# Cleaning Up the Water

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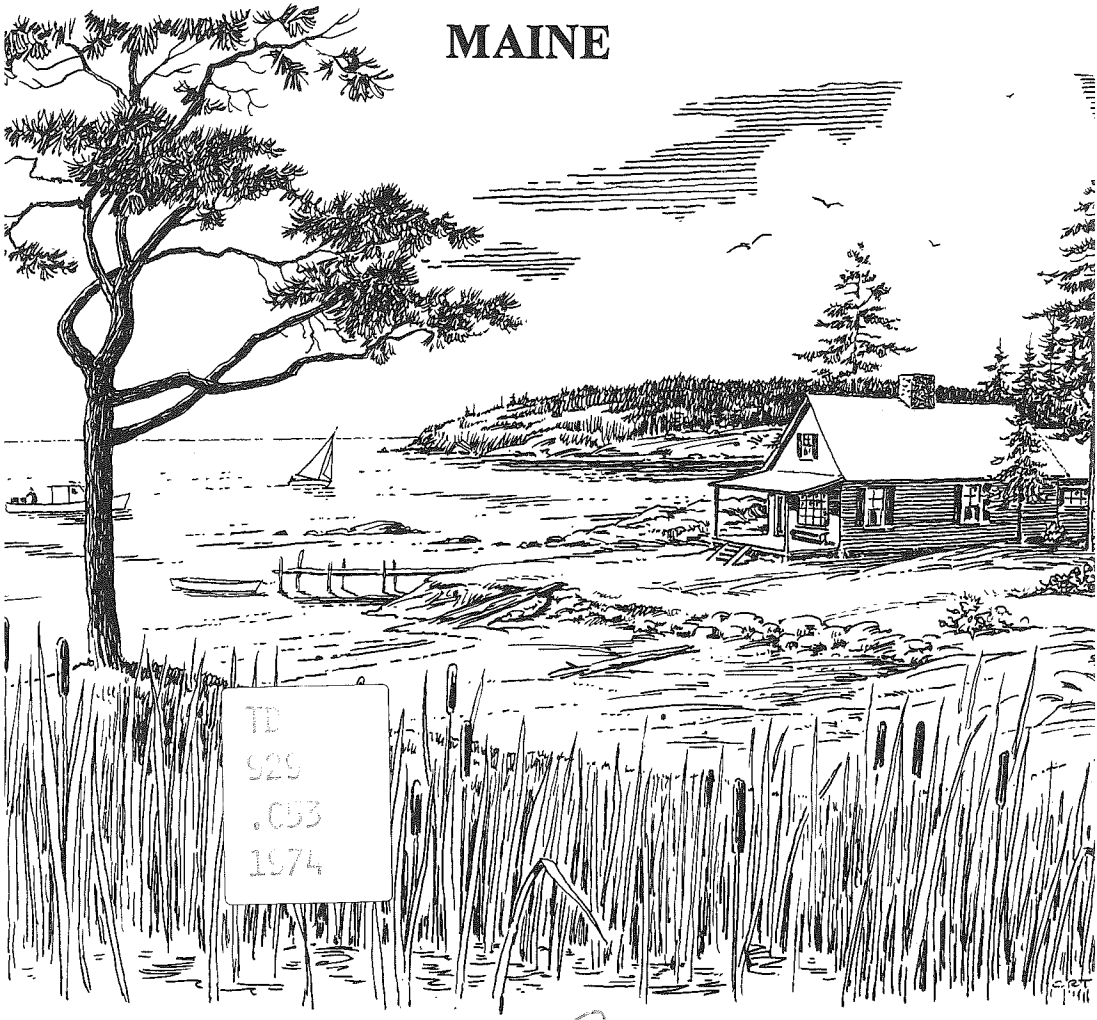
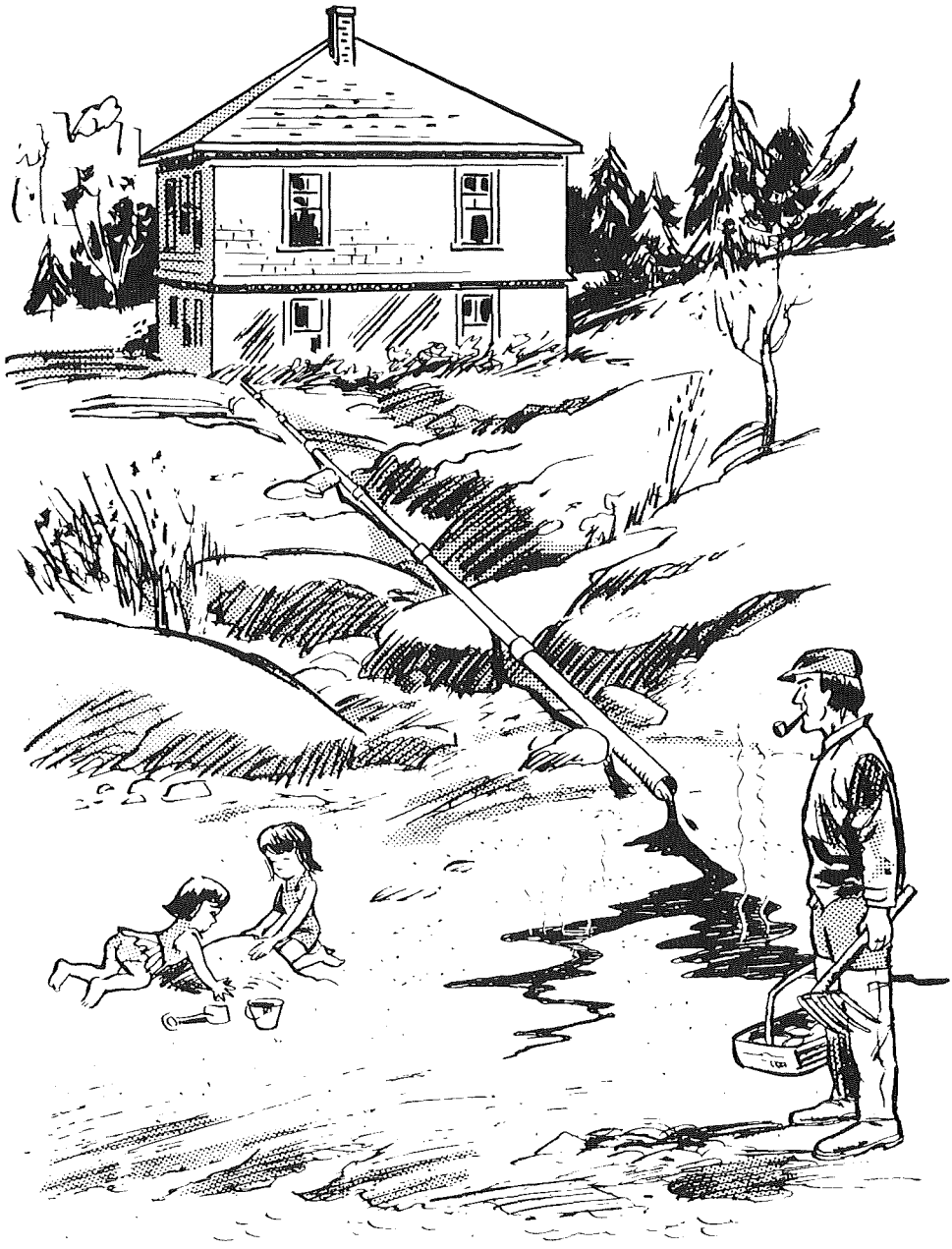
## PRIVATE SEWAGE DISPOSAL IN MAINE







**Maine Department of Environmental Protection**



## *Introduction*

A straight pipe discharging untreated waste into the water — for many years this has been an all-too-common sight in Maine. In many parts of the state, this condition still exists. It is one of the reasons for the present pollution in much of the inland and coastal waters.

Largely because of the rural nature of the state, some 50% of Maine households are not linked, and probably never will be, to municipal sewage systems. For the most part then, waste must be dealt with on an individual basis. The best solution to this problem is an underground disposal system; however, soil conditions in some parts of Maine rule this out. Some alternative means of disposal must be used; such as a self-contained system or treated discharge into the water.

The state, as part of its continuing effort to clean up our waters, has ruled that **no untreated discharge** of waste will be permitted in Maine waters after **October 1, 1976.** Under the state's timetable, homeowners currently discharging into the water should already have applied to the Department of Environmental Protection for a license to discharge (December 31, 1973). The next step is for these homeowners to determine the most appropriate method of treating their waste, and once approved, to install that method. All new houses must provide treatment before the home may be occupied.

By outlining the alternatives available, this booklet is intended to be a guide for both seasonal and year-round homeowners who must deal with waste disposal on an individual basis. The type of system you choose will, of course, depend on the conditions of your particular situation, but the goal of cleaning up Maine's waters will be the same. Individuals can do much by acting promptly to choose the best means available to deal with waste disposal, thereby eliminating untreated discharges into the water.

July, 1974

## *What Is Wastewater?*

Wastewater within the home generally comes from the combined water uses of the kitchen, bathroom, and laundry. It is comprised of "black water", or that which contains human waste, and "gray water" which is all other domestic liquid waste (from washing machine, bathtub, etc.) Although toilet and garbage waste constitutes only about ½ of the daily volume this portion contains more than ⅔ of the organic waste material. These wastes are primarily responsible for the odors and pollution associated with untreated wastewater. The gray water contains only ⅓ of the organic waste material (from soaps and food waste).

Volume depends on the size of the family, the number and use of appliances (sinks, toilets, dishwashers, garbage disposals, etc.), the availability of water and, to some extent, the amount of income. The average volume of wastewater for a single family house is 30-100 gallons per person per day, with 60 gallons per person per day a good average. Thus, a family of four would use an average of 240 gallons per day, though this might reach as high as 600 gallons per day for luxury homes. Conversely, a home with few appliances might use as little as 120 gallons per day.

## *Why Must Wastewater Be Treated?*

Wastewater **must be treated** because harmful and disease-causing bacteria present in the water contaminate adjacent shore and water areas.

The Department of Marine Resources has estimated that 353,000 acres of tidal flats support shellfish populations along the Maine coast, and of this total about **75,000** acres in 1974 were **closed due to pollution** — largely domestic sewage. This represents **20%** of the available area, yet in terms of productivity this would be closer to **50%.** This is particularly true in the heavily populated counties of York and Cumberland. The harvest of shellfish and marine worms forms a significant part of Maine's coastal economy.

Inland waters are also very much subject to domestic waste pollution. Here the situation is perhaps more critical, because lake water moves slowly and the flushing action present in tidal and river areas does not exist. Polluted shore areas represent a loss of recreation when these areas must be closed to water sports. In addition, the unsightliness and odor of pollution is undesirable both economically and aesthetically.

## *What Is Treated Wastewater?*

Treatment removes the floating and suspended materials that cause unsanitary and unsightly conditions on Maine's waterways. Solid material can then

be decomposed naturally by bacterial action in the treatment system. If water is to be reused in the system or discharged into a waterway, it would also have to receive treatment with a disinfectant. Wastewater can be treated at three levels: primary, secondary and tertiary. At the primary level, solids are removed from waste. Secondary treatment removes organic matter. Tertiary treatment removes some nutrients, such as phosphorous, which can cause algae problems in lakes and streams. Most systems described in this booklet treat water to the secondary level.

## *What Is The Most Effective Way To Treat Wastewater?*

On an individual homeowner basis, **underground disposal** is the most effective and least costly method. However, approval of individual waste treatment facilities will only be granted for those areas where public treatment facilities are not available.

A subsurface disposal system discharges partially treated wastewater into the ground. It should only be used whenever soil conditions permit. Normally a septic tank is used for this partial treatment. Such systems include leaching trenches, beds, chambers and mounds. The partially treated wastewater percolates (filters) down through the solid layers where it is acted upon by soil bacteria and other life forms, and is converted from organic material to simpler forms. The soil acts as a natural filter and removes many solids and the major portion of dissolved materials before the wastes reach ground water.

However, if soil conditions are not suitable, and sufficient filtering does not occur, this method may pollute the ground water and may become unsightly or odorous.

## *What About Discharging Waste Into The Water?*

If the soil conditions are not suitable for underground disposal and if the waste is properly treated, it may be possible to discharge into the water. The **direct discharge of treated wastewater** may be accomplished through several commonly used systems, such as filtering the effluent from a septic tank through a sand filter, and disinfecting it before discharge. In another method, a mechanical device provides biological treatment before the wastewater is disinfected and discharged into the receiving water.

## *Are There Other Means Of Disposal?*

Yes, a third possible group of alternatives to underground treatment or direct discharge of treated wastewater includes **waste separation and/or waste storage.** Using a waste separation technique, gray water wastes (laundry, shower, tub, bathroom sink) which are lower in organic content, are separated

out from toilet and garbage wastes. These can then be treated, disinfected and discharged into the water (overboard). In an area where it is not possible to discharge into the water, a gray water holding tank may be approved.

Black water wastes (toilet) may be stored in a holding tank and periodically taken to a suitable disposal area. (e.g. sewage treatment plant). In some methods, toilet wastes are burned. Black water systems **do not** accommodate garbage wastes, which must be disposed of in other manners, such as through a compost pile.

Storage of wastes may be suitable for less frequented homes such as week-end retreats, although these systems are expensive to operate. They are self-contained systems, good in areas when discharge into the environment is not permitted. Homes using holding tanks must be readily accessible to trucks since the holding tanks require frequent pumping. (As much as once a week). At the present time in areas around lakes, when underground disposal is not possible, some method of waste storage must be employed.

## *I Currently Have A Discharge License: What Choices Do I Have For Waste Disposal?*

| **CURRENT LOCATION OF DISCHARGE** | **CHOICE OF TREATMENT** (IN ORDER OF PRIORITY) |
|---|---|
| Coastal Waters | (a) Underground if soils are suitable or choice of: |
| | (b) Overboard discharge (treated) |
| | (c) Waste separation or storage |
| Large Flowing River | (a) Underground if soils are suitable – or choice of: |
| | (b) Overboard discharge (treated) |
| | (c) Waste separation or storage |
| Small Streams, Lakes, Ponds | (a) Underground if soils are suitable |
| | (b) Waste storage |

## *How Do You Determine The Best Type Of Disposal System?*

There are several factors you will want to consider before determining the system best suited to your particular situation.

For example:

—how many people will be using it — including weekend guests?
—will the disposal system be used in winter?
—is water and electricity available on the property?
—what is the type and depth of the soil in the area?
—what is the slope of the land?
—is the land wet or subject to a high water table?
—how much water will be used (e.g., number of sinks, washing machines, showers, etc.)?
—how much money can be spent for the system?
—how large is your lot?

Once you have gathered this information, the steps below should guide you in determining the right system:

**STEP I**

Contact a certified soil scientist, certified geologist, or registered engineer experienced in soils (or others licensed by the Department of Health & Welfare) to examine the soil and site conditions of your property and determine if an underground disposal system can be built. In some instances soil conditions may be suitable, but the proximity of wells, water courses, buildings, etc. may preclude subsurface disposal. (The local Plumbing Inspector or the Department of Health and Welfare will have a list of certified soil scientists).

Depending upon the outcome of Step I, the wise homeowner will follow one of two alternatives:

**STEP II**

ALTERNATIVE A

If the soil is found suitable for a subsurface wastewater disposal system, the Local Plumbing Inspector must be contacted to approve the type of system proposed. Combining the recommendations of the soils expert, the Plumbing Inspector and the specifications of the State Plumbing Code the homeowner should decide on and install a recommended system. An experienced contractor should build such an underground system, although it may be possible to construct it yourself. Either the Plumbing Inspector or the Department of Health and Welfare in Augusta can provide a copy of the State Plumbing Code.

ALTERNATIVE B

If the soil is found unsuitable for an underground disposal system, the homeowner should contact the Department of Environmental Protection, for a list of approved treatment systems (overboard or alternate). DEP can give advice as to the advantages and disadvantages of different systems once you have decided. It is important to **inform** the DEP of the type of system you propose to use before the deadline of **August 1, 1975.**

**STEP III**

Again, an experienced contractor will probably be needed, although the homeowner may want to construct the treatment system himself. Once the system is installed, the homeowner must inform the DEP. A field inspector from DEP may be sent to inspect the work. **The work must be completed by October 1, 1976.**

Although the final deadline is not until 1976, it is recommended that the entire system be built now or in stages. Many systems will have to be built by the 1976 deadline and if all are left until the last minute, it probably would be impossible to have them built by skilled and experienced contractors. **The law does not allow for extensions of time beyond the October 1, 1976 deadline.**

A checklist is available at the end of this booklet.

## *Direct Discharge Of Treated Waste — Specifically What Does The Law Require?*

Maine Statutes (MRSA Title 38) require that all existing discharges into the waters of the state not receiving treatment, or not receiving sufficient treatment, must be treated or discontinued by October 1, 1976, and preferably as soon as possible. The discharge (either by itself or in combination with other discharges) must not lower the classification or water quality of the receiving water. By August 1, 1975, all owners of discharges must submit data to the Department of Environmental Protection as to the type of system they plan to use. This system must be approved by DEP and installed and working by October 1, 1976.

Treated discharges will be permitted into coastal waters, large rivers and streams. However, even discharges receiving secondary treatment will not be allowed in small brooks, irrigation ditches, lakes and ponds.

## *Why Are Direct Discharges Limited To Large Or Flowing Waters?*

Generally, the amount of treatment provided by systems described in this booklet does not achieve a high removal of nutrient materials such as phos-

phorous and nitrogen. This may result in algae blooms in lakes and ponds. Moreover, the amount of flow in small streams or in lakes and ponds is not sufficient to insure adequate mixing and dilution of wastes. Particularly in small streams, discharge of treated wastewaters may cause water quality to be lowered, as many of these have little or no flow during the summer.

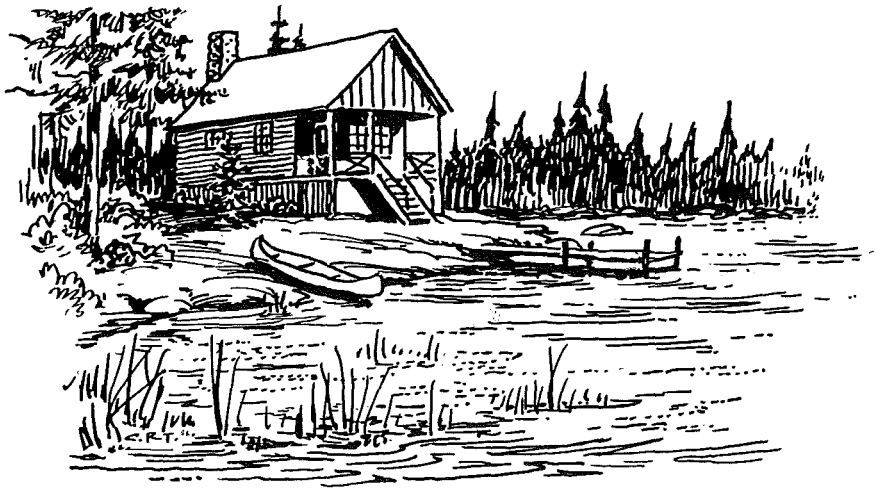
From a practical point of view, treatment systems suitable for direct discharge into lakes and ponds (tertiary treatment) are too costly for the average homeowner.

## *Who Administers The Law?*

The Department of Environmental Protection is responsible for licensing all discharges into Maine waters. It is the agency which must approve systems discharging treated waste directly into the water.

However, if the soils expert determines that soil conditions are suitable for underground disposal, such a system would be approved by the Local Plumbing Inspector under the State Plumbing Code. Plumbing Inspectors are licensed by the Department of Health and Welfare, which is responsible for enforcing the Code.

In unorganized territory, new and existing systems fall under the State Plumbing Code as above, or the Department of Environmental Protection when discharging into water. All new buildings must, in addition, obtain permits from the **Land Use Regulation Commission,** which includes demonstrating that an adequate sewage disposal system has been provided.



## *Types Of Disposal Systems*

In this section, we will look briefly at the three methods of sewage disposal and some of the systems available. Persons and agencies who can provide help and assistance are listed at the end of the booklet. Be sure to look at the State Plumbing Code for the exact specifications before you begin to build.

### DISPOSING OF WASTE UNDERGROUND

#### THE SEPTIC TANK

The septic tank is a widely used means of home waste disposal in combination with both underground and direct discharge waste disposal systems. It acts as a settling tank, accomplishing primary treatment only. The organic solids, from human and garbage wastes, sink to the bottom and are slowly decomposed. This material is called sludge. Lighter solids float to the top (scum) with liquid in between. The septic tank does not purify sewage, eliminate odors, or destroy solid material. It does remove solids from the wastewater so it can undergo further treatment.

The septic tank is a large rectangular or cylindrical tank made of concrete, steel, or reinforced fiberglass. It has baffles on each end to slow incoming wastewater and to keep solids from escaping. All wastes can go into a septic tank except for paper (other than toilet paper), although the use of garbage grinders is not recommended because of increased loading on the system.

Septic tanks are a highly reliable and effective method of treatment, **provided** they are carefully constructed and maintained. The soils must be suitable; not shallow bed rock or in a high water table and the site cannot be close to wells, water, or property lines. The tank must be large enough for the family and the number of appliances it will have to accommodate. A slightly larger tank will provide more complete treatment.

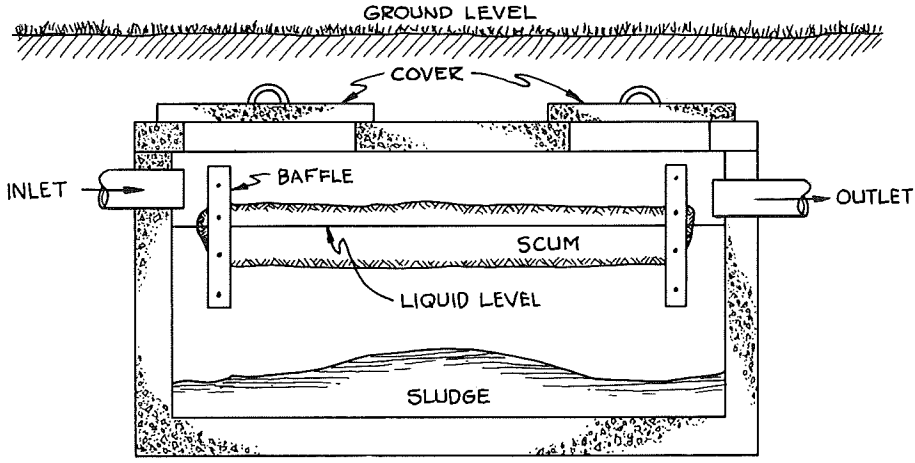
| Number of bedrooms | Capacity of tank (gallons) |
|---|---|
| 2 or less | 750 |
| 3 | 900 |
| 4 | 1000* |
| each additional bedroom | 250 |

*The Department of Health & Welfare recommends use of a 1000 gallon capacity septic tank for a single family dwelling.

Once every year the depth of sludge and scum should be checked. When the total depth of the sludge and scum exceeds one-third (⅓) of the liquid

depth of the tank, the tank should be pumped out. Under normal use this is every 2-3 years. Make sure you find a **qualified** service agent to do this.

Septic tanks are used with
1) leach field (trenches)
2) leaching chambers
3) subsurface disposal beds
4) mounds

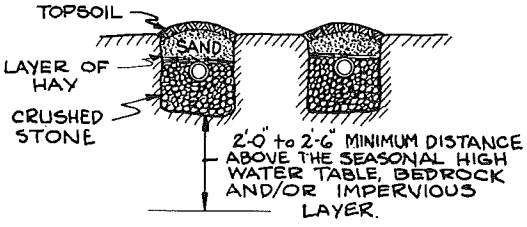



CROSS SECTION OF A TYPICAL
CONCRETE SEPTIC TANK

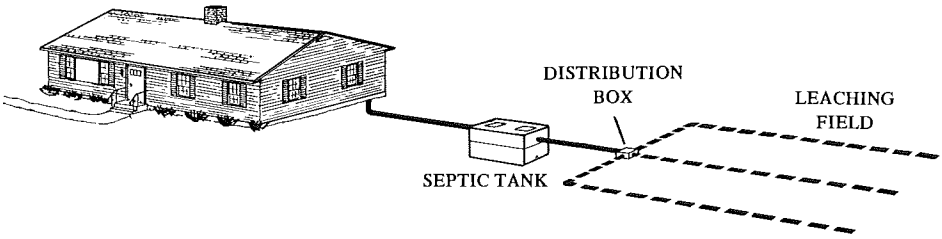
## THE LEACH FIELD TRENCH SYSTEM

In these systems wastewater flows from the septic tank directly into a leaching field. This is a series of long narrow trenches filled with crushed stone which surround a perforated pipe. The crushed stone layer is covered with hay and the trench is filled with sand and covered with topsoil. The pipes should be pitched so that the liquid can be distributed throughout to allow more effective percolation (filtering) into the ground. The size of the leach field must be large enough to allow for adequate filtering. This depends on factors such as the size of the family, the slope of the land, and the type of soil.

CROSS SECTION
OF A TYPICAL
ABSORPTION TRENCH



TYPICAL LAYOUT OF A SEPTIC TANK
AND LEACHING FIELD

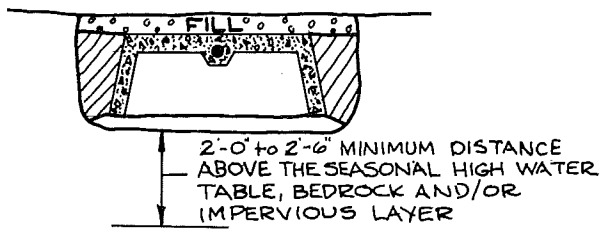



If the leach field is placed in poor quality soils, slow decomposition will result and the soils will become progressively clogged. Eventually water may break through the surface causing an unsightly and odorous condition. Similar problems may occur if the leach field is placed under a paved area such as a driveway. Keep it away from trees and bushes or you may have problems with roots, and avoid driving heavy equipment over the leach field as it will compact the soils. It's a good idea to mark leach field boundaries, in case repairs have to be made.

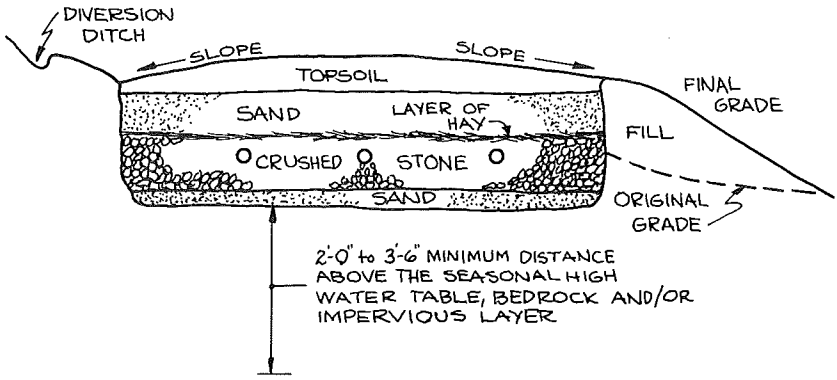
## THE LEACHING CHAMBER

Sometimes a series of concrete leaching chambers is used instead of a leach field. A series of open concrete boxes are placed end to end with the open side down and covered over with soil. Wastewater flows through these chambers and filters into the soil, where it is purified in the same manner as the leach field.

CROSS SECTION
OF A TYPICAL
LEACHING CHAMBER



## SUBSURFACE DISPOSAL BEDS




CROSS SECTION
OF A TYPICAL
SHALLOW FILTER BED

Here, waste from the septic tank flows into a distribution box, then into a sand filter bed. These beds are similar to leaching trenches, with a perforated pipe running through a layer of sand and crushed stone. They are much wider than leaching fields, however, and have an intermediate layer of sand. They can be constructed above or below ground depending on the height of the water table and/or depth of the rock. Because the beds are smaller, they can be used in areas where the property is not large enough for the long trenches required in the leach field.

## MOUNDS

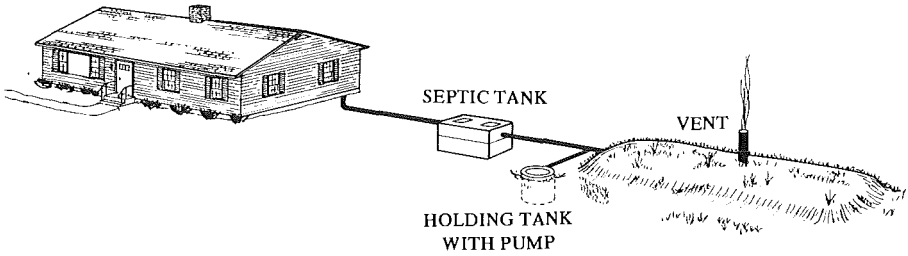
A mound is actually an above-ground leach field.

Wastewater flows from the septic tank into a second tank where a pump periodically lifts a portion of the wastewater to the mound. Then it slowly filters back down to the ground. The mound is made of porous sandy soil with a trench out through the sand. Again a perforated pipe is used, laid on crushed stone and covered with hay and at least 24 inches of sandy soil. The entire mound is graded to provide for runoff and covered with vegetation. A clay barrier built around the mound keeps liquid waste from seeping out onto surrounding ground.

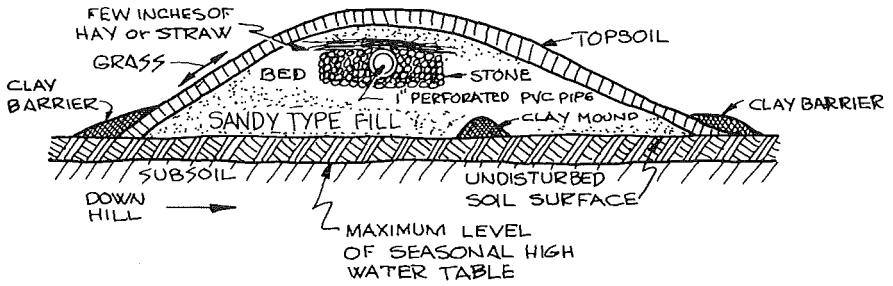
This system has the advantage of being useable in areas where soils are marginal or where a high water table exists. But the bedrock or ground water

still must be at least 15 inches below the surface. The mound is a more efficient means of dealing with wastewater, because surface soils can absorb more water than sub-surface soils. It is a more expensive system, but once installed, requires little maintenance except that the pump must be kept in running order.

TYPICAL LAYOUT OF A SEPTIC TANK
WITH MOUND TYPE DISPOSAL AREA




CROSS SECTION
OF A TYPICAL
MOUND TYPE DISPOSAL AREA



## DISPOSING OF WASTE "OVERBOARD"

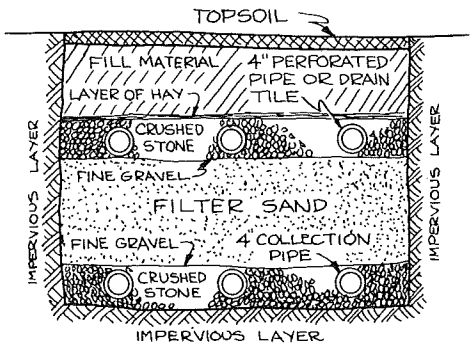
When treated waste is discharged into a body of water, the system is called an overboard system. Overboard methods are categorized as **treatment** methods rather than **disposal** methods, because the wastewater is not disposed of permanently — it is treated, disinfected, then discharged. Remember that overboard systems are only approved by the Department of Environmental Protection if an underground system is not feasible. Currently the septic tank/sand filter method can be used for single family homes on inland waters, excluding lakes, ponds and small streams, while the aerobic treatment units are approved only for tidal and salt water discharges. Disinfection to kill bacteria is **required** of all units discharging into the water, and the effluent must be tested regularly.

### SEPTIC TANK/SAND FILTER/DISINFECTION METHOD

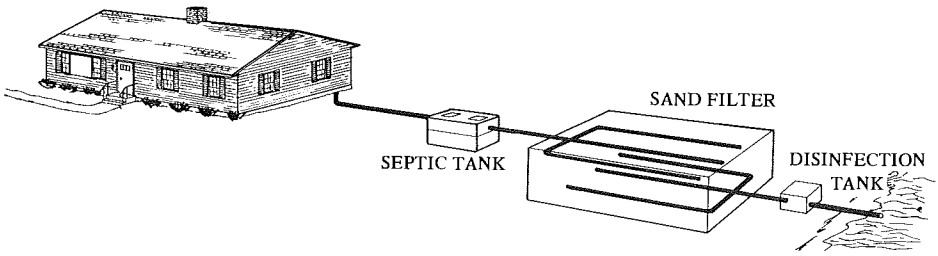
In this system the partially treated wastewater goes from the septic tank into a second tank which periodically filters water down through a sand filter. This allows the filter to dry out somewhat before the next dose. As the water filters down the wastes are decomposed and purified by bacteria. The water is then collected at the bottom and piped to a disinfection unit. After disinfection, it can be discharged into the water.

The sand filter must have a bottom lining of clay or plastic to prevent wastewater from leaking out. Starting with the lining, place a layer of crushed stone, then perforated collection pipes, followed by a layer of sand and another layer of crushed stone. Distribution pipes run through this second layer of stone. Finally 8-12' of topsoil is placed on top. This system provides a very reliable treatment method and maintenance is low because there are no mechanical parts. The initial cost is high, however, and the filter may have to be replaced after several years.

CROSS SECTION
OF A TYPICAL
"UNDER-DRAINED" SAND FILTER



TYPICAL LAYOUT OF A SEPTIC TANK,
SAND FILTER AND DISINFECTION UNIT

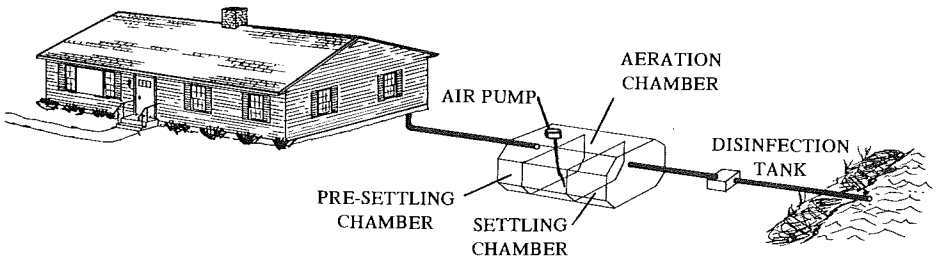



## MECHANICAL TREATMENT UNITS / DISINFECTION METHOD

These are packaged systems which treat wastewater much in the same way as large municipal treatment plants. A variety of units is available. Usually, the water passes through a series of compartments in which the solids settle out. Much treatment results from aerobic decomposition by oxygen-dependent micro-organisms which live on the solids. Air must therefore be introduced. This is done by a blower or mixing device (and sometimes both) which brings the micro-organisms in contact with the dissolved waste materials. The organisms use the nutrients (phosphorous, organics, carbon, nitrogen, etc.), as well as the oxygen, for energy and growth. Thus, a major portion of the waste material is converted into carbon dioxide, water and sludge. After mixing, the wastewater goes into a settling area where sludge settles out. The liquid portion then goes into another area for disinfection.

Mechanical treatment units can produce a good quality effluent but only if they are properly operated and maintained. Decomposition by the micro-organisms requires a steady source of both electrical power and wastewater. Thus, these units are not suitable for weekend retreats. In order to insure that they are working properly, the Department of Environmental Protection **requires a service contract** between the owner of the unit and a competent service organization.

TYPICAL LAYOUT OF A MECHANICAL
TREATMENT UNIT AND DISINFECTION TANK



## PACKAGE BIOLOGICAL TREATMENT SYSTEMS

| MANUFACTURER | NAME | TYPE | GALLONS PER DAY | FACTORY REPRESENTATIVE |
|---|---|---|---|---|
| Competent Contractor | Sand Filter | Filtration | All Amounts | Information available from Consulting Engineers |
| Cromaglass Corporation<br>Williamsport, Pa. 17701 | Cromaglass | Extended<br>Aeration | 500<br>900<br>1,500 | Mr. Donald T. Leavitt<br>Boothbay Harbor,<br>Maine |
| Jet Aeration Company<br>750 Alpha Drive<br>Cleveland, Ohio 44143 | Jet | Extended<br>Aeration | 500<br>2,500 | Superior Concrete Co., Inc.<br>982 Minot Avenue<br>Auburn, Maine 04210 |
| Multi-Flo, Inc.<br>500 Webster St.<br>Dayton, Ohio 45401 | Multi-Flo | Extended<br>Aeration | 500<br>2,500 | Edwards Supply Co., Inc.<br>245-249 Commercial Street<br>Portland, Maine 04111 |
| Nayadic Sciences, Inc.<br>Village of Eagle<br>Uwchland, Pennsylvania 19480 | Nayadic | Extended<br>Aeration | 600<br>1,000<br>2,500 | Enco Sciences<br>Box 591<br>Rockland, Maine 04841 |

NOTE: State of Maine law requires that **each** installation be approved by the appropriate State agency.

For installations where the final effluent is absorbed underground:

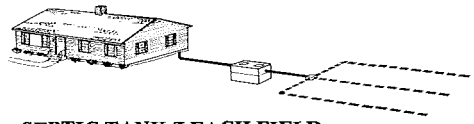
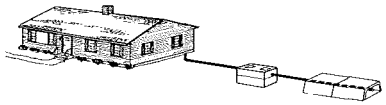
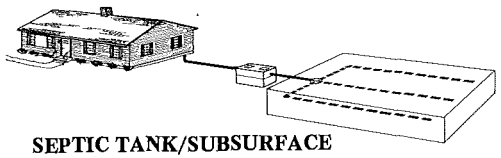
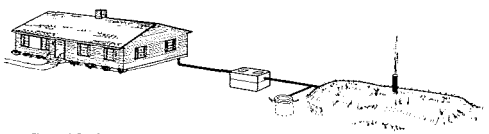
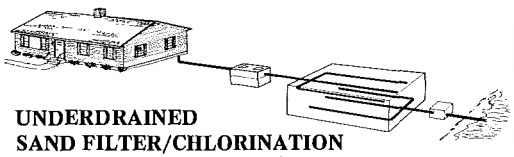
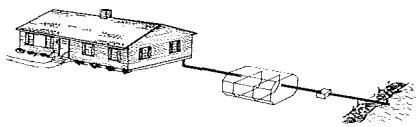
Department of Health and Welfare, Division of Sanitary Engineering, State House, Augusta

For installations where the final effluent is discharged to surface water, fresh or ocean:

Department of Environmental Protection State House, Augusta, Maine 04330

The above listing is for the convenience of people seeking the location of manufacturers of small waste treatment plants. The list is not necessarily complete nor should it be construed as an endorsement.

The above systems can, with proper installation and maintenance, meet the discharge requirements of the Department of Environmental Protection.

| METHOD | INSTALLATION | APPROXIMATE INITIAL COST (1974) |
|---|---|---|
| UNDER-GROUND DISPOSAL SYSTEM |  **SEPTIC TANK/LEACH FIELD ABSORPTION BED** | $1,000 - $2,500 Depends on length of leach field required and length of pipe required for proper location of field. |
| |  **SEPTIC TANK/LEACH FIELD CHAMBERS** | $1,500 - $3,500 Depends on number of chambers needed and piping required for proper location of chambers. |
| |  **SEPTIC TANK/SUBSURFACE DISPOSAL BEDS** | $1,000 - $5,500 Depends on size of filter bed required, piping required for proper location and need for pumping. |
| |  **SEPTIC TANK/MOUND** | $3,000 - $7,500 Depends on size of mound required, piping needed for proper location of mound and whether fill and/or loam must be trucked. |
| OVER-BOARD DISCHARGE METHOD |  **UNDERDRAINED SAND FILTER/CHLORINATION** | $3,000 - $6,000 Depends on location of filter and piping used. |
| |  **MECHANICAL UNIT/CHLORINATION** | $2,000 — $6,500 Depends on piping required, installation required, particular unit purchased and size of unit. |
| ALTER-NATIVE METHOD |  **HOLDING TANK** | $2,000 - $4,000 Depends on location, piping required and size of unit. |

| OPERATING COST | ADVANTAGES | DISADVANTAGES |
|---|---|---|
| Very little. Septic tank requires pumping every 2-3 years. | 1. Least costly of all disposal methods.<br>2. Requires little maintenance.<br>3. Provides highly effective and reliable treatment.<br>4. No power and no moving parts unless a pump is required.<br>5. Operationally stable. | 1. Requires specific soil conditions with adequate space.<br>2. Cannot be used in shallow bedrock areas.<br>3. Cannot be used in areas of high water table.<br>4. Cannot be close to wells and surface waters.<br>5. Soil may become clogged if maintenance program is not followed. |
| Very little. Septic tank requires pumping every 2-3 years. | 1. Next least costly of all disposal methods.<br>2. Requires little maintenance.<br>3. Provides highly effective and reliable treatment.<br>4. No power and no moving parts unless a pump is required.<br>5. Operationally stable. | 1. Requires specific soil conditions with adequate space.<br>2. Cannot be used in shallow bedrock areas.<br>3. Cannot be used in areas of high water table.<br>4. Cannot be close to wells and surface waters.<br>5. Soil may become clogged if maintenance program is not followed. |
| Very little. Septic tank requires pumping every 2-3 years. | 1. Disposal beds can be used on some lots where underground disposal is suitable but where lot size is too small for leaching trenches.<br>2. No mechanical parts are involved if pumping is not required.<br>3. Requires little or no maintenance unless a pump is needed. | 1. Requires specific soil conditions with adequate space.<br>2. Cannot be used in shallow bedrock areas.<br>3. Cannot be used in areas of high water table.<br>4. Cannot be close to wells and surface waters.<br>5. Soil may become clogged if maintenance program is not followed. |
| Varies. Depends on whether pump or siphon used. (No power required with siphon). Septic tank requires pumping every 2-3 years. | 1. Mounds can be used in areas where impervious soil will not allow trenches or beds.<br>2. Surface soils tend to absorb more water than subsurface soils.<br>3. The wind helps to keep the bed dry.<br>4. Vegetation on the mound or bed conceals the field and uses up a portion of the wastewater. | 1. Expensive to build.<br>2. May require pumping.<br>3. Requires maintenance and power costs if mechanical equipment is used. |
| Cost of chlorine tablets depends on amount of use — Septic tank requires pumping every 2-3 years. | 1. No mechanical parts.<br>2. Little or no maintenance.<br>3. Can be used in areas where impervious soils or bedrock exist.<br>4. Most reliable overboard treatment method. | 1. Costly to build.<br>2. The filter may have to be replaced after several years. |
| $30 - $60 a year plus chlorine costs. Service Contract: $40 - $100 a year. | 1. Mechanical units can be used in areas unsuitable for underground disposal.<br>2. Mechanical units provide good quality treatment if properly operated and maintained.<br>3. They require a small area for installation. | 1. There is a possibility of mechanical failure.<br>2. Mechanical units may be adversely affected by surge flows or non-regular use.<br>3. Mechanical units require regular maintenance and service. |
| $70 - $100 a month for a family of four with a pump-out once a month. | 1. Holding tanks can be used for storage of wastes in areas where underground disposal is not suitable.<br>2. Can be used in areas where an overboard discharge is not possible. | 1. Require frequent pumping out.<br>2. May be expensive to purchase.<br>3. Cannot be used in inaccessible areas.<br>4. Very costly to operate. |

## DISINFECTING WASTE

Disinfection is required for all systems which discharge into water. There are several methods available, but generally a disinfection agent is added to a tank which follows the mechanical unit or sand filter. With all overboard systems, the homeowner must make a series of tests (either by himself or a service company) to make sure that the solid material is removed and harmful bacteria are destroyed before the wastewater is discharged to a body of water. Examples of tests are shown on p. 26.

Chlorine is probably the most widely used disinfectant. It is sold as a gas, as a solution of hypochlorite, or as a solid hypochlorite. Whatever the form, enough chlorine must be provided to destroy all harmful organisms and bacteria. The amount of chlorine required varies with the type of system used. Chlorine gas is commonly used in municipal sewage treatment plants. Gas is **very hazardous** to handle however, and is **not recommended** for home use.

Sodium hypochlorite is available in a solution. It will corrode ordinary metals, and should be handled in glass or plastic containers. The solution can be pumped directly into the wastewater or injected into a stream of water, which is then added to the wastewater. Several types of feeder systems are available.

Calcium hypochlorite comes in dry form. After being diluted in water, it is fed to the wastewater by a pump or other type of feeder equipment. The equipment is inexpensive and not hard to operate.

Solid hypochlorite in sticks or pellets has recently come onto the market and has proven quite successful in Maine. Chlorine tablets are placed in a box which contains slotted tubes. Wastewater enters the box and flows around the tubes, dissolving the chlorine.

## OTHER METHODS OF DISPOSING OF WASTES

### SEPARATING AND/OR STORING WASTE

Alternative types of wastewater treatment and/or disposal systems have several advantages. They can be used where underground disposal is not possible, in houses used only occasionally, in areas limited in water or electricity, or in areas unsuited for overboard treatment (e.g., lakes and ponds). The wastewater is separated into gray water (bath, shower, washing machine, etc.) and black water (human waste). Thus, more intensive treatment can be given to the small volume of black water, while gray water can be treated with less expensive methods.

Black water treatment systems described **cannot** handle garbage wastes. Since garbage grinders **must not** be installed, garbage wastes would have to be handled in another method, such as composting. The system of separation of

wastes uses less water, since in this system the toilet unit is generally a low water or waterless device. Initially, the system may involve a change in plumbing. Maintenance will vary with the system chosen. If a lot is suitable for underground disposal, but is limited in size, a separated wastewater system with an undersized leach field may be approved with conditions by the Local Plumbing Inspector.

## TREATING GRAY WATER

Typically, the system for treating the separated gray waters is a **septic tank,** where any solids can settle out and be decomposed biologically. The water then flows into a disinfection tank and can be discharged into the water. This system has the advantage of not requiring a filter bed as in an unseparated system, because there is little organic waste in the water.

In an area where it is not possible to discharge into the water, a **gray water holding tank** may be approved. This tank should hold at least 2,000 gallons, with a recommended size of 4,000 gallons. In order to reduce the volume of water as much as possible, low water devices should be installed on bathtubs and sinks. Washing machines require too much water and cannot be used. The system must also have an alarm to indicate when the tank is full, and the tank must be vented, protected from frost, and also from possible flotation by ground water.

## TREATING BLACK WATER

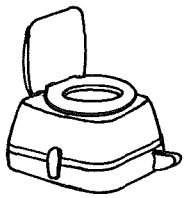
Most black water systems are self-contained units which use little or no water. Some examples follow:

## INCINERATOR TOILETS

Incinerator toilets burn up solid waste and evaporate liquid, leaving only sterile ashes. Most models run on electricity or natural or propane gas; some use a 12 volt battery. They are equipped with blowers to remove odors, heat, and vapors, but in most cases additional bathroom vents are necessary. (These vents are generally not included in the cost of the units).

Incineration starts automatically by closing the cover or setting a timer switch. The ashes must be disposed of weekly and the unit cleaned. These types of toilets are relatively inexpensive and easy to install. They have the additional advantage of being feasible on islands or in areas of high water tables.

## SLIDING VALVE TOILETS



These units contain 2-6 gallons of water, plus a package of deodorizing chemical. They come with a holding tank and toilet structure and are generally portable. However, if a sliding valve toilet is permanently installed, there must be an external holding tank or a means to discharge to some other type of system, as well as an external water supply. Sliding valve toilets are relatively simple to operate. A pedal is pushed and a valve slides open. A swirl of water and chemical washes waste materials from the bowl down into a small holding tank. Depending on the model, the unit can handle 50-130 flushes before it must be cleaned and refilled with water and chemicals. Although these units are good for remote cabins, since they do not require running water or electricity, you must dispose of the waste in the holding tank periodically.

## CHEMICAL TOILETS

Chemical toilets contain a lift-out bucket in which there is a deodorizing chemical. Some models include a venting system. The bucket requires periodic dumping, cleaning, and refilling with the deodorant. Chemical toilets are inexpensive to maintain and install (most are portable), making them ideal for remote homes where use is occasional and where there is no running water or electricity. Minor odors may develop with the unit, however, and there must be a means to dump the tank without polluting the environment.

## RECYCLE TOILETS

Recycle toilets treat wastewater by filtration, separation or aeration, (or all three). The flushing liquid (either water or oil) then goes into a tank to be reused. With only occasional changes necessary, the recycling process saves large volumes of water. Many models of recycle toilets are available.

1. Chemical Recirculating Toilets

Chemical recirculating toilets are similar to portable sliding valve toilets in that the waste is flushed into a holding tank by a water-chemical mixture. Before use again, the water is filtered. The system uses a hand or automatic pump. The whole system can be portable or permanently installed, but if permanent, there must be a supply of water and an external holding tank. They are relatively inexpensive, but holding tank waste must be dumped frequently and the water-chemical mixture changed approximately every week.

2. Separation-Type Recirculating Toilets

These toilets use a special chemical fluid as the flushing medium. When the toilet is flushed, the waste/fluid flows into a holding tank where waste materials settle out. The fluid is pumped off the top of the tank, treated and, once cleaned, is returned to the tank. This system is designed to stop functioning if the holding tank becomes full or if for some other reason the unit breaks down. The holding tank must be pumped out yearly. Although they are expensive and require yearly service, these self contained systems provide odorless and bacteria-free waste disposal in areas unsuitable for underground disposal. They do require a source of power to operate the pump.

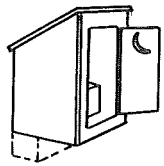
3. Biological Recycle Toilets

There are several types of recycle toilets that use biological methods for purifying waste water for recycling. Flushed wastewater is pumped into a tank for filtering. The liquid portion is disinfected before it is reused for flushing. In most models, solid material decomposes within the unit, but sludge must be pumped out every year or two. When the tank is pumped, it must be refilled with fresh water. Some models occasionally require the addition of bacteria to aid in decomposition. It can be added by dropping a capsule or packet into the toilet. The filters must be replaced approximately every year. Most units require a source of power and some require special plumbing.

4. Biological Recycling Units (Mechanical)

In this system, liquid wastes are filtered down through a bed of gravel and a special filter, which purifies the water. The cleaned liquid is then used for flushing, by means of a hand pump. This unit requires venting to eliminate odors. If soil conditions do not permit the effluent to be discharged into the ground, a holding tank is necessary. If so, chlorine tablets will be needed and the tank will have to be emptied periodically. No water or electricity is required, but this system must be used 4-5 times a day to operate effectively. If not used for 2-3 days, it requires a digesting powder. Also, if the temperature goes below 50°, the unit must be heated.

## OUTHOUSES



Generally, a well built, properly maintained privy is an environmentally sound solution to the problem of human waste disposal. Again, because privies discharge into the ground specifications for their construction will be found in the State Plumbing Code.

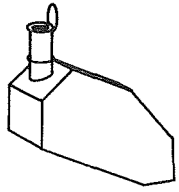
1. Open Pit Privy

This type of privy consists of a small building on top of a hole in the ground which has been lined with timber. Open pit privies should not be located on a high water table, on a flood plain, or in an area where bedrock is within 24' of the surface. In the pit, the wastes decompose aerobically into solid materials, liquids and gases. This liquid, along with liquid wastes, seeps into the ground, so the drainage must be good. When the pit is filled to within 1 foot of the top, it must be emptied or abandoned. Pit privies are one of the most inexpensive and effective means of waste disposal. Venting the house should eliminate minor odor problems.

2. Sealed Vault Privy

This system is similar to the open pit privy except that the small building sits on top of a holding tank or sealed vault. The tank, which should have a capacity of 1,000 gallons, holds wastes which must be periodically pumped out. They must be air and water tight except for a waste entry hole and a vent stack. This ventilation should extend from the vault to the roof. The building should have a self closing door. As with the open pit, sealed vault privies should not be installed on a flood plain, or a high seasonal water table.

## COMPOSTING TOILETS



In this system, human and garbage waste are decomposed in much the same manner as the garden compost heap. Wastes are deposited in a decomposition chamber by vertical chutes located in the toilet and kitchen. The decomposition chamber is generally located in the basement or buried in the ground and has three sloping sections. Decomposition takes place in the lowest chamber, which has vents to allow air to aid in the decomposition process. Heat generated by waste causes this air to rise up from the chamber, where it is released by a vertical duct to the roof. Decomposition can take from several months to

two years. Because it needs a certain amount of heat to operate properly, the system must be insulated for cold weather operation.

Initially, a layer of garden soil or humus followed by a layer of leaves is placed on the bottom of the decomposition chamber to absorb liquid and slow down its rate of passage. After about two years, humus can be removed from the unit at a rate of 2-3 pailfuls a year, and can be used as fertilizer.

## OTHER SOLUTIONS

1. Holding Tanks

These are watertight receptacles which receive and hold wastewater prior to disposal by some other means. As a greater volume of liquid waste is involved, the tank will need pumping more often and the system will be quite expensive. Holding tanks will only be approved by the Department of Health and Welfare for existing structures where no other solution is possible.

2. Pumping to a More Favorable Location

In a few cases, pumping wastewater to a better location may be more economical than providing an on-site treatment system. Examples might include pumping waste to a nearby municipal treatment facility, or pumping to an underground disposal system at another site. In some cases, several cottages might consider sharing a system.

## MAKING SURE THE SYSTEM IS WORKING PROPERLY

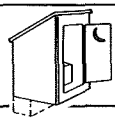
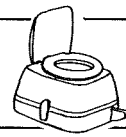
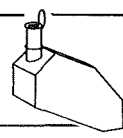
One of the most important things in insuring a successful system is careful installation, according to the proper specifications. Problems will occur if the soils are not suitable for the type of system chosen, if the septic tank is too small, or if there is a seasonally high water table. A system may be installed by the homeowner, or by an experienced contractor. In any case, the homeowner should consult the State Plumbing Code for specifications for the system.

## INSPECTING THE SYSTEM

Once the system is installed, it must be maintained. In many cases, the homeowner is qualified to make sure that the system is in good working order. Due to the complex nature of mechanical treatment devices, however, a **maintenance contract** between the sales or service company is **required.**

All treatment devices should be inspected periodically by the owner. The frequency of inspection will depend on the unit used. Septic tanks for example, should be inspected yearly, sand filters monthly. All other units should be inspected weekly. All chlorination equipment on overboard systems should be inspected weekly to make sure they have not run out of disinfectant. It is a good idea to inspect the system weekly even if a service contract has been made.

# A FIELD GUIDE TO THE TOILETS

| | Manufacturer or Distributor | Hookups Required | Principle of Operation |
|---|---|---|---|
|  Outhouse | Homemade | none | Wastes biodegrade in pit and seep into soil. Pit gradually fills and outhouse must be moved. |
| Conventional Flush Toilet  | Ubiquitous | 3/8" water<br>3" waste | Wastes are siphoned through a trap by a sudden rush of water. |
|  Sliding Valve Toilet (fixed) | Thetford<br>Mansfield | 3/8" water<br>3" waste | Pedal opens valve in bottom of bowl and actuates swirl of fresh water to rinse bowl. |
| Sliding Valve Toilet (portable)  | Thetford<br>Corlon<br>Sears | none | Same as above, but carries own water supply. Detachable holding tank with handle for dumping of waste. |
|  Marine Toilet | Any marine supply house. | 3/4" hose inlet<br>1 1/2" hose outlet | Hand pump brings water to bowl. Valve is turned, same pump ejects wastes. Can pump wastes uphill. |
| Chemical Toilet  | Sears<br>Wards | vent only | Wastes drop directly into bucket of deodorizing chemical. Bucket is dumped and recharged periodically. |
|  Recirculating Chemical Toilet | Mansfield<br>Monogram<br>Thetford | Varies from no hookups, to 115V and 3" waste, to 12V battery and holding tank. | Pump swirls filtered, treated wastes thru bowl. Unit fills up, must be dumped and recharged with chemical. |
| Digesting Toilet  | Hawkeye | 2" vent hose, small effluent hose, 115V elect. | Microorganisms digest wastes aerobically. Hand pump uses effluent for flush. Small outflow of harmless, clear effluent. |
|  Incinerator Toilet | LaMere Research Products | 115V or 12V electricity, 4" vent, 3/8" gas optional. | Wastes are incinerated in timed cycle after each use. Ash must be removed periodically. |
| Composting Toilet  | Clivus Multrum | 6" vent | Garbage and human wastes are digested by microorganisms, producing fertilizer. |

ADDRESSES OF MANUFACTURERS AND DISTRIBUTORS

Clivus Multrum Inc.
14 A Eliot St.
Cambridge, Mass. 02138

Corlon Mfg. Corp.
1711 Floradale
S. El Monte, California 91733

Hawkeye Purification, Ltd.
1827 - E State St.
Bettendorf, Iowa 52722

LaMere Industries, Inc.
Walworth, Wis. 53184

The above listing is for the convenience of people seeking information about toilet systems. The list is not necessarily complete nor should it be construed as an endorsement.

| Approximate Initial Cost 1973 | Approx. Monthly Operating Cost, Family Use | Water Consumed Per Use | Liquid Waste Generated Per Use | Advantages | Disadvantages |
|---|---|---|---|---|---|
| $0 - $75 | $0 | none | Less than one pint | Easy, inexpensive, no pipes, no water required, no moving parts. | Unpleasant odors, cold in winter, inconvenient of access, can contaminate water sources. |
| $25 and up | Depends on cost of water; family of 4 would use about 4,000 gallons per month for flushing. | 5 - 7 gallons | 5 - 7 gallons | Clean, odorless, relatively easy to repair, relatively cheap to buy. | Uses enormous quantities of water to dilute small quantities of wastes. Ultimate disposal of sewage is a problem. |
| $100 - $125 | Depends on cost of water; family of 4 would use about 100 gallons per month for flushing. | Approximately 1 pint (quantity used depends on how long pedal is depressed). | Approximately 1 pint. | Fresh-water flush but very low water use. No chemicals or recirculating. Can be used as mobile unit with holding tank. | More expensive and more complicated than flush toilet. Sewer lines clog more easily due to weaker flush. |
| $100 - $120 | Ditto, plus required deodorizing chemical for holding tank. | Ditto | Ditto | Ditto, but is compact and portable. Holding tank can be carried into public rest room for dumping. | Must be emptied and refilled periodically. |
| $75 - $200 | $0 at sea; otherwise, cost of water only. | Approximately 1 quart., | Approximately 1 quart. | Relatively low water useage. Can pump its waste uphill. Pumps its own water. | Clogs relatively easily. Relatively complicated to use. Pollutes waterways in marine use. |
| $30 - $40 | Varies, but is low. | negligible | Less than 1 pint. | Cheap, simple. | Little more than an indoor outhouse. Disposal of wastes is problematical. |
| $200 - $250 | $6 - $10. Must be dumped every five days for family of four. | negligible | Less than 1 pint. | Uses little water and generates little sewage. Can be used as mobile unit. | Relatively complex, relatively costly to buy and use, requires frequent dumping and recharging. |
| $230 - $695 depending on level of expected use. | About $1 for electricity (to run aerator) and $1 for microorganism cultures. | negligible | Negligible; much is evaporated through vent. | Uses no water, produces little effluent. Relatively easy hookup. Some models can be used as mobile units. | Requires weekly addition of microorganism cultures. |
| $650 - $750 | Depends on price of fuel; uses about 1/4 lb. gas per cycle, or equivalent electricity (Roughly .08 kwh). | none | None (liquids are vaporized into atmosphere). Small amount of ash must be removed weekly. | No liquid wastes generated, and very little solid waste. | Uses energy. Some models require use of paper bowl liner with each use. Relatively complex mechanism. |
| About $1,000 | None, some value created in fertilizer. | none | None (liquids evaporate). | Puts the nutrients back on the land. No moving parts. Little maintenance. No water or sewer hookups. | High initial investment. Unit is very large, requiring considerable basement space. |

Mansfield Sanitary, Inc.
Perryville, Ohio 44864

Monogram Industries, Inc.
6357 Arizona Cir.
Los Angeles, California 90045

Research Products Mfg. Co.
2639 Andjon St.
Dallas, Texas 75220

Sears, Roebuck and Company
Minneapolis, Minn. 55407

Thetford Corp.
P.O. Box 1285
Ann Arbor, Mich. 48106

Montgomery Ward and Co.
Chicago, Illinois

Material furnished compliments of MAINE TIMES

## TESTING THE SYSTEM

Below are two tests you can use to determine if your wastewater has been properly treated before it is discharged.

### Settleable Solids: Weekly Test

1. Use a clear **quart** size jar.
2. Fill the jar up to the top with effluent water from the treatment unit. The water should be collected where it comes out of the chlorination unit.
3. Allow the water sample to stand for 30 minutes.
4. Examine the sample after 30 minutes. If no material has settled to the bottom of the jar, the treatment unit is working satisfactorily. If there is 1/8 inch or more material on the jar bottom maintenance personnel should examine the system.

### Chlorine Residual: (amount of chlorine) Weekly Test

This test indicates how well the treated wastewater has been disinfected. If approximately 1 part per million (ppm) of chlorine is present in the effluent, most of the bacteria have been killed.

1. Chlorine residual can easily be determined by using a "swimming pool testing kit". These kits cost about $5.00 and have enough materials for many tests.
2. Collect in a clean jar a sample of effluent as it flows from the chlorination unit.
3. Follow the directions in the "test kit" to determine the amount of chlorine present. The test basically involves adding a chemical to the sample. The chemical will turn the sample a specific color depending on the amount of chlorine present. The color of the sample is compared with the color on a chart to determine the amount of chlorine present.

## *Some Useful Reading*

**State Plumbing Code**

**"Plans and Specifications for Building The System Yourself"**

Dept. of Health and Welfare, Div. of
Health Engineering, Augusta, Maine 04330

**Wastewater Treatment Systems for Rural Communities**

Commission on Rural Water, Washington, D.C. 1973
Steven Goldstein and Walter Moberg, Jr.

**"Building in the Wildlands of Maine"**

Land Use Regulation Commission
Augusta, Maine 04330

**"A Field Guide to the Toilets"**

Maine Times, March 15, 1974

**"Septic Tank Systems"**

Ontario Dept. of Health
Public Health Engineering Service
1 St. Clair Ave., W. Toronto, Ontario

**"Manual of Septic Tank Practice" #526 (35c)**

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 21201

**"Keep It Clean"**

On Sewage Disposal in the Cottage Country
A Pollution Probe Primer Pamphlet
University of Toronto, 25 Harbor St., Toronto, Ontario

The material in this booklet has been compiled by the Dale E. Caruthers Company, Gorham, Maine, for the Department of Environmental Protection.

Edited by M. M. Smith, Natural Resources Council, Augusta, Maine.

## *Sources Of Help And Information*

The Department of Environmental Protection can give you advice, as can professional engineers. The Department of Environmental Protection controls all discharges into state waters. For information about underground systems, the homeowner should contact the Local Plumbing Inspector or the Department of Health and Welfare. The Inspectors are licensed by that Department. In unorganized territories, residents must also contact DEP and/or the Department of Health and Welfare. If it is a new building in the unorganized territories, they will also need a permit from the Land Use Regulation Commission.

Department of Environmental Protection 289-2591
Division of Licensing and Enforcement
Augusta, Maine 04330
**Systems discharging into water**

Department of Health & Welfare 289-3826
Division of Health Engineering
Augusta, Maine 04330
**Underground systems**

Land Use Regulation Commission 289-2631
Augusta, Maine 04330
**New construction in the unorganized townships**

Local Plumbing Inspectors
Licensed by Dept. of Health & Welfare
**Inspect all new installations**

Congress of Lake Associations 622-3101
20 Willow Street
Augusta, Maine 04330
**Advice on protecting water quality**

# *CHECKLIST*

The following checklist should help you determine which wastewater treatment system will give you the "best practical treatment" for your particular situation.

☐ 1. Contact — certified soil scientist, certified geologist or certified engineer with a soils background or others recognized by the Department of Health & Welfare to examine soils and site conditions. Your local Plumbing Inspector will have a list of certified soil examiners, or you can contact the Department of Health & Welfare, in Augusta.

☐ 2. On site visit by soils expert.

☐ 3. A. Soils found **suitable** for underground disposal.

( ) Choose appropriate system
( ) Contact local Plumbing Inspector for permit to construct system.
Contact experienced contractor or construct system yourself.
(The Department of Health & Welfare has information on "do it yourself" construction.) Exact specifications for building are in the State Plumbing Code.

☐ B. Soils found **unsuitable** for underground disposal
( ) Contact Department of Environmental Protection for list of approved systems or refer to this booklet.
( ) Choose system and inform DEP of decision. (August 1, 1975)

☐ 4. Contact experienced contractor or build system yourself.

☐ 5. Inform DEP that system is installed and working and that you no longer are discharging untreated waste into Maine's waters. (October 1, 1976)

# *IMPORTANT DATES*

**Before August 1, 1975 — Contact the Department of Environmental Protection and inform them of the type of system chosen.**

**Before October 1, 1976 — Contact the Department of Environmental Protection and inform them that the system is installed and operating.**

State of Maine
**Department of Environmental Protection**
State House, Augusta, Maine 04330