are totally unsewered, have lot sizes generally half-acre or larger. This half-acre lot size is important when considering home-sites with septic systems; as a rule of thumb this represents the smallest lot size which will permit installation of a second drainage field should the first system fail beyond recovery. Thus, proper installation and maintenance are even more important when lot sizes are small.

SEPTIC SYSTEMS

WHAT IS THE PROBLEM?

The indirect discharge of pollutants from improperly located, malfunctioning or crowded septic systems plus pollutant-rich urban stormwater discharges cause major problems to the waters of New England. The addition of nutrients and pathogenic organisms present a potential hazard to both human health and the water quality of our lakes.



The concentration of nutrients (in particular nitrogen and phosphorus compounds) in a lake is a major determinant of the numbers of animals and plants in the lake. Normally, nutrients enter the lake primarily via precipitation, storm discharge, overland flow from the surrounding watershed, and groundwater. An excess of nutrients from failing septic systems can, however, create an imbalanced concentration of animals and plants. This can, at times, indicate a decrease in the stability (health) of a lake and its biological communities.

In Lake Cochituate, trout have had difficulty surviving because the concentration of oxygen in the water is too low at certain times of the year. The low concentration of oxygen can be blamed on the excess nutrients which support high numbers of certain populations of algae (algal blooms). These algae increase their numbers to such an excess that the concentration of oxygen at various depths and at different times of day becomes critically low for many organisms in addition to trout.

Decreases in the water quality of lakes and ponds reduces the lake's recreational value and appeal, as well as local property values.

WHAT IS WASTEWATER?

Home wastewater generally comes from the combined water uses of the kitchen, bathroom, and laundry. It is made up of "blackwater," containing human waste, and of "greywater," containing all other liquid waste. Although toilet and garbage wastes constitute half or less of the daily volume, they contain more than 70 percent of the organic waste material and are primarily responsible for the odors and pollution associated with untreated or inadequately treated wastewater.

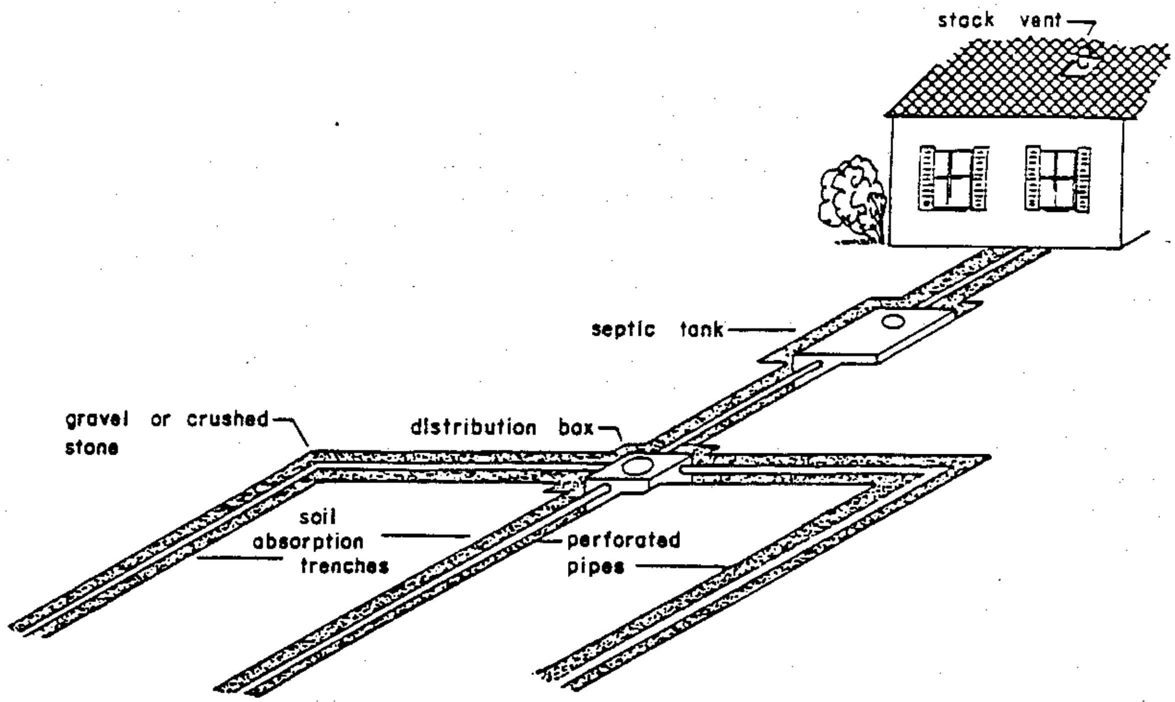
Raw wastewater contains many contaminants including nutrients, solids, and organics. Wastewater must be treated to remove disease-causing bacteria which may contaminate the adjacent shore and water areas as well as the waters flowing into the lake. A properly functioning septic system will eliminate most harmful bacteria and floating and suspended solids as a result of partial decomposition by natural bacteria in the septic tank. Additional treatment is provided by the soil itself. The system can greatly reduce any detrimental impacts on the surface water quality. Lakes are especially vulnerable to domestic waste pollution because they lack the flushing action typical of rivers. The actual volume of wastewater depends on the family size, number, and use of appliances, etc. In general, the average residence uses about 60 gallons of water per person per day, which then end up in the septic system.

THE SEPTIC SYSTEM

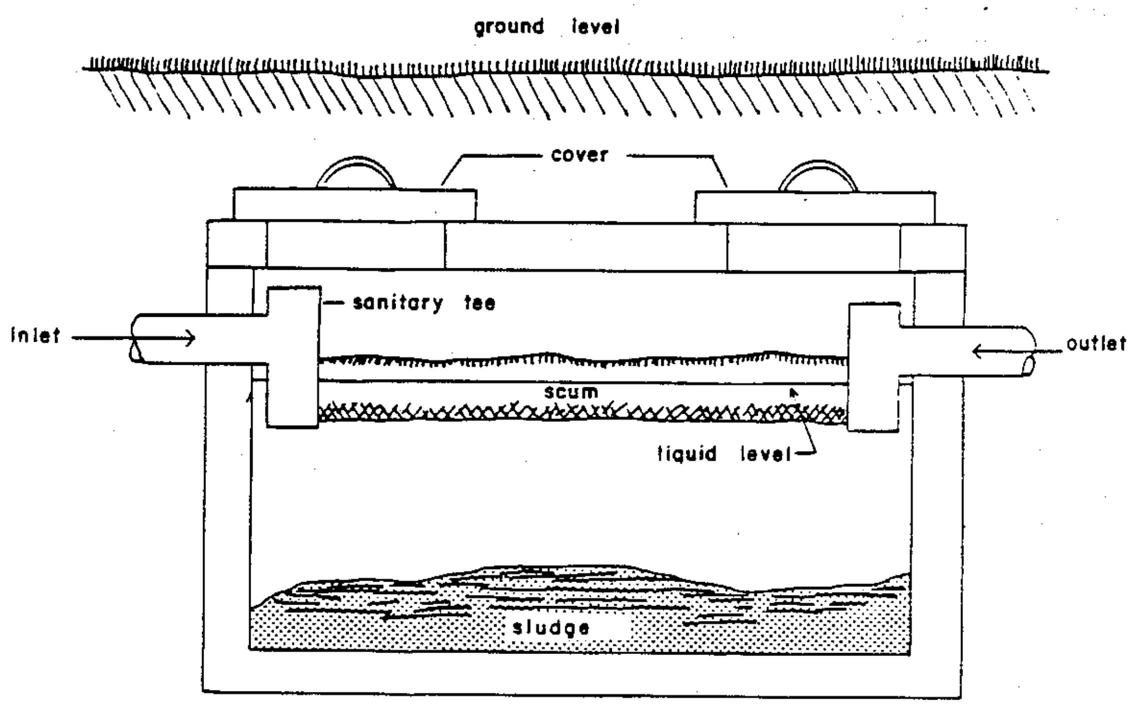
The septic system is a homesite sewage treatment system, consisting of two parts: the septic tank and the drainfield. The tank is usually a rectangular concrete box with a sanitary tie at each end to slow the incoming flow and prevent solids from escaping. Solids entering the tank settle to the bottom where they are slowly digested by bacteria. Grease and light material rise to the top and are trapped above the outlet tee to await removal by pumping. The wastewater, minus the gross solids, passes through the outlet, through the drainfield distribution system and into the ground.

The soil absorbs viruses, strains out bacteria and renovates wastes into reusable nutrients, part of which are consumed by organisms in the soil itself. The treated water moves through the soil, returning to groundwater, streams, and plants. The drainfield distribution system usually consists of one of the following:

- subsurface beds: wide areas with crushed stone and distribution pipes
- leaching trenches: long narrow trenches with perforated tile pipe
- leaching chambers: inverted open concrete boxes
- mound: an above ground leaching bed
- leaching pit: a deep stone-lined pit, sometimes referred to as a dry well



Typical Household Septic Tank System



Cross Section of Typical Concrete Septic Tank

In the Lake Cochituate area, the most common on-site means used to treat wastewater is a septic tank with a leaching bed. On some smaller sites with good soils and deep water table, the leaching pit is used in place of the bed, with good results.

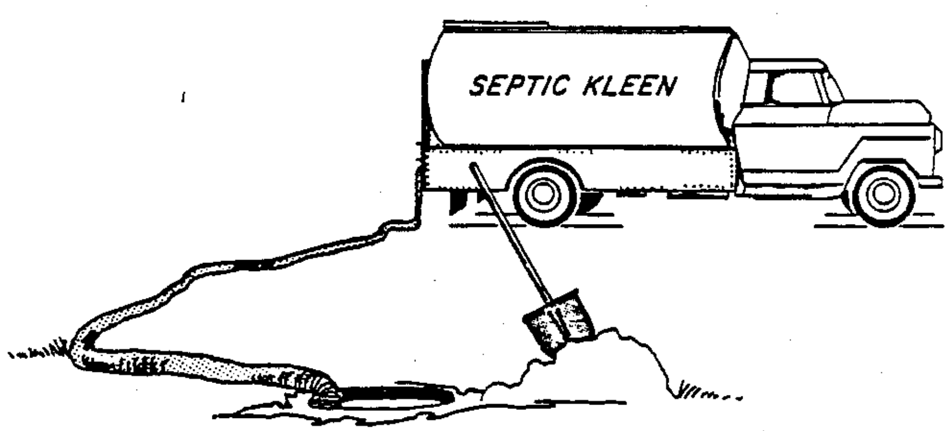
WHAT SORT OF MAINTENANCE IS NEEDED?

In order to take proper care of a septic system, the homeowner must know where it is located. If the access manholes are at ground level, this is no problem. Unfortunately, however, the manholes are often buried somewhere under the lawn. To locate the tank, go into the basement and find where and in what direction the sewer pipe goes out through the basement wall. Check the lawn in that area for places where the grass won't grow or for areas that are slightly depressed or mounded. Any likely spot can be probed with a thin metal rod. In the winter, excessive snow melt may be a good indication of tank location.

If this doesn't work, ask someone who may have seen the tank installed or pumped, a neighbor, the builder or the previous owner. For recently installed or repaired systems, your own Health Department probably has a plan showing the location of the system and access manholes. If all else fails, turn the problem over to your local septic tank pumper who usually has the proper equipment to locate the tank.

Once a buried manhole has been located, it should be either brought up to ground level or marked permanently (mark the site with a stake, bird feeder, bird bath, etc., or record its location on the basement wall). Also locate it on the form provided at the end of this brochure.

Do not wait until your system shows signs of failure to have your septic tank pumped out. Call a licensed pumper to do this work at least once every three years. For a list of operators licensed to do this work in your community, contact your town Health Department or consult the yellow pages under "Cess-pools-Cleaning." If the access manholes are at ground level or are clearly marked, the job should be quick and simple.



While your tank is being pumped out, ask the operator to inspect the inlet and outlet tees. Normally, one of the two access covers is located directly over the inlet sanitary tee. If either tee is broken, have repairs done immediately to avoid an early recurrence of problems. The inlet should also be checked to determine if leakage into the tank is occurring from other sources such as groundwater. If the leaching area consists of a pit or dry well, there should be no need to have the pit pumped. If it is full of liquids, a serious clogging problem is indicated which should be referred to a qualified sanitarian.

It is not necessary to leave any of the sludge in the tank as "seed." Incoming sewage contains all the bacteria needed for proper operation. The use of acids or bleaches to clean the tank is not recommended as a part of normal maintenance.

The use of enzymes and other miracle septic system additives have not been shown to be of any value. While their use may not harm your system, they do not in any way take the place of regular pumping.

WHY SYSTEMS MALFUNCTION

- The microbes in the septic tank must be treated with care. Small amounts of soaps, detergents, bleaches, and the like will not harm the treatment process taking place in septic tanks; but, an overdose of any of these can be fatal to the needed biological activity.

- Cigarette butts, filters, sanitary napkins, disposable diapers, hair, paper towels, and napkins cannot be properly digested in the septic tank and simply add to the sludge volume. These items should be disposed of in the trash bin.

- Grease and fat float to the top as scum and are usually not fully digested. When combined with detergents or when emulsified, grease passes through the tank into the drainfield, thus, clogging the soil.

- Systems may be too small for an intended use. The soil in the leaching field may be insufficient or unsuitable to absorb the volume of wastes being introduced.

- Careless workmanship can be a problem. For a variety of reasons, systems may not have been installed according to specifications.

- Systems may be improperly sited, too close to adjacent systems, or designed and installed too near the water table. In this last case, wastes are added directly to the groundwater without adequate purification in the soil.

- A septic tank may fill with accumulated sludge, overflow into the leaching bed and clog the soil in the leach field.

- The infiltration capacity of any soil will decline with time. Unless this loss in capacity is accounted for in the field design, the system will eventually malfunction.

- Pipes may be crushed by heavy objects such as trucks.

Overloading of a septic system will contribute to an early failure of the system.

In new construction this can be minimized by proper tank sizing. Of course, water usage will vary according to one's habits. Water using appliances contribute to the flow and shorten the life expectancy of the system, unless properly accounted for in the design. The capacity of septic systems in older homes is often exceeded as new appliances are introduced, families grow, and home additions are constructed.

WHAT IS SOIL CLOGGING?

Soil clogging does not necessarily mean that your system has permanently failed. Some degree of soil "clogging" is normal in leaching fields. With use, effluent will build up in the leaching bed, leaving a crust known as the "clogging layer." Under normal working conditions, this crust will develop to a point where a balance exists between the soil saturation and the amount of pooling of liquid in the leaching trench. This equilibrium condition results in maximum pulling, or capillary action, of the liquid into the soils, and the best flow of water.

When this clogging layer becomes too thick, none or very little of the wastewater infiltrates the soil and permanent pooling of liquid and surfacing may result. In a system exhibiting early signs of clogging (i.e., intermittent system backups or pooling), if the system is "rested" (not used) for several weeks, the crust, which has clogged, may break down as aerobic bacteria decompose the organic matter. In a system in which the clogging becomes permanent, this breakdown does not take place and the crust remains, resulting in failure of the system.

HOW TO PREVENT SYSTEM FAILURE

To help protect a septic system against premature failure, the homeowner should follow these simple procedures:

1. Pump the septic tank at least once every three years. Do not wait until the symptoms of failure show up.

2. Minimize water use in the home. Excess water will decrease the effectiveness of the septic tank and lead to flooding of the leaching area. Never empty basement sumps or other sources of clear water into the septic system. Use water saving plumbing fixtures where possible (faucet, aerators, low-flow shower heads, low-flow flush toilets, flush tank dams, etc.) and run dishwashers and washing machines only with full loads. Fix all leaky faucets and toilets promptly.

   Additional water conservation information is available from the Division of Water Supply, Room 406, 600 Washington Street, Boston, MA 02111 and at local Water Department Offices.

3. Certain materials interfere with effective operation of your septic systems; although small amounts of garbage material may be acceptable, avoid the use of a garbage grinder. Don't dispose of the following substances in the septic system (recycle them by composting or put them in the trash):

   - coarse organic matter such as vegetable trimmings, ground garbage, sanitary napkins, eggshells, cigarette filters and coffee grounds clog the septic tank with sludge and promote frequent septic tank pumping.

- automotive oil should never be put into the septic system. Cooking oil and bacon grease, etc., may pass through the septic tank and clog the leaching area causing the system to back up.

- pesticides, disinfectants, acids, medicines, paint, paint thinner, etc., will kill the bacteria which decompose organic matter in the septic tank, thereby causing increased sludge accumulation. As a result, more frequent pump-outs will be required to keep the system operating properly.

4. Insist on proper location and construction of any new leaching area. Improper location and construction will usually result in problems and failure of the system.

5. Keep heavy vehicles off of the leaching area; their weight could lead to crushed pipes and expensive repairs, as well as loss of soil infiltration capacity (due to soil compaction).

6. Don't plant deep rooted trees or bushes over the leaching area; their roots may clog or dislocate pipes.

WHAT TO DO IF A MALFUNCTION OCCURS?

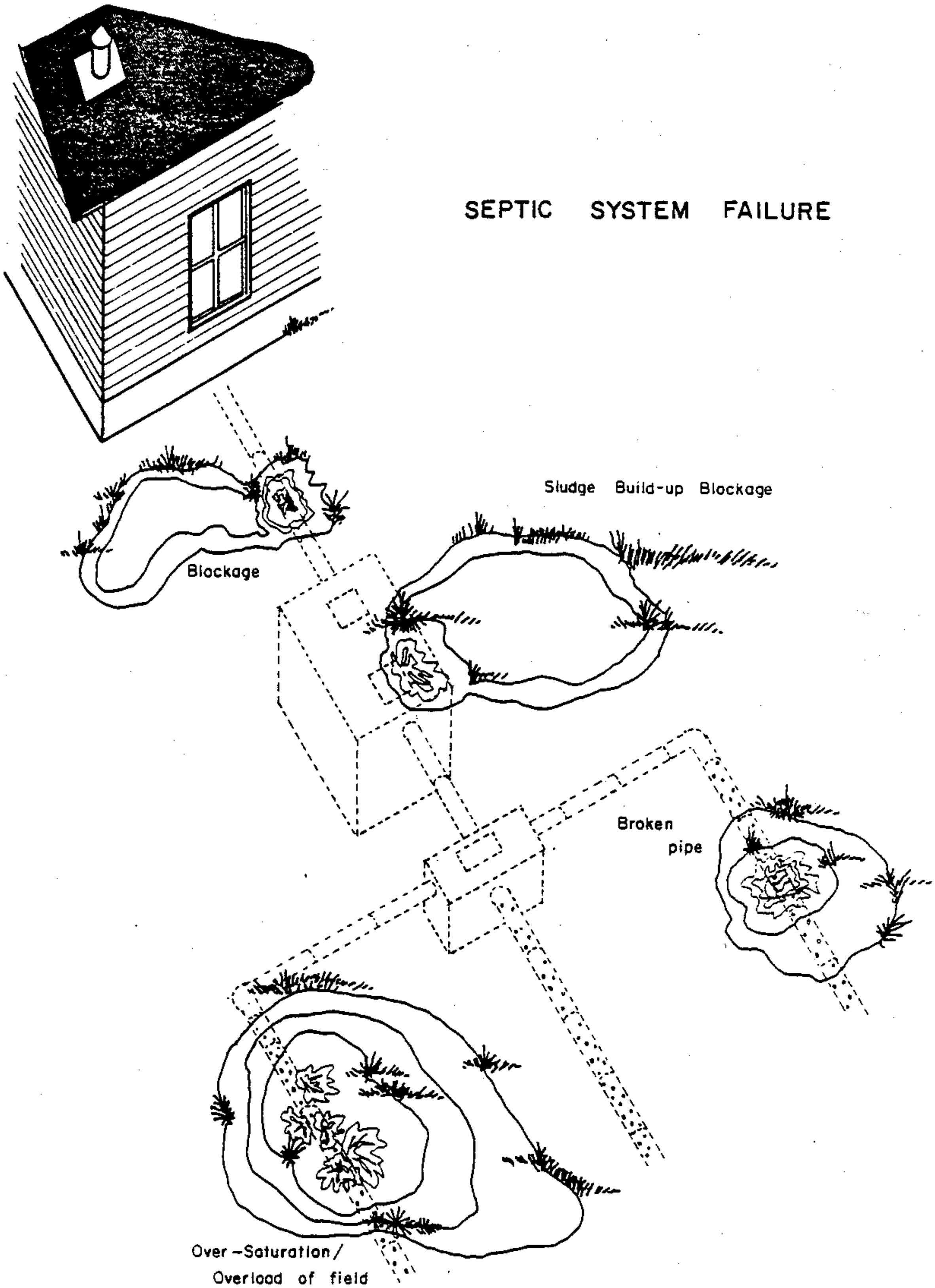
How can a system which isn't working properly be identified? Blatant failure is evident when wastewater breaks through the ground surface. The odor will dispel any doubt about what one sees.

Unfortunately, lesser degrees of malfunction are very difficult to identify. A septic system may allow objectionable materials to filter into groundwater before blatant symptons appear. Dye tests for detecting malfunctions are often unreliable. Only periodic pumping and proper maintenance will prevent malfunction.

In general, a reduction of the wastewater flow through the system helps if the problem is recognized early. With less water passing through the field, there will be a greater chance for aerobic bacteria to act on the crust, thus, providing system relief, or "resting" time. Yeast and bacteria preparations which are flushed down the toilet are not generally considered effective. Oxidizing agents could be applied directly to the soil in an effort to break down the crust, but these too are not well understood and not recommended without consultation by professionals.

If a replacement system is called for, the Town Health Department or a sanitary engineer can outline available alternatives. If another portion of the lot offers sufficient space and adequate soil, it may be possible to construct a second drainfield. Reserve area is now required by Title 5 of the State Environmental Code of Massachusetts. Before any corrective work is undertaken, a permit must be obtained from the Town Health Department.

SEPTIC SYSTEM FAILURE



ALTERNATIVES TO SEPTIC SYSTEMS

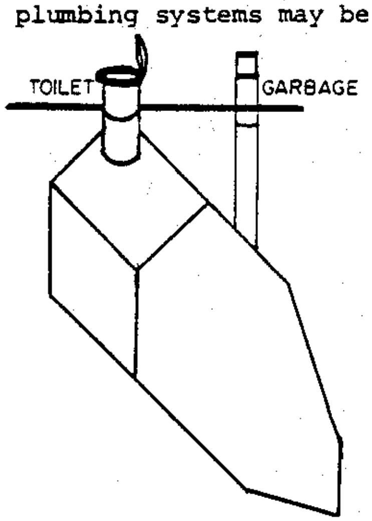
WHAT ARE THE ALTERNATIVES?

There are a variety of alternative systems available to the homeowner other than the septic system form of wastewater treatment. Options which are permitted under the State Environmental Code with the written approval of the Department of Environmental Quality Engineering include:

- Composting toilets
- Digesting toilets
- Recirculating toilets
- Sliding valve toilets
- A variety of leaching systems
- Municipal sewers
- "Cluster" sewerage systems

Most of these alternatives still generate a reduced amount of less harmful liquid effluent (greywater) which must be properly disposed. On lots where septic systems have failed as a result of poor soils or a high groundwater level, disposal of greywater may still pose significant problems. In all cases, the homeowner should seek professional assistance.

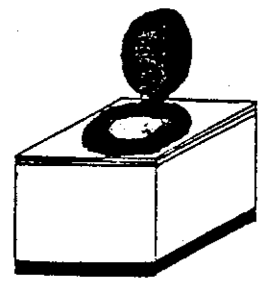
These options which separate "black" and "grey" wastes require a dual plumbing system in the home: one part to handle the toilet and human wastes and the other for the greywater. In many existing homes, the installation of separate plumbing systems may be expensive and difficult to accomplish.



Composting toilets (also called "Dry" or "Humus" toilets) were developed in the late 1930's in Sweden but it was not until the mid 1960's that the idea was fully developed and marketed in the United States.

The composting system uses micro-organisms to decompose toilet waste and garbage within in a sealed bin, vented to the atmosphere. The heat of decomposition creates sufficient draft to prevent odors. Composting toilets require organic kitchen and garden scraps for proper operation. The final product is an inert humus material which requires occasional removal. The cost of a composting system is $1,000 and up, in addition to the cost of a separate piping and disposal system for the greywater.

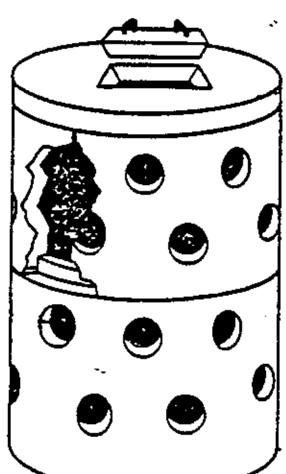
Digesting toilets are similar to composting units, but require less space. Digesting toilets use electricity to heat waste for optimal biological decomposition by micro-organisms. The units are sealed, vented to the atmosphere, produce little or no liquid effluent and small quantities (2 lbs. per year) of humus which can be used as fertilizer-mulch. The costs range from $250-$750, depending on use. There is a monthly cost for electricity and micro-organism cultures. Digesting units require a separate system for greywater.



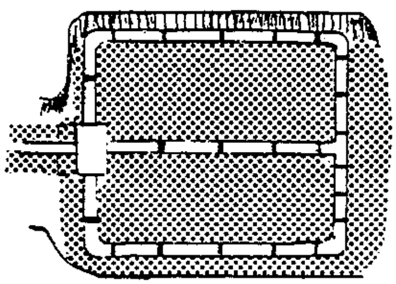
Recirculating toilets are useful in water-short or "no discharge" areas. They reuse a chemically stabilized water or oil transport fluid by settling or filtering the solids from the transport fluid. The concentrated waste is stored in a holding tank which is periodically pumped. The pumped material is deposited at a waste treatment facility. These systems are mechanically complex and provide little treatment. Periodic professional maintenance is usually required. The cost is approximately $300-$400, plus $10-$15 monthly maintenance. As with the above systems, one must provide a separate plumbing and treatment system for the greywater.

Sliding valve toilets are low water use systems that can handle blackwater. Since approximately 1 pint of water is used for each flush, a family of five would use about 100 gallons per month with this system as compared to 4,500 gallons for a standard flush toilet. The toilet discharges to a holding tank, septic system, or sewer system. The low flow is an advantage when a holding tank or septic system is used, but sewer lines, which have been laid at a minimum slope, may clog more frequently due to the smaller flush of water. The costs range from $175-$250 and are presently frequently used on boats and campers. Existing toilets can be modified to use less water by changing the flushing mechanism or altering the tank.

Wastewater effluent from a septic tank can be disposed of by the following subsurface disposal options: leaching pit; leaching bed and trench; leaching gallery or chamber; Fuldos concept or the cesspool.

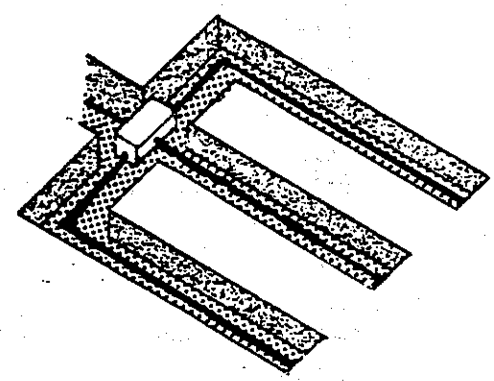


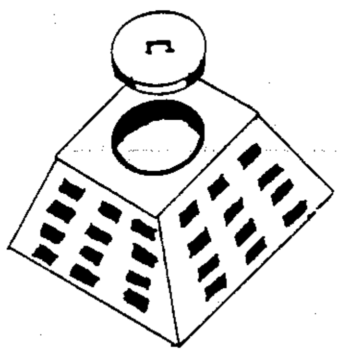
- Leaching pit, sometimes called a seepage pit or drywell, is a covered pit with an open-jointed lining from which the effluent may seep or leach into the surrounding porous soil. Its use is limited to areas where the soil is deep and where depth to the high groundwater level and bedrock is at least 4 feet below the bottom of the units. Leaching pits are usually circular and can be constructed of concrete block, brick, or precast concrete. If more than one seepage pit is used, the spacing between excavation sidewalls cannot be less than twice the effective width or depth of the pit, whichever is greater. The area in between the pits is used as a reserve area in case clogging or failure occurs. Leaching pits are looked upon as being the most favorable subsurface disposal devices if conditions are appropriate for their use as they are the least susceptible to clogging.



- Leaching bed (fields) are the most common and least effective method of all disposal systems. The bed is an area of washed, crushed stone with leaching lines to distribute the wastewater effluent evenly throughout the bed. Conventional distribution pipes are rigid perforated pipe usually 4 inches in diameter. The depth of excavation is governed by the depth to the seasonal high groundwater and bedrock or impervious stratum. To ensure good removal of pollutants as the wastewater passes through the soil, the leaching bed must be kept aerobic.

- Leaching trenches are similar to the leaching bed except that the leaching bed lines are separated by undisturbed soil. The leaching trench can easily avoid obstructions, whereas, in construction of leaching beds, one has to remove the obstructions.



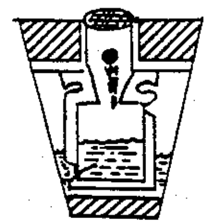


- Leaching galleries and chambers are made of precast concrete. These units are placed on level sand or gravel and are used to maximize the effective leaching area and to minimize the amount of stone required.

- The Fuldos concept, also referred to as the "full-dose" system, was first introduced in 1974 by A.E. Sullivan and consists of an accumulator in a void (trench, gallery, or pit) surrounded by fill material (washed stone). A dosing capacity is calculated to fill the void volume of the fill to a predetermined elevation in an effort to dose the entire bottom and sidewall area of the void during each dosing cycle. The dosing device discharges the wastewater directly to the crushed stone ring surrounding the accumulator.

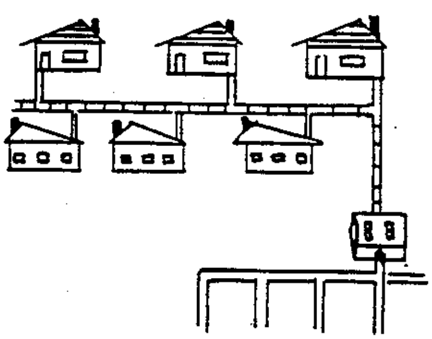
The Fuldos system simultaneously utilizes all of the surface area of the leaching device, whereas the leaching trench, pit, gallery or chambers only utilize the bottom surface areas first. The actual loading rate on the bottom of a conventional leaching pit, trench, or bed is commonly two to three times that of its original design, and is very susceptible to clogging and failure.

The Fuldos system utilizes the entire infiltrative surface of the soil from the first day of operation. Less nutrients are applied per unit of area and hence the fulldose system theoretically takes longer to clog. Since fulldose systems do not overload the bottom areas as conventional leaching systems do, they should last longer and pass less pollutants through the bottom surface to the groundwater table.



- The cesspool, now banned from use in new homes, by the State Environmental Code, is simply a deep vertical hole in the ground into which household wastes pass directly without benefit of a septic tank. Very little treatment of the waste takes place in a cesspool system, resulting in groundwater pollution problems. Older homes, with preexisting cesspools, can be renovated to comply with modern standards very simply. Once the cesspool has failed (no liquid flows through in the soil), it is effectively a sealed tank. A drainage field can be connected after adding sanitary tees to the inlet and outlet and pumping out the contents of the cesspool. Cesspools are often converted to leaching pits simply by installing a septic tank ahead of one. This is often referred to as a "dual tank" system.

Municipal sewers are a costly but more permanent alternative to the use of individual household treatment systems. However, in circumstances where there are widespread septic or cesspool system failures, it may be advisable to install a sewerage system or connect to a nearby sewer if one is available. This decision must be made at the municipal level following a detailed engineering analysis.



"Cluster" sewering to service homes in close proximity to one another may prove to be a feasible and economically attractive solution if the household treatment systems do not function properly and cannot be easily remedied. State and federal funds are available for such "cluster sewerage systems" if they are owned and operated by a municipality. If your septic tank problems are shared by several of your neighbors, you may want to investigate this option further and discuss it with your local officials.

The systems described above offer alternatives as solutions to problems which have occurred with the present treatment and disposal system, or as options to be considered in the construction of new homes.

GLOSSARY OF TERMS

AEROBIC: This refers to life or processes that can occur only in the presence of oxygen.

ANAEROBIC: Relates to life or processes that occur in the absence of oxygen.

BLACKWATER: Concentrated domestic wastewater containing human wastes.

BOD (Biochemical Oxygen Demand): A measure of the amount of oxygen consumed in the biological processes that break down organic matter in water. Large amounts of organic waste use up large amounts of dissolved oxygen; thus, the greater the degree of organic pollution, the greater the BOD.

BUILDING SEWER: The pipe which begins 10 feet outside the inner face of the building wall and extends to a public sewer, septic tank, or other place of sewage disposal.

CESSPOOL: A covered pit with open-jointed lining in its bottom portions into which raw sewage is discharged, the liquid portion of the sewage being disposed of by seeping or leaching in the surrounding porous soil, and the solids or sludge being retained in the pit to undergo partial decomposition before intermittent removal.

CHLORINATION: The application of chlorine to drinking water, sewage, or industrial waste for disinfection or oxidation of undesirable compounds.

COMPOSTING TOILET: A self-contained toilet from which liquid or solid waste materials are regularly discharged and from which a humus-like end product is produced. (Also called "Dry" or "Humus" Toilet).

DEEP OBSERVATION HOLE: An open pit dug to permit the examination of the soil and to determine the groundwater elevation.

DISTRIBUTION BOX: A watertight structure which receives settled sewage and distributes it in substantially equal portions to two or more lines leading to a leaching area.

DISTRIBUTION LINE: The pipe used for dispersion of sewage into leaching trenches or leaching fields.

DOSING TANK: A watertight structure placed between a septic tank and distribution box and equipped with a siphon or a pump designed to discharge settled sewage intermittently to a leaching facility and to provide a rest period between such discharges.

DRY TOILET: See "Composting Toilet."

EFFLUENT: A discharge into the environment, partially or completely treated or in its natural state. Generally used in regard to discharges from treatment plants or industries into surface waters.

FILTRATION: In wastewater treatment, the mechanical process that removes particulate matter by separating water from solid material, usually by-passing it through sand.

GREYWATER: Sanitary sewage, excluding the waste discharges from toilets, i.e., any water-carried organic waste resulting from the discharge of laundry tubs, washing machines, sinks, showers, dishwashers, etc.

GROUNDWATER: The supply of water under the earth's surface in an aquifer or soil that forms a natural reservoir.

HUMUS: Decomposed organic material.

HUMUS TOILET: See "Composting Toilet."

LEACHING: The process by which soluble materials are dissolved and carried through the soil by percolating water.

LEACHING FACILITY: An approved structure used for the dispersion of sewage effluent into the soil. These include leaching pits, galleries, chambers, trenches, and fields.

MGD: Millions of gallons per day. MGD is commonly used to express rate of flow.

NUTRIENTS: Elements or compounds essential as raw materials for organism growth and development, for example, Carbon, Oxygen, Nitrogen, and Phosphorus.

PERCOLATION: Downward flow or infiltration of water through the pores or spaces of a rock or soil.

PERCOLATION TEST: A means of determining the suitability of soil for the subsurface disposal of sewage.

PHOSPHATES: Nutrients which are needed by algae and other organisms for growth and reproduction.

POLLUTANT: Any introduced gas, liquid or solid which makes a resource unfit for use.

RESERVE AREA: An additional ground area of at least equal capacity as the original sewage disposal area, suitable for subsurface sewage disposal and upon which no permanent structures will be constructed.

SANITARY SEWAGE: Any water-carried organic waste resulting from the discharge of toilets, laundry tubs, washing machines, sinks, showers, dishwashers, etc.

SCUM: A mass of solids floating at the surface of a septic tank.

SEPTAGE: That material removed from any part of an individual sewage disposal system.

SEPTIC TANK: A watertight receptacle which receives the discharge of sewage from a building sewer and is designed and constructed so as to permit the retention of scum and sludge, digestion of the organic matter, and discharge of the liquid portion to a leaching facility.

SEWAGE DISPOSAL AREA: The area used for subsurface dispersion of the liquid portion of sewage.

SEWER: Any pipe or conduit used to collect and carry away sewage or stormwater runoff from the generating source to treatment plants or receiving streams. A sewer that conveys household and commercial sewage is called a sanitary sewer. If it transports runoff from rain or snow, it is called a stormwater sewer.

SLUDGE: The solids removed from sewage during wastewater treatment. Sludge disposal is then handled by incineration, dumping or burial.

SURFACE WATER: Water on the earth's surface exposed to the atmosphere, such as rivers, lakes, streams, and the oceans.

SUSPENDED SOLIDS (SS): Small particles of solid pollutants in sewage that contribute to turbidity and that resist separation by conventional means. The examination of suspended solids and the BOD test constitute two principal analytical tests of water quality performed at wastewater treatment facilities.

WASTEWATER: Water carrying wastes from homes, businesses, and industries which is a mixture of water and dissolved or suspended solids.

LAKE COCHITUATE, 314 PROJECT

Lake Cochituate is widely recognized as one of the most important recreational lakes in Massachusetts. Less well known is the fact that the quality of its water has steadily decreased due to a complex series of causes. In order to reverse this deterioration, the Massachusetts Department of Environmental Quality Engineering applied for and received from the U.S. Environmental Protection Agency a grant (under Section 314 of Public Law 92-500) to examine the feasibility of, and construct where justified, a variety of innovative facilities to decrease the amount of nutrients entering the lake. Hopefully, nutrient reduction will lead to a decrease or elimination of the unpleasant algae growth that occurs in late summer and early fall.

If shown to be environmentally sound and cost effective in decreasing nutrients, engineering solutions will be implemented at three of the lake's tributaries: Pegan Brook, Snake Brook, and Beaver Dam Brook.

Aware that the above three activities can deal with only a portion of the problem, the MDEQE decided to contract with the Lake Cochituate Watershed Association to carry out a citizen awareness campaign. The campaign is aimed at informing individuals living within the Watershed, particularly in the Course Brook and Snake Brook basins, of activities that produce excessive nutrients, and to help citizens learn how they can decrease the input of nutrients through individual actions. This brochure is a major part of that effort. Others deal with phosphate washing detergents and lawn fertilization.

Thanks to the support of local industry and commerce, state and local water pollution control and health agencies, and to the tireless energy of its many volunteer members, its efforts have led to the successful reduction of levels of hazardous pollutants, oils, acids, and algae fertilizing nitrates and phosphates entering the lake.

MAINTENANCE RECORDS

CHECKLIST FOR SEPTIC SYSTEM MAINTENANCE

How can I insure that my septic system will continue to work properly?

____ Annual maintenance inspection, with pumping as needed (every 1-3 years).
____ Care in the use of soaps, detergents, and bleaches.
____ Keeping cigarette butts, filters, diaper liners, sanitary napkins, hair, paper towels, grease and fat, etc., out of the system.
____ Water saving habits such as installing low-flush toilets and low-flow showers; fixing leaking faucets or toilets; running dishwashers and washing machines only with full loads.
____ Locating trees and bushes so that their roots will not interfere with the drainfield system.

How do I spot signs of a problem?

____ Greener grass in the area of the septic system.
____ Area of melted snow above leaching area, in winter.
____ Wet spots in the areas of the system.
____ Strong Odors.
____ Backup into or slow discharge from plumbing fixtures (toilet, bath drains in the house).

What should I do if I have a problem with my septic system?

____ Have it inspected to find what the problem is.

Is it the tank?

____ Check sludge level and pump, if needed.
____ Check inlet and outlet pipes. Minor reconstruction of these may substantially improve performance.
____ Check for leaks.

Is it the field?

____ Major problems may require reconstruction.
____ Obtain professional advice and assistance.
____ Check piping for damage or clogging. This requires major excavation.
____ Minor problems may be corrected by "resting" or implementing water-saving habits.
____ Try an oxidizing agent, such as hydrogen peroxide. Caution: this should only be attempted by one familiar with its use.

TANK INSPECTION RECORD

DATE INSPECTED	INSPECTOR/ CONTRACTOR	SYSTEM PUMPED	COST	RESULTS OF INSPECTION OF DESCRIPTION OF WORK

SYSTEM LOCATION

NOTE: Locate and dimension: house, septic tank access, manhole, limits of drainage field and any other major structures.