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ABSTRACT

Sewage disposal systems, water pollution, over-development, and the involvement of cottage associations are highlighted in this manual for cottagers or summer vacation homeowners. Its aim is to both inform and involve the cottage owner in the protection and preservation of his vacation environment. By reviewing a variety of problems peculiar to the development of vacation areas and homesites, an attempt is made to translate environmental principles into action toward concrete changes in legislation, economic priorities, and consumer habits. The problems and possible solutions are treated in eight sections: (1) the septic tank and tile field system, (2) other methods of sewage treatment, (3) purification of water for drinking purposes, (4) solid waste disposal, (5) pesticides, (6) boating, (7) eutrophication of a lake, and (8) development. A five-phase Self-help Guide in the final section offers investigations and actions cottage associations may undertake to protect the vacation environment. These include: education and individual correction, government pressure, water quality surveys, sanitary surveys, and community standards enforcement. A chart of government departments and functions, list of information sources, glossary of terms, index, and form letters are appended. (BL)

KEEP IT CLEAN

A Manual for the preservation
of the Cottage Environment
by

POLLUTION PROBE

at the University of Toronto

What is Pollution Probe?

Pollution Probe is a citizens' group based at the University of Toronto. There are affiliated groups across Ontario and throughout the rest of Canada.

Probe's aim is to alert Canadians to the price we pay for uncontrolled exploitation of our water, forest, mineral, and energy resources. Probe attempts to translate sound environmental principles into action toward concrete changes in legislation, economic priorities and consumer habits.

PREVIOUS ACHIEVEMENTS

DDT Probe campaign prompted 90% reduction in DDT use in 1969.

HYDRO Challenge to Ontario Hydro's higher stack policy brought about partial switchover to natural gas – a cleaner fuel – in Toronto.

PHOSPHATES Phosphate content of detergents published in early 1970 – Federal Government now plans to phase out phosphates by 1972.

ATTITUDES AND AWARENESS Public debate, speaking and school programmes carried our message of fundamental problems causing pollution. Programme won 1970 Greer Award for most outstanding group contribution to public education in Ontario.

SEWAGE Continued demands for proper treatment for municipal sewage along the Great Lakes resulted in ½ billion dollar building programme for treatment plants.

PARKS Probe aided in the successful drive to stop logging in Quetico Provincial Park.

RECYCLING Citizen action and research aimed at replacing incinerators and landfill of valuable 'garbage' with resource recycling (from setting up depots to changing industrial tax incentives).

NOISE Regulations for machinery, snowmobiles, and construction equipment to combat the insidious effects of increasing noise.

RECREATION A continuing programme to provide cottage associations with the tools to police pollution on their own lakes.

URBAN Co-operation with community groups working on neighbourhood environmental problems to control urban growth.

ENERGY The development of guidelines for an environmentally sound energy policy (gas, oil and nuclear power) and the drive to have them embodied in Canadian Government policy.

EDUCATION Creation and testing of environmental studies programmes for introduction into Ontario schools.

YOU CAN HELP. Probe needs people to investigate pollution complaints, to speak to schools, to do research, to give moral and financial support. You can also work for environmental quality through any organization or association you belong to – in the city or at the cottage.

Pollution Probe is financed by contributions from individuals like you, from corporations, government and foundations. We need your support.

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See the Pollution Probe membership form at the end of this manual.

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Editorial

Pollution Probe has written and published this manual for cottagers because we believe that information is power – power to clean up your sewage system, power to police your lake against pollution, power to prevent over-development, power to pressure the government – in short, power for *you*, the cottager, to protect *your* vacation environment. But information is only half the equation, it is only potential power until it is used. You have to be willing to act, you have to become involved in protecting your lake and your vacation environment against pollution, over-development and decay.

If your only interest is a good time today, with no thought for the future; if you are unwilling to commit time and money, then there is no hope. All the accurate information in the world will do you no good. Your cottage environment will continue to degrade until it resembles the city from which you fled.

If, on the other hand, you are concerned about your vacation environment and want to ensure its long-term quality, and if you are willing to devote time, effort and a little money, your lake and its surroundings can continue to be a source of pleasure and reward for many years to come.

However, on a broad basis across Ontario, Pollution Probe can usually supply only the information, you have to supply the desire and action.

We believe that there are three basic problems in the cottage country which deserve mention here. They and others are examined in greater detail in the pages that follow.

1. Sewage Disposal Systems

There is a tremendous need for a totally efficient and reliable sewage disposal system for cottages. The conventional septic tank and tile field system is, in our opinion and that of many experts, not suitable for large portions of our recreational area.

When installed in accordance with all government specifications, this system should, if not abused, be effective in removing bacteria and organic matter. However, it is likely to add nutrients to the lake, especially if it is installed in sand or gravel, as the Government presently recommends. These nutrients (especially phosphates) promote eutrophication – the most severe threat to our recreational lakes. (See Futrophication Chapter).

The Government has for many years been promoting a system which is probably a major contributor to present-day problems. As you might expect, government officials are therefore very reluctant to reverse themselves and admit this fact. What is worse, the government is doing a totally inadequate amount of research on septic tank modification or alternatives. A number of such systems have been proposed and some are even on the market. But instead of performing research to perfect and integrate such systems into workable and efficient alternatives, the government refuses to approve most of them. Furthermore, the government does not know how to accurately test the overall efficiency of a given septic tank system. For this reason, the Summer Sanitary Surveys are somewhat misleading in that they may give the cottager a false sense of security about his system.

It is imperative, therefore, that the Provincial Government recognize the shortcomings of the present system and undertake massive research programmes to develop either modified (and improved) septic tank systems or more effective alternatives.

But what can you, the cottager, do at the present time with inadequate septic systems and no totally viable alternatives? First, you should see that your septic tank system conforms to provincial standards and operates to maximum efficiency. This should ensure that there is little bacterial or organic pollution. To this end, our first section is devoted to a discussion of septic tank systems and the Self-Help Guide outlines how to perform a septic tank inspection.

Secondly, pressure must be brought on the Government to develop alternatives and you and your neighbours must be willing to install them when they are ready.

2. Over-Development

Lakes, like any other ecosystem, can sustain only so much human pressure, only so much development, before they begin to collapse under the load of pollutants and other by-products of human activity. There are also social factors such as noise, overcrowding, construction and bad planning which further reduce the enjoyment of one's recreational environment.

At present, the Provincial Government has no reliable method of determining the capacity of a lake to safely sustain development of various types – either from an ecological or sociological point of view. Studies are proceeding towards the production of such formulae but they are at least several years away. Yet, in the absence of this information and with the present inadequate sewage systems, the government is still allowing rapid and extensive development of fragile recreational lakes. In many of these cases, the decisions to allow development are being made right now in the absence of any real knowledge about capacities. The results in several years' time will often be disastrous.

Pollution Probe, therefore, proposes that a two or three year freeze be placed on cottage development until the necessary research is performed and regulations enacted and properly enforced so that we can proceed with intelligence.

3. Involvement of Cottage Associations

The Government, in its role as regulator, has assumed that it can handle all of the 250,000 cottages now in Ontario, that it can effectively control the 15,000 new subdivided lots each year, and that it can police activity on the thousands of Ontario lakes. Yet this is a tremendous task and the government performance to date has not been satisfactory.

Despite the workload, the government has adopted a very paternalistic attitude, implying that it is the only body qualified to perform these functions. It has virtually ignored a tremendous human resource – the cottager who has a keen interest in water quality and the potential to control it himself. The government should be providing him with accurate information, professional guidance, free testing and analysis facilities, and encouraging him and his neighbours to undertake their own self-help and self-policing programmes. Only in this way can we ever hope to effectively control pollution on our vast number of recreational lakes.

Lastly, we would like to acknowledge the funds provided for publication of this manual by the Ontario Department of Health and thank the Hon. Bert Lawrence for his personal efforts. We make no apology, however, for criticizing government departments or for presenting information, proposals, or suggestions contrary to official government policy. The grant provided for publication of this pamphlet came, after all, from public funds – from the taxpayers of Ontario. We believe you should get maximum value for your money – and this means an unbiased approach and a presentation of all the facts, not just those used by government departments to justify their current programmes and policies. As mentioned earlier, the government agencies concerned with cottage country problems (now concentrated mostly in the Ministry of the Environment) are far from perfect (in spite of valiant efforts being made by some junior researchers). In fact, if they had been doing a proper job there would be far less need for this pamphlet. But they haven't and this is why you, as a concerned cottager, must become involved in both pressuring the government and in taking action on your own lake. To initiate the former, we have provided several form letters as means of communication to the Government. If you have the time to write personally, so much the better. Do it often. In order to promote the latter, we have included in the last chapter, Self Help Guide, some plans on how you can begin to control pollution on your own lake.

Chapter I

The Septic Tank and Tile Field System

A. INTRODUCTION

Ontario is an area comprising nearly 250,000 lakes offering its visitors every conceivable opportunity for water recreation. At least a quarter of a million cottages can testify to the popularity of Ontario as a summer and winter recreational area.

Around some lakes, the summer population is so dense that a severe strain is being imposed on their natural facilities. The land is unable to absorb and decompose the wastes from the cottages. The result is a rapid deterioration of the water quality and excessive development of aquatic plant growth.

The fact that sewage must be treated properly cannot be stressed enough. Discharging untreated domestic wastes into a natural water source can lead to contamination of *your* water supply by disease-carrying organisms endangering *your* health. It also may impose too great an absorption burden on your lake or river to the point where its usefulness, even for recreation, is threatened.

1. Types of Sewage

For our purposes, we shall call "sewage" all waste that is carried out of the house in water. Faeces and urine and anything that comes out of toilets, we shall call human wastes. And we shall call anything else wash wastes.

There are three types of pollution that can result from sewage: bacterial pollution, organic pollution, and nutrient pollution.

A. Bacterial

In the intestines of man and animals are found bacteria which act upon wastes to decompose them. Also present in these wastes are "PATHOGENIC" bacteria and viruses that can cause such diseases as hepatitis, cholera, typhoid, dysentery and polio. Once they get into the lake, they are diluted considerably. Nevertheless, they do constitute a potential health hazard, especially if they get into drinking water.

To determine the occurrence of bacterial pollution, we test for the presence of a group of bacteria known as "COLIFORMS." Some members of the coliform group are found naturally in soil and on vegetation, but faecal coliforms (*E. coli*) is found only in the intestines of warm-blooded animals and thus is a reliable indicator of sewage pollution.

The Department of Health and your local Medical Officer of Health will supply you with sample bottles and information on how to collect samples for testing your drinking water supply. But remember, the coliform count for a bottle of sample water tells only one thing – the amount of bacterial contamination in that one bottle. A thorough water quality survey of the area, taken in a number of locations over an extended period of time by experienced personnel, is the only real way to tell whether your lake or a section of it is polluted.

B. Organic

Most sewage contains a great deal of organic material which decays under the action of bacteria. Any type of organic garbage, food, and human waste will decay. This process depletes the water of dissolved oxygen which may hasten eutrophication and deprive water animals of necessary oxygen. It also stimulates the growth of pollution resistant fauna and flora such as sludge worms, brown algae and others.

C. Nutrient

Sewage contains many chemicals which, when added in sufficient quantity, can potentially change the chemistry and hence the biology of the lake. Many of these chemicals are called nutrients, as they are food for the plants that grow in the lake. Carbonates, nitrates, phosphates, magnesium and other chemicals are all nutrients. The nutrients that "limit" the growth of plants are those which are in the shortest supply at the time. In most of our lakes, phosphate is the limiting nutrient for algae and weed growth as it generally is the one in least supply. Thus, when phosphates are added to a lake, there is a resulting increase in algae and weed growth, often in the form of blooms of blue-green algae on the lake surface or attached algae near the shore. The algae also tends to become dislodged in storms and gets washed ashore where it decays, producing a very offensive odour. Not only is this aesthetically unpleasant but when the blooms eventually die and settle on the bottom, they undergo decay by bacteria which uses up oxygen. If large amounts of algae are decayed, the lower waters can be completely stripped of oxygen. This results in the death of most kinds of aquatic life including gamefish. This process of over-fertilization is also known as EUTROPHICATION and is the most severe and long-lasting threat to our recreational lakes.

Man's input of phosphates in our recreational areas is about 50% from human waste and about 50% from phosphate detergents in wash waste. The input from human waste is the difficult one to control for it involves all the problems of sewage treatment and nutrient removal. The input from detergents, on the other hand, is easy – eliminate phosphate detergents. Instead, use a phosphate-free detergent or better yet, soap, which works very well in the soft water found in many recreational lakes. Another alternative is to do your laundry back in the city. This also saves the extra water load on your septic tank system.

At the outset, Pollution Probe would like to state its position on the conventional septic tank and tile field system. Although a large portion of this manual is devoted to the description of this system, we believe that in its present form and under present regulations, it is *not* the answer to the problem of effective sewage disposal in the cottage country, especially as far as nutrient removal is concerned. Modifications and totally effective alternatives must be developed soon. But in the meantime, the best a cottager can do is to ensure that his septic tank system meets the standards and is functioning to maximum efficiency.

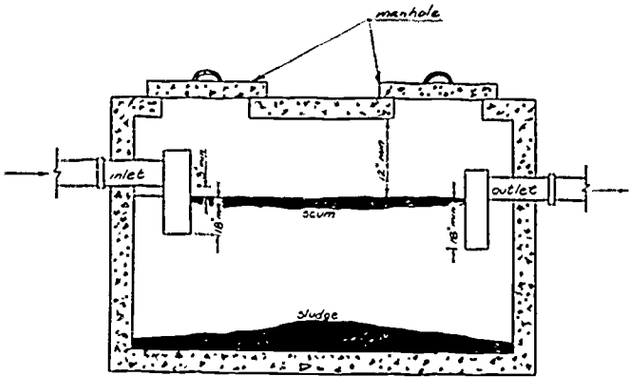
B. DESCRIPTION OF THE SEPTIC TANK AND TILE FIELD SYSTEM

1. What is a Septic Tank?

A septic tank is a rectangular or cylindrical container through which sewage is allowed to flow slowly. It permits solid particles to settle to the bottom while the "EFFLUENT" flows out and into a tile field.

2. What is a Tile Field?

A tile field is a system of drainage pipes placed below the ground level. The lengths of the pipes are either perforated or separated at the joints to allow the effluent from the septic tank to seep into the soil. The total length of the tiles used depends largely on the number of people using the system and the soil characteristics.



Conventional Septic Tank

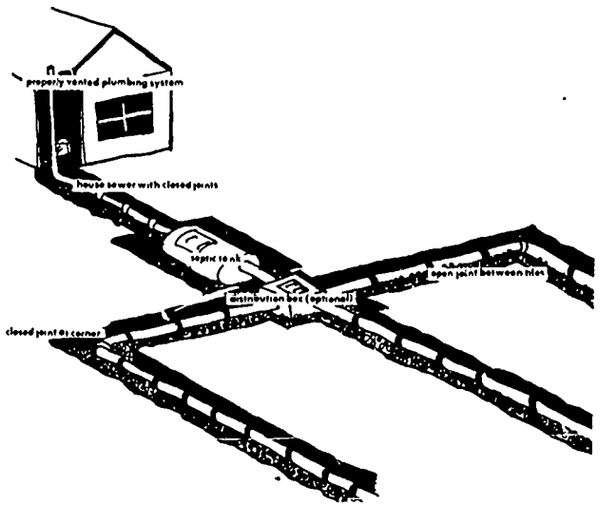
C. FUNCTIONS OF THE SEPTIC TANK AND TILE FIELD SYSTEM

1. What the Septic Tank Does

The septic tank receives the liquid wastes (human and wash wastes) from the residence and performs the functions of:

- Containment (away from children and disease vectors such as flies and rodents)
- Sedimentation (of settleable solids)
- Decomposition (of solids into liquids and gases)
- Sludge Storage

At this stage, the effluent is only partially treated and still poses a pollution and health hazard. It requires secondary treatment in the tile field.



A typical septic tank-tile bed system with three lateral tile lines

2. What the Tile Field Does

The tile field is the secondary means of treating sewage. As the effluent percolates through the soil of the tile bed, the bacteria, organic solids and nutrient materials are acted upon by a host of living organisms between the soil particles. Bacteria are trapped and die, organic material is broken down by organisms in both the presence and absence of oxygen, and under the best of conditions some of the nutrients are bound. In most cases, however, the nutrients pass through the soil. Nitrogen is very seldom retained to any degree and unfortunately the type of soil so often found in tile beds is not effective in binding phosphates. Thus the effluent has been treated (to remove bacteria and organic matter) but nutrient removal is often not achieved to a satisfactory degree.

One must take care not to abuse the system. If it is overused and too much effluent enters the tile field, then the soil pores may begin to fill up. Without any free oxygen left in the pores, decomposition slows down drastically. The result is clogging which prevents proper filtration. This will eventually lead to ponding of the effluent on the surface which is a dangerous health hazard.

D. THEORY BEHIND THE SEPTIC TANK AND TILE FIELD SYSTEM

1. (a) How the Septic Tank Works

The septic tank works by the action of anaerobic organisms and the sedimentation process. As sewage enters the tank, its velocity is reduced, thus allowing particles of solids to either sink to the bottom (sludge) or rise to the surface (scum).

Complete settling out of the particles never occurs but in a properly designed tank 60 to 70 per cent of the "suspended" solids (particles) can be removed. The settleable solids are retained in the tank while the effluent passes through to the tile field. In the tank they are subjected to anaerobic decomposition or the breaking down of organic matter by the action of bacteria in the tank.

These organisms, which thrive in the absence of free oxygen, reduce the "BOD" of the organic matter by about 30-40%. To put it simply, some of the solids are liquefied and gases are given off. This process is slow and the gases produced are offensive. It is important that your tank be large enough to allow a suitable retention period for the sewage. If not, "short-circuiting" may occur and large amounts of solid material will be carried into the tile field, necessitating replacement of the field. Over a period of time sludge and scum will build up until removal by a servieeman is required. Also necessary is proper ventilation through the toilet stack to provide an exit for malodourous gases.

(b) The Effluent

The effluent is dark in colour and odourous. When it leaves the septic tank it is NOT completely treated or safe because organic matter, pathogenic bacteria, viruses and high concentrations of nutrients (especially phosphates and nitrates) are still present. Further treatment is thus necessary and this is provided by the soil.

2. (a) How the Tile Field Works

The tile field's effectiveness is dependent upon the soil. It must be able to permit the effluent to percolate through without clogging. Soil particles range in size from 3" to .001 mm. Gravel consists of particles from 4.76 mm to 3 inches. Sand is .074 mm to 4.76 mm and clay and silt are made up of particles in the range of .001 – .074 mm. In between the soil particles there are pores. In these pores the biological and chemical treatment of the effluent takes place.

The soil in the tile field should be able to "breathe." It should contain air in the pores in order to supply free oxygen for the decomposition of particles filtered out of the effluent. This process of decomposition is thus aerobic. Sewage bacteria are also trapped in great numbers in the pores of the soil where there is not enough food for all of them to survive. Also the temperature and other factors are not correct for the survival of most pathogens. They in turn decay along with the other organic matter.

Chemical changes also take place in the soil. Nitrogen, primarily in ammonium compounds, is found in the organic matter after anaerobic digestion is completed. When in contact with aerobic action in the soil, the ammonium ions are converted to soluble nitrites and nitrates.

If the pores are too small in the soil (such as in clay) then the effluent begins to saturate the field. This displaces the air (oxygen) from the pores and anaerobic decomposition then occurs. This process is very slow and may lead to "ponding" on the surface.

If the pores are large and allow the effluent to pass through

rapidly, contamination of the ground water may occ·r. The effluent must pass through the tile field slowly enough for decomposition to occur and fast enough so that there isn't any backup or clogging.

(b) Distribution in the Tile Field

1. Continuous Distribution - Continuous distribution is the arrangement of absorption trenches in such a manner that the effluent is distributed to all the tile lines equally. These tile fields are most commonly used in flat areas - that is, if the ground slope in the absorption field area does not exceed 6" in 100 feet.

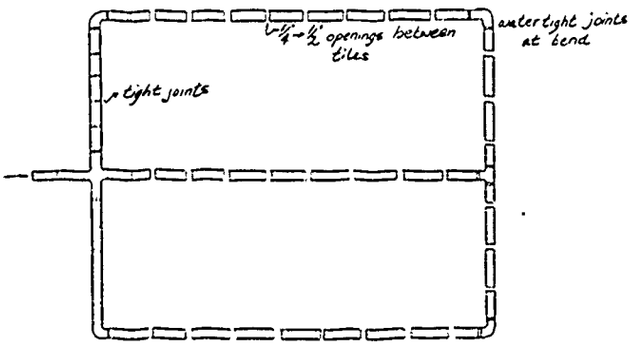
There should be a minimum of 12" of earth cover over the gravel fill in all trenches of the system. Also, the bottom of the trenches and distribution lines should be level.

2. Serial Distribution - Serial Distribution is the arrangement of individual absorption trenches in such a manner that each trench is forced to fill to the full depth of gravel before effluent flows into the next trench. However, if the first line becomes clogged or damaged, there is no alternative route as there is in continuous distribution. Serial distribution is only recommended for sloping ground.

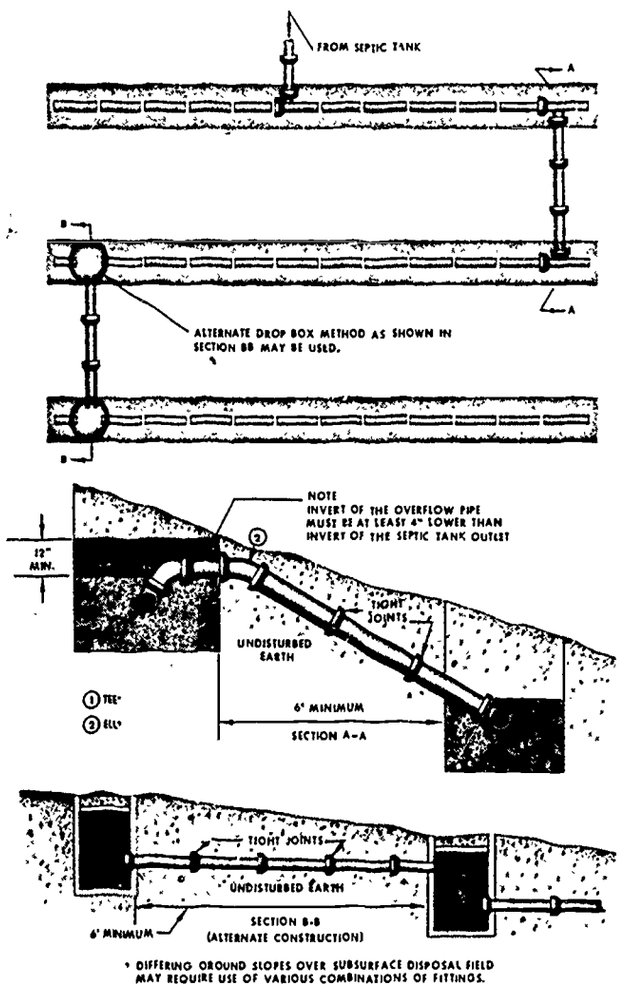
If the slope of the ground surface in the absorption field area exceeds approximately 6 inches in 100 feet, then the serial distribution method may be used. Each adjacent trench is connected to the next by a closed pipe line laid on undisturbed ground.

All the effluent is thus discharged to the first trench until it is filled. Excess liquid is then carried by means of a closed line to the next or lower trench, using each portion of the system in succession. The following procedures should be noted:

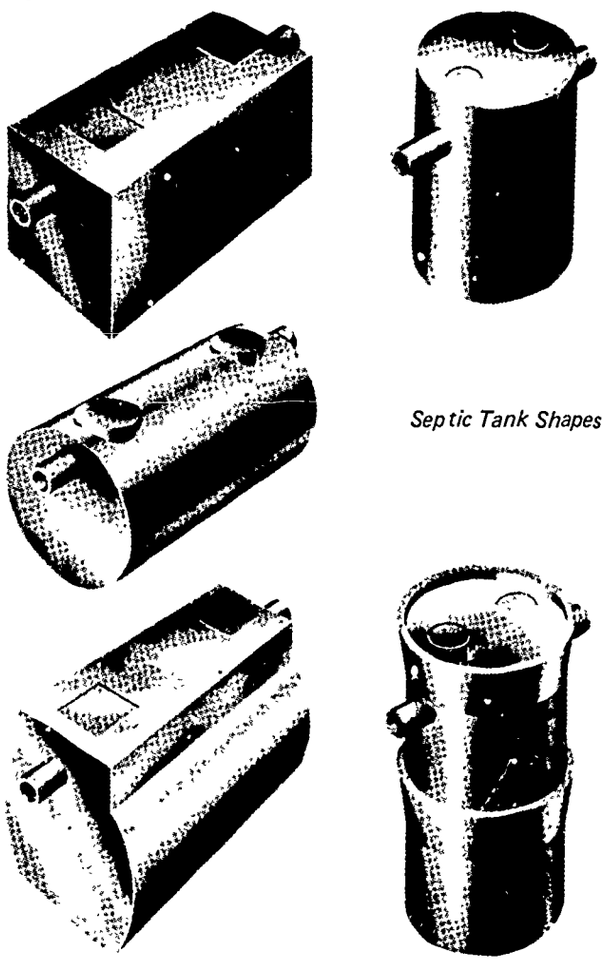
a. The bottom of each trench and its distribution line should be level.
b. There should be a minimum of 12 inches of ground cover over the gravel fill in the trenches.
c. The direction of the absorption trenches should approximately follow the ground surface contours to minimize variations in trench depth.
d. A minimum of 6 feet of undisturbed earth should be kept between adjacent trenches and between the septic tank and the nearest trench.
e. Adjacent trenches can be connected with a relief line with or without a drop box arrangement.
f. The opening of the overflow pipe must be at least 4 inches *lower* than the opening of the septic tank inlet so that backup does not occur.



Continuous Distribution



Serial Distribution



Septic Tank Shapes

E. CONSTRUCTION OF THE SEPTIC TANK AND TILE FIELD SYSTEM

1. (a) The Septic Tank – Types

Septic tanks are constructed of reinforced concrete, reinforced plastic or steel. They come in mainly two shapes – rectangular and cylindrical.

(1) Concrete Tanks – Probably the best material for tank construction is concrete. They can be pre-cast or cast-in-place. To ensure water tightness and reduce corrosion, coat the inside and outside with a water-proofing material. Pre-cast tanks should not be less than 3 inches in wall thickness while cast-in-place tanks should not be less than 4 inches (preferably 6 inches). These are minimums because the thickness depends on the tank capacity. Both types of tanks should be adequately reinforced with steel rods. Before building one, see your local Medical Officer of Health.

(2) Steel Tanks – Steel tanks are the least costly. They should be coated to protect them from corrosion; however, corrosion can still occur. The average life of a steel tank is about seven years, but depends upon the thickness of the steel and the corrosive characteristics of the soil.

(3) Plastic Tanks – Plastic tanks are light and corrosion resistant; however, there may be a problem with their structural stability. They are also very expensive.

(b) The Inlet and Outlet

The inlet to the septic tank should be of 4 inch diameter pipe and at least 3 inches above the liquid level inside the tank to provide for the temporary rise of the liquid during discharges into the tank. Vented tee pipes or baffles are used to divert the incoming sewage downward. The pipe or baffle should penetrate at least 18" below the liquid level but no further than the distance allowed for the outlet.

The outlet should also be of 4 inch diameter pipe with its tee or baffle extending down to 40% of the liquid depth for a rectangular tank. This part below the water level controls the volume of scum retained and limits the volume of solids which will discharge with the effluent. The recommended minimum liquid depth is 4 feet.

(c) Siphon Chambers

Tile fields over 500 feet in length require an additional compartment to be added to the septic tank, called the "siphon" or pump chamber. This will result in better tile field performance. The siphon chamber has a capacity of 2/3 to 3/4 of the full volume of the tile lines – equivalent to 40 gallons per 100 feet of 4 inch diameter tile.

The siphon or pump discharges the effluent into the tile lines so that proper distribution may be obtained throughout the tile area and it also gives the bed a chance to rest or dry out between dosings. Once properly installed, the siphon works automatically. It contains no moving parts.

The use of a siphon entails a more complicated design. For information and advice, contact your local MOH (Medical Officer of Health).

(d) The Size of Your Septic Tank

Septic tank size is of prime importance. Always obtain one which will adequately handle the amount of sewage your cottage produces. The Ontario Department of Health bases their recommendations on the assumption that there are two persons per bedroom and an average sewage flow of 60 gallons per person per day.

They recommend a tank with a minimum working capacity of 500 gallons. The working capacity is the volume taken up by the liquid inside the tank. The 500 gallon figure is assuming a liquid depth of 4 feet. This working capacity doesn't include the volume above the liquid level, so the tank really has a volume greater than 500 gallons.

(e) Locating Your Septic Tank

A septic tank should be located no closer than:

- 50 feet to any well, lake, stream or pond
- 5 feet to any building
- 10 feet to any property boundary

Capacity of Septic Tank with Respect to Number of Bedrooms

Number of Bedrooms	Combined Working Capacity of Tank (Imperial Gallons)
2 or less	500
3	600
4	720
5	900

Installation takes place in the ground with the tank being completely covered. However, be sure to have your local Medical Officer of Health inspect and approve your *entire* system *before* it is covered.

(f) A Final Word

When building or purchasing your tank, make sure two manholes are present in the top of the tank – one over the inlet pipe and one over the outlet. The manholes provide access to the tank for servicing and cleaning. They should have a minimum of 20 inch diameter with handles attached to the manhole covers.

2. The Tile Field

(a) Soil

The primary consideration for the location of the tile field is the soil. Without the right kind or sufficient amount of soil, the field is useless. The soil must be able to "absorb" the effluent. The rate at which the liquid is absorbed is known as the "PERCOLATION" rate.

Soil depth is a major problem facing the cottagers of Ontario. Tile fields should be located where there is *at least 5 feet* of permeable soil above the maximum elevation of the water table, above bedrock, above clay or above any other impervious strata. At any depth less than this there is the danger that the effluent will not be completely treated, thus contaminating the ground water, lake or river. Unless these conditions are met, the septic tank system may not be effective.

In the majority of the cottage country where the Pre-Cambrian Shield is so dominant, it is very difficult to find these conditions naturally. One answer to the problem of insufficient soil is to have fill imported. The fill should be placed on top of existing soil and not just over bare rock. The existing soil or fill should be of adequate permeability so that there is enough time for decomposition as the effluent passes through. Also, the texture should not be so fine that it will not allow the effluent to pass through at all.

The better soils, of intermediate texture, are the loams which are made up of clay, sand and mixtures of decayed vegetation. This soil allows the effluent to be retained long enough to permit the required biological activity. These organic soils have the quality required to bind phosphates. Iron enriched soils also help precipitate out phosphate. Organic-free coarse sands and gravels should never be considered as a tile bed medium.

(b) Location or Site of Tile Field

The best site for the tile field is one which is fairly level. A slope greater than 10% is usually not considered suitable as a tile field area.

(c) Planning the Tile Field

Before constructing your tile field, submit plans of the proposed system to your local Medical Officer of Health for approval. Plans should keep the following in mind.

1. How much usage the system will get (use all year? Number of people.)
2. The kinds of wastes to enter the system (e.g. all laundry, bath and wash wastes should enter the tank).

The Tile Field Should be Located

1. 100 feet from the nearest dug well or other source of domestic water supply.
2. 50 feet from a drilled well which has a casing 25 feet into the ground.
3. A minimum of 50 feet from a lake, stream or water course.
4. 10 feet from property boundaries.
5. At least 10 feet from large trees or dense shrubbery so roots from these will not destroy the tile field (where root trouble is expected, place 12 inches of gravel under the tile instead of the usual 6 inches.)
6. 25 feet from any building.

3. The slope of the proposed site.
4. The soil depth and percolation rate.

(d) Guidelines for Installation of Tile Field

1. The length of any individual tile line should *not* exceed 100 feet but a 60' maximum is preferred.
2. The spacing between lines should be at least 6 feet of undisturbed earth. If the trenches are too close, then effluent from adjacent trenches may cause saturation and disrupt the percolation process.
3. When selecting a lot, you need at least 5 feet of good soil.
4. If a garbage grinder is used, then the length of tile should be increased by 1/3 and the tank size by 1/5.
5. A "Percolation Test" is very necessary. It should be done with accuracy so if in doubt about its procedure, see your local Medical Officer of Health for instructions.

(e) Tile Field Materials

Approval for tile material is required from your Medical Officer of Health.

1. Clay Tile

Glazed pipe is used for the headers; non-glazed for the distribution lines. They are usually 4 inches in diameter. They are the least expensive piping but care must be used in installation so as not to damage them.

2. Bitumen Impregnated Fibre

This type of pipe is moderately inexpensive. It comes in 3½ to 4 inch diameters with two rows of holes, 4 inches apart, at 120 degrees spacing on the circumference. This type of pipe requires care in laying to ensure that the holes on each side of the pipe are at equal elevation.

3. Polyvinylchloride (P.V.C.) and Acrylonitrile Butadiene Styrene (A.B.S.)

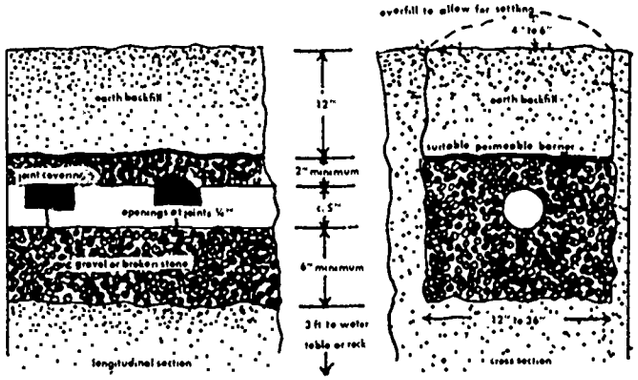
These two types come in 10 foot lengths with 3 and 4 inch diameters. There are ½ inch diameter holes at 5 inch centers and 120 degrees spacing on the circumference. Once again, make sure the holes on each side are at equal elevations. This pipe is fairly expensive.

4. Corrugated Plastic Pipe (Polyethylene)

These are relatively new and their manufacturers are still improving their design. Basically they are 4 inches in diameter with ¼ - ½ inch holes. Spacing on the circumference is 120 degrees. They too are expensive.

(f) Trench Construction

1. The trench should be from 18 to 36 inches wide and at least 25 inches deep.
2. Careful excavation is necessary so as not to smear or compact bottom and sides of the trench.
3. Rake smeared or damaged surfaces to a depth of 1 inch, removing loose material to prevent clogging of soil pores.
4. During construction keep open trenches free from debris and water.
5. Keep the trench on a constant slope not exceeding 4 inches in 100 feet.
6. Lay each line in at least 13" of graded gravel, broken hard burned clay brick or other similar materials. This will distribute the effluent to the soil slowly, preventing clogging.
7. The above material should be at least 2 inches above the top of the pipe and 6 inches below the bottom.
8. Clay tile in the distribution lines should be non-glazed and ¼ to ½ inches apart. ¼ inch open joints are more desirable to allow sewage to pass further along in the system and thus prevent clogging.
9. Treated building paper should be placed over the open joints to prevent the gravel from falling in and blocking the flow.
10. Also place untreated building paper over the top layer of gravel to prevent backfill from clogging gravel pores.
11. Earth backfill should be of sandy loam or topsoil and overfilled to allow for settlement.
12. Earth covering should be to a depth of between 1 and 2 feet with grass planted to aid in evaporating some of the liquid.
13. The ground surface around the tile field should slope away so as not to collect surface water, which might cause the system to malfunction.



Tile Field Trench

(g) The Percolation Test

The percolation test is a method of testing soil to determine if the "PERCOLATION RATE" of the soil is suitable for effluent disposal. You can perform the test yourself by following the description below. However, it is not a simple test and it is advised that you have an experienced person perform it. The test determines the absorption characteristics of the soil.

(h) Method of Determining the Percolation Rate

The Test

1. Select six or more test sites uniformly spaced over the proposed drainage area.
2. Dig or bore a hole with horizontal dimensions of from 4-12 inches and vertical sides to the depth of the proposed absorption trench.
3. Carefully scratch the bottom and sides of the hole with a knife blade or sharp-pointed instrument, in order to remove any smeared soil surfaces and to provide a natural soil interface into which water may percolate. Remove all loose material from the hole. Add 2 inches of coarse sand or fine gravel to protect the bottom from scouring and sediment.
4. Carefully fill the hole with clear water to a minimum depth of 12 inches over the gravel. In most soils, it is necessary to refill the hole by supplying a surplus reservoir of water to keep water in the hole for at least 4 hours and preferably overnight. DETERMINE THE PERCOLATION RATE 24 HOURS AFTER WATER IS FIRST ADDED TO THE HOLE.
5. If water remains in the test hole after the overnight swelling period, adjust the depth to approximately 12 inches over the gravel. From a fixed reference point, measure the drop in water level over a 30-minute period. This drop is used to calculate the percolation rate. If no water remains in the

hole after the overnight swelling period, add clear water to bring the depth of water in the hole to approximately 12 inches over the gravel. From a fixed reference point, measure the drop in water level at approximately 30-minute intervals for 4 hours, refilling 12 inches over the gravel as necessary. The drop that occurs during the final 10 minutes is used to calculate the percolation rate.

The Results

The test is not the most accurate way of determining how good the drainage is. One reason for this is the difficulty in saturating the soil. But if done at all, it must be done right. If done poorly, it will often give wrong results. The reason for using this method at all is that it is relatively quick and inexpensive. It also gives an experienced inspector a good idea of soil quality.

The percolation rate is measured in minutes per inch, that is, time (in minutes) required for the water level to fall 1 inch.

If the percolation rate is above 60 minutes-per-inch, the soil is unsuitable for any kind of soil-disposal system. If the percolation rate is from 30-60 minutes-per-inch, the soil is unsuitable for seepage pits but still may be able to handle a septic tank-tile bed system. Obviously extremely fast percolation, where the water disappears instantly gives the sewage little time to percolate correctly. If this occurs, there is insufficient time for bacterial action. See the Medical Officer of Health with the results before you start to build.

Percolation Rates Time "t" in minutes for water to fall 1"	No. of feet of 18" wide trench per bedroom (Allowing two persons per bedroom)
1	20 (But not less than 150' total)
5	44 " "
10	64 " "
20	90 " "
30	110 " "
40	126 " "
50	140 " "
60	154 " "
Over 60	Not suitable for subsurface absorption

(i) Interpreting the Percolation Rate

Thus, the percolation test measures the rate at which water flows through the soil. If the rate is too fast, there may be a number of reasons pertaining to the composition of the soil. The soil could contain coarse gravel which would not filter out the sewage. Or if the soil is limestone or dry clay, cracking can take place allowing the water to make a direct path to the water table.

If a slow rate is the case, this indicates that the water is not being absorbed by the soil. Fine silts and clays have too small pores to permit a sizeable amount of water to enter.

This test is performed with water. However, remember that the liquid which the tile field must dispose of is the septic tank effluent and it may clog some of the pores in the soil, altering your percolation rate.

(j) The Water Table

You can find out where the water table is by digging a hole with a post-hole digger or hand auger down to a depth of 6-7 feet (if possible). Cover the hole over so that no surface or rain water gets down through and leave it for a day. After a day, the water in the bottom of the hole will indicate the depth of the water table from the surface. The level varies with time of year and conditions. The tile should be at least 3 feet above the highest water table level. If there is bedrock below the soil, then there often isn't any water table because the water will drain off down the rock to the lake. Clay is considered impermeable and so is regarded the same as the water table or rock table when deciding the depth of good soil.

(k) The Distribution Box

The distribution box is a means of distributing the effluent evenly throughout the tile field. The box is placed in the ground so that the exits leading to the various tile lines are at equal elevations.

The distribution box is often not necessary and unless it is properly installed, it may hinder rather than aid the system. Your local MOH should be consulted for approval and advice about distribution boxes.

F. MAINTAINING THE SEPTIC TANK AND TILE FIELD SYSTEM

1. The Septic Tank

(a) What Should Enter Your Septic Tank

All household sanitary wastes, including those from the toilet, sink, showers, baths, washing machine and garbage-grinder should enter the septic tank. The amount of grease ordinarily encountered in household kitchens will not have any detrimental effects on the tank.

(Note:) For large or commercial establishments, the addition of a grease trap will probably be necessary).

Do not add disinfectants or other chemicals to the tank. No products are required to clean the tank or accelerate or improve its action. All the necessary bacteria are present in the tank and once the anaerobic process begins, nothing special needs to be added

Ordinary household cleaners and disinfectants used in normal quantities should not hinder the bacterial action of tanks which are of recommended size for the household. Wastes from water softener units have no adverse effect on the tank, but they can reduce the life span of your tile field if certain clay minerals are present in the soil. Your local MOH should be consulted concerning the installation of one of these units.

(b) What should NOT Enter Your Septic Tank

Water from roof drains, foundation drains or from any other source of run-off drainage should NOT enter the septic tank. These large volumes of water will overload the system, causing scouring and subsequent clogging of the tile field.

Paper towels, disposable diapers, cigarette and cigar butts, newspapers, wrapping papers, rags and toilet paper substitutes should also NOT enter the tank. They are difficult to decompose and can clog the system.

Remember, DON'T overload your tank. If you are having a party, be sure you know the capacity of your tank. Extra guests mean extra strain on your system! If you maintain your system properly, it can give you many years of adequate service.

(c) Maintaining Your Septic Tank

Your septic tank will perform properly if given the required maintenance. Annual inspection is necessary to note if cleaning is required. If so, then a reputable pump-out service should be contacted.

Note: Be sure you know *where* the service man discharges the waste before you engage him. Careless dumping can be a major source of pollution.

When inspecting your tank, the depth of the sludge and scum should be measured near the outlet pipe or baffle.

Procedure for Inspecting Your Septic Tank

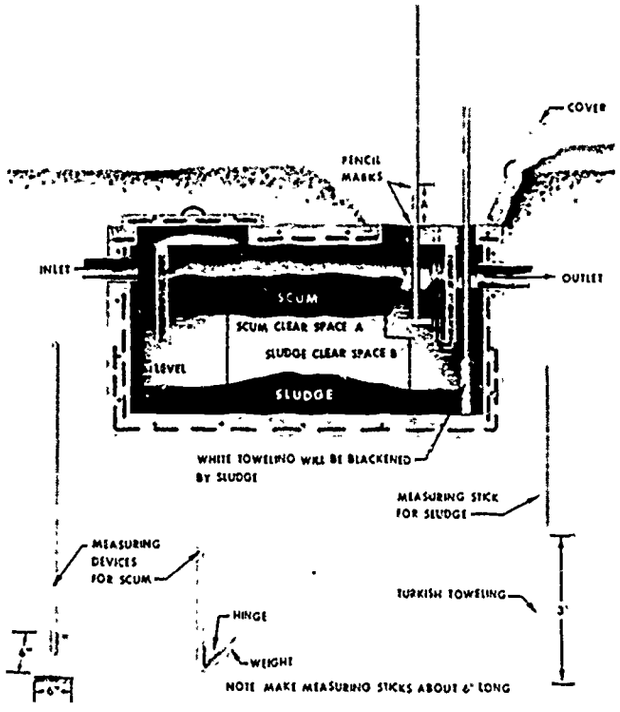
Measuring the Depth of the "Scum"

1. Attach a 6 by 6 inch piece of board with a hinge to a stick approximately 6 feet long.
2. Find the bottom of the effluent pipe or baffle by breaking through the scum.
3. Mark your stick with a pencil to indicate the depth.
4. Find the bottom of the scum in the same manner and again indicate its level by a pencil mark.
5. If the two pencil marks are 3 inches apart or less, then the tank requires cleaning.

Measuring the Depth of the "Sludge"

1. Wrap 3 feet of rough, white towelling around a long stick.
2. Place the stick down into the sludge behind the baffle.
3. Hold it there for several minutes, then remove, noting the sludge line.
4. If the sludge line is within 18 inches of the outlet fitting, then the tank requires cleaning.

The tank should never be disinfected or washed after a pump out. A small quantity of sludge should also be left in the tank to start the anaerobic process in the fresh sewage.



Measuring Sludge & Scum

Use of the cottage during the winter requires that the tank be pumped out to within 6 inches of the bottom in the fall. The tank can then be used as a storage compartment for sewage during any winter use. When you abandon a tank, fill it in with earth or rock.

2. A Guide to Maintaining Your Tile Field

1. Keep all heavy vehicles off the field. If one of the tiles breaks or is relocated, the system could very well fail.
2. Mark the boundaries of the field distinctly.
3. Fence the field in so as to keep people and vehicles away from the area.
4. Draw a map to indicate distances from buildings, trees, shrubs, etc. This will aid in locating the area for cleaning and repairs.
5. Don't water the grass on the tile field. It receives enough water from the sewage.

SEE YOUR LOCAL MOH ABOUT SIZES, TYPES AND LOCATION OF SEPTIC TANKS AND TILE FIELDS. HE MAY BE ABLE TO REFER YOU TO A REASONABLE AND RELIABLE CONTRACTOR. DO YOUR PART AND SEE THAT *YOUR* WASTES ARE BEING DISPOSED OF PROPERLY.

3. Summary

If you are in doubt about your present disposal system, consider the following:

Does your disposal system:

a) contaminate drinking water supplies?
b) contaminate or pollute bathing areas?
c) become accessible to insects or rodents or any other possible disease carrier?
d) become accessible to children or household pets?
e) cause nuisance due to odours or unsightly appearance?
f) neglect any applicable laws or regulations governing sewage disposal or water pollution?

If your system is lacking in any of these areas, see to it that the problem is rectified before you have a bigger problem on your hands.

G. SUMMARY OF RECOMMENDED STANDARDS GOVERNING SEPTIC TANKS AND TILE FIELDS

Tank –
- minimum of 500 gallons (imperial)
- inlet at least 3" above liquid level
- baffle should penetrate at least 18" below liquid level
- the minimum liquid depth should be 4 feet
- located at least 50 feet from any well, lake, stream or pond
- located at least 5 feet from any building
- located at least 10 feet from any property boundary
- should be completely covered with earth *after* being inspected
- the two manholes should be at least 20" in diameter
- the tank should be increased by 1/5 if a garbage grinder is used

Field –
- *at least* 5 feet of permeable soil above the maximum elevation of the water table, above bedrock, above clay or any other impervious strata
- should not consist of organic-free coarse sands and gravels
- a minimum of 12" ground cover over the gravel fill in the trenches
- a minimum of 150' of tile should be used with a 500 gallon tank
- a maximum of 60 feet for length of individual tile lines
- at least 6 feet of undisturbed earth should be left between tile lines
- the tile should be increased by 1/3 if a garbage grinder is used
- the trench must be 18-36" wide and at least 25" deep
- each tile line should be placed in at least 13" of graded gravel
- a siphon should be used with the tank if the tile exceeds 500 feet
- located at least 100 feet from any dug well or other source of domestic water supply
- located at least 50' from a drilled well which has a casing 25 feet into the ground
- located at least 50' from lake, stream or other water course
- located at least 10 feet from large trees or dense shrubbery
- located at least 10 feet from property boundaries
- located at least 25 feet from any building

Chapter II

Other Methods of Sewage Treatment

A. INTRODUCTION

In this chapter alternative methods of sewage treatment are described. They range from older forms of treatment such as privies up to modern methods like chemical toilets and package sewage treatment plants. Each one in itself may not be the complete answer for sewage treatment in the cottage country. Several, such as privies, chemical toilets, and incinerator toilets make no provision for proper disposal of wash wastes. Those which rely on total containment, such as holding tanks and chemical toilets, still pose the problem of ultimate disposal. However, with possible additions and/or alterations, these systems may provide a greater and more reliable degree of treatment than the septic tank system. If the cottager refrains from using high-phosphate detergents and properly treats his wash wastes (perhaps in a seepage pit or a septic tank), then several of these systems offer great advantage in the treatment or containment of human sewage. We would strongly suggest that the feasibility of using these systems (or two systems in conjunction) be actively researched by the government and that, if feasible, their use be approved and promoted.

B. PRIVIES

1. Description

Privies or outside toilets are a very basic method of disposing of human sewage. There are various types and care should be taken to see that each is constructed and maintained properly.

Privies are suitable for a site which has no pumped water available. They are often erected by people who have just purchased land on which they wish to build a cottage. However, privies are primitive and they by themselves should not be considered as a permanent means of sewage disposal. Furthermore, privies do not deal with the problem of wash wastes. An approved seepage pit or some other approved system should be constructed to handle these wash wastes. You can obtain plans for a privy from the MOH. In some cases, however, the MOH will not approve privies because of local by-laws or inadequate soil depth.

2. Types

(a) Concrete-Slab Pit Privy

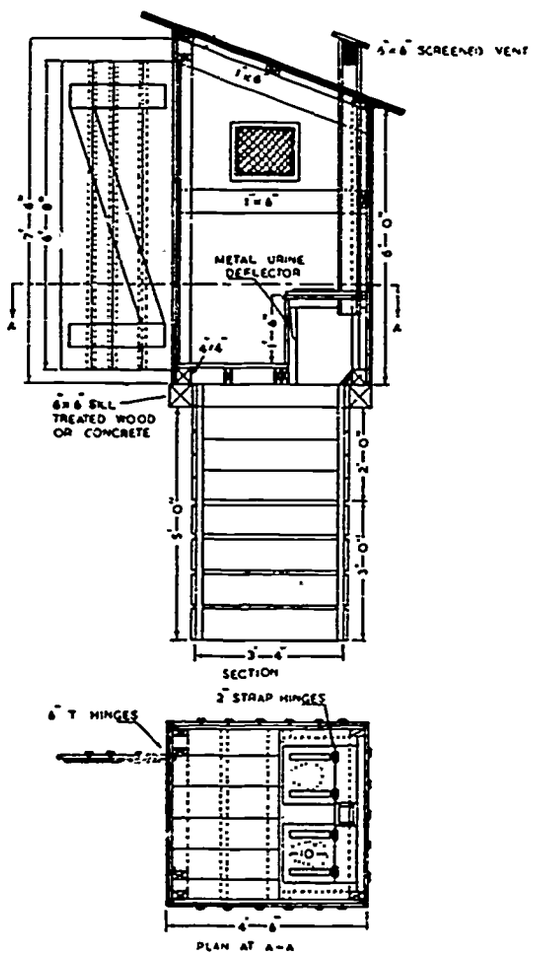
This type of privy is simply a small shack placed over a reinforced hole in the ground. Planks are placed on the walls of the pit to act as reinforcement so that the sides don't cave in. A ½" space is left in between adjacent boards with the exception of the bottom two, which are together. This allows the liquid wastes to percolate into the soil. The bottom of the pit is covered with a layer of gravel to prevent clogging. The bottom should be at least 2 feet from becrock, clay or the highest point the water table reaches. The pit size has to be large enough to allow 2 cubic feet/person/year for year-round use. It should be placed in soil with an overall depth of at least 7 feet to accomplish this. On top of this pit is a 4 foot square concrete slab with a hole. Raise it 4 inches by using a sill. Earth is then mounded all around the slab so that surface water will run down and away from the pit.

Each privy should have a screened ventilator and be made flytight in order to keep animals and flies out. If water gets into the pit, kerosene dropped in at weekly intervals will discourage mosquito breeding. Odours can be controlled with chlorinated lime or by covering the wastes periodically with wood ashes. Other chemicals need not be used for controlling odours. An overhang of the roof should be constructed to prevent rain water from entering the pit. Problems encountered with pit privies are overuse, clogging of soil, improper drainage and poor construction. A good suggestion to prevent overuse is to build two and alternate monthly.

Note:

! Plans for this type of privy may be obtained from the Ontario Department of Health.

2. The privy should not be located within 50 feet of a lake, stream or any other watercourse.
3. It should also be located at least 100 feet downstream (in the direction of ground water flow) from any well.
4. It should be located at least 100 feet from any kitchen.

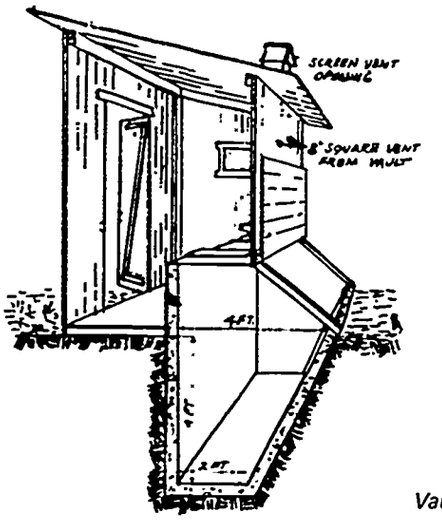


Concrete Slab Pit Privy

(b) Vault Privy

Where the water table is close to the ground surface, a vault privy can be used. It consists of a completely water-tight tank enclosed by a shack. There is a hinged door in back of the tank so that sewage can be pumped out when it is full. The vault itself is made of brick or concrete. The problem with this type of privy is that the vault may crack and start to leak, thus con-

taminating nearby water. It also contains a semi-liquid which is very odourous. Regular pump-out by a reputable serviceman is a necessity. Once again, approval is required by the MOH for this system.

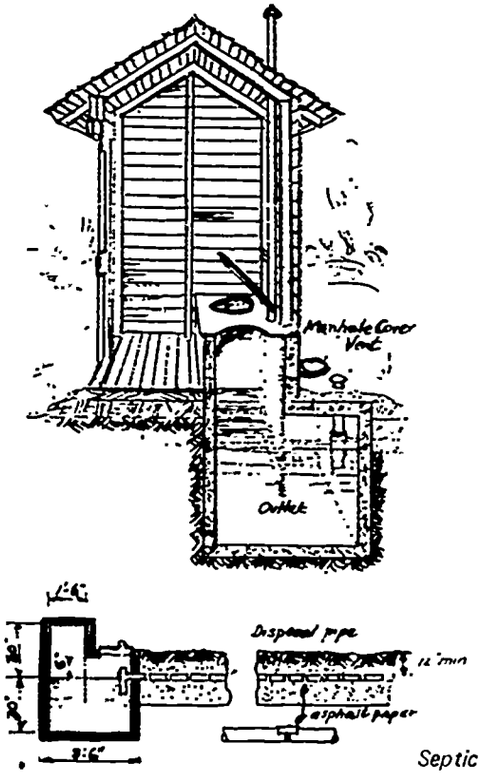


Vault Privy

(c) Septic Privy (Aqua)

This type of privy consists of an outhouse placed over a water-tight tank. There is a manhole in the back of the tank to make it accessible for pumping out. This privy works like a septic tank except there is no running water. Attached to the tank is a small tile disposal field which allows the effluent to percolate into the ground. The tile field should be from 50 to 75 feet from any well, lake, stream or pond.

After the tank is filled with water to the overflow level, then approximately 5 to 8 gallons can be added daily. This type of privy is often used with a low-volume flush toilet. The tank can be made of concrete or steel. It is good practice to pour kerosene over the tank contents to prevent mosquito breeding and keep odours down. Your local MOH should also be consulted for his approval.



Septic Privy

Note. In general, privies should be kept free of insects and animals with the use of self-closing doors, fly screens and proper maintenance.

C. CHEMICAL TOILETS

1. Stationary Toilet

Chemical toilets are self-contained units with a chemical charge added to about 2 gallons of water. The chemical is usually blue when inserted into the toilet and turns a gray-brownish colour when it is time to clean and recharge it. Each charge is good for about 50 usages and can accommodate a 4-person family for a weekend. If a small holding tank is used with this toilet, then the period is increased to about a week. At the end of the period the toilet and/or the tank must be thoroughly cleaned out and recharged with the same amount of chemical and water. There is also a larger 3 gallon tank good for 80 usages.

These toilets sell for about $220 (slightly higher for the model with the bowl rinsing apparatus).

The type with the rinsing apparatus operates on a 12 volt, D.C. power source. A converter for changing 110 A.C. to 12 D.C. can be purchased (for about $30) in order to make the system adaptable to the household electrical system. One of the models also is equipped with a rinsing apparatus that connects to your water supply.

These toilets may be advisable for boats, trailers and campers, but in their present form, not for cottages. The cottager is still faced with the problem of what to do with the wash and chemical wastes. They may be stored in a vault privy or small holding tank.

If you purchase one of these toilets, be sure the contents of the holding tank are disposed of in an appropriate manner – one which is approved by the Health Unit.

Chemical Toilet

2. Portable Toilet

The portable toilet is a single container chemical toilet in which 4 to 5 ounces of disinfecting chemical is added to ½ to 1 gallon of water. When the toilet fills up, you must empty its contents into a Municipal sewage system or large holding tank. Don't empty contents into Septic Tank System as it may interfere with the bacteriological action. This method is not practical for summer cottage usage. It is, however, good for winter use because the toilet can be carried up on the weekend, used and its contents carried to a sewage system or dumped into a pit privy.

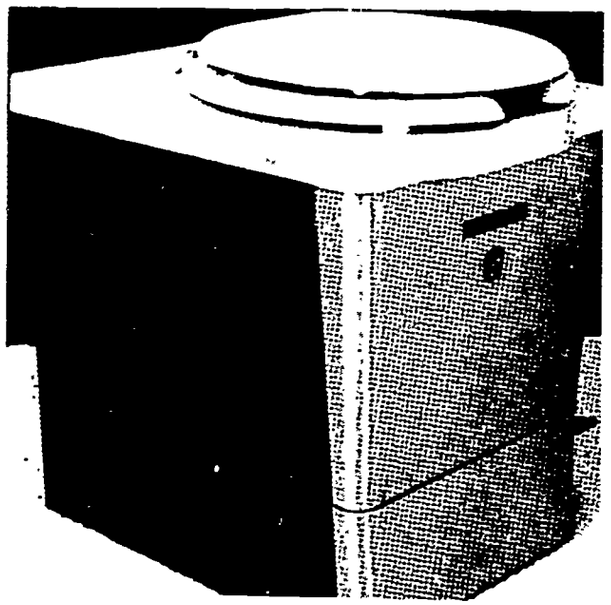
The system is inexpensive but awkward.

D. INCINERATOR TOILETS

Incinerator toilets dispose of wastes by incinerating them into bacteria-free ash. There is no water involved. Wastes are retain-

ed, instead, in wax paper bowl liners, where the contents are incinerated. The ash is then buried or disposed of at a municipal dump.

Although this method disposes of toilet waste so as not to pollute or contaminate water courses, their use is very controversial. In some districts they are not permitted because some models expel a very unpleasant odour. They tend to use up large amounts of electricity. Gas-fired ones are also available. There is the possibility that they will be shut down by the Air Management Branch of the Ministry of the Environment if there is a complaint arising due to the smell.



Incinerator Toilet

The units are expensive – about $550. They also come in a urinal model which is sometimes found in motels and restaurants. If you are considering one of these units, you should consult your local Health Unit first. An alternative method for disposal of wash wastes is required.

E. HOLDING TANKS

1. Description

The holding tank is essentially a large container which holds the sewage until it can be pumped out and disposed of. It is usually installed in those areas of Ontario where there is little or no soil to meet the requirements for a septic tank sewage disposal system. While eliminating the problem of individual pollution, it does place the burden on the municipal sewage treatment plant or lagoon system. The MOH's approval is required before a holding tank can be constructed.

2. Requirements and Construction

The holding tank system must be correctly constructed and installed. It is extremely important that the tank is water-tight and that regular inspection take place to check for leaks.

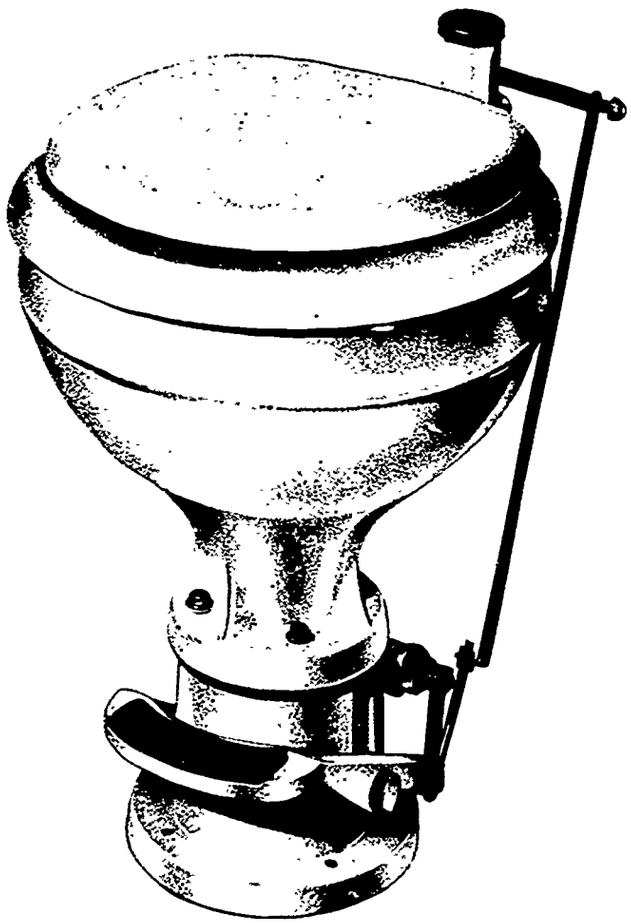
Holding tanks are generally made of cast-in-place concrete with a preferred minimum size of 2,000 Imperial gallons. They must also be equipped with effective and approved over-flow warning and prevention devices. Normal usage of the tank by 4 people requires it to be pumped out every two weeks. However, the period may be extended by using a low volume flush toilet. Because of regular pump-out service, this system tends to be expensive.

3. Regulations

All household wastes (not rain or surface drainage water) go into the holding tank. Before a holding tank system can be installed, evidence must be supplied assuring proper disposal of its contents. Plans, specifications and the above evidence should be approved by the Department of Health before a building permit may be obtained from your MOH. Be certain that sewage pumped out from the holding tank is disposed of in a manner approved by the MOH.

F. LOW VOLUME FLUSH TOILET SYSTEM

The low volume flush toilet is an excellent idea for the cottage. Whereas your standard city toilet uses about 16-20 quarts per flush, the low-volume flush toilet uses only 1-2 quarts. However, there is a problem with this type of toilet – the tank and tile field are often undersized. This means the tile field may be subject to clogging. An excellent suggestion would be to use the low volume flush toilet with the full-size tank and tile system described earlier. This would cut down on the load placed on the tile field, thus lessening the possibility of clogging. Another idea might be to use it with the holding tank. This may cut down on the frequency of pump-out required.



Low Volume Flush Toilet

Remember:
The above systems have one common fault – they do not deal with wash wastes. Because of the high nutrient content of wash wastes, not to mention bacterial & organic matter, they are often just as dangerous as personal wastes. Many people simply dump these wash wastes out the door or let them trickle down to the lake. Some people dump them into the lake. Two methods of getting rid of wash wastes when there is no complete waste disposal system are: The Seepage Pit and the Sand Filter Trench.

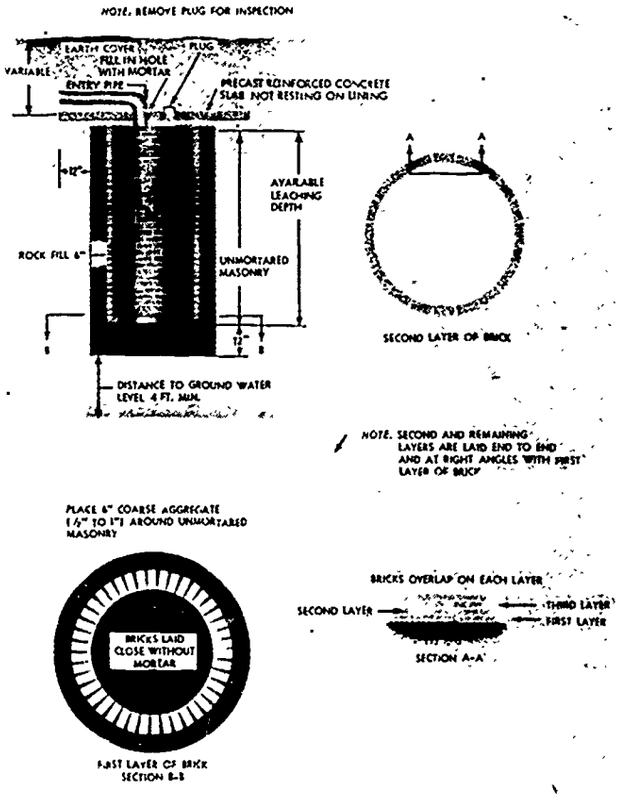
G. THE SEEPAGE PIT, LEACHING PIT, AND THE SAND FILTER TRENCH
(For wash wastes only)

1. The Seepage Pit

The first thing to remember about the seepage pit is that it requires even more good soil than does a septic tank-tile bed system. The percolation rate must be lower than 30 minutes per inch in order for seepage pits to work effectively. Also the percolation test for a deep seepage pit must take into account the percolation rate for each different layer of soil. Good seepage pits are often lined with brick and surrounded by gravel. The percolation into the soil occurs only at the sides. The bottom will become clogged and useless after a short time.

Just digging a hole into the ground is useless. If you want to build a seepage pit, it should be built to last and under suitable soil conditions. Obviously this does not apply to much of the cottage country of Ontario where the topsoil is sparse. Most pits dug in this soil will only serve to facilitate the runoff of sewage into the lake.

You can get valuable information on how to build a seepage pit by writing to the Superintendant of Publications, United States Government Printing Office in Washington, D.C. asking for Public Health Service Publication No. 526 entitled *A Manual of Septic Tank Practice.* It costs 35¢ and contains excellent information on seepage pits and septic tanks. Seepage pits are not recommended in areas having limestone formations or shallow wells for domestic water supply.



Seepage Pit

2. Leaching Pits

Leaching pits are small, simplified versions of a seepage pit. Care must be taken in the construction of these pits so as not to intercept the water table. A suitable size for a leaching pit is 2 feet square and 3 feet deep. The bottom of the pit must not be within 3½ feet of bedrock, the water table or any other impervious layer. This means you need 6½ feet of soil before you can construct one of these pits.

The bottom of the pit should be enclosed with a layer of gravel to prevent clogging. Cover the pit well to prevent mosquitos and other insects from breeding. Regular cleaning and/or rebuilding should take place to prevent malfunctioning. The MOH must approve this method of waste disposal.

3. The Sand Filter Trench

The Sand Filter Trench is a small tile field system or an underdrain system placed in a trench. The field consists of clean, coarse aggregate containing an intermediate layer of sand and an underdrain system for carrying off the filtered sewage. The tank effluent is absorbed to only a small extent in the surrounding soil. This method just filters and disposes of the effluent when it leaves the trench. It is not a sewage disposal system but a sewage treatment one.

The effluent is partially treated and caught in the underdrain system. Then the filtered sewage is chlorinated and discharged into the water course.

Since this system is effluent producing, it must be approved by the Department of Environment and the MOH. This method can work quite well but it is also quite expensive.

For both these methods you need approval of the MOH before installing. In some districts they are not allowed, so be sure to contact your MOH for recommendations.

H. CESSPOOLS

Cesspools and dry wells are basically holes in the ground into which sewage flows. They are generally considered dangerous and *not permitted* by most Health Units. If left uncovered, they will create a public health hazard.

Unattended cesspools can act as a breeding place for mosquitoes and other insects. They also cause clogging of soil pores leading to a build-up of sewage which is unable to seep away. As a result, an unpleasant odour occurs.

Cesspools are also a danger because they can contaminate ground water and shallow wells. Furthermore, untreated sewage may find its way to the water table through cracks and crevices in the underlying rock strata.

I. SINGLE DWELLING AERATION SYSTEMS

Single dwelling aeration systems are quite useful in rocky terrain or where the soil is unsuitable or insufficient for a septic tank tile field. These systems work by aerobic decomposition.

This system consists of a tank with two compartments. One is an aeration section while the other is used for settling. In the aeration compartment oxygen (in air) is mixed with the raw sewage. The bacteria in the sewage use organic materials for growth and produce a biological sludge. This process is faster and less odourous than the anaerobic system. Also, it lessens the load on the soil and therefore reduces the possibility of clogging.

In some cases the effluent can be passed through a trickling filter. From here part of it can be used for toilet flushing, while the rest is disposed of in the tile field. It is generally unsatisfactory to use the raw effluent as flushing water. These systems are generally more complicated than the septic tank. Care must be taken in their maintenance to ensure proper treatment of the sewage. They are more expensive than the standard septic tank system. Before construction, the MOH must be contacted for approval.

J. OXIDATION PONDS AND AERATED SEWAGE LAGOONS

1. Description

Oxidation ponds and sewage lagoons are built to accommodate or hold sewage from a group of cottages, a lodge or other large establishment. They are considered to be "communal systems" and as such require licensing by the Ministry of Environment. An engineering construction firm should be employed in the building of these systems. In principle, they operate by the aerobic process where oxygen is supplied, naturally or mechani-

cally, to decompose the sewage. Bacteria which cause the digestion of the sewage thrive in the presence of this free oxygen.

Lagoons are extremely effective in treating organic and inorganic sewage. They are able to remove much of the organic material which, under untreated conditions, would decay and use up the vital oxygen present in water courses. They can also remove most of the bacteria. In fact, many installations have reported coliform counts showing 99 per cent removal.

2. a) Oxidation Ponds

In oxidation ponds, oxygen is supplied from two sources: the algae which thrive in the liquid and the surface aeration caused by the wind. Bacteria act on the sewage to decompose it into sludge, nutrients and gases. The sludge settles, while the nutrients provide food for the algae. These algae in the presence of sunlight produce oxygen through photosynthesis. The bacteria use this oxygen to decompose the incoming sewage, thus the cycle is continued.

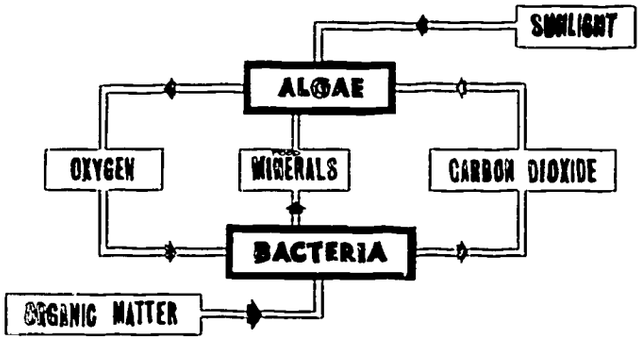


Diagram of Lagoon Activity

Obnoxious gases produced through the decomposition of the sewage are oxidized prior to release into the atmosphere by the algae. Therefore, odours are minimal. Ponds can also be used for phosphorous and nitrogen removal. The algae in the ponds absorb the nutrients. If the algae are harvested during the fall, removal of 90 to 95 per cent of the phosphorous and 75 to 90 per cent of the nitrogen can be achieved. In Ontario though, this method is seldom used and phosphates are therefore still a problem.

(b) Construction

The oxidation pond should be constructed on the basis of one acre of surface area per 100 persons. Its shape should be as regular as possible with a depth of 5 feet. The outlet device has to be designed so that the liquid level in the pond can be adjusted. In summer, a liquid depth of 5 feet maximum should be maintained, while in the fall the liquid level is lowered to 2 feet to allow the pond to act as a storage tank during the winter. Make the bottom and sides of the pond impermeable and seal with cement or clay to prevent contamination of the ground water table.

The oxidation pond has the ability to handle almost any type of sewage placed in it. But it is limited to serving a small population because ponds require a relatively large land mass and can treat only a limited flow. Often towns will use a two lagoon system. However, with the more heavily populated towns this method is inadequate. Approval for construction must be obtained from the Ministry of Environment, Sanitary Engineering Branch.

(c) Costs

The capacity of the pond will determine its cost. Since no heavy machinery is required, only construction and land costs have to be considered. Oxidation ponds also require little maintenance; therefore, operating expenses are minimal. They should, however, be fenced in.

One disadvantage of the oxidation pond is that people tend to ignore the little maintenance that is required to keep the pond from becoming a health hazard. Secondly, oxidation ponds don't erase the problem of nutrient pollution. Phosphates and nitrates are still found in the effluent.

3. (a) Aerated Sewage Lagoons

If not enough land can be found for the construction of an oxidation pond, the aerated lagoon can provide an alternate answer. There are three basic types:

1. The Aerated Algae Pond – This pond retains the liquid from 20 to 40 days. Mixing is done by mechanical methods to increase the bacterial and algal action. It is still, however, essentially an oxidation pond.
2. The Aerobic Facultative Pond – the liquid is retained in this pond from 20 to 30 days. More mixing is provided than in the algae pond and constitutes the major source of oxygen supplied to the pond. This process does not require solid particles to be in suspension for the decomposing action to occur.
3. The Completely Mixed Aerobic Lagoon – The retention period for this lagoon is from 2 to 6 days. The particles are kept in suspension. This is a diluted *activated sludge process* with the oxygen being supplied by a mechanical aerator or by tube aerators on the lagoon bottom.

(b) Construction

The aerated lagoon occupies only about 10% of the land required for an oxidation pond. However, a greater depth of soil is needed, as the lagoon is from 10 to 15 feet deep. Construction and maintenance costs are more than those for an oxidation pond, but operating costs are about the same. There is no significant removal of nutrients by this system since algae growth is not needed to supply oxygen. The effluent is also more turbid than in the oxidation pond and should be discharged to a sedimentation pond. The sides and bottom of the lagoon should be impervious.

Two Cell Aerated Sewage Lagoon

There are different types of aerators available – air compressors which pump air through perforated tubing and mechanical surface aerators are two examples.

These systems are designed to serve a group of at least 5 cottages, but before considering the installation of one of these systems the Ministry of the Environment and a consulting engineer should be contacted. In some areas oxidation ponds and aerated sewage lagoons are controlled by the municipality. These systems would be very expensive and probably not considered in the cottage country. Check with your respective government official or MOH to be sure.

4. (a) Irrigation Using the Lagoon Effluent

Instead of releasing treated lagoon or pond effluent into a stream or lake, irrigating the surrounding land can provide a

satisfactory and convement means of disposal. Irrigation is also very desirable for, if it's done properly, it will remove nutrients. The factors involved in deciding whether or not you can irrigate are: sufficient soil depth and suitable soil composition to remove much of the phosphates and nitrates from the effluent.

(b) 1. Spray-Irrigation: Effluent can be sprayed over an open area (such as a golf course, forage crop field, or any area where disease transfer won't take place). This method can serve several purposes - the stabilization of wind blown soil, water conservation and soil fertilization. The area should be large and the sprayer moved around to prevent overloading one area.

2. Spray Run-Off: Where the ground is sloped, terraces and collection furrows can be constructed. The effluent is sprayed over the area and it percolates through the soil. The furrows can be used to collect the filtered liquid run-off for recycling.

3. Infiltration Basins: They are usually small, dyked areas in a permeable soil formation. The effluent enters the basin and is allowed to soak into the soil. If the soil is of considerable depth and of the right type, they function successfully. At least two should be constructed so that each can be rested after use.

4. Ridge and Furrow Basins: These are similar to infiltration basins except that furrows are constructed across the basin bottom. Vegetation is planted on the ridges between the furrows to aid in effluent disposal. Two of these should be constructed to allow each to rest after being used.

Before any of these methods are considered, you should check with the MOH and Ministry of Environment regarding regulations.

K. PACKAGE SEWAGE TREATMENT PLANT

1. How the Plant Works

The package sewage treatment plant provides a very efficient method of "communal" sewage disposal if properly maintained. It works by means of the "activated sludge process." Fresh sewage collected by a sewer system flows into a tank to be mixed with activated sludge. Bacteria, acting upon the solids, break them down, mainly into water and carbon dioxide. Then the liquid flows into a compartment where the sludge is allowed to settle. After this, part of the sludge is returned to the first compartment to act again on fresh sewage.

The effluent and surplus sludge are chlorinated and disposed of by a method approved by the health authorities. The activated sludge process is fairly quick with a retention time of about 24 hours. It is a most efficient method to treat sewage but unfortunately, with our present systems, little or no nutrient removal results unless a process of nutrient precipitation is employed.

2. Difficulties Involved

A package sewage treatment plant can provide the answers to adequate sewage treatment for a group of cottagers who are willing to co-operate and share costs. However, approval of these systems is difficult to obtain because they must be well-maintained by a qualified person and few cottagers are qualified to do this.

Package sewage treatment plants are also quite expensive to set up and install. The estimated cost of such a plant, to be used by 100 people is $15,000. This does not include the expenses required for an engineer, maintenance man or installation of sewers.

3. If You're Still Interested

If you have a group who are willing to put forth the necessary effort and funding required for a package sewage treatment plant, contact a recognized consulting engineer and the Ministry of Environment. They will best advise you on your needs.

SPECIAL NOTE

The following systems require either special permission or licensing or may be discouraged by the MOH. Be sure to check out their requirements *before* you install.

Chemical Toilets	Single Dwelling Aeration Systems
Incinerator Toilets	Oxidation Ponds
Holding Tanks	Package Sewage Treatment Plants

L. CONSERVATION OF WATER

1. Faucet Flow Reduction Devices

Faucet flow reduction devices are fixtures that can be bought to provide a water saving from shower, kitchen and bathroom sinks. They reduce the water flow while keeping the same velocity by pressure compensation. You can save up to 50 per cent of your water, which means cutting down on the amount of sewage. You can also save from 20 to 40 per cent on fuel used for hot water heating. You can locate these devices at a local hardware or plumbing supply store.

The aerator is another simple device for water saving. Used on your faucet, it can reduce water consumption by about 25 per cent. It reduces the volume of water required by increasing the pressure.

2. Urinals

Compact wall-type urinals are available for home installation. They have flush valves set at 1.5 gallons of water per use. See your local plumbing supply store for details.

3. Clothes Washers

A feature of the automatic washing machine was its ability to store and reuse wash water twice. This idea has not gone over well with the customer. With the new fabrics and permanent press clothes, there is a need for more water.

One way to reduce water is by knowing the weight of the load so that the amount of water needed for washing is measured out accurately.

The use of front-loader washers also reduces the amount of water. The washer rotates on a horizontal axis, mixing the clothes through the water. This wash uses about half the water as a top loading washer and they cost about the same.

Remember: Washing machine wastes can be as much a polluting source as sewage. Don't dump them into a water course or on the ground surface.

4. Other Hints

Don't leave taps running. Too much water unnecessarily used puts an extra burden on your tile field. All that extra water may clog it and render it useless.

Some Points to Remember

1. If at all possible, don't wash laundry at the cottage but at home.
2. If you do have to wash at the cottage, be sure you use a phosphate-free detergent or soap, especially in soft water areas.
3. If water-saving devices are used, then the load on the tile field will be reduced, enabling the system to function longer.
4. Less water used in places where there is a municipal sewage treatment plant puts a reduced load on it, resulting in more efficient treatment.

Chapter III

Purification of Water for Drinking Purposes

Please note that no water from a lake, river or any other surface water source should be consumed in an untreated form. Even though it may be free of coliforms it may contain substances which will cause serious allergic reactions in some people.

A. BOILING

This method of purification is very simple and inexpensive. Boiling destroys disease-producing organisms found in water including bacteria, viruses, spores, cysts and ova. This process is time-consuming, though. The water must be brought to a good "rolling" boil and kept there for fifteen minutes. Boiling drives out the gases dissolved in the water and gives it a flat taste. This flat boiled taste may be lost if water is left to sit in a covered container (to prevent contamination) for a few hours. The taste can also be restored by pouring the water back and forth from one clean container to another.

B. CHLORINATION

Chlorination is also effective. If used properly it will destroy most disease-causing bacteria. Common household bleach can be used for chlorination with good results. Sometimes directions are given on the bleach label. If they aren't, you may follow the procedure below.

How to Chlorinate Water Using a Household Bleach

1. Find the percentage of available chlorine from the label.
2. Add to water as instructed in the following table:

Available Chlorine	Drops per Gallon of Clear Water
1%	40
4-6%	8
7-10%	4

If the strength of the solution is unknown use 40 drops per gallon.

3. This water then should be mixed thoroughly and allowed to sit for ½ hour before drinking.
4. The water should have a slight chlorine odour. If the treated water has too strong a taste, it can be made more desirable by allowing it to sit exposed to the air for a few hours. You can also pour the contents from one container to another several times.

Chlorine tablets can also be purchased with instructions on how to use them. If there are no instructions, then use one tablet for each quart of water.

Note: You can obtain a *free* water chlorination and test kit for drinking water from the Department of Health.

C. BROMINE TREATMENT

Bromine is another chemical that can be used to purify water. It works within minutes but there are handling problems involved. It is impractical for cottage use.

D. OZONE TREATMENT

Water treated with ozone (O_3) is normally extremely clear and sparkling. The advantage with ozone is that it requires no chemicals from an outside source. The necessary gas is created by an electrolytic process from suitably treated air. With this method, however, there is no residual left in the water; therefore, the water may be in a position where it can be contaminated by impurities. However, the ozone treatment tends to be very expensive and not really applicable to cottage use.

E. FILTERS

(a) Sand Filter

The household sand filter is easily made from a steel drum, sand and gravel. The upper layer of sand should be removed periodically. It is effective against large organisms but it can not be completely relied upon to remove bacteria. Thus sand filters are not recommended for domestic use.

(b) Pressure Filter

Household pressure filters are used in residences requiring more than 1800 gallons of water for everyday use. Details for this unit should be obtained from a reputable water engineering firm. Pressure filters are reliable but do need maintenance.

(c) Domestic Filters

**Ceramic* – They are made with fine-grained candles or cartridges to remove bacteria. Frequent examinations of the filter should be made to ensure there are no cracks in the candle. Also these candles should be scrubbed at least once a week with a greaseless brush, then boiled for 20 minutes.

**Earth* – This is the same type of filter except that the filtering medium is diatomaceous earth. They are available in sizes suitable for domestic use.

Silver – When silver is impregnated into a ceramic or diatomaceous earth candle, the bacteria are successfully trapped and killed. These candles need to be scrubbed periodically but are self-sterilizing and don't need to be boiled. However, for these filters the bacteria must be retained several hours for the silver to kill them.

General – All these filters are small and easy to install. They can be bought to fit on or below the kitchen or bathroom sinks. Their cost is quite reasonable. The candle is replaceable for about $12 - $13 and they usually last about 2-3 years. This is about $4 - $6 per year for drinking water. Periodically you should send a drinking water sample from these filters to the Department of Health for analysis, to insure it is working properly. Small bacteria and viruses can sometimes pass through these filters.

**These filters do not disinfect water, but filter out particles and bacteria. A mechanical breakdown could go undetected.*

F. ULTRA-VIOLET

This method of disinfection has the advantage that, while treating water free from any suspended matter, it does not introduce any tastes as odourous chemical treatment does. However, it is very expensive.

In this system the disinfection of the water depends on the degree of transmission of ultra-violet radiation. This transmission is affected by the concentration of dissolved minerals and

organic matter which absorb the radiation. However, if the bacteria are covered by a thin layer, satisfactory disinfection may not occur. For this reason, bacteriological examination of the water after such treatment might be necessary to ensure proper treatment and this takes several days, during which the water might be unsafe to drink.

G. INTERPRETATION OF YOUR DRINKING WATER TEST RESULTS

When you get the results back from the laboratory, they will have two totals on them. They are total coliform organisms and faecal coliform organisms. The following is a chart which will help you to interpret your results.

Interpretation Chart

	Case Number and Examples	Total Coliform Bacteria per 100 ml.	Faecal Coliform Bacteria per 100 ml.	Comments on Examples
1	Both columns report a number other than zero	80+	80+	All the bacteria are faecal types. This indicates recent heavy pollution of sewage origin.
		5 to 80	A number equal to or smaller than the total coliform number.	Slightly less recent pollution of sewage origin.
		1 to 4	An equal or smaller number than the total coliform number.	Still less recent pollution or highly diluted, but of sewage origin.
2	Faecal coliforms reported at zero	80+	0	Heavy pollution from a remote source, probably of sewage origin.
		5 to 80	0	Proportionately less heavy pollution as numbers decrease, but usually of sewage origin. In a treated supply, any coliforms indicate either ineffective disinfection or recontamination.
	All above this line must be disinfected			
		1 to 4	0	This may be from soil or vegetation.
3	Both columns report zero	0	0	This sample is free of any coliform bacteria and is bacteriologically safe for drinking.

Note: 80+ means more than 80 and uncounted above 80

We suggest that even if your results are below 4 total coliform and 0 faecal, that the water be disinfected before drinking. Water quality can change hourly with rain, over-use and wind factors.

Chapter IV

Solid Waste Disposal

A. INTRODUCTION

In the previous sections we have discussed the disposal of liquid wastes. Like sewage, there is a need to dispose of solid matter in a sanitary and non-polluting manner. The best method of doing this is to recycle waste, but at present the problems with this method have not been completely worked out.

For our purposes, we will refer to the solid wastes created by man as garbage. On the average, each person in Toronto contributes 2.5 pounds of domestic garbage every day. In the cottage country this is probably slightly less. An approximate breakdown of the contents of garbage is as follows:

Paper	39.5%
Vegetable matter (food & garden)	39.0%
Glass	8.0%
Metals	6.0%
Plastics	2.5%
Rags	1.5%
Wood	1.0%
Miscellaneous Combustibles	1.0%
Miscellaneous Non-combustibles	1.5%

In the cottage areas, as in the cities, the disposal of garbage is quickly becoming a problem. At present, most of the cottage country's disposal problem is handled by open-pit dumps, some of which burn the garbage.

B. DUMPS AND LANDFILLS

Under the Waste Management Act of 1970, open-pit dumps and open incinerators are illegal in Ontario. These dumps are slowly being phased out and replaced by sanitary landfill sites. However, this process is slow and many dumps can still be found throughout the province. They are an eyesore and a source of pollution. New open-pit dumps should not be started and existing ones should meet these requirements:

- no direct drainage into or from the dumping site
- located at least ¼ of a mile from any residences
- located at least 200 yards from any road or highway
- located at least 100 feet from any pond, stream, lake, or other water course.

Even when these requirements are met, this type of disposal is not desirable. It is a breeding place for mosquitoes and other insects. Rodents find these dumps a suitable place in which to nest. And it stinks!

Sanitary landfill sites are not our ultimate goal in solid waste disposal but they are more adequate than open pits. Refuse is laid down in thin layers and then compacted. After about 7 feet of garbage is spread, it is covered with a thin layer of compacted clean earth. At the end of each working day, all garbage is covered completely. When the fill site is completed, it is covered with 2 to 3 feet of compacted earth. The ground should have a final grade of 1% so that surface water drains away from the site.

This method is infrequently used in the cottage area because of unsuitable conditions and expense. Each site requires a shovel-tracked vehicle and a garage in which to store the equipment. Also, the site requires all weather access and an adequate amount of soil cover. In the cottage country it is very difficult to find a location with enough earth. With the abundant rock formations in these areas, there is the extreme danger of ground water contamination.

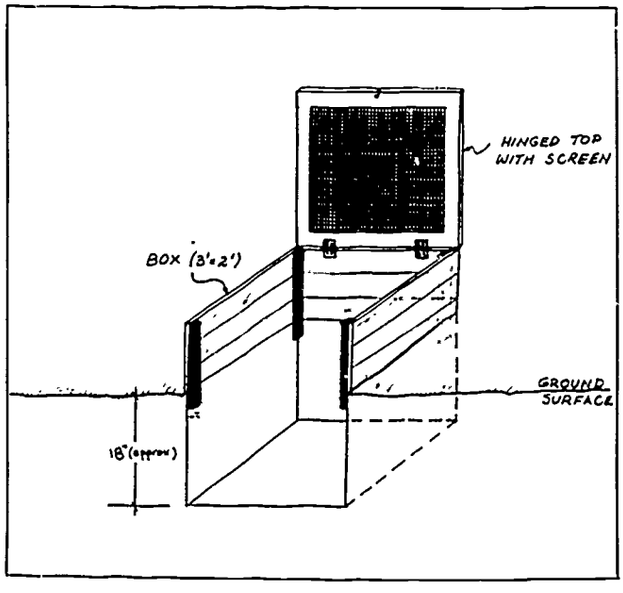
Incineration

Outdoor incineration of solid waste in the cottage country is not recommended. As well as contributing to air pollution, there is a great danger of a forest fire. Many of the cottage areas are very dry and could be set aflame very easily. In some areas before you can have a fire outdoors you must obtain a permit from either the County Clerk or the local forest ranger. Upon incineration, obnoxious gases are given off as well if the temperature is not great enough to completely destroy some plastics.

Composting

This is one of the best methods of solving part of today's garbage problem. Composting is a natural decaying process for kitchen and garden wastes. It is sanitary when done properly and can provide a good soil conditioner. There are at least two methods of composting: the complex method (like that performed by full-time organic gardeners), and the simple method, which will be explained here.

The first step is to dig a hole about 18" deep in the ground. Keep it fairly small (about 3' by 2'). Be sure to keep it away from waterways, wells and at least a foot above the water table. Build a bottomless box (of wood) to fit on top of the hole. A tight cover or screen should be constructed for the top of the box to prevent insects and animals from entering the pit.



Cross Section Through End of New Compost Pit

Now you can put all decomposable kitchen scraps into the pit. This is followed with a thin layer of manure and grass clippings (in that order) to ensure rapid and effective breakdown. It would be handy to keep a bag of dry manure (obtained from nearby farm) and a pile of green matter close to the pit. Each time the garbage is put into the hole, you can follow with the other two layers. We suggest that you dry meat bones before placing them in with the rest of the compost. If not, they will

have a tendency to attract animals (raccoons, etc.). Keep the pit relatively moist because the bacteria require water to survive. Earthworms also help in the decomposition. They thrive in this environment and rapidly reproduce. Who knows, maybe you can raise them for fishing bait. It is suggested that you put them in about 3 weeks from the start. At this time the bottom layers will have decomposed. Continue putting layers into the box until it is full. At this time you can start on another box. Allow the first one 5 to 6 weeks more to completely decompose while at the same time keeping it moist.

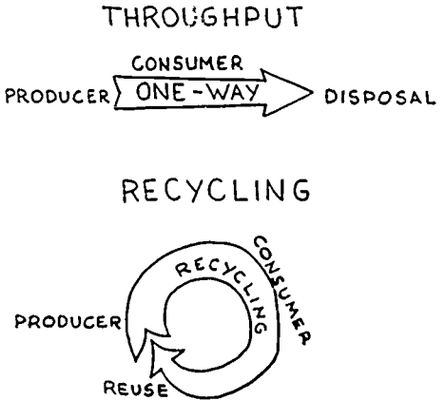
When the pit is finished, remove the compost down to the bottom and put it in piles on a large board in the sun for about 1 to 2 hours. The worms will bunch up at the bottom of each pile and can be easily removed and placed into the second pit. This compost is now ready for the garden.

Recycling

At present, our handling of raw materials can be described by the word THROUGHPUT.

> Resources travel a straight one-way route out of the earth, through our hands and into the garbage to be lost forever.

The long-term result of THROUGHPUT is the depletion of resources (especially non-renewable ones) and the build-up of wastes in the environment, often with detrimental effects.



Recycling is the *re-use* of materials (paper, metals, glass, plastics, food scraps, etc.) which man has taken from the earth. Instead of those materials being wasted through burning or burying, they are recycled and used again and again . . .

But the first step in conserving resources and cutting down on pollution is to reduce wastage. Here are some ways to cut down consumption in the supermarket.

Shop with Your Environment in Mind

1. Choose not to buy overpackaged items and let your grocer know why. If you need an item that is overpackaged, leave your excess packaging at the checkout counter. Consumerism is useless without communication.
2. Buy fresh meat, cheese and produce and have the storekeeper wrap it in plain paper. See that he uses only as much as is necessary. Avoid buying meat and produce prewrapped on cardboard trays in pliofilm, in plastic bags or any other unnecessary wrappings.
3. Buy juice in frozen, concentrated form and mix it in your own container. Better yet, squeeze your own oranges.
4. Choose your pop in returnable bottles. The non-returnable pop bottle, used only once, is the classic example of deliberate spiralling of consumption. A returnable pop bottle is used on the average of 9 times and can be used up to 50 times.
5. Buy milk and cream in returnable glass bottles or plastic jugs. Avoid milk and cream in wastemaker paper cartons, plastic bags and non-returnable glass bottles.
6. Avoid aerosol cans. Besides the fact that so little content goes into such an expensive package, they are a nuisance to dispose of.
7. If an item you need comes packaged in several different ways, select the item with the least amount of packaging and recycle the package.
8. Remember, directly and indirectly you are paying for the unnecessary packaging.

Most cottages have a fireplace that is in use during the summer season. You can burn your scrap paper in it. Newspaper and other large paper articles can be recycled.

Your vegetable wastes don't need to be thrown out either. Kitchen scraps and garden greens can both be put into a compost pit and returned to the Earth.

The non-returnable glass jars can be re-used as jam and jelly containers. This way you don't have to buy any jars when you make your home-made preserves.

Before you throw anything into the garbage, look at it and decide whether or not it could serve another purpose. Use your imagination.

How to Set Up a Recycling Depot for the Cottage

1. Inform everyone concerned of your project. This could be done through the cottage association, a service club, or town or township council.
2. Collect cans, bottles and paper in 45 gallon oil drums in boat houses or garages.
3. Or you could arrange a larger depot for the whole cottage country community. Arrange for volunteers and get a site on a parking lot or schoolyard. This larger depot requires regular work.
4. Then, take the collected waste materials to either a larger recycling depot or to companies who use recycled materials.

The following is a list of those companies in the Toronto and surrounding area who accept metals, glass or paper. Be sure to check with them first before you take a load to them to see that they will receive the type and size of your material. There may also be other dealers in your area, so check your phone book for the one nearest you. Look under "Scrap Metal" and "Waste Paper" in the yellow pages. For glass, check with the Glass Container Council, 10th Floor, 67 Yonge Street, Toronto 215 (364-4109).

Metal

Industrial Metal, 176 Cherry Street South, Toronto (461-6391) $8/ton

M & T Products, 670 Strathearn Avenue North, Hamilton (922-4116) $20/ton for food tins $10/ton for pop cans

Continental Can, 475 Commissioners Street, Toronto (461-0331)

Third and Birmingham, S. Etobicoke

7250 Keele Street, Thornhill (near hwy 7)

Crown Cork & Seal, 7900 Keele, Thornhill (near hwy 7) (669-1401)

American Can, 3300 American Drive, Malton (677-0950) small quantities only

Glass

($15 per ton – separated by colour, metal and plastic removed)

Consumer's Glass, 777 Kipling Avenue, Toronto 18 (Etobicoke) (239-7151)

Dominion Glass, Drapple Street, Hamilton

Dominion Glass, 100 West Drive, Bramalea (457-2423)

Paper

Krever Paper Stock, Ltd., 451 Front Street East, Toronto (364-6226)

Stanton Salvage, 51-A Eaton, Toronto (461-7046)

Salvation Army (366-4686) Call for pick-up in Toronto

Recycling Depots

Since community recycling depots in Toronto are constantly changing, you may wish to contact Pollution Probe (928-6155) to find out their current locations.

Chapter V

Pesticides

A. INTRODUCTION

We have become accustomed to controlling pests (e.g. weeds, insects, mites, fungi, rodents) by the use of pesticides. Today, most pesticides are composed of synthetic chemicals designed to kill or inhibit the plant or animal considered to be a pest.

There are over 200 chemicals available to the cottager as either insecticides, rodenticides, fungicides or herbicides. But most of these chemicals can be considered as BIOCIDES - killers of living organisms.

B. WHY DO COTTAGERS USE PESTICIDES?

There are numerous reasons for the use of pesticides around the cottage. But basically the reasons can be divided into four categories:

1. Control of nuisance insects – such as mosquitoes, black flies, wasps and house flies.

2. Protection of Flowers, Vegetables and Trees against insects and plant disease.

3. a. Control of Weeds on lawns and roadsides by the use of herbicides.
   b. Control of Weeds and Brush on rights-of-way and roadsides by Ontario Hydro, Townships and cottage associations.

4. Control of Aquatic Nuisances
   a. Algicides and Aquatic Herbicides for water plants and algae.
   b. Larvicides for black fly and mosquito larvae.

C. THE EFFECTS OF USING PESTICIDES

Although using pesticides inside the cottage, in the garden or around your lot may seem to be a safe, convenient way of treating a pest problem, the subsequent effects are often far-reaching and highly undesirable. For instance, pesticides leave residues in the air, water and vegetation. These residues may persist for a long time to come, especially if the pesticide belongs to the chlorinated hydrocarbon category. Animals and man, which are part of the complex ecological food web in the environment, may eventually accumulate these residues in their systems. The effects can include nervous disorders, reproductive failure, birth deformities, cancer and death.

For example, DDT, which is a chlorinated hydrocarbon pesticide, acts initially as a nerve poison when released on insects. But there are secondary effects also. DDT is persistent, toxic and accumulates in living tissue. It is a long-term chemical whose residues remain in the environment for many years. (The half-life of DDT is estimated to be between 12 and 15 years, meaning that from 12 to 15 years after the time of application, one-half of the DDT will still be present in the environment.) Prolonged exposure to small doses results in an accumulation of persistant pesticide in the body which can lead to liver, kidney and brain damage, cancer, hormone imbalance, reproductive failure and nervous disorders.

Even if you confine your use of DDT to a select area, the chemical will not remain there. Studies on the mobility of DDT have proven that these chemicals can be found hundreds of miles from the site of application.

Studies have been made in our own province into the effects of DDT. In the Muskokas, for instance, it was found that DDT residues in lake trout were above the acceptable level of 5 parts per million. This level has been set by the Canadian Food and Drug Directorate, indicating the minimum acceptable level at which fish may be sold.

These studies have also pointed out that lake trout are unable to reproduce because of high concentrations of DDT in their reproductive organs.

In Dr. Richard Frank's brief, "Monitoring The Ontario Environment For Pesticide Residues," the following statement was made concerning DDT.

> "Spraying of non-agricultural land and direct application to water on marsh areas has no doubt contributed to environmental contamination of Ontario Lakes... The treating of areas for recreation with DDT and especially the Muskoka Lakes area, will undoubtedly take many years to return to normal."

Recent legislation has banned the use of DDT. Also illegal are the insecticides deildrin, aldrin, heptachlor and the herbicide 2,4,5-T for home and garden use. Some cottagers and homeowners, though, still have one or more of these chemicals in storage. If you're one of these people, be sure you take them to the Waste Management Branch of the Ontario Ministry of the Environment for proper and safe disposal. The phone number in Toronto is 965-6634.

D. WHY PESTICIDES ARE NOT A SOLUTION

1. They Are Not Permanent

Pest populations can recover from initial application. Thus, it is necessary to continually re-spray. Pesticides may provide the cottagers with temporary relief. but they aren't a cure.

2. Insects Develop Resistance

It has often been demonstrated that certain insects within a given population are able to detoxify chemical poisons, render them harmless and survive. Within several generations, the pest population is entirely immune to the toxic effects of the pesticide.

3. They Kill Beneficial Parasites and Predators

Most pesticides are non-selective. They attack forms of life other than the target organism. In this way, beneficial parasites and predators that otherwise might regulate the target pest are killed. In the absence of these natural enemies, higher densities of pest species may occur.

4. They are Hazardous to Many Living Organisms

Because many chemicals (especially those like DDT and other similar chlorinated-hydrocarbons) are chemically stable, they survive in soil, water and living tissue. Their total biological effects upon an organism are not as yet completely known. However, we do know that due to their chemical properties, they can have mutagenic and carcinogenic or cancer causing effects and possibly others.

5. There is No Such Thing As Localized Application

Factors such as wind drift, soil erosion and water run-off can spread those chemicals which you sprayed on *your* property many miles away. Thus they can potentially harm soil, water, or animals which are remote from the point of application.

6. They Are More Costly

In the long run, the use of pesticides in the cottage, home and garden and especially on the farm is very costly. There are other alternatives which provide a much safer and less expensive method of control.

E. KNOW WHAT YOU'RE USING

Toxic chemical pesticides are far easier to obtain than a prescription from the doctor. They are attractively displayed and readily accessible in almost any supermarket, grocery store, hardware or garden shop.

What isn't displayed or noticed are the harmful ingredients of most pesticides. For instance, the moth-proofing material you're using may contain DDD (a by-product of DDT). The kitchen shelf paper that lines your cupboards and drawers may be impregnated with an insecticide. That aerosol spray can you use to kill flies and bugs may have dieldrin in it and you've been spreading it to all parts of your cottage.

To protect yourself and your environment against the ill effects of pesticides, see below.

F. POLLUTION PROBE'S RECOMMENDATIONS

1. If at all possible, avoid the use of any pesticides. This is the safest recommendation we can make. Try the following:
   - For mosquitoes and black flies, use a repellant such as "Off" or "6-12."
   - Do not provide the mosquito with a place to breed. Drain puddles, ditches, and marshy areas near the cottage or home; empty or remove such receptacles as rain barrels, tin cans, catch basins, eavestroughs, and bird baths. Keep grass cut short.
   - Screen all windows, doors and openings. Use a bug hat out of doors.
   - Use a fly swatter. (Remember them?)
   - Use boiling water or a trap for pesky ants. Burn wasps' nests at night.
2. Never, under any circumstances, use DDT, dieldrin, aldrin, heptachlor, or the herbicide 2,4,5-T. Their use is not only highly dangerous but also illegal.
   - DDT, dieldrin, aldrin and heptachlor are all very persistent members of the chlorinated hydrocarbon family of insecticides. They remain in the environment and build up to toxic and even fatal levels in food chains. Furthermore, the carcinogenic properties of DDT have recently been demonstrated. The general use of these chemicals in Ontario has been banned but they are still available through many outlets. If you have any of these chemicals in your possession now, call the Ontario Ministry of the Environment, Pesticide Control Service (965-2401) and ask where you can take it for safe disposal.

     2,4,5-T has been shown to have a mutagenic (mutation producing) effect similar to the drug thalidomide. It was recently banned by the federal government for household, recreational and garden use but not for roadside spraying or Hydro rights-of-way. It is often found in such mixtures as "Brushkill."

     We would recommend that you also avoid the following: chlordane, 2,4-D, sevin, lindane and toxaphene. Do not use Vapona strips near food.
3. If it is absolutely necessary to use an insecticide against mosquitoes and black flies, then we would suggest methoxychlor or malathion, or a combination of these two.
   - Methoxychlor is a short-lived organo-chlorine with relatively low mammalian toxicity. It is dangerous to fish and should not be used on or near water.
   - Malathion is a short-lived organo-phosphorous compound. It also has low toxity to mammals.
   - Warning! These are still dangerous chemicals but less dangerous than others.
4. In using any pesticide there are important rules of handling and application:
   - Follow the directions fully, use only the amount required and no more.
   - Keep out of reach of children and pets.
   - Do not transfer from the original container or mix in milk bottles, soft drink bottles, or other such containers.
   - Never spray near food, food containers, or surfaces which food may touch.
   - Do not inhale or ingest any spray; avoid wind drift.
   - Avoid direct contact at all times. If spilled on the skin, wash at once with soap and water. Remove and wash any contaminated clothing.
   - Do not wash containers or sprayers in the lake or river.
   - Do not try to kill 100% of the pests. This is expensive and adequate control is achieved with 60 to 70% mortality.
5. Remember that the use of any larvicides such as Abate or Batex for control of black fly and mosquito larvae or the use of algicides or aquatic herbicides in lakes, rivers or streams requires a permit from the Water Quality Branch (formerly in the Ontario Water Resources Commission). It is illegal to use these compounds without such a permit.

G. BE A SAFE GARDENER

The first thing to remember about gardening at the cottage (or home) is to aim for control of the pest – NOT EXTERMINATION! Overuse of chemical pesticides will not only destroy the pest (which in most cases can develop a resistance), but also the earth worms, ladybugs, spiders, praying mantis, toads, bees and turtles which are all beneficial to the cottager.

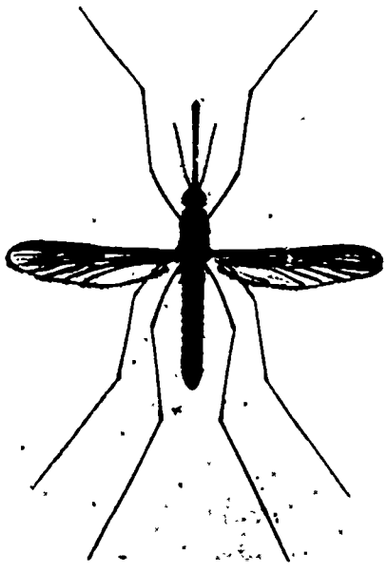
The safest way of controlling pests is not to use a synthetic pesticide at all. Be an organic gardener, or, if you must, use an insecticide that comes from a plant. Such insecticides are: Pyrethrum, Rotenone and Ryania. Or, try using soap suds (*not* detergents) as a spray to control insects on flowers or vegetables. Water itself will act as a spray to wash aphids and slugs from plants. Cayenne pepper dusted over dew-wet vegetables will repel caterpillars, and a bowl of stale beer will attract slugs and drown them.

H. AQUATIC HERBICIDES AND LARVICIDES

Herbicides, algicides and larvicides are chemicals used in the control of aquatic plants and insects. The aquatic herbicides and algicides are employed to cut down on algae and water weed growth while the larvicides are used in water to prevent the breeding of mosquitoes and black flies.

Section 28b, subsection 1, of the Ontario Water Resources Commission Act provides the following:

"No person shall add any substance to the water of any



Mosquito

House Fly

well, lake, river, pond, spring, stream, reservoir or other water or water course for the purpose of killing or affecting plants, snails, insects, fish, or other living matter or thing therein without a permit issued by the Commission."

There are two exceptions to this regulation for which no permit is necessary. They enable:

"1) a person to apply any substance to a pond which is wholly enclosed by his property and has no out-flow, and

2) a person to apply a substance to a drainage ditch for the purpose of controlling emergent aquatic plants if he uses a substance approved for this purpose under the Pest Control Products Act of Canada when applied according to the directions provided with the substance."

This legislation tries to ensure that there will be no unreasonable infringements on the rights of other water uses and that substances will not be used which are toxic to humans, fish, domestic animals and wildlife. It also attempts to ensure that no one will use stable compounds (i.e. chlorinated hydrocarbons) which might tend to accumulate in water, thus posing a threat to potable water supplies.

It is important to remember, however, that using an algicide or an aquatic herbicide to kill unsightly weeds or algae, merely attacks the symptom of the problem and not the cause. The cause is usually high nutrient levels which stimulate an overgrowth of algae and weeds (see chapter on eutrophication). Furthermore, merely killing algae and weeds and then leaving them in the lake to rot not only causes a serious BOD problem but also injects the phosphorus that is contained in the plants back into the water, so that next year's crop will be even more luxuriant. If weeds must be killed, it would be much better to use a mechanical weed cutter and remove the weeds for use as compost or soil conditioner. This would prevent a BOD problem and remove phosphates and other nutrients from the lakes.

But again the real solution to the problem of aquatic growth lies in eliminating the artificial input of nutrients (especially phosphates) not in using poisons or mechanical cutters.

Chapter VI

Boating

A. INTRODUCTION

Boating is fast becoming a great source of relaxation and enjoyment. At the same time, however, it is reducing the recreational values of our waterways. Our lakes and rivers are becoming vastly overcrowded with powerboats in all shapes and sizes. Exhaust gases and oil discharges are part of the problem we face as a result of motor boating. Sewage from heads, discharged without treatment into lakes and rivers, contributes unnecessarily to the pollution problem. Noise, gas spillage and turbulance are other factors not to be overlooked.

The controversy concerning the quantitative effects of pollution caused by outboards is still unresolved. There are two sides to the debate. On the one side there are the motor manufacturers who state that there is minimal pollution due to outboards, while on the other hand some scientists and naturalists claim that there is a destructive effect on the environment. This would suggest the need for more research.

All internal combustion engines produce exhaust gases as a result of the burning of fuel. Outboard motors are generally two stroke engines in which every downward stroke is a power stroke. One stroke is for exhaust and intake while the other is for compression and ignition.

The two stroke engine does have some disadvantages. Since the exhaust and intake ports are open at the same time, there is a loss of unburned fuel. This is the reason for the smoky exhaust you see coming from your motor. Also, the two stroke must operate at a lower compression ratio. Thus there is less power per quantity of fuel consumed. Lubricating oil is mixed with gasoline and then, with air added, it enters the crankcase where some of the gas-oil mix condenses on internal engine parts. Since gas is more volatile, it is partially vaporized leaving essential engine parts coated with a thin film of oil. More and more of this oil mixture accumulates in the crankcase. If it were not removed, it would cause the engine to fail. Therefore, valves were incorporated into the engine to permit part of the oil mixture to enter the exhaust which is discharged into the water. After a short time the gas evaporates and the oil remains as a film on the surface or an emulsion (a milky liquid with particles suspended in it). The wasted fuel is greatest while the engine is idling or at low speeds. A loss of as much as 40% of the fuel can occur but 10-20% is more common.

B. EFFECTS OF GAS AND OIL

The effects of gas and oil are both short and long term. Immediately, the gas has a toxic effect on the micro-biota (small life in water). The oil has adverse effects on the phytoplankton and zooplankton. It may not kill them but it hinders their reproduction and since they are a source of food for other aquatic life, their absence could upset the ecological balance in the lake or river.

There is also a BOD increase as a result of oil in water. One reason for this is that to oxidize the oil, oxygen is depleted from the water. About 3,300 grams of O_2 are required to complete the oxidation of one litre of mineral oil. This would deplete the O_2 from 12,600 gallons of sea water. Another way that oil reduces dissolved oxygen is the thin film on the surface which doesn't allow transfer of O_2 from the air to the water. This aeration is a source of oxygen for aquatic life.

Oil in water has also shown an adverse effect on fish. Studies have shown that it affects their lifetime and growth. Also, infection and disease of their flesh can occur at a level of 8 gallons of outboard fuel per 1,000,000 gallons of lake water per season.

As well as these ecological effects, there is also the aesthetic one. Who wants to swim in water with a film of oil on the surface?

C. EFFECTS OF EXHAUST

There are four main components of exhaust emissions: organic hydrocarbons, carbon monoxide, lead and nitrogen oxide.

As for the lead compounds, they are extremely toxic and accumulate in the aquatic plant and fish life, perhaps to a dangerous level – dangerous both to fish and to people who eat them. This would suggest the need for research by the outboard manufacturers into finding ways of producing engines that can run efficiently on non-leaded gasoline. Some marine fuels sold now are low in lead content. Therefore, if you fill your boat tank at a roadside gas station, you might be avoiding spillage but you are probably purchasing a gasoline with the wrong concentration of lead.

The organic hydrocarbons are also toxic. If 8 gallons of gas are consumed per 1 million gallons of water, then the tainting of fish flesh begins. At 1 gallon gas/1 million gallon H_2O, there is a measurable increase in the threshold odour number of the water.

D. TURBULENCE

Heavy boating on a river is especially destructive to shorelines and docks due to the erosion and damage caused by large wakes. Silting at the shoreline occurs as a result of turbulence and results in increased suspended solids. Organic matter from the bottom is also scoured up into the water. To decompose this matter, oxygen is required. Thus the BOD in the water column is increased.

There is little, if any, legislation regarding water use by boats. Restrictions will probably be inevitable but in the meantime, you and your cottage association can police your own lake. See the Self-Help Guide for details.

E. NOISE

The point at which permanent hearing damage begins through prolonged exposure is 85 dB (Decibel is a measure of relative intensities of sound). Most modern motors are between 64 dB and 77 dB, depending upon make, size and operation but this is at a distance of 50 feet. The noise level would be greater for someone sitting in the boat. If travelling for prolonged periods, permanent damage could result. Also, these levels result from tests on modern motors. Earlier models are not constructed as well so noise levels would probably be higher.

To improve noise emissions from outboards, increased amounts of efficient silencing blanket material could be designed into engine covers. Refinements in operation of the motor could also cut down on noise.

One of the biggest reasons for reducing noise is the aesthetic point of view. The reason one leaves the city to go to the cottage is for peace and quiet, not to hear a continual droning of outboards across the lake.

Sewage From Heads

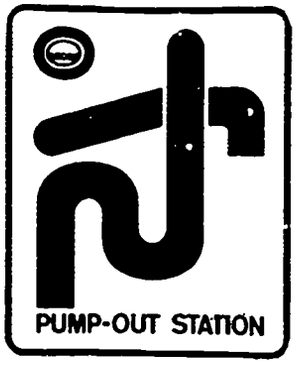
It is *illegal* to dump any raw sewage or garbage into Ontario waters. The Water Quality Branch administers and occasionally

enforces this regulation.

Make sure your cruiser is properly equipped and always use a certified pump-out station. Check to see that sewage is properly disposed of at these sites.

A summary of the requirements of the Regulation is as follows:

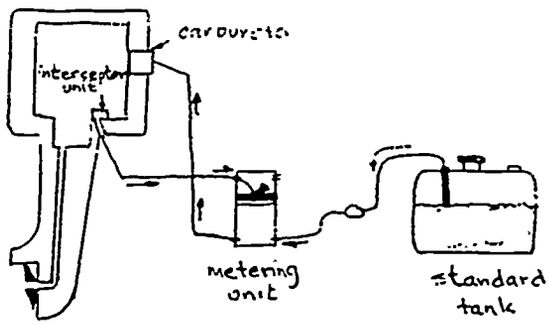
A. Sewage must be retained in equipment of a type approved by the Ministry of the Environment.
B. Equipment which will be approved for the purpose of the Regulation includes:
   1) Retention devices with or without recirculation features which retain all toilet waste for disposal ashore, and
   2) Incinerating devices which reduce to ash all sewage and toilet waste.
C. Approved equipment shall (1) be non-portable, (2) be constructed of structurally sound material, (3) have adequate capacity for expected use, (4) be properly installed, and (5) in the case of storage devices, be equipped with the necessary pipes and fittings conveniently located for pump-out by shore-based facilities. (Although not specified, a pump-out deck fitting with 1½ inch National Pipe Thread (NPT) is commonly used).
D. All pleasure craft, including houseboats and charter cruisers, with a toilet or "head" aboard, must have a holding tank or sewage treatment device. (A boat owner may, if he wishes, remove the head and still comply with the Regulation.)
E. Visiting pleasure boats equipped in accordance with home jurisdiction laws in effect requiring either sewage holding or incineration systems will be considered to comply with the Ontario Regulation. Visitors from a jurisdiction with no home-based regulations or who maintain their boats in Ontario are required to comply with the Ontario Regulation in all respects.
F. An Ontario Regulation requires that marinas and yacht clubs provide or arrange pump-out services for a customer who has a pleasure boat with a toilet aboard. In addition, all marinas and yacht clubs must provide litter containers that can be conveniently used by occupants of pleasure boats. Operators of marinas and yacht clubs offering these facilities to pleasure boaters display the illustrated sign on or near their property.



Engine Improvements

Some steps are being taken to correct the problems caused by outboard engines. When the 1972 models came out, they were drain-free and unused fuel is recycled through the combustion cycle. Many manufacturers are making motors that can run on a 50:1 ratio of gas to oil instead of the old 24:1. Some oil manufacturers are supplying a marine fuel with reduced lead (3/4 less). For better performance, they have produced an oil that can be mixed at 50:1.

Although some improvements are being made in the newer models, what do we do with the existing ones? It is estimated that it would take about 10 years before these would be replaced by newer ones. One answer is to buy an exhaust recycling device. This would take the puddle-gram and recycle it to be burned during combustion. As well as stopping harmful gas and oil spillage, it would pay for itself in gas saved after just one season.



Pollution Control Device

Suggestions for Better Boating

1. Always keep engine tuned because an untuned one wastes fuel (incomplete combustion). This includes clean and adjusted plugs, ignition points, fuel system/ and carburetors.
2. Use correct gas and oil mixture. Use lead-free or low-lead gas if your motor will run on it.
3. Avoid spillage. Fill your tank away from water. Check to see that marina operator doesn't spill your gas and oil.
4. Don't run the motor if it isn't necessary. If waiting at a dock for someone, turn it off. The oil film is most distasteful in swimming areas.
5. Be courteous when driving. Stay away from shore and remember that canoeists, sail boaters, fishermen, swimmers and wildlife would also like to use the lake.
6. Reduce speed near shore or in narrow channels.
7. Insist on a quiet engine when you are buying, or better still, buy a canoe or sailboat – they don't pollute.

Chapter VII

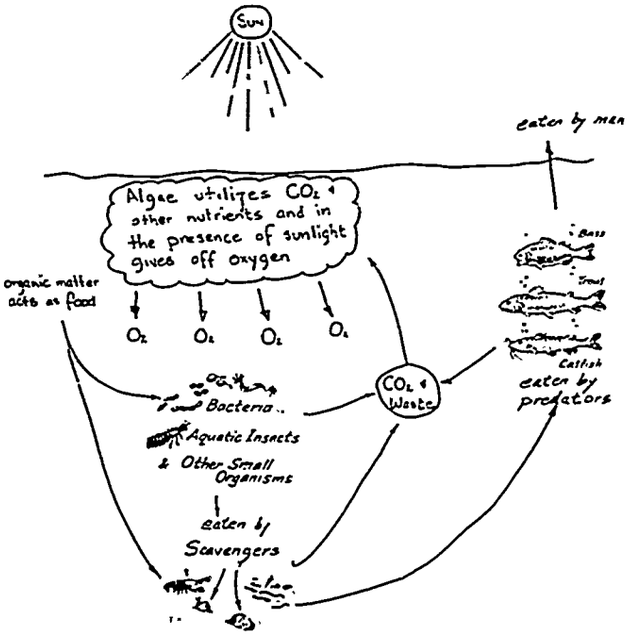
Eutrophication, or where did all the Algae come from?

A. THE PROCESS OF EUTROPHICATION - ITS CAUSES AND SYMPTOMS

Eutrophication is the nutrient enrichment of a lake by either natural or artificial means. It is associated with the increase of the dissolved mineral content of a lake. The most important mineral nutrients for plant growth are phosphates, nitrates and carbonates. They enter the lake through precipitation, land run-off and percolation of soil water into the lake. They originate from natural sources such as vegetation, soil leaching and the atmosphere as well as man-made sources such as detergents, agricultural fertilizers and human sewage. The higher the concentrations of these nutrients, generally the higher the productivity and fertility of the lake. This is reflected in the increased growth of algae or phytoplankton.

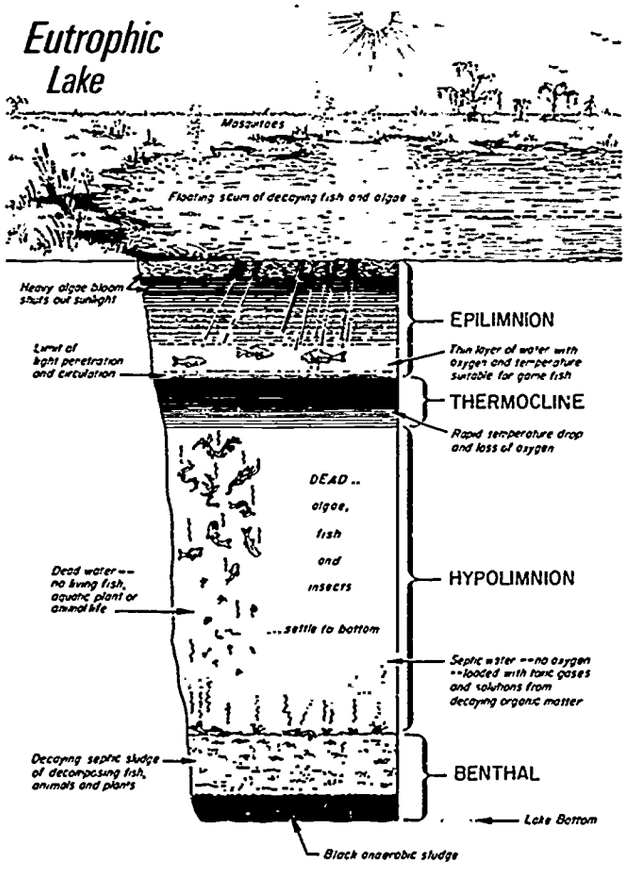
The productivity of algae (and therefore the productivity of whole aquatic ecosystem) is regulated by the amounts of nutrient available as well as climatic conditions such as temperature and sunlight. Also, the characteristics of the lake are contributing factors (size, depth, shape and location). Although other nutrients contribute to eutrophication, phosphates seem to be the limiting factor in most fresh water lakes since they are most often in shortest supply. An increase in phosphate content therefore usually produces a corresponding increase in algae growth.

The algae are an important component of the aquatic system. They provide food for all other levels of the food chain including those game and commercial fish at the top of the chain. However, equally important, they produce oxygen that is necessary for the life of fish and other aquatic life. When there is an abundance of phosphate added to a lake (i.e. from septic tanks and detergents) there is an overgrowth of algae and waterweeds.



Whereas a certain amount of algae and weed is essential for a healthy lake, too much can lead to deterioration of water quality and a permanent loss of recreational value. Algae can cover rocks, piers and shorelines with a green slimy coating. Submerged and emergent weeds can choke bays and channels, making boating or swimming impossible. During storms the algae and weed is often dislodged and washed ashore. Here it decays, producing a foul odour.

Floating algae can impart obnoxious tastes and odours to lake water and attached algae often overgrows water intakes and clogs filtration equipment. But these are only the most obvious symptoms of eutrophication. Excessive algae and animal life dies and falls to the lake bottom and dissolved oxygen is consumed in the decay process. During the summer or winter when the lake is "stratified" and the oxygen in the lower waters is not replaced, this extra oxygen demand from decaying algae and animal life can lead to the deoxygenation of the cool, lower water, resulting in the death of fish and other aquatic life which lives there.



The game fish which need the cool waters and also the oxygen, gradually disappear as a lake becomes eutrophied. The coarse species, such as catfish, carp, and suckers gradually take over. The upper waters become green and choked with life; the lower waters, deoxygenated and dead except for slow anaero-

bic decay and the growth of sludgeworms which ean tolerate very low oxygen conditions. One other important proeess also takes plaee. During deeay in the presence of oxygen the phosphate in plant and animal material is largely trapped in the mud of the lake bottom but when the organic load becomes so great that oxygen is depleted, an important chemical change takes place at the mud-water interface. Phosphate is no longer trapped, it is injected baek into the lakewater where it stimulates further growth and subsequent decay - a vicious eircle.

Large scale deoxygenation of the lower waters is "the poini of no return" for a lake. Once it is reached, the phosphate is no longer removed by sedimentation; it is "reeycled" continually and water quality declines rapidly. The only removal meehanism is flushing of the lake by incoming water but this is often counteracted by a small natural input of phosphate in the incoming water. In the end, the lake will fill in from sediment build-up on the bottom and shoreline growth until it "dies" and becomes a swamp.

This change, known as eutrophication, takes place in all lakes. The lake progresses steadily through several stages like those in a man's life. They are youth, maturity, old age and eventually death. In scientific terms the stages are known as oliotrophic, mesotrophic and eutrophie. Small, shallow lakes may beeome swampy within a hundred years after a glacial retreat while large and deeper lakes can take thousands of years to reach this stage. Man's influence and his artificial input of nutrients, however, can greatly accelerate the process.

The waters are different in the north and south of Ontario. This is due to the geographical differences in the regions. The area in the Muskoka and Haliburton regions is surrounded by granitie bedrock. The lakes in this Pre-Cambrian Shield area are low in the production of algae. They age less rapidly than those lakes surrounded by deeper and richer soils, such as lakes in the Kawarthas and Southern Ontario. These lakes havea high level of photosynthesis activity and are generally referred to as naturally eutrophic. In either case, the artificial input of nutrients by man results in a greatly increased rate of eutrophication and constitutes the greatest threat to not only the quality but the very existence of our recreational lakes.

B. ACTION - WHEN?

Now is the time for us to take action against the artificial fertilization of our lakes. Studies by the OWRC on recreational lakes in northern and central Ontario show that cottage wastes appear to be the only source of artificial nutrients. Approximately one-half of the phosphates added artificially to the lake comes from human sewage while the other half eomes from detergents.

Detergents

We can eliminate one-half the problem by refusmg to buy synthetic detergents containing phosphates. In most of the cottage areas the water is soft and quite appropriate for the use of soap. If your area has a hard water supply, try using soap with hot water and add some washing soda (sal soda) to soften the water. Also, rinse your clothes well.

If soap is too much trouble, use one of the following low phosphate detergents.

Pollution Probe Recommends

SKORTEX	
ARLAC	
STEINBERG	Phosphate free
BYISOL	Light Duty
ENGRIME	Phosphate free
SEARS	Laundry Detergent Phosphate Free
GOLDEN PRODUCTS	Gold Power

Be careful!!! Some phosphate free detergents on the market today contain NTA (nitrilotriacetic acid). There have been some indications that this compound can be harmful. Until further research has been carried out, we suggest that you do NOT use any product containing NTA.

Also, while we're on the topic of washing, we suggest that you do not wash yourself in the lake. Not that pure soap pollutes, but it does leave suds that are unsightly from an aesthetic point of view.

We also discourag' the washing of hair in the lake for the same reason, as well as that some shampoos contain detergents.

Sewage

Now that we have half the problem solved (that's if you do it!), we can start working on the other half - the phosphate in human waste. Here we cannot prevent the input of phosphate to our wastewater as we could with the detergent problem. Instead, we must insure that the phosphates (and hopefully, the nitrates) are removed from the effluent before it enters the lake.

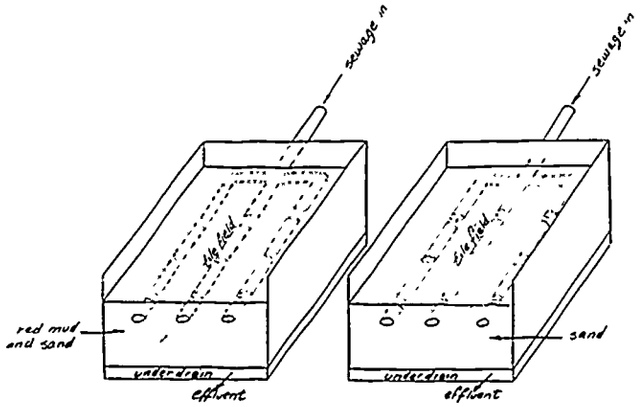
Unfortunately, there has, until recently, been very little attention paid to the nutrient removal capacities of conventional septic tank and tile field systems. Basic soil chemistry will tell us that nitrates are not bound well by any soil type but that phosphates are bound to a considerable extent by good agricultural soil, at least up to a point of saturation. But let's look at the tile bed situation. When the effluent passes from the septic tank and into the soil of the tile bed, the phosphates are largely in solution. If the right type of soil were found in the bed, these phosphates would be either bound to soil particles or precipitated as insoluble compounds, at least until the bed became saturated with phosphate. If the soil does not bind or precipitate phosphate to any appreciable degree or becomes saturated, then the phosphates in solution merely seep through the bed and enter into the groundwater or run down the surfaee of bedrock or clay. Either way, they end up in the lake and contribute to eutrophication. It has been shown that in order to effectively retain phosphate, a soil must have one or more of the following characteristics:

- rich in iron
- rich in organic material

Unfortunately, soil in our cottage country areas, especially the Pre-Cambrian areas, is not noted for these characteristics and furthermore, the Department of Health has for many years recommended sand and gravel as good material for tile beds (especially raised beds). While sand and gravel are good for bacterial removal, they are particularly poor at phosphate removal.

Although research in these areas is far from abundant, there are several studies which support the general conelusions stated above:

(a) Dr. R. Deamisch (formerly of the Health Department) experimented with "red mud" as a phosphate removal agent. "Red mud" is an iron rich byproduct of the aluminum manufacturing process at Arvida, Quebec. Dr. Deamisch set up two tile bed systems in large steel tanks with under-drain systems. In one he put pure sand and in the other he put a mixture of ½% red mud and 99½% sand. He allowed septic tank effluent of a known phosphate content to run into each system and then measured the phosphate content of the effluent from the under-drain system. The "red mud" system provided 90% phosphate removal while the "sand" system removed only 10% of the phosphates.



90% Phosphate Removal *10% Phosphate Removal*

The effect of the "red mud" was important but even more significant was the very low phosphate removal of the sand system – a system which is representative of many tile bed systems in use throughout Ontario.

(b) The OWRC has also set up smaller scale model septic tank and tile-field systems in its laboratory with a variety of soil types. An initial removal of phosphate was found but eventually the concentration coming out was the same as the concentration going in.

(c) During field work in the Muskoka Lakes, OWRC personnel were able to locate several tile systems where an accurate estimate could be made of total phosphate input over the years. The soil in the bed was then tested in an attempt to find this phosphate. The results showed, however, that the phosphate bound in the tile bed soil could not account for the total phosphate input. The large amounts unaccounted for must have gone into the lake.

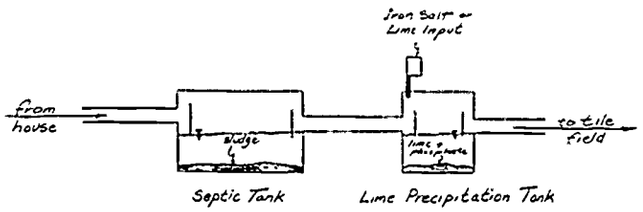
(d) There have been some similar studies performed in the United States. For example, in Maine tests were conducted on three types of soils from the Adams, Plaisted and Paxton series. It was found that the Adams soil had the lowest phosphorous retention capacity. However, it was the only soil of the three suitable for a tile field system. The others were too impermeable and clogged rapidly upon receiving septic tank effluents.

These studies are not totally conclusive and they do need to be followed up by much more intensive research. However, there is considerable evidence that while conventional septic tank and tile field systems may effectively remove bacteria, they are, in certain common types of soil, a major source of phosphate pollution. Even systems which meet all the current standards may still be sources of phosphate input, especially if they use sand and gravel tile beds which the former Public Health Engineering Service, Department of Health (now in the Department of Environment) continues to promote.

There is a desperate need for research into septic tank efficiency (especially phosphate removal), septic tank testing techniques, and alternatives to the conventional systems. Yet the research being carried out by the Provincial Government in these areas is minimal and far from adequate. There are a number of alternative systems and modifications to current systems which need immediate investigation by the Ministry of the Environment. They are:

(a) *"Red Mud" use in tile beds.* This system has already been proven workable under experimental conditions. It needs further work on long-term performance and economic feasibility.

(b) *Iron salt or lime precipitation.* Iron salts or lime, when added to a septic tank, will precipitate phosphates. Perhaps by adding these compounds directly to the septic tank or to a second separate chamber, we could effectively remove phosphates. This system would require removal of the precipitated phosphate material.



Precipitation of Phosphates

(c) *Ion exchange columns.* An ion exchange column which retains phosphates might be fitted to the outflow of a septic tank.

(d) *Incinerator and Chemical Toilets.* These types of waste disposal will alleviate the phosphate problem; but what is to be done with the wash wastes?

(e) *Holding Tank.* The phosphate problem is transferred from several small sources to one large one – the treatment plant. New and better treatment plants (tertiary) will have to be built to handle the additional load.

These are some of the alternatives that have to be investigated.

NOW, BEFORE IT'S TOO LATE. Put pressure on the Government for this type of research. Do it!

Chapter VIII

Development

A. INTRODUCTION

The cottage country of Ontario is assuming characteristics we usually associate with the larger cities of the Province. Beaches that were once used for swimming are now forced to close because the water is unfit. Many of the subdivisions springing up along lakes resemble the more monotonous suburbs of the cities. Interchanges are being built to handle the very heavy streams of auto traffic. Waterways are beginning to resemble highways with the noise, odour and danger produced by motorboats. There is a general tendency toward overcrowding and a decline in the ability to enjoy the environment. Solitude and isolation seem non-existent. Campers are turned away from overburdened parks. Lakes that were once clear and stocked with game fish now resemble green pea soup and the situation deteriorates year by year at an alarming rate.

Sound familiar? It's called development. Last year alone, 15,000 new subdivided cottage lots were sold or leased in Ontario. The tremendous pressure for development and recreation currently being exerted on our cottage country is merely one of the many symptoms of our society's rapid growth on a finite resource base. Unless we stabilize our population, resource consumption, and economic growth at reasonable levels, our cottage country will continue to be gobbled up by "progress."

There's little doubt that the rapid and largely uncontrolled rate of development that our recreational areas are now experiencing is one of the root causes of our environmental problems. Other causes of course include the per-capita production of wastes, the degree of treatment, the lack of strict regulation and enforcement, and the lack of public awareness – most of which we have already discussed. Let us, therefore, focus our attention on development.

The Government and the people of Ontario are beginning to realize that lakes, like all ecosystems, have limits. They have a certain capacity to safely sustain development over the long term. For some large deep Southern Ontario lakes with ample soil, the capacity is high. For other more fragile pre-Cambrian lakes with little soil cover over bedrock, the capacity is quite low. If the level of development is below a lake's capacity then the environmental impact will generally be small (but not absent). If however a lake's development capacity is exceeded (if it is overdeveloped), the combined effects of pollutants and other pressures will bring about a very degraded environment both from an ecological and aesthetic point of view. It may take several years for the effects of overdevelopment to become obvious but there is no escaping the inevitable results. While we know that lakes have development capacities, they are very difficult to ascertain for they vary widely from lake to lake and depend on a large number of geological, physical, chemical, biological and social factors which we have not yet been able to integrate into a model or a formula. The Department of Lands and Forests (now Natural Resources) has for a number of years used a very approximate rule-of-thumb that there should be a minimum of 10 acres of lake surface for each cottage. This criteria, derived from general experience, is oversimplified but it does indicate in a general way whether your lake may be overdeveloped. Find out the surface area of your lake in acres (from a map, the township clerk, or the local Forest Ranger) and divide this by the number of cottages. How did you do? Whatever the result, read on!

B. THE CAUSES OF OVERDEVELOPMENT

The basic causes of overdevelopment are considered to be.

- a high demand for recreational land
- a lack of good planning in recreational areas
- a lack of understanding of safe development capacities
- a lack of regulation over developers

These problems are of course intensified by poor soil conditions and the lack of an effective sewage disposal system for cottages. This tends to make each cottage a worse source of pollution and therefore lowers the number of cottages which a lake can support. Other uncontrolled pollutants or pressures also exacerbate the problem.

Let us examine these causes in more detail:

1. High Demand for Recreational Land

At present, there is an unprecedented and growing demand for recreational land in our cottage country which is due to several factors:

1. Increasing population – More people all wanting to use the cottage country
2. Increasing affluence – People have more money to spend on recreation
3. Increased leisure time – shorter work weeks and longer vacations are giving people more recreational time.
4. Increased Mobility – Faster cars, better roads, and the snowmobile all make the cottage country more accessible throughout the year
5. Increased desire to escape the city – With increased pollution, noise and crowding in our cities and the hectic pace of modern life, people are increasingly turning to the lake country for relief and relaxation.

2. Lack of Good Planning

For the most part, our cottage country is not adequately protected by comprehensive planning either at the municipal or provincial levels. Very few municipalities have developed planning legislation for their areas nor are there effective guidelines to zone or control development now taking place. Unfortunately, in many areas there is little desire to control development, rather the local residents want to see rapid development in order that they might make quick profits through land sales, construction and the supplying of goods and services. There is little regard for the long term viability of the area. If the lakes become overdeveloped and polluted, there will be very little to attract a tourist trade or an active cottage community. No one wants a vacation slum, yet this has happened in Ontario (for example Wasaga Beach and parts of Lake Simcoe), and will continue to happen unless there is first a real desire to control development and secondly the preparation and rigorous enforcement of development plans and guidelines. The Provincial Government and the new Regional Governments (as in Muskoka) also have important roles to play here.

3. Lack of Understanding of Development Capacities

As outlined earlier, each lake has a capacity to sustain a safe level of development, but as yet we have no accurate method for estimating this capacity. In many areas development is allowed to proceed unchecked until the unknown capacity is exceeded by accident and the consequences are then suffered.

4. Lack of Regulation Over Developers
Developers are now required to register proposed developments or severances with the Provincial Government and have them approved by various government departments. (See later section on: "What the Government is Doing"). However, we regard this system as insufficient to prevent overdevelopment. The criteria used by the Department of Health (now in Environment) are neither very strict nor well-researched. They rely largely on the contemporary septic tank system for sewage treatment. Above all, decisions on each lot are made without reference to the development capacity of the lake.

5. Poor Soil Conditions
Much of our cottage country (especially the Pre-Cambrian areas) has very poor soil for effective sewage treatment. If the land is rocky with little soil cover, steep, low and wet or on a clay base, then sewage disposal will be extremely difficult or unsuitable using systems presently available. The problem of phosphate removal in the soil is of paramount importance.

6. Lack of Alternative Sewage Systems
Coupled with the poor soil problem is the lack of totally viable alternatives to the very questionable septic tank systems. Modified septic systems, holding tanks, incineration and chemical toilets and package plants are all possible alternatives but the Department of Health has been very reluctant to research or approve such systems. Instead they promote the conventional septic tank system even if it means bringing in fill to make a tile bed. The poor soil conditions and archaic sewage treatment systems that we employ increase the environmental impact of each cottage or establishment, thereby decreasing the number of such units a lake can support before it becomes overdeveloped.

C. THE EFFECTS OF OVERDEVELOPMENT

The effects of development can be divided into two categories: ecological and social.

Ecological Effects

1. Sewage Pollution
If a lake receives an amount of sewage or partly treated effluent which is beyond its assimilative capacity, the result will be bacterial contamination (a health hazard) and accelerated eutrophication with all of its attendant symptoms including disappearance of good fishing and swimming.

2. Boat Emissions
Excess boat traffic can result in eroded shorelines, damaged docks and excessive levels of oil, gas, lead and exhaust emissions into the water.

3. Erosion
The process of land clearing results in increased water runoff and erosion. This will increase the aging process and the input of suspended solids and BOD.

4. Disruption of Wildlife
With more human pressure on the environment, wildlife habitats, nesting sites and feeding grounds are often destroyed or disrupted. This damages not only the ecological balance but also the enjoyment we derive from such natural features.

5. Increased Levels of Other Pollutants
With development one usually finds increased levels of pesticide use, solid waste production, smoke and a host of other pollutants produced by the industrial and commercial establishments which generally follow development.

Social Effects

1. Noise
You go to the cottage for peace and relaxation, yet this is shattered by the noise from boats, cars, construction and people that is brought on by development.

2. Crowding
Overdevelopment of course brings crowding, close-packed cottages, crowded marinas, crowded stores, crowded beaches, crowded parks, crowded, crowded, crowded. After a while, it all begins to resemble the cities and the hustle and bustle from which you fled. The recreational value of your vacation property is severely reduced.

3. Boat Traffic
The tremendous amount of boat traffic, especially on a Saturday or Sunday afternoon, and all of the conflicting water uses (canoeing, sailing, fishing, water skiing, cruising, etc.) make the enjoyment of your lake difficult and sometimes downright dangerous.

4. Car Traffic
The car traffic, especially in built-up areas and around marinas and store, creates noise, dust, congestion, and danger - all hassles we experience in the city.

5. Loss of Solitude and Aesthetic Pleasure
All of the physical degradation, pollution, and crowding which result from overdevelopment rob us of the very qualities for which we retreat to the lake country. A once highly desirable location because of its offerings of seclusion, peace, clean water and air, and space to breathe becomes transformed into an area of screaming boat motors, tightly jammed beaches, roaring automobiles and far too much sewage entering the lake. As a result, the cottager or vacationer is faced with almost the exact type of rat race from which he wishes to escape.

Lakeshore retreat or urban subdivision? A portion of a developer's brochure.

D. RILEY LAKE - A CASE STUDY OF OVERDEVELOPMENT

Probably the best documented case of overdevelopment is Riley Lake in the Township of Ryde, south-east of Gravenhurst. Riley Lake is a medium-sized lake (about 350 acres) which is star-shaped and therefore has a large amount of shoreline in comparison to its surface area or volume. It is not a very deep lake, reaching a maximum depth of 45 feet with an average of 19.5 feet. Its shore is quite rocky and fairly wooded. Most of these characteristics make it especially susceptible to overdevelopment and eutrophication.

Riley Lake now has at least 150 cottages and another 60 approved lots yet to be built upon. An Ontario Water Resources Commission report and a study performed by Hough, Stansbury and Associates, landscape architects, both show that this lake is already overdeveloped, overcrowded, and severely affected by nutrient enrichment (eutrophication).

Hough, Stansbury and Associates thus classified Riley Lake as a "highly restrictive area" suitable only for light development.

In their study they established 4 basic constraints against future cottage development. These are:
1. inadequate soil conditions for contemporary septic tank practice.
2. potential boating conflicts such as long narrow channels.
3. unique natural features not capable of sustaining cottage development (i.e. marshes).
4. unique scenic elements not capable of sustaining cottage development (i.e. small islands).

They based these constraints on the results of their findings:
1. Riley Lake is suffering from pollution to the degree that no oxygen exists in the deeper portions of the lake. Nutrients added by malfunctioning septic tanks, privies and wash wa-

ter have so stimulated the growth of algae that the water is now turbid and fish populations are severely reduced.
2. Only 25% of the existing and eventual number of cottages are located within the area designated as the most capable of sustaining development.
3. Out of an overall water surface area of 350 acres, only 200 acres may be considered safe for boating (due to long narrow bays with intensive water activities along the edges). Thus Riley Lake could become almost 3 times overdeveloped in terms of safe boating if the proposed development continues.
4. Facilities such as marina and launching, parking, public water supply, recreation and communal areas are severely in need of improvement and expansion.
5. There has been somewhat of a negligent disregard for unique natural features. The case in point is the opening up of a beaver dam which controls lake elevation. A 2 to 3 foot drop in lake level has already been noted and there is a possibility of an eventual lowering of 5 feet. Such a reduction would accelerate the process of eutrophication by decreasing the volume of water and would disrupt existing docking and swimming facilities.

The Hough, Stansbury and Associates study tried to illustrate the importance of properly locating a given cottage population as a part of determining the lake's capacity. It should stand as a warning against indiscriminate development to all lake areas in Ontario.

E. THE GOVERNMENT AND DEVELOPMENT

One of the traditional functions of government is to control or regulate private enterprise where its effects are not in the public interest. Developers, whose only interest appears to be quick profit, can do everlasting harm to an area through the sale of close-packed lots with poor soil conditions, and their total disregard for ecology, aesthetics or development capacities. Developers and subdividers should therefore come under strict regulation by the government. To some extent, this has been done, but in Pollution Probe's opinion, not strictly enough. Let's examine what the Provincial Government is doing.

1. What the Government is Doing

On June 26, 1970, the Provincial Government imposed subdivision control over all of Ontario in an attempt to control development. Under the regulations all new developments (registered after June 26, 1970) come under more stringent controls and must be approved by the Department of Municipal Affairs (now Ministry of Finance and Intergovernmental Affairs) in consultation with other government departments and agencies concerned with development. This was a good first step but at the outset it had two weaknesses. First, it covers only new subdivisions and lot severances as of June 26, 1970 and does not apply to lots not yet developed but registered before that date. Secondly, it relies heavily on the ability of the Health Units and the Department of Health (now Environment) to carry out site inspections. Not only are these agencies generally understaffed but the criteria used for judging a site are far from complete.

Let us examine more closely the subdivision and site inspection procedures. The approval system for subdividing is as follows:

Approval System for Sub-Dividing

In short, there are 5 steps to sub-dividing. They are 1) pre-application (2) draft plan 3) draft study 4) draft approval and 5) final plan.

1. Pre-application

This step includes a feasibility study by the sub-divider, an economic justification, a plan location and a designation of land use.

Following the above, the sub-divider discusses the broad outline of the plan with the local planning board or council to determine if the location, land use and timing of development are acceptable in principle.

2. Draft Plan

The sub-divider submits a draft plan of sub-division with a boundary survey and information required by Section 28 (2) of the planning act, to the Community Planning Branch (Ontario Government) for approval.

3. Draft Study

The Community Planning Branch sends the draft plan to local councils or planning boards, the school board, the Ministry of the Environment, M.O.H., Department of Transportation and Communication and other provincial and federal departments and agencies.

The Community Planning Branch acts after reports and recommendations are received from each of the above agencies. It approves the draft plans with conditions or rejects it with reasons.

4. Draft Approval

After the approval of the draft plan, the sub-divider may rough grade roads, authorize survey and carry out conditions which can be completed, make a written agreement with the municipality to complete all other conditions and have final plan prepared.

5. Final Plan

The sub-divider submits the final pian to the Community Planning Branch for approval. The sub-divider also arranges for a letter to be mailed from the municipality to the Community Planning Branch informing it that conditions of approval are completed or agreements made. The Community Planning Branch arranges for approval of the final plan. In registry office areas, final plans are returned on the day of approval by hand (if instructed) or by express and a copy sent to the registrar. In land title areas, final plans are delivered daily to the Toronto or regional inspector of titles who informs the sub-divider when he can pick them up.

Under step 3, Draft Study, of the Subdivision Procedures, the lot or lots in question must be inspected to determine 1) if they can be supplied with water and 2) if they are capable of receiving and disposing of sewage from the dwelling by means of a subsurface disposal field on the site. The inspector, relying largely on information supplied by the subdivider, classifies the lot as one of the following:

(1) unconditionally recommended for approval
(2) conditionally recommended for approval
(3) not recommended for approval

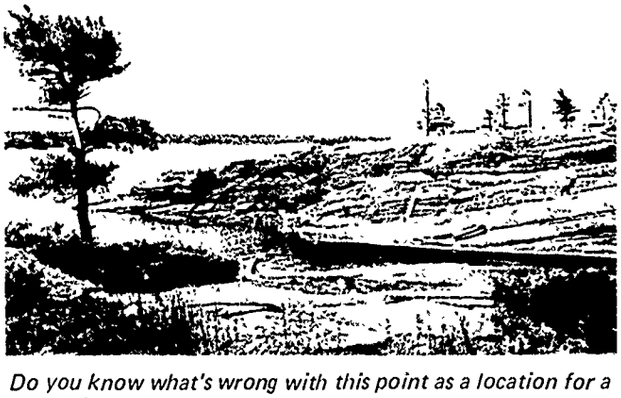
The inspector may request more information before making his recommendation. If the lot as it stands is unsuitable for a septic tank system, he may conditionally recommend it for approval provided that fill is brought in for a tile bed. He may also evaluate the feasibility of using a holding tank system or an underdrained disposal bed. Originally these site inspections were carried out by field inspectors of the local Health Units but were taken over by the Ontario Department of Health last year. Now, presumably they will be handled by inspectors of the local Ministry of the Environment office in each area. A second, more detailed inspection is carried out later when the lot purchaser applies for approval to install a sewage disposal system. The criteria used to appraise a lot are as follows:

Criteria for Lot Approval

In the absence of indications to the contrary, it will be assumed that any lot is capable of providing satisfactory on-site sewage disposal to serve a single family in a residence containing three bedrooms if it is at least half an acre in size and there is an area of 4000 square feet or more available which could be reserved solely for the construction of a soil absorption system of sewage dis-

posal and if this reserved area for sewage disposal in soil meets the following requirements:

(a) no part of it shall be within 10 feet, measured horizontally, of a property boundary,
(b) no part of it shall be within 50 feet, measured horizontally, of the usual *high water mark* of any lake, stream or pond,
(c) flooding of the area from surface drainage can be prevented,
(d) the depth of consolidated soil over the entire 4000 square foot area is not less than five feet measured from final finished grade to the highest level of the ground water or to any rock stratum or to any impervious soil layer. "Consolidated soil," as used here, means native soil, or soil fill which has been in place to final grade over the area for several weeks and having characteristics which give it a predicted percolation test of the Department or by other test acceptable to the Department, of not less than 1 minute for 1 inch of fall nor more than 60 minutes for 1 inch of fall of the free water surface in the saturated test hole, and
(e) The minimum width of the 4000 square feet reserve for sewage disposal should not be less than 38' at any point.
(f) The maximum over-all grade in any direction in the tile bed area should not be greater than 1:10 as measured along the boundaries or across either diagonal of the tile bed area.
(g) There is a mantle of soil between the subsurface disposal bed and the lake or stream towards which surface water drains which has a minimum total horizontal width of 50 feet.



Do you know what's wrong with this point as a location for a cottage?

Pollution Probe regards these criteria as insufficient because they are not based on enough research and data to ensure that such a system will be completely pollution-free, nor do they take adequate account of social or aesthetic factors.

The government, through the former Department of Municipal Affairs, has let a contract for a lake capacity study. It is being performed at the University of Toronto's Institute of Environmental Sciences and Engineering and began over a year ago. It is hoped that this study will discover some of the important factors which determine a lake's development capacity but there is no guarantee that a workable formula will be produced in the near future. It may take several more years of research and perfection by this and other groups before this stage is reached.

2. What the Government Still Needs to Do

There are a number of steps which government could take to more strictly regulate development and assure less environmental damage.

1. All present developments not covered by subdivision control (registered prior to June 26, 1970) should be investigated and control measures taken where necessary.
2. The Provincial Government should greatly increase its research and development of septic tank modifications and alternate systems.
3. Town and township councils should take immediate interim action by requiring the preparation of a tile bed (with fill and retaining walls if necessary) *before* granting a building permit to the owner.
4. The foregoing interim measure should be replaced in due course with a regulation requiring that the developer install a suitable tile bed before being allowed to sell the lot.
5. The Ontario Government should accelerate its efforts (i.e. more funds) to develop a reliable formula for determining a lake's development capacity, taking into account both pollution and aesthetics. This should include a well-researched minimum lot size for Pre-Cambrian lakes and control of perpendicular strip development (i.e. a road running at right angles to the shoreline with cottages on either side and public access at the water's edge).
6. A comprehensive environmental impact statement should be required, made public and judged acceptable before any new cottage development is passed, even if it meets the development capacity criteria.

3. Freeze on Development

Despite the above suggestions, Pollution Probe believes that the most effective way to prevent further overdevelopment of our recreational lakes is to institute a freeze on development until we have the knowledge to proceed in an enlightened manner. The facts are:

(a) Rapid development is taking place on many of our recreational lakes.
(b) The development capacity of our lakes cannot be ascertained at present but studies are underway.
(c) The conventional septic tank system is unreliable for providing total sewage treatment and totally feasible alternatives do not exist at present.
(d) Irreparable damage is presently being done through overdevelopment.
(e) Decisions are presently being made on proposed development which could have similar disastrous consequences.

Pollution Probe, therefore, proposes that a 2 or 3 year freeze be imposed on cottage development until a reliable capacity formula is developed and effective sewage treatment systems have been perfected.

Is this freeze legally possible? Yes, at both the municipal and provincial levels under sections 27 (1) (a) and 30 (1) of the Planning Act.

Is this freeze politically possible? It is a politically difficult move to make since there is considerable pressure from developers, would-be cottagers and others. Whether or not it is politically possible is up to you. Start with the form-letter to Darcy McKeough at the back of this manual. Also, see the suggestions on preventing overdevelopment in the Self-Help Section.

Pollution Probe would like to make one thing perfectly clear. We do *not* propose a freeze on development in order to aid those members of the present cottage community who, simply out of greed, want to exclude the less fortunate from the use and enjoyment of our lake regions. Potential cottagers, campers, picnickers and boaters have as much right (perhaps more) to use our lakes as those who already possess land. (In many cases new cottages will be less polluting than old ones.) Regulation and restriction of development must be undertaken on the basis of an understanding of ecological and social limits and a desire to protect the quality of the environment for all citizens for all time. The sooner our present exponential growth trends come to an end, the sooner we can achieve these goals.

Chapter IX

Self-Help Guide

A. INTRODUCTION

This section is probably the most important one of the manual. Pollution Probe feels it absolutely essential that cottagers and cottage associations become actively involved in protecting the vacation environment. The task is simply too great to leave it up to government agencies. The staff, bureaucracy, and taxpayers' money needed to do a proper job would be prohibitive. Apparently, cottage associations feel the same way as Probe. In the summer of 1971, Pollution Probe carried out a survey of cottage associations. Of the associations that replied, 91% had active anti-pollution programmes and of this number, 47% rated it their top priority. Municipal services and water safety generally rated second and third priority respectively. A large 81% felt that government agencies were unable to adequately perform all of the anti-pollution work on their lakes and 72% felt they (the associations) should increase their anti-pollution activity.

As far as self-help programmes are concerned, we feel that there are five possible levels or phases of self-help that a cottage association can undertake. Each phase has an investigation and action component. We will start with the most basic and easily accomplished phase and proceed, as we hope you will, through each step to the final most comprehensive phase where the community is setting environmental objectives and regulating itself in order to achieve them.

It is important to note that what we present here is not theoretical or untried; each one of these phases is currently being done by one or more cottage associations throughout the province. All that we have done is to collect these plans and programmes together and present them in what we believe to be a logical sequence.

B. PHASE I
EDUCATION AND INDIVIDUAL CORRECTION

A. Investigation

Little investigation is needed to determine that cottagers generally lack comprehensive and accurate information about pollution problems that they cause. (Government has not been a veritable fountain of information on this topic.) If you really want to determine the need for more information, however, try asking the following questions (either informally or in a survey) at the next cottage association meeting or community gathering:

1. Are you concerned about pollution on our lake?
2. Do you know what causes pollution on our lake?
3. Do you have enough information about pollution?
4. Do you know how you can personally prevent pollution?
5. What are you actually doing about your sewage, wash wastes, outboard motors, solid wastes, pesticides, etc.?
6. What can we do as an association?

This exercise should convince you that there is a real need for information and perhaps for motivation as well. Now let's do something about it.

B. Action

1. The first step is to conduct an education campaign, to get the information on the above questions into the hands of every cottager, every resident and hopefully every user of your lake. We would hope that this manual will be the first piece of information you distribute to your fellow cottagers. This could be followed up by other publications, by speakers, perhaps movies and group discussions. A newsletter with up-to-date information and news of local interest is also an excellent way of keeping people informed. If you don't have a cottage association, then return to GO (do not collect $200) and start one. It will be essential if you are going to proceed any further. Announce by notice board, flier or personal visits, a community meeting at which an association will be formed. Many such founding meetings have revolved around the topic of pollution on the lake (after all, it's the one thing you all have in common). Set up an interim executive and strike a pollution committee. Organize your information campaign and get going.
2. The next step is to encourage everyone to use their newfound information to analyze their own property, activities and practices for sources of pollution and then to correct problems in these areas. The details of how to examine and correct your sewage system are contained in Sections I, II, VII and Phase 4 (The Sanitary Survey) of this section. Suggestions on solid wastes, pesticides, boating and detergents are contained in their respective Sections. Send out reminders and check lists. Discuss in groups what you found and what you did.

You cannot ensure, however, that each cottager will be completely thorough and honest in his self-analysis or effective in his correction. (Even if a cottager suspects his sewage system, he may be reluctant to volunteer this information to the association or to the Ministry of the Environment.) All you can do at this stage is to make it quite clear that you (and your association) expect every member to do his part. A certain number of people will be unwilling to correct their problems on a voluntary basis, especially if it involves effort or expense. Sometimes too the major problems on a lake are due to a lodge, farm, camp, factory, town or some upstream source. These are all reasons why Phase 2 is the next step.

C. PHASE 2 GOVERNMENT PRESSURE

We said at the outset of this section that it is unreasonable to expect government to perform all of the anti-pollution work on all lakes in Ontario simply because of the enormity of the task. But it is certainly reasonable to expect and to demand that government departments and agencies enlarge their staff in critical areas, fulfill their present functions properly and efficiently, and help you in your anti-pollution work by performing those functions which you are unable to do.

A. Investigation

As with education in Phase 1, we feel there is general agreement that governments need to be pressured. One does not need to conduct a great amount of research to come to the conclusion that both municipal governments and the Provincial Government are not doing an adequate job of preventing pollution and providing public services.

On the provincial level, this manual has documented many of the shortcomings to which you may be able to add several complaints of your own. Generally, they include: too little research, an inadequate level of inspection and testing, poor information, a lack of co-operation with cottage associations, insufficient development control, and internal policy conflicts. As an association, you should ascertain whether or not your lake has been tested or surveyed by the O.W.R.C., the Department of Health or the Department of Lands and Forests.

Check into your local Department of the Environment office, see if it is functioning yet and whether it is adequately staffed. Also determine what restrictions, if any, have been placed on development in your area by the Provincial Government.

On the municipal level there is a great variation in environmental awareness and action. A few local councils are very good, most leave a lot to be desired. One of the most progressive, the Township of Muskoka lakes has:

- passed its own by-laws on sewage disposal systems
- conducted an information campaign
- hired students to perform a sanitary survey on the most critical areas
- followed-up the survey with correction through its by-law enforcement officers
- promoted a boycott on detergents by hiring students to visit each cottage and trade a box of soap for the cottager's box of detergent
- passed by-laws to restrict development

How does your municipal government stack up against that record? Check into local by-laws on sanitation, pollution control, building codes, development guidelines and conservation. What sort of garbage disposal is provided? Is the local town contributing to pollution of any kind? Is the Health Unit adequately staffed and funded? What sort of information and services does the municipal government provide? Is the council interested primarily in rapid development?

Visit the municipal clerk with a few of these questions. Go to some council meetings. Get to know the mayor or reeve and the councillors.

B. Action

On the basis of your investigations, decide what you want from each level of government and then go after it.

Provincial Level For the Provincial level, we would suggest that you pressure for:

1. Greatly increased research into:
   a) septic tank efficiency and degree of treatment with different soil types
   b) reliable tests for septic tank operation
   c) modifications to septic tanks for removal of phosphates
   d) alternative sewage treatment systems
   e) simplified water quality tests for cottage associations
   f) the effect of outboards on water quality and methods of control
   g) lake development capacities
   h) septic tank regulations
   i) local problems
2. Water quality monitoring and a sanitary survey for your lake (from the Ministry of the Environment).
3. Increased staff and funding for local Department of Environment offices and recreational lake programmes.
4. Provision of more comprehensive and accurate information from the government. This includes public access to all reports, studies and surveys on recreational lakes, and all environmental problems for that matter.
5. More co-operative programmes with cottage associations including the provision of free lab analysis for water samples (bacteriological, chemical and biological) collected by associations in the course of water quality surveys.
6. Greater restriction on development in the cottage country. A 2 or 3 year freeze on development until capacity formulae and totally effective sewage systems are available.
7. Any other measures you feel necessary.

How do you go about achieving these goals? By communicating your demands to those in power in the Provincial Government:

- the Prime Minister: Hon. William G. Davis
- the Provincial Secretary for Resource Development: Hon. A. B. R. Lawrence
- the Minister of the Environment: Hon. James Auld
- the Minister of Finance and Intergovernmental Affairs. Hon. Darcy McKeough
- your MPP at the cottage
- your MPP at home
- the Deputy Minister, Ministry of the Environment: Everett Biggs
- the Assistant Deputy Minister for Water Management, Ministry of the Environment: D. S. Caverly

through such means as:

- form letters (see the ones in the end of this manual)
- personal letters from every member of the association
- resolutions passed by the association
- petitions signed by members of the association
- personal visits by the executive of the association
- communication of your requests to the local newspaper and other media outlets
- by constant communication with these officials

Municipal Level For the municipal government in your area, we would suggest the following objectives:

1. The creation of an Official Plan and development control guidelines.
2. A temporary freeze on development until capacity studies and improved sewage treatment are available.
3. Water quality monitoring and sanitary surveys sponsored by the municipality with follow-up by enforcement officers.
4. Public information programmes.
5. Provision of well-supervised sanitary landfill sites for solid waste.
6. Recycling programmes in the larger towns.
7. The improvement of municipal sewage treatment systems including nutrient removal facilities.
8. A by-law prohibiting the discharge of high-phosphate detergents into municipal sewage systems. (This is legally possible.)
9. Other measures which your local research has turned up.

The means to these goals are quite similar to those employed on the provincial scene: letters, resolutions, petitions, personal contact. There is, however, one added dimension that can have significant impact – votes. The summer cottage resident is now enfranchised in municipal elections and together cottagers hold a considerable block of votes. Why not even run someone for council. Several associations have done this with great success. If municipal elections are held at awkward times of the year (i.e., November), rent a bus and get your fellow cottagers up there to exercise their franchise and protect their interests.

D. PHASE 3 WATER QUALITY SURVEY

The purposes of a water quality survey are to determine the general bacterial, chemical and biological quality of the water in your lake, to detect any significant changes in that quality, and to indicate sources of pollution. The general quality of the water is, of course, an inverse measure of the amount of pollution entering the lake; decreases in water quality indicate increased inputs or a build-up; and localized "hot-spots" usually indicate a nearby source of pollution. If any of the provincial water quality standards are exceeded, this is cause for alarm.

For these reasons, a properly conducted water quality survey can yield a great deal of useful information about your lake, information which will aid in correction. Such a survey can also indicate those problem areas which should receive priority in Phase 4, the Sanitary Survey. But if the Ministry of the Environment (Water Quality Branch), Ministry of Natural Resources (formerly Lands and Forests) or your municipal government is unwilling or unable to do a water quality survey on your lake, you may have to do it yourself.

A. Investigation

How To Do A Water Quality Survey:

First, it must be decided what water quality tests you are going to be able to perform. The most common are:

bacterial (coliform) tests – an indication of recent sewage pollution
dissolved oxygen – a measure of the amount of free oxygen remaining after decomposition of organic matter
BOD – the biological oxygen demand, a measure of the amount of organic matter
pH – the acidity or alkalinity of water, an indicator of eutrophication and organic enrichment
phosphate – the amount of the nutrient phosphate which comes largely from sewage and promotes algae growth (usually measured as total phosphorous)
temperature – the temperature at various depths indicates the degree of stratification, an important factor in eutrophication
chlorophyll – a measure of the amount of the green, photosynthetic material found in plants, including algae; a good measure of algae growth (eutrophication)
algae counts – direct microscopic counting of algae species and numbers of cells per unit of water, indicates degree of eutrophication
zooplankton counts – direct microscopic counting of numbers and species of small animals found in the water, also indicates the degree of eutrophication
turbidity – a measure of the clarity of the water
bottom fauna – samples of the bottom mud and the animals found there; pollution indicators
fish populations – netting of fish and counting of numbers and species

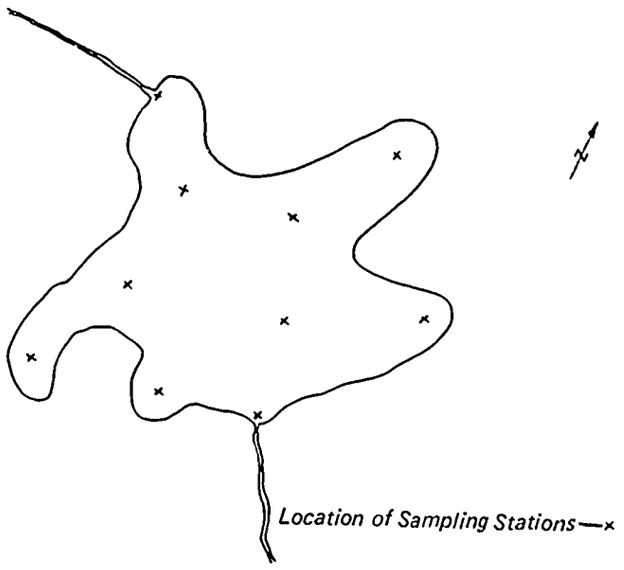
Most of these tests are very specialized, requiring elaborate sampling devices and precise laboratory analysis by trained technicians using expensive equipment. For these reasons, most of these tests are beyond the ability of your cottage association to perform, unless you could:

1. Make arrangements with the Water Quality Branch to lend you the sampling equipment and accept your samples for analysis.
2. Hire qualified university or community college students to do the testing. They would have to have access to sampling equipment and laboratories, perhaps through their universities. Salaries for these students might be obtained through government employment schemes such as Opportunities for Youth.
3. Hire a private laboratory to do the analyses for you. This would be very expensive.

If neither of these schemes is possible, then you will probably have to content yourself with doing only a bacterial water quality survey. This involves making arrangements with your MOH or local Ministry of the Environment office for bacterial sample bottles and complete analysis of the samples you collect (not just the drinking water analysis which only goes up to 80 coliforms/100 mil.) Coliform analyses can be done by the association if it can afford the kit and the supplies from Millipore Ltd. It also helps to have an experienced person perform the analysis.

Make a large map of the lake and locate your permanent sampling stations on it. Stations should be set up at all inflows and outflows to the lake, one in each large bay, one in front of each suspected source of pollution and at least one in the middle of the lake.

Sample at each location at least once a week (Sunday afternoon or evening would be best) by carefully removing the top from the sample bottle, as per instructions, inverting it underwater and then turning it mouth up so as to draw water from below the surface. If you could sample in mid-week, say Wednesday, this would help too. After sampling, refrigerate your samples and get them to the laboratory as quickly as possible. (Next morning will be satisfactory in most cases). When the results come back, note them carefully and when you have enough, prepare a table for each sample location showing maximum, average and minimum readings for both total and faecal coliforms. Enter these results on a large map and perhaps show problem areas with bright colours.



The provincial standards are:

	Swimming* (Recreation)	Drinking (Untreated)
Total Coliform	1000 per 100 ml	0 per 100 ml **
Faecal Coliform	100 per 100 ml	0 per 100 ml
Enterococcus	20 per 100 ml	0 per 100 ml

Note:

* These figures are geometric means (a type of average) of a series of at least ten samples per month, including samples collected on the weekend.

** A maximum of 4 coliforms/100 mls is allowed on any one test. The average should, however, be 0.

It is most important to remember, however, that the bacterial water quality survey measures only that bacteria. The coliform bacteria, especially faecal coliforms, indicate the recent input of sewage to the water. (They will die after several days or weeks). If you have high coliform counts, you can be sure that you also have phosphate and probably organic pollution. If your coliform counts are low, however, this does *not* mean you are free from other forms of pollution, especially nutrient pollution which can come from septic tanks that are effectively removing bacteria. Other tests for algae, dissolved oxygen, phosphates, etc. are required to determine accurately the degree of eutrophication on your lake. The clarity of your lakewater and a simple visual examination of shorelines, rocks and pilings for algae growth will, however, serve as indicators of nutrient build-up. Remember, many lakes with low coliform counts are experiencing algae problems.

B. Action

Now that you have all of this information, what do you do with it?

1. Make large maps showing the readings and indicating "hot-spots." Post these in public places around the lake.
2. Write up a report of the survey. Send copies to:
   - all cottagers
   - the municipal council
   - the MOH
   - the Ministry of the Environment, Water Quality Branch and Private Sewage Disposal Branch
   - your MPP for the area
   - the local newspaper and radio stations.
3. Approach those people in the "hot-spot" areas and ask them to check over their sewage systems. Offer to help with any labour involved in correcting problems.

4. If no action seems to be forthcoming, request the Health Unit or the Ministry of the Environment to check into their systems. Your name will not be revealed.
5. If a municipal sewage system, a lagoon or a factory is suspected as a pollution source, ask the Ministry of the Environment for a report on the installation.

E. PHASE 4 SANITARY SURVEY

The purpose of a sanitary survey is to investigate each sewage disposal system around the lake to determine if it meets the suggested standards and to ascertain whether or not it is a source of sewage pollution. This type of survey is carried out by Health Inspectors and has been used for the last two summers (1970 and 1971) by the Department of Health's Sanitary Survey Crew on a total of about 10,000 cottages. If your lake has not been surveyed and the Department is not able to provide such a service this year or next, we would again suggest that you do it.

One word of caution. Don't expect highly accurate results from this survey. While it is a worthwhile project, it will *not* define for you which systems are polluting and which are pollution-free. It will only indicate those systems that don't meet standards and those that are blatant polluters. It is extremely difficult to determine if a septic system that appears to be satisfactory for bacterial removal is contributing to nutrient pollution through the groundwater. (A system that is "sanitary" is not necessarily pollution-free.) Until the Government develops and perfects more reliable tests for septic tank efficiency (especially phosphate removal), this is as accurate as we or the government can be.

A. Investigation

1. What Is Needed?

The first requirement for carrying out a sanitary survey is the co-operation of the cottagers and other landowners on the lake. If people won't let you on their land, there's not much use. They must be convinced that it is in their best interest and that of the community for everyone's sewage system to be examined and corrected if necessary. Other requirements include:

- students who have some knowledge of soils, sewage treatment, hydrology and ecology
- sample bottles
- analysis for bacterial samples and phosphate samples if this can be arranged (try Department of Environment, MOH, or do coliforms yourself)
- a survey form and other assorted administrative systems
- a large detailed map of the lake showing all establishments
- a boat
- a hand auger
- someone with enough expertise and experience to properly interpret the results
- a plan for follow-up and abatement of faulty systems (see the Action component)

Note that this survey can be carried out by a conscientious cottager on his own property.

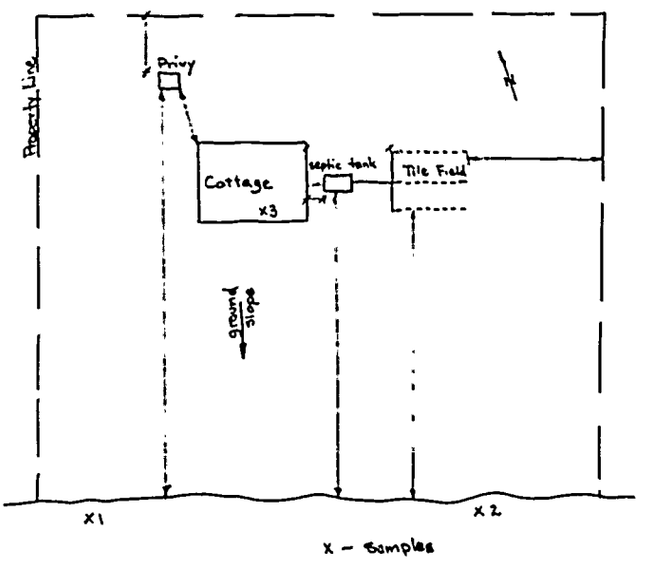
2. The Questionnaire

Each cottage is visited by the survey team and the owner interviewed for data on his system. The interviewer may have to obtain some of the information himself.

The remainder of the questionnaire can be filled out by the interviewer without the help of the cottager. However, through past experience, we have found that the cottager is genuinely concerned and will offer to help all he can (i.e., help with measurements). Some points to cover in this part of the survey are as follows:

Soils: _____ Ft. (Depth) (Use auger)
_____ (Type) (Clay, silt, sand, gravel)

Sketch: North Arrow
All Buildings
Location of Water Samples
Septic Tank and Tile Field
Privy
Ground Slope
Property Lines
All distances
Etc.



Sketch of Property in Sanitary Survey

(A copy of a complete Questionnaire for a Sanitary Survey can be obtained from Pollution Probe for a cottage association or other group.)

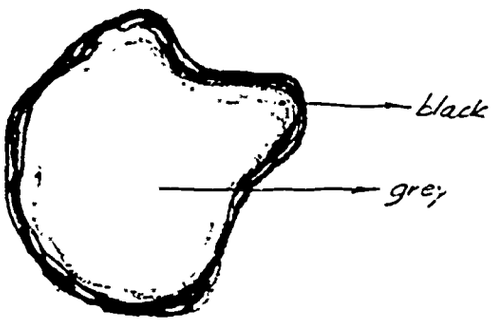
3. Signs of Sewage Escape

During the interview, the surveyor walks around the premises looking for obvious malfunctions in the system. One thing he will look for is ponded effluent or sewage escaping from the septic tank or tile field. The following may help you to recognize escaping sewage.

Characteristic Signs of Sewage Escape

Ponding may occur over the tile field or the tank and can cause odour after a few days. If the tile field is of insufficient length, then there may be ponding at the end of the field. After a week or so there is an accumulation of black and grey solids in the area of ponding. The black particles are humus which is oxidized solids while the grey matter is grease, fats and soaps. The darker the colours are, the longer the sewage has been escaping. Vegetation can also provide an indication as to whether or not sewage is escaping. If the grass is lush and spongy, a malfunction may be occurring. Grass is lush during overloading but afterwards it tends to dry up and lay flat.

Ponding can also be accelerated by an excessive rainfall. Where you suspect ponding, you can take samples for both bacterial chemical analysis. This will give you evidence of whether or not the system is working properly from a fluid dynamics point of view.



Ponded Effluent

4. The Dye Test

During the survey, the inspector looks for unusual pipes and fixtures and tries to find out where they come from and where they are going. This would be one place where a dye test could be used to great advantage. Also, if the inspector suspects "channeling" of effluent, a direct sewage input, or gross pollution, a dye test should be administered to verify this.

Dye Testing

The dye used is usually sodium fluorescene. This powder is reddish brown in colour, and in strong solutions, may appear orange. When diluted in water it appears an irridescent green in reflected light. Place a heaping teaspoon of the dye into the toilet (or sink, etc.) and flush several times. Caution: This dye will stain your clothes, furnishings and skin.

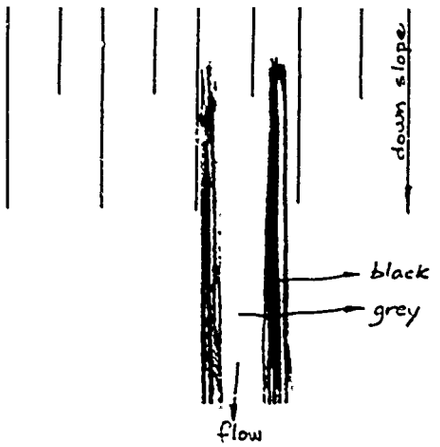
The next step is to watch for the dye in the lake or in ponded areas. If it appears within 48 hours, this is an indication of pollution. It doesn't necessarily have to appear directly in front of the cottage. It could appear along the shoreline within a couple of hundred feet of the cottage. If you spot the dye, you should note the date, time, and location. Also, since this spot would probably be the area of greatest pollution, you should take a water sample here. If the results of the test show high faecal coliforms, you have conclusive evidence.

Unfortunately, too many cottagers have the idea that dye testing is an easy and sure method of determining whether or not a disposal system is functioning properly. This is not completely true. A positive test (i.e. dye in the lake) is reliable, but a negative test is not necessarily reliable. There are several factors which can give a negative result when pollution is actually occurring. The fluorescene may not reach the lake in concentrations great enough to be seen with the naked eye. The dye does fluoresce when subject to ultraviolet light from a fluorometer (Black light), but a fluorometer is expensive and ultraviolet light can be dangerous to the eyes if handled by an inexperienced person. The dye may be trapped or bound in the septic tank or tile field or it may reach the lake at night and not be noticed. Also, when using a dye test, neighbouring cottages should not be done at the same time lest there be confusion as to whose dye is in the lake.

5. Sampling

Along with the questionnaire and the visual check, there should be several water samples taken at each cottage:

- a drinking water sample (from the tap)
- one or two samples taken a few feet offshore and downslope from the septic tank and tile field
- any ponded water near the tile field



Effluent Flowing on a Slope

These samples should be analyzed for coliform and for phosphate (if possible) and the results should be correlated with other data about that site. For instance, if a sample has a high coliform count and the cottage has an old undersized tank, then you have evidence that this tank is contributing pollution to the lake.

In addition, control samples should be taken at weekly intervals – about 50 to 100 feet offshore in front of about every fifth cottage. These will give "background" readings with which to compare the shoreline samples.

6. Compilation and Interpretation

All of the data should be compiled for each site and analyzed by a trained or experienced individual. There are, in this survey, some variables such as wind or wave action, degree of system use, non-uniform soil type, precipitation and temperature which may yield poor or difficult to interpret soil type.

You will probably be able to classify the systems on your lake into the following categories:

• polluting	definitely contributing sewage to the lake (including washwaste)
• public health nuisance	ponded effluent or exposed waste (including washwaste)
• unsatisfactory or suspected	– does not meet standards (e.g. undersized, too close to buildings or lakes, not enough soil, etc.) – likely to break down in future – poor maintenance – inconclusive evidence of pollution
• satisfactory	appears to meet standards and function to maximum efficiency (but this does not preclude the possibility of nutrient input)
• unknown	not enough information to classify

B. Action

A sanitary survey is worth only what use you make of the results. This means abatement and this means social pressure. We would suggest the following course of action.

1. Meet privately with the people whose sewage systems were classified as "polluting," "public health nuisances" or "unsatisfactory of suspected." Inform them of the results concerning their systems. Perhaps they aren't aware of the situation. Stress the possible health problems as well as the effects on the environment. Suggest methods of correction. Offer to help with the labour involved or suggest a good contractor to do the work. Perhaps you could even set up a loan fund in the association for such purposes.
2. Post and circulate to the membership, a map or list of those with faulty systems who are unco-operative or appear to be taking no action.
3. If this fails, then report the offenders to the local Health

Unit or Ministry of the Environment Office. (Your name will not be revealed.) Follow-up to ensure that the government compels the offenders to correct their systems.

F. PHASE 5 COMMUNITY STANDARDS AND ENFORCEMENT

The ultimate in self-help programmes is reached, we feel, when a community begins to set its own environmental standards and to enforce them through a combination of self-control, policing, and unified community action. This type of programme which usually involves the voluntary adoption of rules not already embodied in law, relies almost totally on community consensus that a problem exists and on a community desire to act effectively on this problem.

A. Investigation

First, the community must agree that there are problems, not controlled by present laws or regulations, which are serious and need to be solved. Furthermore, there must be the general consensus that the community can solve these problems. This may mean slight restriction or loss of personal freedom and all members must be willing to accept these restrictions for the good of the community. So it is with the laws under which our society operates.

Circulate an opinion questionnaire in order to gauge the perception and attitude of your members towards problems like:

- boat over-crowding and misuse
- noise
- sale and use of high phosphate detergents on the lake
- use of pesticides on the lake
- the use of garbage incinerators by cottagers
- the need for all cottagers to engage in some form of septic tank modification or treatment for improved efficiency
- the need for all cottagers to convert to a new sewage disposal system such as holding tanks

B. Action

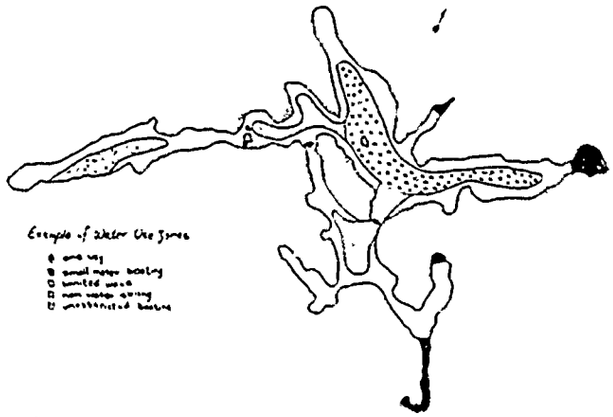
If there is sufficient consensus on any of these topics then regulations or proposals should be drawn up for presentation to the membership for a vote. If passed, then all that remains is to set up some form of mild policing. If a large majority of members agree to the original proposal, then there should not be the need for strict enforcement. The odd reminder should suffice. If need be, however, social pressure measures could be employed.

Two specific examples of community standards will be given here.

1. Boating Restrictions

Due to the overcrowding of our lakes with development, we are also running into problems of boat traffic and conflicting water use desires. In order to alleviate these problems, cottage associations can pass rules to restrict boating or to zone the water surface for different uses. In their study of Riley Lake, Michael Hough Associates (now Hough, Stansbury Associates) made the following recommendations:

a) On a map, plot a non-boating zone along the shoreline at a distance of 200 feet from shore. Movement to and from the shore can be done by travelling perpendicular to the shore at "no-wake" speeds.
b) Try to eliminate water skiing in bays of less than 20 acres (96,800 square yards) while allowing general boating.
c) Water skiing can be done safely in large water areas free of obstructions. Specific time periods for skiing might also be suggested. (Skiing in the afternoon – Canoeing and fishing in the morning and evening)
d) Areas near wildlife should be designated for small motors or no-motors only.
e) Promote one-way traffic around islands blocking large bays and in narrow channels.
f) Post maps of the recommended water use zones in marinas, post-offices, stores, etc. Distribute copies to lake users.



2. Preventing Overdevelopment

The members of the association may decide that until reliable development capacity guidelines and effective sewage systems are available, it would be best to restrict further development of their lake in order to prevent overdevelopment. If the lake were to become useless due to overdevelopment and eutrophication, practically everyone's property would become useless. The only people who would suffer from a community restriction on development would be those who want to subdivide and sell their property. There are two levels of action available to cottage associations – government action and community self-help.

a) Government

Your township has the power to enact planning controls concerning land use in your region. There are three basic plans available for the council to pass:

- Official Plan – general guidelines for regional development and restriction of land usage over a whole township or specified area.
- Subdivision Control – restricts sale of land and lot size
- Zoning By-laws – restrict the usage of the land and thus can control the type of development on specified property. They are also the specific means for implementing the Official Plan and must follow its guidelines.

To find out the existing planning restrictions in your area, go to the township office (county) or write to the Ministry of Economics and Intergovernmental Affairs, Community Planning Branch, 801 Bay Street, Toronto. If you want restrictions placed on the land in your area, write letters and submit petitions to the local township council which has the power to enact by-laws. (See Phase 2) Also write to Hon. Darcy McKeough, Minister of Economics and Intergovernmental Affairs. If you can convince the Province to act then this will result in added pressure on the local officials. If there is no local government, then go directly to the Provincial Government, requesting a Minister's Order for development restrictions.

b) Self-Help

In many cases there is a lack of government action to restrict cottage development, so the association must take the first step. To prevent development in specific areas of the lake, it may be advisable to undertake one of the following:

- group purchase of a section of shoreline
- request the Ministry of Natural Resources to designate undeveloped scenic areas and wildlife regions which are on Crown Land as restricted from sale for private development or as Crown Reserves (at least 25% of a lakeshore is supposed to be in public (crown) ownership.
- pay the owner of land a lump sum per year over a certain period in return for which he agrees not to develop the land
- purchase a conservation easement along the shore from the owner
- take out an injunction against the developer for potential pollution damage to the lakes

Appendices

APPENDIX 1:
NEW GOVERNMENT STRUCTURE

During the past fall and winter, some significant changes have been made in the structure of the Government of Ontario. Basically, all of the government departments and functions have been grouped into three Policy Fields and two administrative ministries. Some departments have been reorganized and renamed.

Economics and Intergovernmental Affairs Ministry	Revenue and Government Services Ministry	Resources Development Policy Field	Social Development Policy Field	Justice Policy Field
(contains Community Planning from Municipal Affairs)		Agriculture and Food Environment Labour Natural Resources Trade and Industry Transportation and Communications	Colleges and Universities Education Health Housing and Social Services	Attorney General Correctional Services Public Protection

*The Departments in bold are those of particular interest to the cottager.

Changes of importance to the cottager are the following.

1. The Public Health Engineering Service of the Department of Health has been transferred to the Ministry of Environment under the new name of Private Waste and Water Management Branch.
2. The duties of the local Health Units in the area of septic tank inspections and site evaluations have been transferred to the Ministry of Environment and local Environment offices are being set up in the cottage country. (Legal and jurisdictional problems are yet to be resolved, however). If your area does not yet have an Environment Office, continue to consult your Medical Officer of Health.
3. The Ontario Water Resources Commission has been disbanded and now makes up several divisions and branches of the Ministry of Environment.
4. The Department of Lands and Forests no longer exists in name but together with Mines (from Mines and Northern Affairs) makes up the new Ministry of Natural Resources. They cover Provincial Parks, fisheries, forestry, crown land, etc.

APPENDIX 2:
NAMES, ADDRESSES AND TELEPHONE NUMBERS

Government of Ontario – General Number 965-1211

Provincial Secretary for Resource Development ... 965-7721
Hon. A.B.R. Lawrence

Ministry of Environment, General Number 965-2533
135 St. Clair Avenue West, Toronto
- General Pollution Information 965-7117
- Minister's Office – Hon. James Auld 965-1611
- Deputy Minister's Office – Everett Biggs 965-1995
- Private Waste and Water Management Branch ... 965-4071
  1 St. Clair Avenue West, 8th Floor, Toronto
- Water Quality Branch 965-6957
- Water Pollution Complaints 965-2537
- Sanitary Engineering Branch 965-1491
- Laboratory Branch 248-3001
  Resources Road (Islington and 401)
- Air Quality Branch
  800 Bay Street, Toronto 965-4081
  Complaints (Toronto) 965-5895
  Complaints (Outside Toronto) 965-1971
- Waste Management Branch 965-6634
  880 Bay Street, Toronto
- Pesticides Control Service 965-2401

Ministry of Economics and Intergovernmental Affairs
- Minister – Hon. Darcy McKeough 965-6361
- Community Planning Branch 965-5789
  801 Bay Street, Toronto

Ministry of Natural Resources
- Minister – Hon. Leo Bernier 965-1301
- Your local Forest Ranger ..... _____

Medical Officer of Health in your area ..... _____

Ministry of the Environment Office in your area .. _____

Pollution Probe at the University of Toronto 928-6155
Toronto 181, Ontario

Glossary

Aerobic	in the presence of oxygen
Algae	mostly microscopic non-vascular plants containing photosynthetic pigments such as chlorophyll. Algae growth is stimulated by nutrients.
Anaerobic	in the absence of oxygen
Bacteria	one-celled microorganisms found in soil, water, sewage, and most types of waste
BOD	(Bio-chemical Oxygen Demand) The amount of dissolved oxygen in parts per million required by organisms for the aerobic biochemical decomposition of organic matter present in water
Carcinogenic	cancer causing
Coliforms	group of bacteria found in soil, vegetation and sewage which, due to their physical and chemical properties, are used as indicators of sewage. Faecal coliforms are found only in sewage.
Diatoms	one group of microscopic algae found in fresh water. They have silica cell walls and are yellow or brown in colour.
Dissolved 0_2	atmospheric oxygen which is dissolved in the water
E. coli	these bacteria are found only in the intestines of warm-blooded animals
Ecosystem	this is a small world within a larger one. It has the ability to sustain itself and support life.
Eutrophication	the intentional or unintentional enrichment of a lake or stream owing to the presence of essential plant nutrient such as phosphorus and nitrogen. It results in rapid algae growth and deterioration in water quality.
Faeces	human and animal excrement
Groundwater	all subsurface water
Mesotrophic Lake	these lakes support a moderate amount of aquatic life. There are not too many large fish or other water life. These lakes are in the middle stages of eutrophication, between oligotrophic and eutrophic.
Oligotrophic Lake	these are relatively unproductive lakes. They are clean, fresh water without much aquatic life due to low concentrations of nutrients. They usually have an abundance of dissolved oxygen at all depths.
Pathogenic Bacteria	disease-causing bacteria
pH	a means of expressing the degree of acidity or alkalinity. Distilled water is a neutral solution at normal temperature and has a pH of 7.
Photosynthesis	the process by which simple sugars are manufactured from carbon dioxide and water by living plant cells with the aid of chlorophyll in the presence of light.
Phytoplankton	free-floating microscopic algae which are slightly motile and exist at or near neutral buoyancy.
Pollution (Water)	the destruction of the purity of water by impairing its quality to a point where it becomes unfit for the many uses for which it is required.
Scum	the impurities which rise to the surface and float in a septic tank.
Sedimentation	the process by which tiny particles of waste, sand or other material settle to the bottom.
Sludge	the settled waste material (liquid or solid) found in septic tanks or other sewage treatment plants.
Tainting	decay, disease or infection of the fish flesh.
Tertiary Treatment	it is the final step in sewage treatment where nutrients are removed.
Threshold Odour No.	the number at which the odour becomes perceptual or conscious.
Turbidity	cloudiness caused by sediment suspended in water.
Zooplankton	animal micro-organisms living unattached in the water.

Information Sources

Manual of Septic Tank Practices U.S. Department of Health, Education and Welfare
Septic Tank Systems Ontario Department of Health (available from Information Services Branch, Department of Environment)
Subdivision Procedures Department of Municipal Affairs (now Department of Economics and Intergovernmental Affairs)
Riley Lake Project: Master Plan Report Hough, Stansbury Associates, Ltd., 51 Colborne Street, Toronto
Boating and Marina Regulation
Drinking Water Objectives
Water Pollution – What Can I Do?
The Cottagers' World of Water
There are Three Ways to Get a New Water or Sewage System
What You Should Know About Water Wells
The Water Study
The Cottager's Lake

O.W.R.C., pamphlets available from Information Services Branch, Department of Environment

Safe Water
Understanding the Bacteriological Report on Your Drinking Water
The Cottage, The Lake and You

Department of Health, pamphlets available from Information Services Branch, Department of Environment

Status of Enrichment of Riley Lake, Township of Ryde, 1970 O.W.R.C.
Muskoka Lakes Eutrophication Study, Report #1, July, 1971 O.W.R.C.
Guidelines and Criteria for Water Quality Management in Ontario, June, 1970 O.W.R.C.

Index

Dear Sirs:

As a cottager, I am concerned about the effects outboard motors have on the ecology of our lakes. I strongly urge you to continue making improvements in your engines. I assure you that such things as noise abatement, exhaust recycling, engine efficiency, ability to run on low or no lead gasoline and reduced gas and oil discharges will figure heavily in the purchase of my next outboard.

Sincerely,

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_____ (Address)

_____ (City or Town)

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_____ (City or Town)

KEIKHAEFER MERCURY OF CANADA, LTD.
1166 CALEDONIA ROAD
TORONTO 19, ONTARIO

CHRYSLER CANADA OUTBOARD LTD.
BARRIE, ONTARIO

OUTBOARD MARINE CORPORATION
ENVIRONMENT AFFAIRS DEPARTMENT
4143 NORTH 27TH STREET
MILWAUKEE, WISCONSIN 53216

Hon. James Auld
Minister of the Environment
Queen's Park
Toronto, Ontario

Dear Mr. Auld:

As a concerned cottager, I would be interested in seeing more action taken by your Department in the following areas:

1. More research into methods of private waste disposal (septic tanks and alternatives).
2. The resolution of the conflict between the Water Quality Branch and the Private Waste and Water Management Branch concerning the efficiency of septic tanks for nutrient removal.
3. More staff for monitoring, surveys, and correction.
4. More co-operation with Cottage Associations.
5. The provision of more free analysis for water samples collected by Cottage Associations.

Sincerely yours,

_____ (Name)

_____ (Address)

_____ (City or Town)

Hon. W. Darcy McKeough
Minister of Economics and Intergovernmental Affairs
Queen's Park
Toronto, Ontario

Dear Mr. McKeough:

I demand that the government put a freeze on development in the recreational areas of Ontario. We are just now discovering the irreversible effects that large-scale development is having on our lakes. At present, we have neither a formula for determining safe levels of development nor an effective means of sewage treatment. Yet, we continue to develop. I think that a two to three year freeze would be enough time to discover the limitations to which we can develop our cottage country without damaging our environment.

Sincerely yours,

_____ (Name)

_____ (Address)

_____ (City or Town)

POSTAGE

Hon. James Auld
Minister
Ontario Department of the Environment
Queen's Park
Toronto, Ontario

POSTAGE

Hon. W. Darcy McKeough
Minister of Economics and
Intergovernmental Affairs
Queen's Park
Toronto, Ontario

ORDER FORMS

With today's complex problems, correct and complete information is the key to understanding and solutions. We feel that the information presented in this manual will be of great assistance to you and your neighbours on the lake. Put a friend on the road to doing something about environmental degradation.

Please send a copy of this manual to:

Name _____ Name _____

Address _____ Address _____

City or Town _____ City or Town _____

Province _____ Province _____

Name _____ Name _____

Address _____ Address _____

City or Town _____ City or Town _____

Province _____ Province _____

POLLUTION PROBE MEMBERSHIP FORMS

PROBER

I am interested in working actively to fight pollution and will agree to my name being added to the volunteer list.

I will receive a newsletter six times a year and notice of all public meetings sponsored by Probe.

Name _____

Address _____

Telephone Number _____

Enclosed is _____ Make cheques payable to Pollution Probe

PROBACKER

I am interested in giving my moral and financial support to the work of Pollution Probe. I will receive a newsletter six times a year and notice of all public meetings

Name _____

Address _____

Telephone _____

Enclosed is $_____ I would like a receipt for income tax purposes _____ (yes) _____ (no)

Tax receipts for amounts over $5.00

Make cheques payable to *Pollution Probe at the University of Toronto*

Pollution Probe
University of Toronto
Toronto 181, Ontario
Canada

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