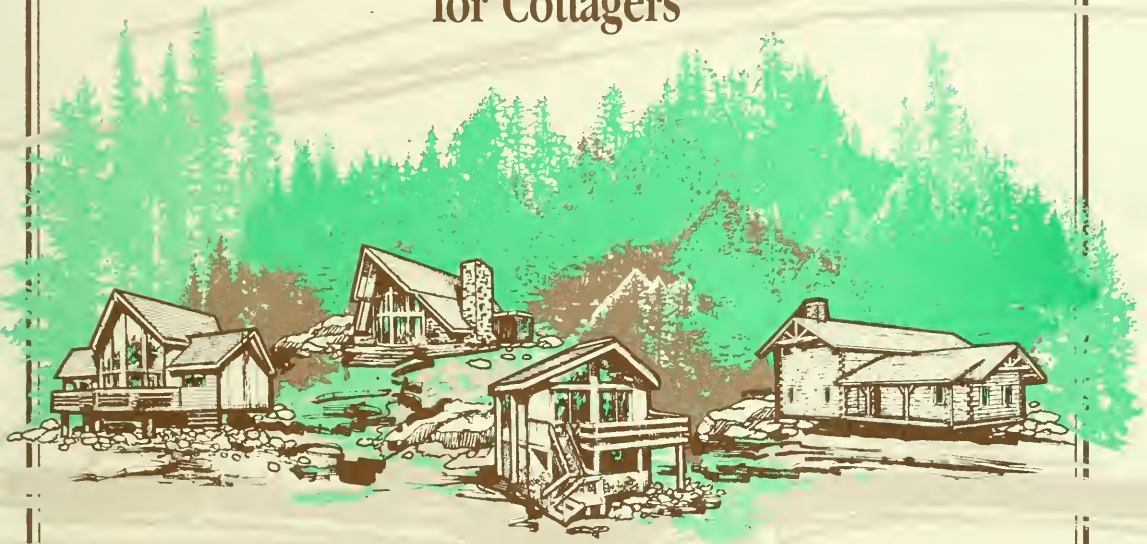
COTTAGE COUNTRY

Environmental Manual for Cottagers



Environment Ontario

COTTAGE COUNTRY

An Environmental Manual for Cottagers

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RECYCLABLE

Cette publication existe également en français.

What Can the Cottager Do?

How do I purify my water for drinking? What can I do about lake water quality? Are sport fish safe to eat? Can I use pesticides? How shall I dispose of my garbage? How much of a pollution problem does boating cause?

These, and countless other questions, are continually being asked by the cottager. We, at Environment Ontario, recognized the need to provide a readily available reference source to help cottagers protect their environment.

With the co-operation of many technical experts and the Federation of Ontario Cottagers Associations, we have updated this manual specifically examining cottage country environmental problems.

Certain sections of this manual describe activities and techniques that manipulate habitat to make it more suitable for swimming or boating. It is important, however, that before undertaking any activity in or near the water that the local District Office of the Ministry of Natural Resources first be contacted in order to assess the impact of the project on fish habitat.

Section 35, (1) of the federal *Fisheries Act*, states that "No person shall carry on any work or undertaking that results in the harmful alteration, disruption or destruction of fish habitat".

"Fish" includes shellfish, crustaceans, marine animals and the eggs, spawn, spat, and juvenile stages of fish, shellfish, crustaceans and marine animals.

"Fish habitat" means spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes.

Changes or alterations to habitat need not be large or widespread to do serious harm or damage to the fish community in a lake or stream. Therefore, before removing aquatic vegetation, clearing shoreline, dredging, filling or any other activity that could impact fish habitat, visit your local District Office of the Ministry of Natural Resources to discuss the project and apply for the appropriate approval. Owners or contractors who undertake such work *without* the necessary permit may be in violation of the *Fisheries Act* and subject to a fine as well as a court order to correct the situation at their own expense.

We have tried to answer as many of your questions as possible. Where appropriate, we've also detailed sources of further information, including available literature and contact points at various government agencies. Feel free to contact them. There will likely be an office close to you.

Meanwhile, good reading and good cottaging.

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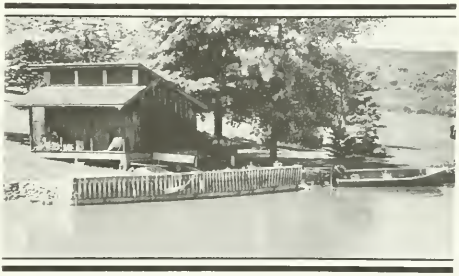

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CHAPTER I

Countless factors affect your lake's water quality. Some you can do something about. Some you can't. In either case, you should know the facts.

Let's look at the major influences.

Good Bacteria, Bad Bacteria

For the sake of simplicity, water micro-organisms can be divided into two groups:

1. bacteria that thrive in a lake environment and make up the natural bacterial flora; and
2. disease-causing micro-organisms, called pathogens, which can infect human tissues.

The pathogens are generally introduced to an aquatic environment by raw or inadequately treated sewage, although a few are found naturally in the soil. Other sources of pathogens include cats and dogs, chipmunks and even loons.

The presence of these bacteria does not change the appearance of water, but it poses an immediate health hazard if the water is used for drinking or swimming (hence, the obvious need to disinfect the water supply from the lake).

This hazard does not necessarily mean that you will contract such serious waterborne infections as typhoid fever, polio or hepatitis, but you may catch the less serious gastroenteritis (stomach flu), dysentery or diarrhea.

Included in this minor category are eye, ear and throat infections that swimmers encounter every year and the more insidious, but seldom diagnosed, subclinical infections usually associated with several waterborne viruses.

This type of microbial pollution can be remedied by preventing wastes from reaching the lake. Since disease-causing bacteria usually do not thrive in an aquatic environment, water quality should return to satisfactory conditions within approximately one year after remedial measures are implemented.

The Effect of Bacteria on Oxygen

The remaining bacteria, instruments of normal and necessary decay, live and thrive within a lake environment. Any organic matter in the water will be used as food by these organisms and cause a subsequent increase in their number.

These lake bacteria play an important role in breaking down natural organic matter, as well as sewage, kitchen wastes, oil and gasoline. Unfortunately, degradation of organic waste by micro-organisms uses large amounts of dissolved oxygen. If the organic content of the lake gets high enough, the action of these bacteria will deplete the dissolved oxygen supply in the bottom waters and threaten the survival of many deep-water fish.

Rainfall Runoff — A Hidden Polluter

The "rainfall effect" relates to a phenomenon in which heavy precipitation flushes the land around a lake and carries contaminants (including sewage organisms and natural soil bacteria) into the water.

In this way, total coliforms, fecal coliforms and fecal streptococci, as well as other bacteria and viruses from human waste disposal systems and animal droppings, can contaminate a lake. This phenomenon is particularly evident in Precambrian areas, where there is inadequate soil cover, and in fractured limestone areas, where fissures in the rocks provide access to the lake.

Melting snow provides the same transportation function for bacteria, especially in an agricultural area where manure spreading is carried out in winter on top of snow.

Scientific research suggests that, at sampling points 15 to 30 metres from shore, any contamination generally appears within 12 to 48 hours after a heavy rainfall.

To combat this hidden polluter, natural vegetation between the cottage and the lake should be preserved to absorb the runoff and seepage.

Vegetation slows down runoff and acts as a natural filter of storm water from roads, parking lots, patios and cottage roofs.

In places where the natural vegetation has been removed, cottagers should plant new trees and shrubs. Mature trees and shrubs on a cottage lot dissipate the energy of rainfall and reduce soil erosion.

The area over septic tank tile beds should be planted with grass and left open to the sun and wind so that maximum evaporation can take place.

The natural filtering by trees, grass and shrubs around a cottage provides significant protection for lake waters. During the summer, the vegetation also uses nutrients that reach the ground water from septic tank systems.

However, note that when you fertilize your lawn, you also fertilize the algae and weeds in the lake.

What's a Coliform?

Bacteriological tests on water are made primarily to determine the presence of organisms of the coliform group. These exist in the intestines of some warm-blooded animals (including humans) and are used as an index of the presence of fecal material.

Their presence in any significant amount in water samples is an indicator of pollution, and the presence of other harmful pathogenic bacteria must be assumed until proved otherwise.

Conversely, the absence of coliforms is considered sufficient evidence of the absence of pollution and indicates the water is suitable for drinking, bathing, etc., at the time of sampling. However, no surface water is recommended for drinking even though coliforms are absent.

Telltale weeds, symptom of eutrophication

Excessive Fertilization

Why We Need Weeds, Why We Don't

In recent years, most cottagers have become well aware of the problems associated with nutrient enrichment (eutrophication) of recreational lakes.

The symptoms are well known: algae and excessive weeds.

But it's important to realize that small to moderate amounts of aquatic plants and algae are necessary to maintain a balanced aquatic environment.

They provide food and a suitable environment for the growth of aquatic invertebrate organisms, which serve as food for fish. Moreover, shade from large aquatic plants also provides protection for young game and forage fish and helps keep the lower water cool, which is essential to certain fish.

In addition, numerous aquatic plants are used for food and/or protection by many species of waterfowl.

Too much growth, however, creates an imbalance in the natural plant and animal community. The end result is that there may be too much cover for fish, causing their growth to be stunted. Also, such desirable forms of life as sport fish can be eliminated, and unsightly algal scums can form, causing interference to recreation.

The lake is not "dead" but is considered esthetically unpleasant with its abundance of growth.

Perhaps you've seen ponds and lakes covered with dense mats of decomposing surface-type algae. You'll know then how they can ruin such recreational activities as fishing, swimming or boating. In addition, decaying masses of vegetation may cause water to become less palatable to humans or to domestic livestock. Also, winterkills of fish may result from oxygen depletion in the water caused by plant or algae decomposition under the ice.

Water Quality Changes with Depth

Changes in water quality with depth are a very important characteristic of any lake. Water temperatures are uniform throughout a lake in the early spring and winds generally keep the entire volume well mixed.

Shallow lakes may remain well mixed all summer so that water quality will be the same throughout.

In deep lakes, on the other hand, the surface waters warm up during late spring and early summer and float on the cooler, denser water below.

The difference in density offers a resistance to mixing by wind action and many lakes do not become fully mixed again until the surface waters cool down in the fall. The bottom water receives no oxygen from the atmosphere during this unmixed period, and the dissolved oxygen supply may be all used up by bacteria as they decompose organic matter.

Cold-water fish, such as trout, will have to move to the warm surface waters to get oxygen, and because of the high water temperatures they will not thrive, so that the species will likely die out.

Algae Aggravates

Low oxygen conditions in the bottom waters are not necessarily an indication of pollution. But excessive aquatic plant and algal growth and subsequent decomposition (particularly at the end of the season) will aggravate the condition. In some cases this results in zero oxygen levels in lakes that had previously held some oxygen in the bottom waters all summer.

Although plant nutrients normally accumulate in the bottom of lakes, they do so to a much greater extent if there is no oxygen present.

When the lake mixes in the fall, these nutrients become available for algae in the surface waters, and dense algae growths can result.

Consequently, lakes that have no oxygen in the bottom water during the summer are more prone to having algal problems and are more vulnerable to nutrient inputs.

Algae Problems Associated with Nutrient Enrichment

When algae become so abundant that they create visible shoreline scums, slime or ooze, then they are a nuisance impairing the water for recreational, domestic and esthetic pursuits.

Microscopic blue-green algae (a component of the phytoplankton) which grow throughout the lake may become buoyant and concentrate at the surface of the water during quiet weather. A slight onshore breeze can concentrate this buoyant accumulation so that it forms a pea-green scum which fouls beaches as it piles along the shoreline.

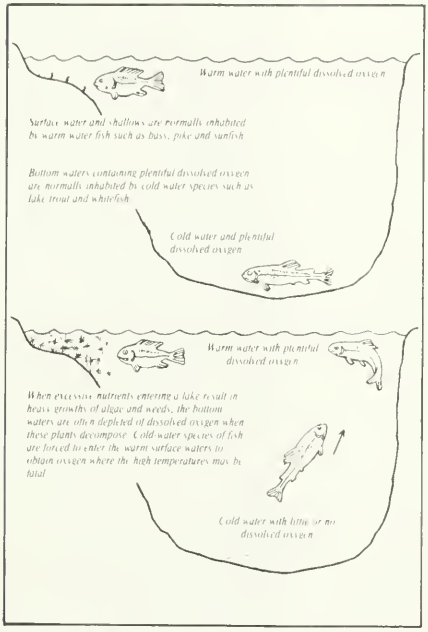
Filamentous green algae, such as *Spirogyra* and *Cladophora*, can create large cottony tufts or clouds that are suspended in the water or attached to suitable substrates such as rocks, logs and other rooted vegetation. When these masses break loose during storms, they can be blown to shore along with any other debris in the lake. There they may accumulate in thick mats that rapidly decompose creating a foul-smelling black ooze.

Less noticeable, but equally upsetting, are microscopic algae capable of imparting chemical tastes and odors to water. The algae may not be large or abundant, but the odors (cucumber, grassy, musty, fishy, rotten cabbage, etc.) they impart may make the water unpalatable for washing, cooking or drinking.

Foaming conditions observed along many lakeshores in the cottage country are usually the result of the release of emulsifying agents in aquatic plants and algae during the natural decomposition process.

Wind and wave action will cause some shoreline foaming. Some foaming may also be seen at the base of a waterfall or rapids. The amount of foam material is usually quite small from this source and dissipates rapidly as soon as the wind and wave action ceases.

Environment Ontario has facilities for identifying most forms of freshwater algae, be it microscopic, free-floating phytoplankton or larger attached forms that appear as visible green strands in the water. A small sample (25 mL) submitted to any of the ministry's offices, can, if preserved properly with Lugol's solution, be forwarded to our Toronto laboratory for analysis. (MOE Aquatic Biology Section, Aquatic Plant Unit (416) 235-5792).



Decomposition of plant matter at the lake bottom can lead to death of deep-water species.

Pine Pollen Problems

Pine pollen, a mustard yellow powder found floating on the water surface in June, is frequently mistaken for an oil or chemical spill. Nevertheless, the yellow scum is natural and not a health hazard.

Yellow pollen from coniferous trees or sandy brown or gray pollen from deciduous trees is most prevalent in June. It finds its way into the lakes and streams, or accumulates along shorelines and beaches when high winds transport it from surrounding forests. It is buoyant and easily blown across the surface of the water.

En route to shore, the pollen traps floating algae and other aquatic debris. The accumulation of material that reaches the shore may be unsightly and may create an unpleasant odor when it decomposes.

But this condition is seasonal and by early July, most traces of the yellow scum will disappear due to wind and wave action and will eventually settle to the lake bottom where it will decompose naturally.

How to Limit Nutrients

Like humans, aquatic plants and algae require a balanced "diet" for growth. Other special requirements, including light and temperature, are needed for certain algae and plants. Chemical elements such as nitrogen, phosphorus, carbon, and several others are also required, and must be in a form available for uptake by plants and algae.

Algal growth can be limited by a scarcity of any single "critical" nutrient. Nitrogen and phosphorus are usually considered "critical" nutrients because they are usually in scarce supply in natural waters, particularly in Precambrian Shield lakes.

Human and livestock wastes can be a very significant source of these and other nutrients for lakes.

It is extremely important, therefore, that cottage waste disposal systems function so that seepage of nutrients to the lake does not occur. Indeed, excessive growths of algae and aquatic plants in a lake may well indicate a seepage problem.

The Phosphorus in Your Detergents

Scientists have recognized that phosphorus is the key nutrient in stimulating algal growth in lakes and streams.

In past years, approximately 50 per cent of the phosphorus contributed by municipal sewage was added by detergents. Federal regulations reduced the phosphate content (as P_2O_5) in laundry detergents from approximately 50 per cent to 20 per cent on August 1, 1970, and to 5 per cent on January 1, 1973.

But automatic dishwashing compounds were not subject to the government regulations and are consequently high in phosphorus. Surprisingly, many automatic dishwashers are present in resort areas (a questionnaire indicated that about 30 per cent of the cottages in the Muskoka lakes have automatic dishwashers). Cottagers, therefore, may unknowingly be contributing significant amounts of phosphorus to their lakes.

Fortunately, in much of Ontario's vacationland, the source of domestic water is soft enough to allow the exclusive use of liquid dishwashing compounds, soap and soap flakes, which are generally relatively low in phosphorus.

The Environmental Protection Service of Environment Canada regularly samples a large number of domestic, commercial and industrial laundry detergents to ensure that its phosphorus regulations are met.

Table 1
Laundry Detergents

(a) Samples of the following laundry detergents for domestic, commercial or industrial use were found to contain less than one per cent P_2O_5 or "No Phosphate" at the time of testing in 1991:

ABC
ALL
ARCTIC POWER
ARCTIC POWER LIQUID
BASIC BRITE
BASIC H
BASIC L
BILTRITE
BREAK
CHEER
CLARIX
COMBAT
CONTROL-C.E.K. MFG.
CREST LO
CULLIGAN
CYCLONE WHITE
DETERGENT I
DYNAMO
ENVIRO LAUNDRY
FABRI SURE
FABRI SURE PLUS
FLUFF 2000
GENIE
HARMONIE
HELP
IVORY SNOW
IVORY SNOW LIQUID
KER CELL
KITCHEN LADY
LAUNDREX LAUNDRY DETERGENT
LAUNDRI CONCENTRATE
LAUNDREX DETERGENT
LAUNDRI CONCENTRATE
LAUNDRI MIRACLE
LAUNDRI SOFT
LAUNDRI SOFT LIQUID
LAUNDRI SOUR
LAWRA DETERGENT
LAWRA SUPER SOAP
LEMON PLUS
LIQUI ALKA SUDS
LIQUID LAUNDRY
LIQUID LAUNDRY SOFT
LOC HIGH SUDS
LOC REGULAR
LOW SUDS
LYDET 442
LYDET CF-9
METRO HEAVY DUTY
METRO WITH BLEACH
NEPTUNE
OLYMPIC LO SUDS
100% PHOSPHATE FREE
PERSONELL
PRESIDENT 'S CHOICE GREEN
RED LEAF
RINTEX
SA8 DETERGENT POUCH
SA8 LIQUID
SEAR'S LIQUID LAUNDRY
SEAR'S SUPER CONCENTRATE
SMASHING WHITE
SOBEY'S
SOVEREIGN
SOVEREIGN PLUS
SPARKETTE
SUDS
SUNFRESH
SUNLIGHT
SUNLIGHT LIQUID
SUPER FORMULAE IV
SUPER LAUNDRY LIQUID BREAK
SURE SHOT
TIDE FREE
TIDE LIQUID
TOTAL
TREASURE
TRI-ZYME
TRIUMPH NEUTADET
TRIUMPH PRESETO
TS PLUS
VALUE PRICED
VOUCH
WHIRLAWAY ONE SHOT
WISK
WOOLITE LIQUID
ZEP #1455
ZERO

(b) Samples of the following laundry detergents were found within the five per cent P_2O_5 limit at the time of testing in 1991:

A&P LEMON
AERO-ACME
AERO
AMAZE
BIO AD
BOLD
BREEZE
CHOICE
CONDITIONER IV
CONTROL
CYCLONE 20/20
DIAPER PURE
DREFT
FABRI BREAK
FORMULA 19
JEAN COUTEAU
K BRAND BUILT
KENSUDS
KENTEX
KLOR-X-TRA
LAUD
LAUNDREX
LAUNDRY FORMULA BL
LAUNDRY FORMULA HV
LAUNDRI NEUTRALIZER
LAUNDRI SUDS
LAWRA INDUSTRIAL
LAWRA SAVE
LAWRA SURF
LEADER
LEMON FRESH
LEVER PRO
LIBERATE PLUS
LIQUI DETERGENT
LO SUDS
MAGNUM
MAJESTIC BREAK
MCDONALD'S
OXYDOL
PENNICO PLUS
PENNSUDS
PERMA BRITE
PRESIDENT'S CHOICE
QUIX
RENDETTE
RICHELIEU
SA8 POWDER
SA8 PLUS
SADETTE
SKORTEX
SL 2000
SUPER C
SUPER C LEMON
SUPER CONCENTRATED POWDER
SUPER LAUNDRY LIQUID
SURF
3-D LAUNDRY
TIDE
TIDE WITH BLEACH
ULTRA-K
XP30
ZELLERS
ZERO

Facts About Laundry Detergents

Table 1 is extracted from surveys conducted during 1987 in Ontario.

It must be noted that since manufacturers can, and do, change their product lines from time to time, only those products that were available at the time of the testing are reported.

For further information on the Canada Water Act, Phosphorus Concentration Control Regulations, or the activities of the Detergent Phosphorus Concentrations Control program, please contact:

Environmental Protection
Publications
Conservation and
Protection
Environment Canada
Ottawa, Ontario
K1A 0H3
(819) 997-3405

How to Measure Enrichment in Your Lake

Large amounts of suspended algae, which materialize from excessive inputs of nutrients, result in turbid water of reduced clarity or transparency.

On the other hand, lakes with only small inputs of nutrients and correspondingly low nutrient concentrations (characteristically large and deep lakes) often support only small amounts of suspended algae and, consequently, are clear-water lakes.

An indication of the degree of enrichment of lakes can therefore be gained by:

- measuring the density of suspended algae (as indicated by the chlorophyll **a** concentration — the green pigment in most plants and algae); and
- examining water clarity with a Secchi disc.

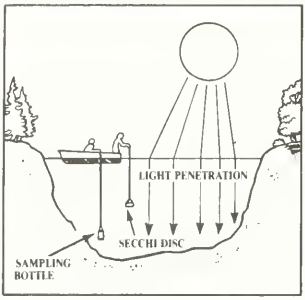
Ministry staff have been collecting these data from numerous Ontario lakes and have developed a relationship between these parameters to help cottagers understand the processes and consequences of nutrient enrichment.

In the absence of excessive colored matter (eg. drainage from marshlands), lakes low in nutrients are generally characterized by small amounts of suspended algae (i.e. chlorophyll **a**), and are clear-water lakes with high Secchi disc values.

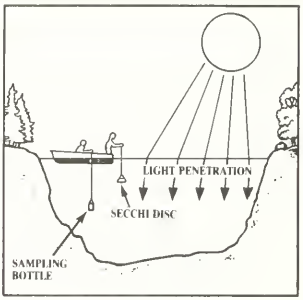
Table 2
Your Lake's Enrichment Status

	SECCHI DISC (S.D.) (depth in metres – m)	*CHLOROPHYLL a (Chloro-a) (micrograms per litre-μg/L)*
Enriched	*0-3 m*	*High Algal Density 4 μg/L or greater*
Moderately Enriched	*3-5 m*	*Moderate Algal Density 2-4 μg/L*
Unenriched	*5 m or greater*	*Low Algal Density 0-2 μg/L*

N.B. These data do not apply to many northern lakes where water color limits Secchi disc visibility.



UNENRICHED LAKE



ENRICHED LAKE

What's a Secchi Disc?

A standard size metal disc is painted in black and white quarters and suspended by a rope from its centre. Cottagers can roughly measure water clarity by simply lowering this disc beneath a lake's surface and noting the depth at which it disappears from view.

Start Your Own Self-Help Program

Collecting these data is something your cottage association can do. It is part of the "Self-Help Program" started in 1971 in response to requests for water quality surveys from concerned cottagers.

Cottage associations are supplied with sampling kits that include a Secchi disc, a water sampler, sampling bottles and instructions. Cottagers are asked to take Secchi readings and collect water samples bi-weekly during the ice-free season.

Using a Secchi disc is a simple way for cottagers to measure water clarity and estimate the degree of their lake's enrichment.

The water samples are mailed to the nearest Environment Ontario laboratory for analysis. Of course, the true value of this program is only realized if it's continued for a number of years so long-term trends can be monitored.

Table 2 shows how your readings and measurements can approximately be interpreted.

CHAPTER II

You have extensive aquatic plant and algal growths in your lake. They interfere with boating and swimming, and may ultimately diminish shoreline property values. What are you going to do?

The answer may be chemical or mechanical controls, or habitat manipulation.

Mechanical Methods

Temporary control of aquatic plants may be achieved by removing the plants with rakes or dragging chains through the weeds. In some cases, small boat-mounted cutters have been used.

Whatever the means, remember floating plant fragments may develop roots and grow elsewhere or wash onshore and decompose. Cutting the vegetation without removing material often makes the problem worse.

On a larger scale, harvesting and dredging machines may be used to remove vegetation from large areas; however, the cost and maintenance of this equipment is prohibitive for individual cottagers.

Habitat Manipulation

To develop a small swimming area, heavy-duty black construction polyethylene can be placed on the lake bottom to prevent weed growth. In sheltered areas of a lake, this can be accomplished by placing the sheet of plastic on the ice in late winter, and weighing it down with sand, gravel and small stones. When the ice melts, the plastic will sink to the bottom.

Once the plastic has settled to the bottom, it can be covered with additional sand. Numerous small air holes should be punctured in the plastic to allow gases that form on the lake bottom to escape.

Individuals who have used this technique report mixed results. Wave action and traffic over poorly weighted plastic have caused it to shift and sometimes tear. Plants may also grow through the air holes or re-establish after a period of years on the overlying substrate, particularly if the sand contains organic matter.

Extensive aquatic plant and algal growths can interfere with boating and swimming.

Other habitat manipulation techniques, including dredging and water drawdown (lowering water levels over the winter to freeze and kill plants), have been tried with variable success.

Other vegetation control methods are being investigated, which largely involve habitat alteration to discourage plant growth.

Chemical Methods

Chemical control methods are currently the most practical for temporary control of weeds in small shoreline areas, considering the ease with which they are applied. However, the herbicides and algicides currently available usually provide control for only a single season, and sometimes less. The decay of dead vegetation will use large quantities of dissolved oxygen, reducing the amount that is available for a healthy fish population. (For this reason, mechanical removal of weeds is the better solution.)

Permits and Licences

It's obviously important to ensure that an algicide or herbicide which kills the nuisance plants does not, at the same time, affect fish or other desirable aquatic plants.

Under The Pesticides Act and Regulations, a person applying a pesticide directly to water must obtain a water extermination licence, and a permit to purchase and/or perform a water extermination (unless exempt under the Regulations).

No licence or permit is required by the owner to treat a pond located entirely within the owner's property and with no outflow beyond the property boundaries.

The licence requirement ensures that pesticide applications to areas of significant size, which are accessible to the public, are made safely. Through the licencing system, a person may be educated on safe handling, correct storage and use of a pesticide, and its impact on the aquatic media

A permit authorizes the purchase and use of a registered pesticide under specific conditions. Permits are issued on an annual basis by Environment Ontario in co-operation with the Ministry of Natural Resources.

A cottage association proposing to control submergent aquatics in a bay or lake area fronting numerous cottages will require a "multiple property" water extermination permit if they plan to carry out the treatment themselves or a permit and a licenced exterminator to carry out the treatment for them. An individual treating his/her own cottage frontage will require only a permit.

A water extermination permit (issued for one year) ensures that there will be no unreasonable infringements on the rights of other water users, and that the substance applied will not be toxic to humans, fish, domestic animals, or wildlife.

Through the permit system, the area of vegetation treated in any one lake may be regulated so that important fisheries and other wildlife habitat will not be significantly affected.

To secure a permit for applying a chemical or other substances to control nuisance conditions in any area of water, an individual or commercial agency must submit pertinent information on an official application form. In this way, the nature of a project and possible consequences may be evaluated

Where to Get Permits/Licences

Application forms may be obtained by writing to Agricultural and Industrial Chemicals Section, Environment Ontario, Suite 100, 135 St. Clair Avenue West, Toronto, Ontario M4V 1P5.

An application should be submitted well in advance of the time that the chemical is to be applied. While every effort is made to process applications as quickly as possible, six weeks may be required for issuing a permit, since it is often necessary to correspond with the appropriate district office of the Ministry of Natural Resources or to investigate the area.

Acquiring a permit or a licence does not absolve anyone from responsibility for undesirable effects arising from a treatment.

Anyone applying a substance without the authority of a licence or permit, or who violates the terms and conditions provided in a permit, is liable to prosecution.

Types of Aquatic Plants

Aquatic plants may be divided into three categories:

1. Submerged rooted aquatics — which may have leaves that float on the water surface;
2. Emergent plants — which may have most of their foliar structures above the water surface; and
3. Algae — which color the water green or brown, or appear as "pond scum."

Aquatic herbicides vary greatly in the range of vegetation that they will control. It is therefore important to consult the label when control of a particular kind of nuisance species is desired. It is also very important to identify the species of vegetation present accurately as some plants are not controlled by any of the currently registered herbicides.

When to Treat

Algae and rooted submergent plants should be treated during the spring or early summer, while the plants are developing rapidly and before they reach nuisance proportions.

During this period, chemicals will provide more effective control, and there will be less likelihood that fish will die as a result of shortage of oxygen, which can be one result of the decomposition of a large number of dead and dying plants.

Algicides and herbicides are generally more effective in warmer water, and better control will be achieved if the water temperature is above 18°C.

In many lakes, these temperatures are not reached until well into the summer months, after the time of optimum control with a herbicide.

However, since weather conditions (particularly the severity of winter and the rate of snow melt) will influence time of new growths of plants, it is important to 1) monitor the site each spring season and 2) start your control program when the nuisance species are showing new growth. This may be early, mid- or late June through early July.

Control of emergent vegetation should be undertaken about the time of flower or seedhead formation on days that are calm and sunny. Windy weather increases the hazard to the person applying the chemical and to nearby valuable plants.

If rain falls shortly after a spray is applied, it will wash the chemical off the plants, thus reducing the effectiveness of the treatment.

Read the herbicide label carefully to determine time and conditions of application, since each product behaves differently.

General Suggestions on Herbicides and Algicides

Before any chemical control measures are undertaken, all owners adjacent to and in the general vicinity of the treatment area must be notified.

Due consideration must be given to any objections voiced by other parties who may use water from the surrounding area for drinking, swimming, fishing, watering domestic animals or irrigation.

Use of treated water following any application should be restricted according to label directions.

Where fish are present and there is a heavy growth of algae or aquatic plants, the entire pond or bay should not be treated at one time. As mentioned previously, decomposition of a large plant mass can deplete the dissolved oxygen supply so that the fish will suffocate. Under such circumstances, different parts of the water body should be treated in sequence, each about a week apart.

Where algicides or herbicides are actually mixed with or distributed throughout the water, it is important that the chemical be distributed evenly throughout the area to be treated. If localized high concentrations develop, fish and other aquatic life may be destroyed and control of the plants may be spotty. The amount of chemical applied should be in proportion to the depth of water to be treated. If there is an obvious current due to wind action, a larger proportion of herbicide should be applied to the upwind side of the treatment area.

All herbicides and algicides must be handled carefully because of their toxic properties and often corrosive nature. Follow the application instructions closely.

Facts on Chemicals

Information on specific herbicides and algicides has not been included in this publication since new products and changes in formulations are continually being developed.

The Ontario Weed Committee publishes recommendations each year in Publication 75 ("Guide to Chemical Weed Control") of the Ontario Ministry of Agriculture and Food. Pertinent extracts from this publication are available upon request from the Public Information Centre, Environment Ontario, 135 St. Clair Avenue West, Toronto, Ontario M4V 1P5.

Further Information

Methods of chemical application, calculations of water volumes and dosage rates and illustrations to help you identify plants can be found in the booklet "Aquatic Plant and Algae Control."

Write to your nearest office of Environment Ontario.

Mechanical harvesting of weeds is often used to remove vegetation from large areas.

CHAPTER III

What is Acidic Precipitation?

Acidic precipitation, commonly referred to as "acid rain," kills aquatic life, erodes buildings and structures, damages soils and forests, and can affect human health.

Acid rain generally evolves through a series of four consecutive stages: 1) emissions of sulphur and nitrogen oxides, which originate chiefly from the combustion of fossil fuels (coal and oil); 2) long-range transport of these contaminants by winds; 3) transformation of chemical properties in the atmosphere to form acidic compounds; and 4) fallout of these pollutants to earth.

Fallout from the atmosphere occurs through either "wet deposition" precipitation in the form of rain, mist or snow, or by "dry deposition," such as fine particulate matter or dust that becomes acidic.

Sulphur dioxide (SO_2) emissions, largely from coal-fired electric utilities, smelters or industrial furnaces, account for roughly two-thirds of acidic pollution in North America. Nitrogen oxide (NO_x) emissions account for about one-third, half of which is due to motor vehicle combustion of gasoline.

Since the greater part of the world depends upon fossil fuel, it's not surprising that acidic precipitation is a world-wide phenomenon.

Concern and Effects in Ontario

Environmental scientists have known for several decades that atmospheric sources of acid had caused damage to lakes in Sweden, Norway and New York State. Environment Ontario studies in 1975 revealed that this province was also seriously affected.

The areas of the province most susceptible to acid rain are the central and northern parts, because of their limited watershed buffering capacities. The buffering capacity is related to local geology. Areas within the Canadian Shield are dominated by granite bedrock rather than limestone, which provides buffering or neutralization of incoming acid. Many recreational lakes in Muskoka, Haliburton, Parry Sound and Algonquin Park will lose their fisheries if no abatement action is taken.

Soils with low buffering capacity can acidify and release nutrients and heavy metals such as aluminum. These metals may enter lakes and streams and are potentially toxic to various forms of aquatic life and wildlife if concentrations are high enough. The toxic metals accumulate as they are passed up the food chain from mollusks and crustaceans to the fish, birds and mammals that feed on them.

Acid rain threatens mollusks, insects such as mayflies and stoneflies, amphibians and fish by preventing successful reproduction. Calcium uptake in common species of crayfish is inhibited, resulting in delayed hardening of the exoskeleton, increased parasitism, and egg and young mortality.

Fish, such as lake trout, spawn in the fall and their eggs develop through the winter and hatch in the spring. The spring emergence of sensitive young fish coincides with the "spring melt," when melting snow and ice dump large amounts of acidic water and sometimes toxic metals into lakes, rapidly changing pH. The fish experience a pH shock, so this event is also referred to as "spring shock." Since the early life stages of fish are particularly sensitive to acid pulses, failure to sustain new generations has been implicated as a major factor in the decline of fish populations in acidifying lakes.

Many amphibians spawn in pools of meltwater, making them very susceptible to spring acid shock, which will often wipe out these species long before the lake itself reaches a low pH.

As lakes acidify, the diversity of species declines. Undesirable species of slimy filamentous algae appear more frequently as other species die out. Community composition is changed and the food chain is disrupted. These algae also reduce the appeal of the water body for recreational use.

The situation is aggravated since particulates of certain metals and ozone, known to harm the environment, are also transported great distances by prevailing winds.

Most threatened by acid rain is Ontario's and eastern Canada's freshwater heritage. Tens of thousands of Ontario's lakes are threatened and, of those surveyed, about 250 are already acidified and 934 are extremely sensitive.

Acid Rain — The pH Parameter

Scientists measure the acidity or alkalinity of a solution by a parameter called the pH, which is a logarithmic measure of the hydrogen ion concentration on a scale ranging from 0 to 14. On the pH scale, a chemically neutral solution has a value of seven. The greater the acidity, the lower the pH. A change of one pH unit downward implies a tenfold change in the hydrogen ion concentration or a tenfold increase in acidity; a change of two is hundredfold. If, for example, a pH is four, it is 10 times more acidic than a pH of five; a pH of three is a hundredfold more acidic than a pH of five.

Due to carbon dioxide naturally present in the atmosphere, the pH of normal or "clean rain" in eastern North America is about 5.6.

In areas of southern Ontario, such as the Muskoka and the Kawartha lakes, the pH of the rain is often found to be 4.5 to 4.0, meaning that the rain is many times more acidic than that of

"clean rain." Aquatic life in susceptible lakes is considered to be vulnerable when the pH of the lake drops below six.

There is widespread concern that if acidic conditions are sustained over long periods, serious detrimental effects will be experienced by aquatic and terrestrial ecosystems.

Turning Off The Sources

In Ontario, about 50 per cent of the acid rain comes from United States' sources. Because of tall smoke stacks and prevailing weather conditions, the U.S. Environmental Protection Agency (EPA) acknowledges that Canada receives from the U.S. two to four times as much SO_2 and 11 times as much NO_x as the U.S. gets from Canada.

In the 1970s, the governments of North America were preoccupied with local or "ambient" air quality. SO_2 emissions in Ontario were cut in half as provisions under the *Environmental Protection Act* forced the use of abatement technology on polluters.

In the United States, passage of the *Clean Air Act* also provided a means to protect local air quality. Some states reduced their total SO_2 and particulate emissions to safeguard their cities, while other states increased their SO_2 emissions.

However, local air quality legislation was inappropriate for addressing the problem of long-range transport of acid rain. In some cases, laws designed to protect local air quality led to the construction of tall smoke stacks that increased the long-range transport of acid rain.

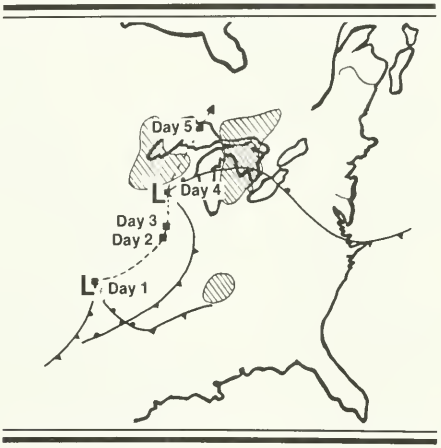
Ontario became the first jurisdiction in North America to require SO_2 reductions from companies already in compliance with local air quality regulations.

In December 1985, Ontario announced a new program, "Countdown Acid Rain," which was aimed at major Ontario polluters. The program will significantly reduce acid rain in Ontario, Quebec, New York State, and New Hampshire.

Ontario hopes that by setting yet another example it will encourage its American neighbors to demand further action from their state and national governments to reduce the 50 per cent of our acid rain deposition that comes from the United States.

North American Areas Containing Lakes Sensitive to Acid Precipitation

Source: James N. Galloway and Ellis B. Cowling, Journal of the Air Pollution Control Association 28, no. 3 (March 1978).



Typical development of Northeastern North America weather phenomena

The severity of the situation in Ontario, and the need for quick abatement action, results from the increase in acidity of precipitation over the past several decades. U.S. sulphur emissions from the electrical utility sector have nearly quadrupled during the past 25 years and now account for two-thirds of the U.S. total. It is projected that 300 new power plants will be built in the U.S. during the 1980s and 1990s.

Acid rain has increased to the point where the average pH of rainfall in the part of Ontario lying south of the 50th parallel is less than 5.0. Many regions of the province regularly receive rain of pH 4.5 to 4.0.

Solutions—Abatement the Only Answer

It is essential that Canada and the U.S. develop an effective mechanism to deal with the long-range transport of transboundary airborne pollutants. If Ontario eliminated every source of sulphur and nitrogen oxides in the province, it would have virtually no impact on the continuing damage to our lakes, unless the U.S. jointly reduced its emissions (Table 3).

Moreover, we now expect more use of fossil fuels, especially coal and oil, and, therefore, more potential production of SO_2 and NO_x. We must continue to work for abatement at the international level.

Table 3
1984 SO_x Total Emission in North America
(Thousands of metric tonnes/year)

Country	Province/State	Total SO_x	Util.
CANADA	Newfoundland	37.8	11.3
	Prince Edward Island	2.0	.2
	Nova Scotia	200.7	148.0
	New Brunswick	161.6	113.7
	Quebec	736.8	.2
	Ontario	1,574.3	444.2
	Manitoba	466.2	2.4
	Saskatchewan	110.7	88.0
	Alberta	517.1	61.2
	British Columbia	147.9	.2
	N.W. Terr./Yukon	2.0	.0
UNITED STATES	Ohio	2,425.3	1,914.5
	Indiana	1,763.8	1,251.6
	Pennsylvania	1,485.2	1,238.4
	Illinois	1,312.9	1,090.6
	Texas	1,173.9	385.8
	Missouri	1,160.9	1,096.2
	W. Virginia	984.8	830.7
	Georgia	951.5	769.2
	Tennessee	832.8	689.5
	Florida	818.3	552.9

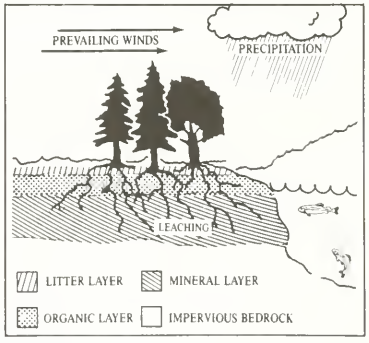
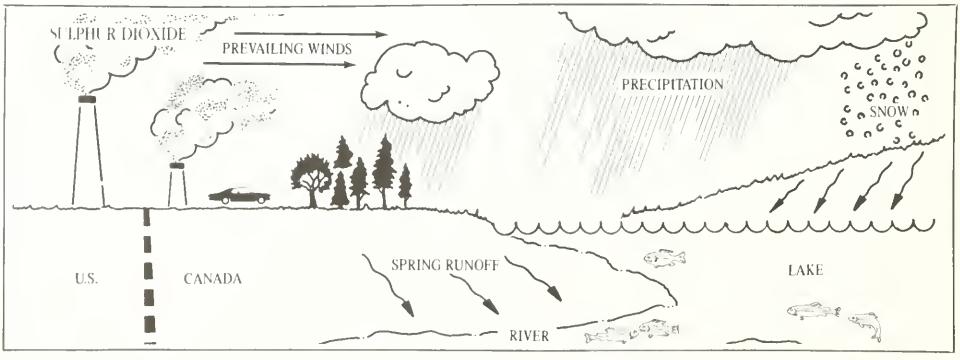


Illustration of Terrestrial Lake Effects

Long-Range Distribution of Sulphur Dioxide



Find Out About Your Lake

How acidified is your lake?

You can find out by phoning Environment Ontario's Acid Precipitation Office at (416) 323-5051 between 8:15 a.m. and 4:30 p.m. Collect calls are accepted at this number.

You have access to a continuing program that analyzes the susceptibility of Ontario's recreational lakes to acid attack.

Researchers are examining the alkalinity of lake waters. This is a measure of a lake's natural acid-neutralizing capacity.

Lakes vary greatly in their ability to neutralize acid loadings. Some can handle acid rain quite well, particularly lakes on alkaline soil or limestone deposits.

Lakes are listed in the "Acid Sensitivity of Lakes in Ontario Guide." This booklet now includes information about 6,063 lakes, listed as not sensitive, low sensitivity, moderate sensitivity, extreme sensitivity and acidified.

Lakes are arranged by county or district and listed alphabetically within each division.

A free copy of the booklet is available from:

Public Information Centre
Environment Ontario
135 St. Clair Avenue West
Toronto, Ontario M4V 1P5
(416) 323-4321
or
Acid Precipitation Office
Environment Ontario
Suite 100
135 St. Clair Avenue West
Toronto, Ontario M4V 1P5
(416) 323-5051

CHAPTER IV

Bacteriological Safety

In cottage country you're surrounded by water, and it looks clean. But can you drink it?

You have to remember that all water (from a lake, river or any other surface water source) is open to contamination by humans, animals and birds, all of which can be carriers of disease. Consequently, no surface water may be considered safe for human consumption without prior treatment, including disinfection.

Only water that comes from a protected source, such as a well, or that which has been subject to some kind of treatment, should be considered suitable for drinking.

How Is Bacteriological Safety Determined?

To determine their safety for drinking, samples of drinking water are tested for the presence of two groups of bacteria: total coliforms and fecal coliforms. Total coliform bacteria are always present in animal wastes and sewage but are also found in soil and on vegetation. Fecal coliform bacteria are only found in intestinal contents of warm-blooded animals.

The presence of fecal coliforms is therefore more likely to indicate sewage contamination, which is of greater concern because of the risk of disease agents that may be present in sewage. Fecal coliforms tend to die off more rapidly outside the body; consequently, their presence in water indicates relatively recent sewage contamination.

No one should drink water containing fecal coliform bacteria.

Only water which is treated or from protected sources is safe to drink without prior testing.

How Does Water Become Contaminated?

Water sources may become contaminated by:

- runoff or ground drainage seeping into unprotected surface waters or inadequately sealed wells and springs;
- pipes and soil during construction of a new well (new wells should be disinfected before testing and use);
- surface drainage and ground percolation into shallow dug wells that are improperly sealed;
- sewage disposal systems close by or up hill from the water source;
- pipes, pumps, aerators or splash preventers, non-sterile sample containers, dust and human hands.

Minimizing Contamination of Lake Water

A lake is subject to contamination at any time, either through natural surface runoff or through human intervention.

Common sense suggests that any water intake should not be located near where people swim or where boats leak gasoline or stir up sediment. Private sewage disposal systems should be located far enough from the lake so as not to pollute.

Even if these precautions are taken, never assume or depend upon the purity of untreated lake water.

Minimizing Contamination of Well Water

Well water, too, can easily become contaminated. Regular testing is an essential precaution.

A well may become contaminated in one of two ways: 1) the groundwater that supplies it may itself be polluted, or 2) the well may admit pollution through faulty location or construction.

If the groundwater is polluted, continuous chlorination of the well is essential. If the groundwater is pure and the well is faulty, the fault can usually be corrected and the well disinfected.

How to Keep Wells Clean

Pollution usually enters a well through the top. It may get in directly, through a loose lid, or indirectly, by way of unsealed sidewalls. To prevent this sort of pollution, do the following:

1. Make sure that surface water cannot drain into the well. If the well is located in a dip of land, raise the top above the surrounding area so that the rim is well above the trickle level of even a heavy rainstorm.
2. Have the walls of the well sealed for a distance of at least three to four metres below ground level.
3. See that the lid is sealed — around the rim of the well, around the pump base, and around the manhole, if there is one.

If the well is already contaminated, make these corrections before disinfecting it, or it will quickly become contaminated again, restoring the risk of disease. New wells, renovated wells, or wells upon which any construction work has been done should be disinfected before use.

Test Your Water

The Ministry of Health provides sterile bottles in which you can submit samples of your drinking water for bacteriological testing. The tests are performed without charge. To have a water sample analyzed, follow this procedure:

1. Secure a water sample bottle from your local Medical Officer of Health or from one of the Public Health Laboratories (Table 4).
2. Fill the bottle with a sample of the water to be tested, following the sampling instructions provided with the bottle.
3. Send the sample immediately, in the mailing tube provided, to the nearest Public Health Laboratory, Ontario Ministry of Health (Table 4).

Unprotected surface waters are always considered unsafe, and samples from these sources should not be submitted unless some form of treatment has been applied first.

How Many Samples Should Be Collected? . . . and When?

- For well water in general, three samples with acceptable results collected one to three weeks apart indicate a safe supply. Testing once or twice a year after that is sufficient, unless there has been some change in source conditions

Table 4
Sources of Sampling Bottles

Sterile sample bottles for submission of water samples may be obtained from any one of the following provincial public health laboratories.

LOCATION	*TELEPHONE*	*POSTAL ADDRESS*
Hamilton — Hamilton Psychiatric Hospital, 250 Fennell Avenue West	416/385-5379	P.O. Box 2100, Hamilton, Ont. L8N 3R5
Kingston — Government Buildings, 181 Barrie Street	613/548-6630	P.O. Box 240, Kingston, Ont. K7L 4V8
London — London Psychiatric Hospital, Off 850 Highbury Avenue	519/455-9310	P.O. Box 5704, Terminal A London, Ont. N6A 4L6
Orillia — Highway 11B South, 750 Memorial Ave.	705/325-7449	P.O. Box 600, Orillia, Ont. L3V 6K5
Ottawa — 346 Moodie Dr.,	613/828-2442	P.O. Box 6301, Station J, Ottawa, Ont. K2A 1S8
Palmerston — Midwestern Regional Children's Centre, Hwy. 23	519/343-3102	P.O. Box 700, Palmerston, Ontario N0G 2P0
Peterborough — 1341 Dobbin Avenue	705/743-6811	P.O. Box 265, Peterborough, Ontario K9J 6Y8
Sault Ste. Marie — (Albert and Brock Streets) 160 McDougall St.	705/254-7132	P.O. Box 220, Sault Ste. Marie, Ontario P6A 5L6
Sudbury — 1300 Paris Crescent	705/522-2640	1300 Paris Crescent, Sudbury, Ont. P3E 3A3
Thunder Bay — 336 South Syndicate Ave.	807/622-6449	P.O. Box 1100, Station F, Thunder Bay, Ont. P7C 4X9
Timmins — 67 Wilson Avenue	705/264-9571	67 Wilson Avenue Timmins, Ont. P4N 2S5
Toronto — 81 Resources Rd. (Hwy. 401 & Islington Ave.)	416/235-5952	Box 9000, Terminal A, Toronto, Ont. M5W 1R5
Windsor — 3400 Huron Church Road	519/969-4341	P.O. Box 1616, Windsor, Ont. N9A 6S2

or physical appearance of the water

- At the cottage, two or three samples should be taken during a season, if all are acceptable for drinking.
- A well supplying a summer cottage should be tested as soon as the cottage is opened each spring, and the water should not be drunk without treatment before the results of the test are obtained. In addition, a well should be tested once or twice during the season, preferably after heavy rains
- A new or repaired well should be sampled after disinfection and again one to three weeks later to confirm acceptable results.
- A well should be sampled after flooding or any other changes that may introduce contamination. If repeat samples show continuing contamination, some corrective action is necesary to eliminate the source of the contamination. Repeated testing alone will not provide a safe water supply.

Sampling From Wells

Following the general instructions provided with the sample bottle, the following additional steps should be taken if sampling directly from the well:

1. If the well has a mechanical pump, take the sample from a previously cleaned tap on the rising main or from a nearby tap before the water reaches the reservoir or cistern.
2. If the well has a hand pump, pump the water continuously for at least five minutes before taking a sample. Then clean the mouth of the pump and pump several more gallons of water to waste. Take the sample by allowing the pump water to flow directly into the bottle.
3. If the well has only a bucket or a can, do not fill the sample bottle from this bucket. Rather, lower the bottle itself into the water.

Table 5 shows how to interpret the bacteriological report you receive after submitting your sample.

Table 5
How to Interpret a Bacteriological Report

Remember that strict numerical limits for safety are difficult to establish and that as the number of coliform bacteria increases so does the risk of disease agents being present in the water.

Coliform bacteria per 100 mL		
Total	*Fecal*	*Interpretation*
>160	*>60*	*Unsafe for drinking. This water is contaminated and should not be used for drinking under any circumstances. Do not attempt to apply these standards and interpretations to surface waters used for swimming.*
10-160	*1-60*	*Unsafe for drinking. Pollution source may be some distance from the water source, diluted with large volumes of pure water, or the sample may not have been received within 48 hours of being taken. Samples older than 48 hours cannot provide reliable results.*
10-160	*0*	*Unsafe for drinking. Contamination is not likely to be of sewage origin unless far removed from the water source or unless there has been a delay in receipt of sample. Common with new wells before disinfection and shallow dug wells which are not properly sealed.*
2-10	*0*	*Doubtful for a single sample, but safe for drinking if condition remains stable and supply is protected and located at least 30 - 40 m from any source of human or animal wastes.*
<2	*0*	*Safe for drinking. Repeat samples may not show exactly the same results because bacteria are not distributed uniformly in water. Contamination tends to enter intermittently and numbers can change during sample transit time.*
Est		*Unsafe for drinking. Number has been estimated due to some interference with the test. Exact number is not really critical, especially if in excess of limits shown above, for judging safety.*
O/G		*Doubtful condition and not recommended for drinking. No coliform bacteria could be detected because of "overgrowth" by other bacteria. This condition frequently occurs with new wells, dug wells receiving soil drainage, or wells which have been idle for some time. Collect another sample and identify clearly "REPEAT SAMPLE."*

Treating Your Water

If you are not sure of the quality of the water, treat it by boiling or by chlorination. Never use water of unknown quality for drinking, brushing your teeth, washing dishes, or washing fruits and vegetables that are to be eaten raw.

Boiling

Heat the water to a rolling boil for at least five minutes to destroy any bacteria.

One disadvantage of boiling is that the gases dissolved in water are driven out, resulting in a flat "boiled" taste. This can be removed, however,

if the 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.

Chlorination

Add a small amount of chlorine to the water to make it safe to drink.

Chlorination in Batches

Using a dropper, add eight drops of household bleach (4 to 5.25 per cent available chlorine) to four litres of water; stir, and allow the mixture to stand for 15 minutes before using it. At the end of that time, there should still be a faint odor of chlorine left. If there is not, repeat the process.

This is a strong dose of chlorine, and it will make most water safe to drink. However, if the water does not need that much (i.e., if the "chlorine demand" is low) the chlorine not used up will leave a taste.

If the treated water has too strong a taste, it can be made more palatable 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.

If the strength of the bleach is not 4 to 5.25 per cent available chlorine (some labels may read "active ingredient sodium hypochlorite 5.25 per cent") and you do not have a testing kit, calculate the number of drops required. Just divide 40 by the percentage of available chlorine in the bleach.

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 or litre of water

Continuous Chlorination

For continuous water disinfection, you may obtain a small domestic water hypochlorinator (sometimes coupled with activated carbon filters). These are supplied by firms listed in the Yellow Pages under "Water Purification."

Do not load these hypochlorinators with the "stabilized" chlorine tablets, or "pucks," supplied for use in swimming pools. These contain a substance which could have potential health effects when consumed in drinking water.

Where a chlorinator is used, it is essential to have a means of testing the amount of free chlorine residual injected into the water. A "DPD" chlorine testing kit should be used, which is available from most equipment suppliers.

The water supply should carry a free available chlorine residual of 0.2 to 0.5 parts per million (ppm), as determined by a test made after at least 15 minutes chlorine contact time. While the operation of the chlorinator is relatively simple, it is a good idea to ensure that the person who is responsible for the chlorination is familiar with both the operation of the machine and the required tests.

Note: Solid particles in the water can shield bacteria from the action of chlorine. If the water is cloudy, filter it before you chlorinate it.

Chlorination Procedures for Wells

Ontario Regulation 612/84 requires that all newly-constructed wells be chlorinated by the well contractor with 250 mg/L available chlorine over a contact time of 12 hours.

The chlorination of existing wells, because of poor bacteriological analysis results or following repairs to either the well or the pump, requires only 50 mg/L over a contact time of 12 hours.

The following steps are necessary to chlorinate a well:

1. Calculate the Amount of Chlorine Solution

The following are two examples of procedures recommended to calculate the amount of bleach required to chlorinate a well.

A1. A simple formula (Environmental Health Review, Spring 1986) for directly calculating, in either the imperial or metric systems, the amount of household bleach (5.25 per cent sodium hypochlorite) to add to your well water to obtain 250 mg/L available chlorine is given in the following:
$15\ R^2H = Q$

A2. To obtain 50 mg/L available chlorine, the formula is:
$3R^2H = Q$
where R is the radius of the well in feet or metres,
H is the number of metres of water in the well casing, and
Q is the number of litres or fluid ounces that must be added to the well water.

B. Measure the diameter of the well. Determine, by measurement, the number of metres of water in the well. From Table 6, obtain the volume of water, in litres, contained in the well for every metre of water.

After calculating the number of litres of water in the well, calculate the amount of chlorine or compound containing chlorine that must be added to the well water to obtain the desirable concentration. Numerous household bleach solutions (e.g. Javex) containing sodium hypochlorite are available, and they contain about 3 to 5.25 per cent available chlorine. Calcium hypochlorite is also available in granular or tablet form and contains 70 per cent available chlorine by weight. Either of these two products may be used.

The following relationship will help you to determine the amount of these products to add to your well water:

For every 1000 L of well water, add 1 L of household bleach (five per cent) or 71 g of calcium hypochlorite to obtain a 50 mg/L concentration of chlorine and 5 L of household bleach or 355 g of calcium hypochlorite to obtain a 250 mg L concentration of chlorine.

Tables 7 and 8 give the amounts of household bleach to be added to dug wells up to 1 metre in diameter or drilled wells up to 15 cm in diameter at various depths.

2. Let the Chlorine Work

Stir the water if possible. If the water is piped to the house, pump the chlorinated water through the piping system.

Before disinfecting the water distribution system, remove or isolate any carbon filter from the system, since a filter will tend to remove the chlorine. In addition, the water heater should be completely drained and be allowed to fill with chlorinated water.

Table 6
Volume of Well Water

Inside Diameter/ (mm)	Water in the Well/ (L/m)
50.8	2.03
101.6	8.11
127.0	12.7
152.4	18.2
177.8	24.8
203.2	32.4
609.6	291.9
762.0	456.0
914.4	656.7

To be sure it disinfects the entire system, allow each faucet to run until you can smell the chlorine and then turn it off.

Let the chlorinated water stand in the well and in the piping system overnight (about 12 hours).

3. Remove the Chlorine

Pump the water to waste until the well is dry or until no further odor of chlorine can be detected in the water at any of the taps.

None of the water being wasted should be allowed to enter the septic tank and tile field.

4. Take a Sample

In about a week, send a water sample for a bacteriological examination. Boil or chlorinate all drinking water until the bacteriological results are returned. Two consecutive "safe" tests will probably indicate that the treatment has been effective.

Table 7
Chlorine For Dug Wells Up to 1 m in Diameter

Water Depth (m)	Household Bleach (L)
1.5	0.95
3.0	1.9
4.5	2.8
6.0	3.8
7.5	4.7
9.0	5.6

Chlorine Use

(a) If calcium hypochlorite powder is used, it should be mixed with water to form a solution before being added.

(b) With most drilled wells, the chlorine solution can be added through the vented sanitary cap.

(c) CAUTION — Any chlorine solution should be handled carefully. It can bleach clothing and injure the eyes and skin. In case of spills, wash off with water for at least 10 minutes.

Table 8
Chlorine for Drilled Wells Up to 15 cm in Diameter

Water Depth, (m)	Household Bleach, (mL)
7.5	150
15.0	300
22.5	450
30.0	600
37.5	750
45.0	900
52.5	1050
60.0	1200

Notes:

(a) If the water level is between two of the values given, use the chlorine dose for the higher water level.

(b) If you do not know how high the water stands in a drilled well, use the well depth to estimate the chlorine dose.

(c) These quantities are based on bleach with five per cent available chlorine. If your bleach has a different strength, choose the correct amount of five per cent bleach for your well size, multiply that amount by five, and divide the product by the percentage of available chlorine in the bleach. The result will be the proper amount of bleach to use.

Water Treatment Devices for Home Use

Although no regulations currently exist to control the sale of these devices, information has been developed to protect the public. This was prepared by a joint voluntary government committee in co-operation with the Canadian Water Quality Association, whose members manufacture many of the devices on the market.

The following provides extracts from an Environment Ontario publication, "Information on the Use of Home Water Treatment Devices." Full information may be obtained by referring to the original document

Useful Advice

Any device should be cleaned regularly, following manufacturers' instructions, especially after a period of non-use.

The construction material of these devices and contact systems should not react with water or with disinfection chemicals, nor give toxic constituents to the treated water. The device should be constructed to avoid any risk of contamination or any electrical or fire hazard.

Disinfection

These guidelines were developed specifically to cover the aspects of disinfecting water. Municipal supplies already meet microbiological requirements for drinking water.

Certain conditions may prevent the satisfactory treatment of a raw water source by these devices alone. Different raw water quality requires a case-by-case review of a combination of treatment processes to produce water of drinking quality

The following situations require careful consideration:

(a) Excessive Bacterial Population
It is recommended that raw water should not contain greater than 1000 total coliforms per 100 mL or greater than 100 fecal coliforms per 100 mL.

(b) The Known Presence of Human Pathogenic Viruses
Raw water within these limits for coliform levels would normally not be expected to present a virus problem, but when human pathogenic viruses are present, certain devices should not be used.

(c) Presence of Protozoan Parasites
Protozoan parasites require the use of a filter with a pore size equal to, or less than, 5µm.

(d) Excessive Color, Turbidity, Iron or Organic Impurities
Appropriate devices for esthetic or chemical treatment may be required to address any of these factors. It is important that subsequent bacterial analyses of the treated water be made with sufficient frequency to demonstrate the efficacy of the device in use.

(e) Storage Recommendation
Treated water, by any process, should not be stored indefinitely. It is preferable to keep treated water under refrigeration, but not for more than two days.

Ceramic Filters

To ensure the proper functioning of the equipment, consumers should be aware that care is required when handling, transporting, installing and cleaning a filter unit. A cracked or otherwise damaged filter may be rendered ineffective.

Ceramic filters do not provide complete protection against the buildup of micro-organisms in the distribution system. Initially, and after a period of non-use, disinfection of the plumbing system downstream of the filter is recommended, in some circumstances, before putting it into operation.

Ultraviolet Irradiation

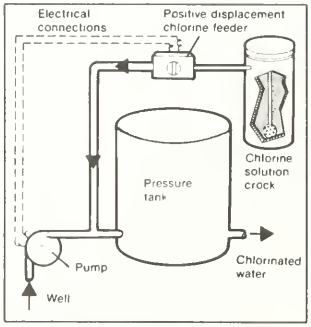
The unit should incorporate a device for monitoring or sensing ultraviolet transmission through the maximum depth of water in the chamber. The monitoring or sensing device should be designed to trigger an alarm should the lamp or sensor fail or if insufficient ultraviolet light reaches the sensor.

Ultraviolet irradiation will work best when voltage or cycle variations do not exceed manufacturers' specifications.

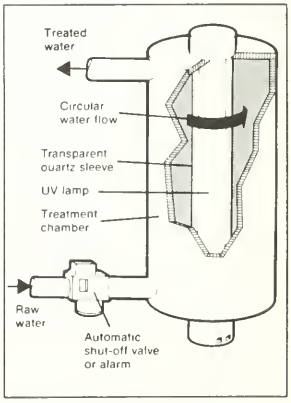
Since ultraviolet treatment does not provide residual bactericidal action, disinfection of the distribution system is recommended after any period of non-use.

The device should be cleaned regularly.

The output of an ultraviolet device decreases with age, so the lamp should be changed periodically, as required.



A typical hypochlorination system



A typical UV irradiation device

Distillation

During the process of distillation, any steam volatile organics in the input water (such as phenolics) may be carried over and concentrated in the condensate. Claims for the removal of chloroform, pesticides, herbicides or other organics should be backed by adequate test data.

Microbial recontamination of the distilled water in the reservoir with undesirable micro-organisms may be a problem, unless the reservoir is effectively washed and cleaned regularly.

Distilled water should be stored in non-metallic containers or in receptacles specifically designed for distilled water.

Chemical Methods

Iodination, chlorination and ozonation processes require a test kit supplied with the device. Regular testing for residual levels is essential. Carbon filtration could eliminate chemical residuals.

Chlorination

The device should be capable of providing a dose that will produce a free available chlorine residual of at least 0.5 mg/L following a contact time of at least 20 minutes. Other dose/time combinations may be used to achieve at least ct = 10 (where c = concentration of free available chlorine residual and t = time in minutes). A retention tank, in addition to a pressure tank, may be required to achieve this.

Iodination

The iodinator should be capable of providing a dosage of iodine that will produce a continuous iodine residual of between 0.5 and 1.0 mg/L, following a contact time of:

15 minutes for well waters

30 minutes for surface waters

A retention tank, in addition to a conventional pressure tank, may be required to achieve proper contact time.

Because the rate of disinfection may be slower at low temperatures, a contact time of 30 minutes is required, particularly in near-freezing waters.

An appropriate activated carbon filter positioned after the iodinator's retention tank may be advisable when used year-round because of possible adverse physiological effects of iodine on certain individuals.

Ozonation

The device should provide a measurable amount of free residual ozone to the treated water immediately after treatment. An ozone-specific test kit for residuals in the range of 0.1 to 1.5 mg/L ozone should be provided with the unit, to enable the user to periodically test for the desired residual levels.

Excess unused ozone from the treatment compartment should not be released to the immediate environment.

Ozonation does not provide persistent residual bactericidal action. After a period of non-use, the distribution system should be disinfected before putting it back into operation with the ozonation device.

Esthetic and Chemical Improvements

Activated carbon and reverse osmosis devices are used to improve the chemical composition and the esthetics of the water, but they do not disinfect. They may support the growth of entrapped bacteria, which will be released into the effluent water. The use of these devices should be limited to microbiologically safe water or combined with one of the disinfection devices.

Activated Carbon Devices

The vendor should be able to provide evidence that each model/type has the potential to operate effectively over its lifetime at the maximum recommended flow rate. Appropriate data should be generated over the claimed lifetime of the device to substantiate removal claims (for example, evidence for the removal of chloroform, pesticides, herbicides and other chemicals should be provided).

The major drawback and concern in the use of activated carbon units is that they may support the growth of bacteria, which may feed on the nutrient base of particulate matter and organic or inorganic compounds absorbed onto the surface of the carbon filter. Bacteria, including pathogenic species, may multiply and be released into the effluent water at higher numbers than the effluent water. This potential health hazard, together with the possible interference with any coliform test, limits the use of this device to microbiologically safe water only. It is recommended that the tap be flushed for at least 30 seconds after any period of non-use.

Chemical impurities may be released when the capacity of the carbon filter has been exceeded. This stage is very difficult to determine without extensive chemical analyses, and, therefore, frequent changes of the cartridge are recommended.

Reverse Osmosis

Reverse osmosis (RO) is a water conditioning process by which water is separated from dissolved minerals or ions by the use of a semi-permeable membrane.

Evidence should be available from the vendor that each model/type has the potential to operate effectively over its lifetime at the minimum recommended pressure. Appropriate data should be generated over the claimed lifetime of the device to substantiate removal claims (for example, evidence of the removal of inorganic and organic substances should be recorded).

The permeate in the reservoir should not be considered as a source of sterile water.

For more information, complete guidelines may be obtained from the Drinking Water Section, Water Resources Branch, Environment Ontario, 3rd Floor, 1 St. Clair Avenue West, Toronto, Ontario, M4V 1K6.

Toilets and Waterless Waste Disposal Systems

CHAPTER V

Summary of Sewage Systems by Class

Class 1 System

Includes various types of waterless toilets. Its use with new construction is uncommon due to the sewage disposal requirements for non-human waste (see Class 2 system), unless water conservation is important. With a Class 4 or 6 system installed to handle a pressurized water system, there is no advantage to a Class 1 system. Does not require a certificate of approval.

Class 2 System

A soak or leaching pit. Only used for non-human waste and only suitable where waterborne waste volumes are low. Not normally authorized with new construction, as a sewage system capable of treating all waste from modern plumbing and appliances is preferred. May be authorized for use in conjunction with a Class 1 sewage system and requires a certificate of approval.

Class 3 System

A cesspool. Similar in construction to a Class 2 leaching pit, but only used to receive waste from a Class 1 system, such as human waste. Requires approval to install.

Class 4 System

A septic tank system. Requires approval.

Class 5 System

A holding tank, only used to correct problems or in temporary situations. Rarely approved with new construction. Requires approval.

Class 6 System

Packaged aerobic treatment plant system. Requires approval.

What To Do With Your Sewage

With more than 300,000 cottages in Ontario, it's not surprising that the disposal of human waste is one problem all cottagers have in common.

Where toilet facilities can be connected to municipal sewage systems, the solution is obvious.

But in most cases, municipal services are not provided. A good alternative is a septic tank system or a system using an aerobic packaged plant. These systems are capable of treating all the sewage from a cottage residence.

Other systems include privies and chemical toilets.

The Septic Tank System (Class 4) What Does It Do?

Where you can't connect to municipal sewers, a septic tank system is a good choice. It consists of a septic tank to settle the solids out of the sewage, followed by an underground leaching bed in which the sewage is treated and dispersed into the soil.

The big advantage of this system is that it will accept all household waste water: from the bath, the dishwasher, and washing machine, as well as the toilet.

If treated with reasonable consideration, a septic tank system will accept all these waste waters without complaint for several years, until it's time to pump the accumulated sludge out of the tank. If the system can be located so that the sewage flows by gravity to the tank and then to the leaching bed, it needs no machinery or power and (apart from pumping out the tank occasionally) little maintenance.

DANGER

LEAVE CLEANING AND MAINTENANCE TO THE PROFESSIONALS.

Non-licensed persons should never enter septic or holding tanks. Over the years many people have died in them, owing to lack of oxygen, or the effects of the toxic gases found in the tanks.

Solutions May Vary

Please note: the disposal methods described in this chapter are not equally acceptable everywhere. Local bylaws, as well as soil conditions, may rule out some methods.

Note also that all figures and specifications mentioned in this chapter are for guidance only. To find out which forms of sewage disposal are approved in your area (and details of the regulations), contact your local Environment Ontario or health unit office. See Chapter 12 for offices nearest you.

All sewage disposal installations, except Class 1 sewage systems, require approval and a permit for use.

How Does It Work?

The only way to dispose of sewage, as distinguished from merely sending it somewhere else, is to prepare a comfortable home for the micro-organisms that eat it.

Many strains, often known as "bugs," perform this useful function. They can be divided into two groups: the aerobic ones, which need oxygen, and the anaerobic ones, which can't abide it.

The Septic Tank

Anaerobic bacteria live and work in the septic tank, which is just that, a tank. It's big enough to hold several days' worth of sewage and is shaped so that the flow is slow and reasonably uniform.

Sewage from the cottage enters the tank, where the solids settle to the bottom as a sludge; fats and greases rise to the top to form a scum. The sludge is partly decomposed by the anaerobic bacteria. If the system is working well, the liquid portion that flows out of the tank is relatively clear, although it still has an odor and carries disease.

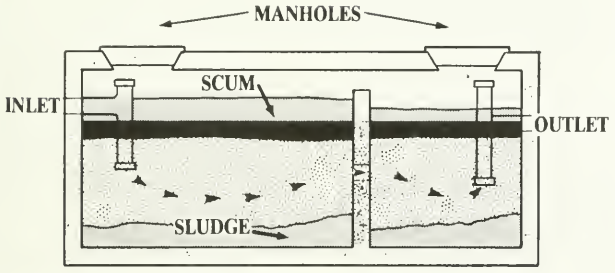
It shouldn't go anywhere but into the leaching bed (or equivalent treatment facility). It should never go into a ditch or watercourse!

With the tank capacities listed in Table 9, it may not be necessary to pump out the tank more than once every three years. It should, however, be inspected at least once a year and pumped out if necessary. Failure to pump out a septic tank when required will result in sludge or scum being carried into the leaching bed, which in turn will clog and cease to function. In this event, not only will the tank have to be pumped out, but the leaching bed will have to be replaced.

Operation and Maintenance

An on-site sewage system should, with proper care and maintenance, provide many years of service. There are, however, some things which you, the homeowner, should be aware of that will help the system to function properly.

1. Do not allow roof drains to discharge to the system or surface waters to drain towards the area of the leaching bed.
2. Water usage in the home should be kept to a minimum. If automatic washers and dishwashers are used, make sure full loads are washed each time. Excessive use of water (such as doing numerous washings in one day) could flush solids from the tank to the leaching bed. Or better still, oversize your system for the future.
3. Moderate use of household drain solvents, cleaners, disinfectants, etc., should not interfere with the operation of the sewage disposal system; however, indiscriminate use may cause problems.
4. Various preparations are on the market which are said to start, accelerate or improve the action in the septic tank. There is no need to add any such product, since all the necessary bacteria are already contained in the sewage entering the system. Environment Ontario does not promote or endorse the use of any of these products.
5. The system should be inspected at least once each year and the tank pumped out when necessary — every two or three years is suggested. Failure to pump out a tank when required may result in sludge or scum being carried over to the leaching bed resulting in soil clogging and complete failure of the system.
6. Vehicular traffic (including snowmobiles) should not be allowed over the leaching bed.
7. The area over a leaching bed should have a good cover of grass but shrubs or trees should not be planted over the area. Good ventilation and adequate sunlight should be maintained in the area of the leaching bed.



Cross-section of the Actual Septic Tank

Table 9
Minimum Septic Tank Working Capacities (Household and Cottage Systems)

Number of Bedrooms (2 persons per bedroom)	Minimum Total Working Capacity L
2 or less	2700
3	3600
4	4500
5	4500

Drawbacks

There are few disadvantages to the septic tank system since the system handles all household wastes.

One major drawback is simply that it can't be used everywhere. Consult your local Environment Ontario or health unit office for more information.

Also, remember access by road or boat is required for installation and pump-out servicing.

Leaching Beds

Conventional Bed

A conventional leaching bed is constructed entirely in the native soil and consists of two or more rows of buried distribution pipe, each row of which is set in a bed of 2-cm stone in a trench, known as an absorption trench system. Such beds are frequently called "tile" beds. Earlier practice, which is still permitted, was to use lengths of clay or cement pipe about 30 cm long, called "tiles," which were set in a row 6-12 mm apart, allowing the sewage to flow into the stone layer. The distribution pipe now commonly used is plastic pipe and is perforated with small holes (usually at the 4 and 8 o'clock position) along its length. The stone layer acts as a reservoir from which the sewage can seep slowly into the soil.

The dimensions of the trench and the details of how it should be filled in, the characteristics of the soil, the required length of the distribution pipe, and other particulars of the burial are important and are specified in Ontario Regulation 374/81. A minimum of 1.5 m of soil is required for a conventional absorption trench system.

Sewage leaving the septic tank flows down the rows of distribution pipe, leaking continuously into the soil through the holes or gaps. In the soil it encounters a flourishing population of aerobic bacteria, which finish the good work begun in the tank by the anaerobic "bugs."

Using Imported Soil

Where it is not possible to install a conventional absorption trench-type bed (e.g. where a minimum of 1.5 m of acceptable soil is not available) the regulation permits the installation of a leaching bed in imported soil. This type of bed is obviously more expensive. The regulation permits two types of imported soil leaching beds: 1) an absorption trench system, which is similar in design, layout and size to a conventional bed; and 2) a filter bed, which, while smaller, requires the importing of specially manufactured sand.

All leaching beds constructed in imported soil must have a soil mantel of percolation time between one and 50 min/cm and at least 0.25 m in depth under the bed and beyond the outer pipes in any direction that the effluent from the bed will move in the soil. If the percolation time of the mantel material is greater than 15 min/cm, any material placed above it to form the leaching bed must have a percolation time not greater than 75 per cent of the percolation time of the mantel material.

For example, if the first layer of the mantel material has a percolation time of 40 min/cm, then the second layer must be 75 per cent of 40, which is 30 min/cm. This is still not less than 15 min/cm. Therefore, another layer is required, at 75 per cent of 30, which is 22.5 min/cm. Then the next layer will be 75 per cent of 22.5, which is 16.9 min/cm, and so on, until the final layer is less than 15 min/cm. Then the bed can be built. The result of this is many layers of material at great expense. It is cheaper and easier to use material in the 10-15 min/cm range to start with.

Raised Bed

In an absorption trench system, selected material is used to form a mound in which the absorption trenches can be set so that the desired 0.9 m clearance below the trenches is obtained.

The filter bed is a leaching bed in which the sewage from the treatment tank is spread evenly over the surface of a sand filter by a network of distribution pipes set in a stone layer continuous over the area of the filter sand. The regulation specifies the gradation of the sand that is acceptable, and it is important that only sand meeting the requirements is used. The filter medium must be at least 0.75 m deep. Depending on the nature of the underlying soil, the filter medium may have to be extended at its base to provide a suitable contact area. Full particulars are in the regulation and should be obtained from the health unit or Environment Ontario office. The only advantage of a filter is that it requires less space than an absorption system and can be used providing that the underlying and surrounding soils can disperse the bed effluent.

The soil surface should be planted or otherwise protected for stability and erosion control.

Clearance distances outlined in the following sections must be increased by an amount equal to two units horizontal for each unit vertical height of the surface of the leaching bed above natural grade.

Location of Leaching Beds

The preferred location for a leaching bed is on a level site with well drained, sandy loam soil, remote from any wells or surface water. For the leaching bed to work satisfactorily, the maximum elevation of any rock formation or layer of impervious material must be at least 0.9 m below the elevation of the bottom of the absorption trenches or the surface of the filter medium. The minimum separation between the highest ground water table and the surface of a filter or the bottom of an absorption trench is 0.5 m.

Where the water table is the limiting factor, it is the highest water table that is of concern, rather than the average or that found at the time of site investigation.

Trickle (gravity) discharge from the tank to the bed is permitted for leaching beds with up to 150 m of distribution pipe. If the length of distribution pipe is more than 150 m, either a pump or a syphon must be used to dose the bed. If the land is sloping, a pump may be used to lift the effluent to a point where gravity flow will resume. A minimum of 3" trade-size pipe must be used for gravity flow systems and 1¼" trade-size pipe for pressure systems.

The maximum length of any single run of distribution pipe is 30 m.

Leaching beds may be constructed on a sloping site providing the slope does not exceed 25 per cent. The cost and other problems of levelling the required area will generally limit conventional construction methods to slopes of not greater than one in 10 (10 per cent).

Special installation methods are required for more steeply sloped sites. Information on these may be obtained from ministry or health unit offices and may be used on slopes up to 25 per cent (one in four).

Separation Distances

In locating an on-site sewage system, all clearances are to be measured horizontally.

These distances are a minimum according to the regulation. They may have to be increased to prevent pollution if soil or other site conditions dictate.

Soil Assessment

The suitability of the soil for absorbing the liquid waste depends on such characteristics of the soil as its grain size and gradation, the presence of organic compounds, its structure, density, moisture content, "plastic" properties and chemical composition. These characteristics must be assessed and a judgement made on the percolative capacity of the soil for handling septic tank effluent.

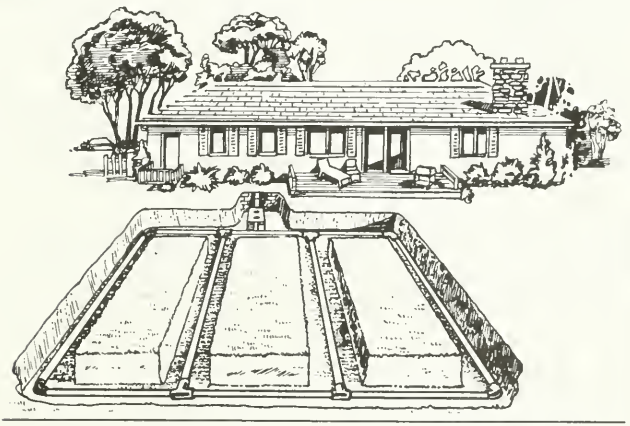
To make this assessment, an inspection must be made of the property. The result of the inspection and any soil testing is the selection of a percolation rate, "T" time, expressed in minutes per centimetre.

Table 10
Clearances for Septic Tanks and Proprietary Aerobic Treatment Plants

	Distance in Metres
Building or structure	1.5
Lake	15
Pond	15
Property Line	3
Reservoir	15
River	15
Spring	15
Stream	15
Well	15

Table 11
Leaching Bed Distribution Pipe Clearances

		Distance in metres
1.	Well, other than a well referred to in the next item, or a spring used as a source of potable water	30
2.	Well with watertight casing to a depth of 6 metres	15
3.	Building or structure	5
4.	Property line	3
5.	A spring not used as a source of potable water or a lake, river, pond, stream or reservoir	15



Typical Lay-out of Septic Tank Tile Bed System

The Aerobic Sewage System (Class 6)

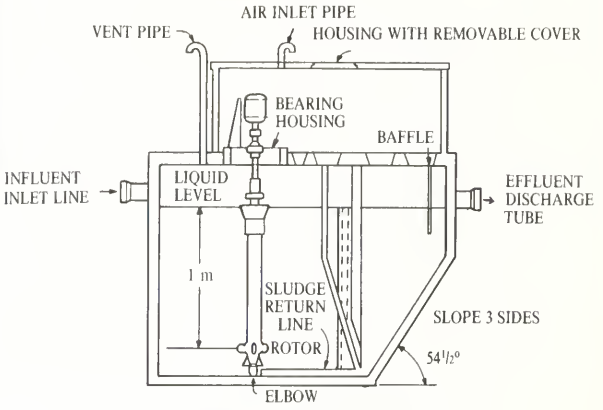
These systems are, in many ways, similar to septic tank systems, except that the "anaerobic" septic tank treatment is replaced by an "aerobic" treatment facility. This system features an aeration tank and, like a septic tank, can accept all normal household waste water.

The system is, in effect, a small activated sludge plant, similar to the secondary treatment plant of many municipal sewage works. Air, vigorously stirred or bubbled into the wastes, nourishes aerobic bacteria, which break down the complex organic compounds of the wastes into simpler, inoffensive ones.

The products of their labor are a reasonably clear liquid and sludge. The liquid is discharged to a leaching bed. The sludge, like sludge from a septic tank, must be pumped out periodically by a licensed contractor and disposed of in a manner approved by your local health unit or ministry district office.

Although these aerobic units are more expensive than septic tanks, they give a purer effluent. For this reason, in comparison with a septic tank system, less distribution pipe is required in an absorption trench leaching bed, and in a filter-type bed, a smaller area is permitted. This often means, for example, that trees which would have to be cleared for a septic tank system may be saved if an aerobic system is used.

Before purchasing an aerobic system, be sure that it is accepted by the Ministry of the Environment. Check with your local health unit or ministry district office.



Typical Aerobic Treatment System

Privies, Chemical Toilets, etc. (Class 1)

There are other types of sewage systems which may be used in Ontario, under certain circumstances to treat sewage. Various types of waterless toilets (earth or pit privies, vault privies, removable pail privies, chemical toilets, incinerating and composting toilets) are used to dispose of human waste and are collectively called Class 1 sewage systems.

They are usually used because of their simplicity and low installation costs. When properly installed, used, and maintained, they can give good service without damaging the environment.

When a Class 1 sewage system is used, a second separate sewage system is needed to dispose of the waterborne wastes from the kitchen sink, baths, showers, laundry, etc. This waste is frequently referred to as "grey water."

Providing the quantity of grey water is low, as in a cottage without a pressure water system, a leaching pit or Class 2 sewage system may be used.

It should be stressed that the following "solutions" to toilet waste disposal may be unacceptable in many parts of Ontario because of terrain and in any event, they are only suitable for primitive cottage installations.

Where the water system is pressurized, a soak or leaching pit is generally inadequate, and a septic tank or aerobic system is needed. Under these circumstances, the cottager will frequently use either a Class 4 or a Class 6 septic system for all sewage.

As a final point it should be noted that the contents of a Class 1 sewage system must be disposed of in an approved Class 3 sewage system.

Privies

Pit Privy

A pit privy is a hole in the ground, fitted with a seat for comfort and a shed for privacy. It is popular because of its simplicity and has been widely used in the past.

Despite this simplicity, a privy must be planned.

To begin with, the pit should be large enough to last at least five years before it fills up. For sizing a privy, based on year-round family use in well-drained soil, estimate 600 L per person per year. Bear in mind that this figure may not apply to camping conventions or busy resorts, where the pit may fill too quickly for normal drainage and decomposition.

Build the shed stoutly, include a window, and assemble screens to keep out flies, rodents, and other carriers of filth. Metal sheathing on the outside walls may discourage porcupines.

Don't forget to vent the pit. Fresh air and foul should balance themselves through an adequate vent system, preferably two vent pipes, rather than through the seat.

A screen on the top of the vent pipe will discourage flies, and a sloped roof will keep out the rain. Environment Ontario supplies a working drawing on request.

Well-vented and considerately used, a privy is reasonably inoffensive and should not cause odor problems.

Consider also the soil in which the pit will be dug. There must be enough of it to surround the pit with 0.6 m of earth in all directions around it as well as below it.

The soil must have the right composition. If it's too sandy, the walls of the pit will have to be shored to prevent cave-ins. If it's solid clay, the liquids will just sit.

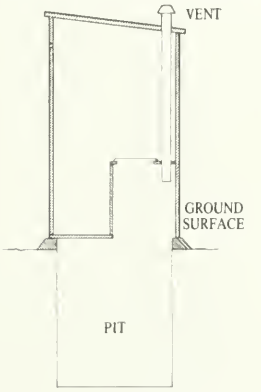
Ideally, the soil should be porous enough to permit liquid to seep through it, tight enough to keep liquids from running through too fast, and deep enough so that there will be at least 0.6 m of it below the bottom of the pit before you reach rock, an impervious soil layer, or water table.

("Groundwater" is the water that saturates the ground beneath the surface. This water feeds springs and is tapped by wells. The "water table" is the top level of groundwater.)

The ground should slope away from the hole on all sides. Do not dig your pit in the centre of a hollow. Also, build a low mound around the privy to keep out rainwater runoff.

Be sure you stop digging the pit 0.6 m above the water table. Remember that it varies during the year — higher in wet weather and lower in droughts. Check the level shortly after the spring thaw.

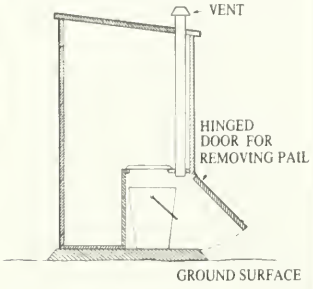
A final safety note: don't let a small child use the privy unattended.



Pit Privy

Pail and Vault Privies

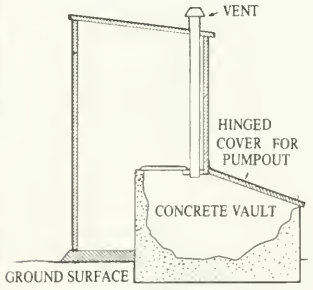
Variations on the privy theme include the pail privy and the vault privy. These differ from the self-contained pit privy in that neither of them ultimately disposes of waste. They merely collect it and postpone the problem.



Pail Privy

The pail privy substitues a pail for the pit, while the vault privy uses a small holding tank, the "vault." (The latter, in lightweight plastic, is often encountered at construction sites and clubhouses.)

The pail or vault privy will need to be emptied periodically. It is permissible to dispose of the contents into a Class 3 sewage system (cesspool) constructed on the property providing the necessary approval has been received.



Vault Privy

Drawbacks

Waste from a pail privy may be dumped into a cesspool. But this will be more difficult in the case of the vault privy, which is generally emptied by a contractor who pumps

the contents into a tank truck for disposal elsewhere. The contractor must be licensed by the province and have a certificate of approval for the final disposal of the sewage.

Unless suitable soil is a long walk from the house, you're better off with a pit privy. However, if the choice is between a pail privy or a vault privy, the vault is the better choice. The pail is cheaper, but you may not enjoy carrying it.

Chemical Toilets

There are various forms of chemical toilets, ranging from a temporary homemade unit to a sophisticated commercial unit.

The chemical used in the unit can act in one of three ways: as a caustic, a preservative, or a dye. Accordingly, it may decompose the waste, preserve it, or merely improve its appearance.

The first two kinds of chemicals make the waste harmless. The caustic soda or lye liquifies and partly decomposes the waste. At the same time, it kills bacteria and destroys parasite eggs, a significant feature in controlling disease.

A chemical preservative, such as formaldehyde, also destroys bacteria present; however, it prevents waste from decomposing.

Killing bacteria reduces odor and many chemical charges also contain a perfume and, possibly, a blue or green dye.

Killing the bacteria also means that a chemical toilet (using either a caustic or a preservative) may safely be located in the cottage.

If the chemical charge consists of only dye and perfume and lacks either kind of bactericide, the improvement in appearance is deceptive.

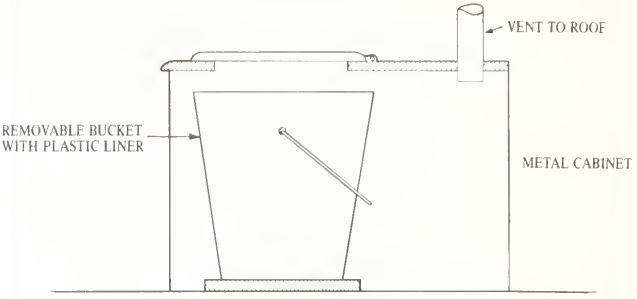
Buckets

The most basic version of the chemical toilet is a simple bucket, often fitted with a removable plastic liner and placed in a small, vented metal cabinet in the bathroom.

The approach is simple and the unit is odorless when properly installed and operated.

On the negative side, the contents of the bucket are open to view at all times. Furthermore, when the bucket is more than half full, a user may be splashed with caustic, which burns, and dye, which may stain clothing.

There is also the problem of the bags, which have a limited capacity, filling quickly. They must be disposed of in an approved Class 3 sewage system, and steps must be taken to prevent punctures.

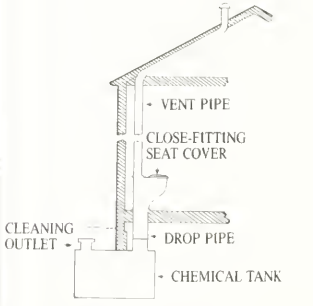


Chemical Toilet (Bucket Type)

Splash Pan and Drop Pipe

Other models of the chemical toilet offer refinements to the basic concept.

A splash pan is available, shaped like the bowl of the standard flush toilet, which prevents all but a rare splash. To allow room for the splash pan, however, the bucket containing the charge becomes a small tank (the plastic bag is no longer used) and the contents of the tank must be drained at intervals to an approved Class 3 system or pumped out by a licensed hauler.



Chemical Toilet (Drop Pipe)

Another version locates the toilet over a tank buried in the ground beneath the cottage. The connection is usually made by a drop pipe, and the drop is usually sufficient to eliminate the need for a splash pan. The tank must be pumped out by a licensed hauler at suitable intervals and the contents disposed of at an approved site.

Recirculating

The recirculating chemical toilet is similar to the splash-pan toilet, except that it uses the contents of the tank to flush the bowl.

The contents are liquified and dyed blue by the chemical charge. The unit is designed to eliminate splashing and is esthetically similar to the standard flush toilet. (This is the toilet of the aircraft washroom.) The need for a recirculating pump, however, increases the cost of this unit and limits its use to areas where electricity is available, although some units can be operated with a hand pump.

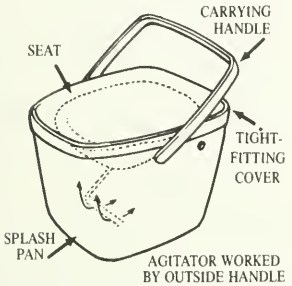
Portable

A useful variant on the chemical toilet is the portable model. This is much like the basic bucket model, though it may have a splash pan and is fitted with a fairly tight lid and carrying handle.

It must be carried with some care to avoid splashing or spilling. Its capacity is limited by the need for portability and the usual requirement for safe disposal of the contents.

These units may be drained into a standard toilet and flushed to municipal sewers or to a septic tank, providing the quantity is limited in comparison to other flows received by the tank.

While looking at portable toilets, you should consider weight and stability. By the time it's ready for emptying, the toilet may weigh 30-35 kg; for many people, that's a lot to lift. Also, some models are unstable and may need a frame for convenient use by children or older people.



Portable Chemical Toilet

Drawbacks

The chief disadvantage of the chemical toilet is that like the pail and vault privies, it does not solve the problem.

Using a chemical disinfectant is also a coin with two sides. The same chemical that so conveniently inhibits decomposition during use continues to inhibit it afterwards, and disposing of wastes must ultimately take place through bacterial decomposition.

A chemical toilet may discharge through an overflow, or be emptied into a cesspool. Otherwise, it must be periodically pumped out by a service contractor in the same manner as a vault privy. Even if a cesspool is used, periodic cleaning out of settled solids and removal by a pump-out contractor are required.

Incinerator Toilets

In these units, which may be heated by either gas or electricity, the wastes are burned to a dry, sterile ash.

The toilet consists of the incinerator unit, the necessary insulation, and the stack to lead combustion products away. Operation may require burning after each use, or permit storage of sewage for incineration at a more convenient time. In the former type, the burning cycle may be interrupted at any time for further use, but the frequency of interruptions is limited by the "storage" capacity of the equipment.

Toilet wastes are mainly composed of water. Consequently, before the solids can be burned, they must be dried. The drying process consists of boiling, and this, as well as the actual incineration, may create odors. Good design, high combustion temperatures and catalysts are used to attempt to overcome this problem.

In a well-designed system, the end product is a light ash, which may be easily removed. Operating costs include the electric power or gas used in incineration, and may be expensive. As with other forms of toilets, the advantages and disadvantages should be considered in light of individual circumstances and preferences.

Only toilets whose electrical or gas burning components have been approved by the Canadian Standards Association, the Underwriters Laboratory of Canada, or the Canadian Gas Association should be used.

Composting Toilets

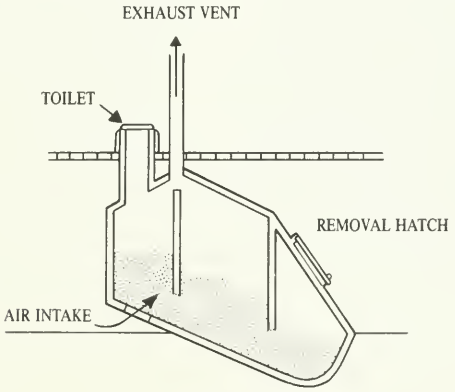
A comparative newcomer to North America, the composting toilet has been available for some years in Scandinavia. Its principle is simple. Like the compost heap in the garden or the manure pile beside the barn, the composting toilet allows organic materials to decompose in the presence of air. When fully composted, the residual material is an inoffensive earth-like substance. Unfortunately, not all toilets of this type will produce a fully composted end product.

The toilet of a large unit is located in your bathroom, connected by a drop pipe to the tank directly below.

If your cottage does not have a basement, particularly if you're on thin soil, you have a problem.

Odor is eliminated by an insulated vent pipe connecting the interior of the tank with the out-of-doors. When all goes well, this vent is not merely a passive conduit, but a chimney. The composting material in the tank is warm, as are the water vapor and carbon dioxide rising from it.

Since warm air rises, the warm gases in the toilet flow upward and out through the vent, creating a partial vacuum within the composting tank. This vacuum draws replacement air into the tank from two sources: 1) an air intake, designed to flow air through the wastes and keep them aerobic; and 2) the toilet seat, when the lid is up. The slight down-draft through the toilet seat also prevents odors from reaching the bathroom.



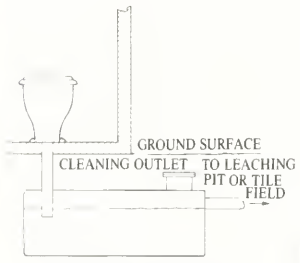
Large Composting Toilet

Alternative Approaches

Low-Volume (Minimum-Flush) Toilets

These toilets closely resemble the standard flush toilet, except for the reduction in water use. If purchasing a low-volume toilet, make sure it is CSA approved.

In areas lacking pumped water, some units can be flushed manually by pouring a litre or so of water into the bowl. The disadvantages tend to centre around the seal. Toilet paper can prevent the plate from sealing properly, so the water seal is lost and, with it, odor protection.



Minimum-Flush Toilet

Repeated use can distort the plate or gasket slightly, with the same result. And don't let your foot slip off the pedal controlling that spring-loaded plate. The plate has been known to snap back into place with such vigor that the contents are spilled.

Low-volume flushing toilets do not reduce the solid content of the sewage. For this reason, the requirements for a Class 4 or Class 6 sewage system are the same as a normal flush toilet system.

Water-Saving Devices

Some cottagers are installing water-saving devices (in the tank of conventional toilets) to conserve water.

While this will not affect the size of the tile bed required, using less water will extend the bed's life and reduce the chances of nutrients reaching your lake.

Incidentally, putting a brick in your toilet tank to save water is a questionable solution. The brick displaces water and reduces the water available for a flush, i.e., you will not get such an efficient flush. Also, over the years the brick will deteriorate, and brick particles will likely then prevent the tank's outlet flapper from closing, which means you will lose water continuously.

A better alternative to the brick is a 1-2 L heavy-gauge polyethylene bag, such as a sandwich or milk bag. Fill the bag with water, tie it off with a tin tie, and hook the bag over the tank. It will mold to any shape.

Cesspools (Class 3)

A cesspool, known as Class 3 sewage system, is similar in construction to a Class 2 sewage system or leaching pit. The difference is that a Class 3 system may receive only human waste from a Class 1 system, whereas a Class 2 system is only for non-human waste.

A cesspool requires approval and must be constructed to meet the standards of the regulation. The clearance distances from a cesspool to wells, surface waters, etc., are contained in the regulation.

Holding Tanks (Class 5)

There are instances for existing dwellings where, because of inadequate soil on the lot or the limited size of the lot, a satisfactory Class 4 or Class 6 subsurface sewage disposal system is not possible.

In these circumstances, the only solution may be to install a holding tank.

A holding tank is exactly what the name implies. It is a tank that will hold the sewage until it can be pumped out and disposed of.

A holding tank, by regulation, must be of at least 9000 L capacity and equipped with either a visible or audio alarm system (preferably both). This alarm system should be set to trigger while there is still a sufficient capacity left in the tank until the pump-out truck arrives.

Holding tanks are not recommended, as the annual pumping cost is extremely high and ministry policy does not permit the use of holding tanks for new development, except under very exceptional circumstances.

CHAPTER VI

Which Sport Fish to Eat?

Fish in many parts of the world have been affected by industrial or natural contaminants. In Ontario, the metal mercury has been the principal trace contaminant affecting fish. The government's continuous testing program has also detected such compounds as polychlorinated biphenyls (PCBs), mirex and DDT in some fish from some water bodies. We're all concerned about this because prolonged consumption of contaminated fish could lead to health problems.

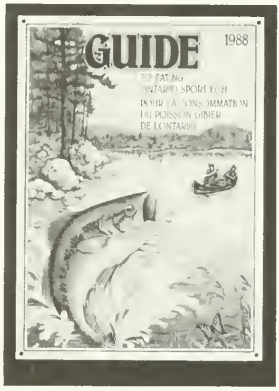
These contaminants, however, have never been detected in water in sufficient quantities to make any Ontario lakes or rivers unfit for swimming or as a source of treated drinking water.

Thousands of Ontario's lakes and rivers have fish that are free from significant contamination. Others contain fish that are contaminated to some degree and may be consumed occasionally. Fish from some lakes contain enough contaminants to make them unsuitable for consumption. Usually, these are the larger, more mature fish that have accumulated the contaminant over many years.

The Contaminants of Concern

The contaminants detected in Ontario sport fish that can cause health problems are mercury, PCBs, dioxin, mirex and DDT. Other substances, such as lead, arsenic and cadmium, are also being monitored, but concentrations found to date indicate that these do not pose a hazard.

Fish containing mercury, PCBs dioxin, mirex or DDT show no outward effects, and only modern laboratory techniques can determine levels of contamination.



Mercury

Mercury is a naturally occurring metallic element familiar to people through its widespread use in thermometers. It is found in low concentrations in most rocks and soils and is particularly abundant in some areas of the Precambrian Shield.

Natural deposits are thought to result in elevated levels of mercury in fish in areas far removed from human activity. Airborne mercury from both natural and industrial sources may further be contributing to mercury in fish in some areas.

Mercury has also been widely used in industrial and commercial applications, such as the production of chlorine and caustic soda in chlor-alkali plants and the manufacture of scientific and technical equipment.

Mercury compounds have also been used to prevent the growth of fungi in pulp and paper mills, treat seed grains, and prevent snow mould on golf courses.

Action by government and industry during the late 1960s and early 1970s has virtually eliminated mercury discharges from major industrial sources.

Effects on Fish

Mercury — whether naturally occurring or from an industrial source — attaches to small sediment particles and settles to the lake or river bed. In these bottom sediments, micro-organisms convert almost any mercury compound to the organic or methyl-mercury form.

It is thus readily available for rapid absorption by a fish, either directly from the water passing over its gills or ingested with the organisms that form its diet. Since fish eliminate mercury at a very slow rate, concentrations gradually accumulate.

The longer a fish has been exposed to mercury in the environment and the more mercury-contaminated food it has consumed, the higher its mercury level. Thus, large or old fish that consume primarily smaller fish will contain much more mercury than smaller and younger fish, or fish that have a varied diet.

Effects on Humans

Humans eliminate methylmercury at a much faster rate than fish. Therefore, if fish are consumed only during a fishing trip of a few days or weeks (or if fishermen limit their long-term intake of mercury-contaminated fish to occasional meals) dangerous levels will not accumulate in the body.

Mercury, however, is present in small concentrations throughout the environment. Consequently, everyone has small amounts of mercury in their body. Most individuals have a level of up to 2 or 3 mg total body burden, a level not known to cause any problems.

Based on methylmercury poisoning epidemics in Japan and Iraq, signs or symptoms of mercury poisoning are not found in individuals with body burdens of less than 20 mg of mercury (or about seven to 10 times the body burden of average Canadians).

The central nervous system is most affected by methylmercury.

Some signs of poisoning include lack of co-ordination, the feeling of "pins and needles," numbness of the lips and mouth, constricted visual field, night blindness, tremors, deafness and diminished taste and smell. At the extreme, mercury poisoning may result in death.

It should be pointed out that many symptoms listed above are common to other ailments not associated with mercury. Extensive medical testing is required to confirm mercury poisoning.

The consumption guidelines developed for use by Ontario's anglers are based on federal guidelines supplemented by recommendations prepared by the World Health Organization.

Consumers following the guidelines can be assured that mercury levels in their bodies will remain far below levels where poisoning symptoms begin to appear.

The guidelines were developed for adults and, since the mercury level within the body is directly related to body weight, extra caution must be taken to protect a child or a fetus. It is therefore recommended that children under 15 and women of child-bearing age should consume only fish with a mercury content of less than 0.5 parts per million (ppm), the federal guideline for commercially marketed fish.

Polychlorinated Biphenyls (PCBs)

PCBs are a group of chlorinated organic compounds developed in the 1920s. These chemicals are not formed in the natural environment so their presence in fish can always be attributed to human activities.

PCBs are very stable; they do not easily break down chemically or naturally, and burn only at extremely high temperatures.

These properties led to widespread use of PCBs in transformer fluids, hydraulic fluids, oils, greases, fire retardants, and plasticizers in such products as paints, inks and adhesives.

PCBs are of human health concern because of two types of effects which have been identified in scientific studies. PCBs are considered to be cancer-causing and have been shown to affect normal fertility, pregnancy, birth and development of offspring when tested on laboratory animals.

Until the environmental and health hazards of PCBs were discovered, no special precautions were taken to prevent losses to the environment. Today, the use and disposal of PCBs or PCB-contaminated equipment is very closely regulated. These user restrictions have resulted in declining levels of PCBs in the aquatic ecosystem, as demonstrated by recent sport fish and minnow data.

The high affinity of PCBs for fats is a significant factor affecting concentrations in fish. Species with a high fat content, such as salmon, will tend to accumulate more PCBs than lean fish such as walleye. Even within one species, individual fish with a higher fat content will generally contain more PCBs.

The federal guideline for the commercial sale of fish containing PCBs is an upper limit of 2.0 ppm. The angler's guidelines, based on the advice of medical specialists, suggest that fish with a PCB level above 2.0 ppm should be eaten only by adults occasionally (except women of childbearing age and children under 15) as outlined in the consumption guidelines. (See Chapter 13.)

Mirex (Dechlorane)

Mirex is a chlorinated carbon compound used as a pesticide in the southern United States, but never registered for such use in Canada. Because of its chemical stability, mirex (also known as Dechlorane) was used by two southern Ontario companies in the 1960s as a fire retardant in their manufactured products.

The behaviour of mirex in the aquatic environment is similar to that of PCBs in that it does not break down easily by natural processes. It too has a high affinity for fats and, following ingestion, accumulates in the fatty tissues of fish.

Animal experiments have shown that mirex is a possible cause of cancer.

In Ontario, mirex has been detected primarily in fish from Lake Ontario. The sources were found to be a former processor of mirex in Niagara Falls, New York, and a manufacturing plant in Oswego, New York. Mirex in water or fish from sources adjacent to the two former Ontario users has not been detected.

The provincial guideline for the commercial sale of fish containing mirex is 0.1 ppm. The angler's guidelines suggest that fish with mirex above 0.1 ppm should be eaten only by adults occasionally (except women of childbearing age and children under 15) as outlined in the consumption guidelines. (See Chapter 13.)

DDT

DDT was developed during the Second World War to control a wide variety of insects. Afterwards, it gained widespread use as an insecticide for agricultural and public health use.

DDT is also not easily broken down in the natural environment. The accumulation of DDT in fish caused markedly reduced reproductive capability in a number of species and led to restrictions on its use in the mid-1960s. In 1969, the Ontario Pesticides Act limited its use to very specific purposes by special permit only. No permits have been issued this year.

As a result of these actions, there have been substantial reductions of DDT levels in fish. Therefore, there are now no restrictions on the consumption of Ontario sport fish due to DDT.

Dioxin

Dioxins are a group of 75 chemicals of the chlorodibenzodioxin family. One compound, 2, 3, 7, 8-TCDD (tetrachlorodibenzodioxin), is extremely toxic. At low doses 2, 3, 7, 8-TCDD has been shown to be carcinogenic and to affect reproduction in laboratory animals; it is therefore considered to have the potential to cause similar effects in humans.

Dioxins are not useful manufactured chemical compounds; 2, 3, 7, 8-TCDD, for example, is a trace by-product of the manufacture of 2, 4, 5-trichlorophenol and may therefore be found in very small amounts in that chemical, its manufacturing wastes and in chemicals manufactured from it, such as the herbicide 2, 4, 5-T.

Dioxin can be emitted from combustion sources.

Ontario's Fish Contaminant Monitoring Program

Since the mid-1960s, when DDT was first measured in fish, Ontario has completed an extensive monitoring program. During 1969 and the early 1970s, intensive sampling for mercury in fish was undertaken in the English-Wabigoon system of northwestern Ontario and the St. Clair River-Lake St. Clair system (of the Great Lakes) in southwestern Ontario. Both these basins were affected by mercury discharges from industrial sources. Since that time, the program has expanded to investigate the impact of other industries, mining sites, areas of natural mineral deposits, commercial fishing areas, and lakes used as a source of food supply by Ontario's native peoples. In more recent years, the program has been broadened to include surveys of popular angling waters.

The Fish Contaminant Monitoring Program is a co-ordinated undertaking of the Ontario Ministries of Natural Resources, Environment and Labour.

Fish are collected primarily by staff of the Ministry of Natural Resources and analyzed at the Environment Ontario laboratories. Medical implications of contaminants are evaluated by medical specialists with the Ontario Ministry of Labour.

Federal agencies and other laboratory facilities have also carried out fish contaminant testing. The Ministries of Natural Resources and Environment will include these data in the guidelines whenever possible.

How Lakes Are Selected for Testing

There are more than 250,000 lakes and uncounted rivers and streams in Ontario. With the staff and facilities currently available, the province can sample and analyze about 6,000 fish per year. With the analysis of all appropriate species and representative size ranges of each species from each lake, about 150 lakes or rivers can be sampled every year.

Obviously, every lake and river cannot be tested. To make the best use of resources, sampling site selection is a most critical challenge. The selection program is carried out principally by the Ministries of Natural Resources and Environment. Test areas are selected for one or more of the following reasons:

- a popular angling area;
- a commercial fishery;
- a major source of food for local inhabitants (usually lakes in the vicinity of Indian Reserves);
- a known or suspected source of pollution nearby;
- lakes opened for recreational development.

Some areas are also sampled for scientific studies of the long-term behaviour of contaminants in fish populations. For example, the analysis of annual fish samples from Lake St. Clair since 1970 has revealed a steady decline in mercury levels since major industrial sources were stopped.

Biologist from Ministry of Natural Resources lake survey team removes a lake trout from the fishing net.

What Fish Species Are Selected?

Within most lakes and rivers there are obviously many different species of fish. Given the limitations of manpower and analytical resources, it would be impractical and, in fact, unnecessary to sample all species.

Mercury, for example,is a classic food chain pollutant. Such fish as walleye, pike, lake trout and bass eat other fish as a major part of their diet. As a result, they contain higher mercury levels than such non-predatory fish as whitefish, sunfish and catfish.

Therefore, when testing the fish from any given watercourse, predators are usually selected on the assumption that if their mercury content is low, then non-predatory species will also have low mercury levels.

When testing for PCBs, mirex or DDT, a different selection process is followed. The organic pollutants have a high affinity for fats. Therefore, fish with a high fat content such as salmon, smelt and perch are collected.

Most fish are collected using netting techniques. In some cases, fish are selected from commercial fishermen's catch. Whenever possible, the collection includes 15 to 20 fish of each species, representative of the size range from the lake being tested.

For each fish collected, the length, weight and sex are recorded. In some cases, scale samples are kept so that the age of the fish can be determined.

A boneless, skinless fillet of dorsal muscle is removed from the fish, preserved and packaged for shipment to Environment Ontario laboratories for chemical analysis.

Information about the individual fish, along with laboratory analysis results, is used in developing the lake-by-lake, species-by-species, size-specific contaminant classification tables.

What About Your Lake?

The lake selection process is influenced in some cases by the interest shown by anglers.

If there are lakes you would like to see tested, please write to the appropriate regional or district offices of either the Ministries of Natural Resources or the Environment. A listing of these offices appears in Chapter 12.

More Information

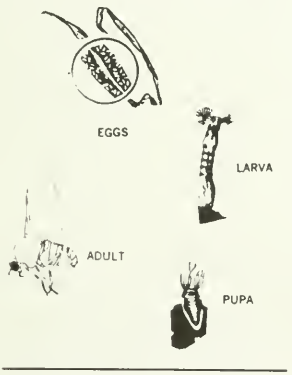
For more details on fish contaminant levels in Ontario lakes, see *Guide to Eating Ontario Sport Fish,* available from offices of the Ministries of the Environment and Natural Resources. Readers requiring particular information about the guide, the program and the contaminant data on which the advised consumption levels for each species and water body are based should contact:

Sport Fish Contaminants Program
Water Resources Branch
Ministry of the Environment
1 St. Clair Ave. W.
4th Floor
Toronto, Ontario
M4V 1K6
Telephone (416) 323-4994

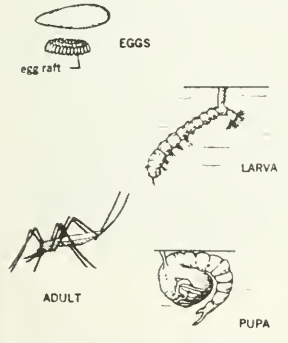
Environment Ontario technician separates interfering substances from fish muscle extract before analysis for PCB contamination.

After landing, fish are filleted and tagged.

CHAPTER VII



Blackfly



Mosquito

Controlling Mosquitoes and Blackflies . . . Without Using Pesticides!

Those insects! They bite you and your pets and just make your life miserable.

What can you do?

Why not try insect control — without using pesticides?

Pesticides are not always the answer, for a number of reasons.

First, pesticide spraying or fogging near cottages produces extremely temporary benefits, and usually doesn't justify the hazard involved in possibly contaminating nearby water.

Second, eradication of biting fly populations is very rarely possible under any circumstances. Significant control is rarely achieved without large-scale programs involving substantial funds and trained personnel.

Limited use of approved larvicides in small areas of swamp or in rain pools close to private property can be carried out by individual cottagers. But permits are necessary wherever treated waters may contaminate adjacent streams or lakes.

Because of these drawbacks, two other ways of reducing insect attack are preferred:

1. improving land drainage and eliminating the pools where they breed,
2. using repellants.

Ways to Eliminate Mosquito Breeding Sites

The following suggestions will help you to reduce the mosquito population:

- Eliminate all standing water around the cottage if possible.
- Change water in wading pools or bird baths every week.
- Prevent water pooling on the surface of pool covers or other similar plastic coverings.
- Keep swimming pools properly filtered and chlorinated.
- Dispose of empty cans or pails; upend buckets or any other containers left outdoors.
- Clean out clogged eavestroughs; drain flat roofs.
- Empty old tires and dispose of them.
- Do not clog drainage ditches with trash; make sure that ditches and driveway gutters drain properly.
- Cover rain barrels.
- Fill in sunken land to prevent standing water from accumulating.
- Reduce vegetation through mowing weeds and grass, trimming hedges and removing unnecessary shrubbery and trees that protect the adult mosquito against sun and wind.

How to Avoid Bites

- If working or visiting in areas where mosquitoes are abundant, wear loose protective clothing, e.g., long-sleeved shirt, light jacket, slacks and socks.
- Where blackflies are abundant, be sure shirt cuffs and pant legs are tightly secured to stop insects from crawling inside.
- Note: Lighter colored clothing is less attractive to mosquitoes than dark clothing; dull material is more attractive to blackflies than shiny material.
- Restrict outdoor activity in the evening when mosquitoes are most active and in daytime in wooded areas.
- Repair holes in windows or door screens; ensure the screens are tight.
- Close the damper on your fireplace when not in use.
- Use netting over carriages when babies are left outside.

Chemical Control

Repellents are available, for temporary relief, in both liquid or stick form. Read the label and follow instructions carefully. Do not get the material in your eyes or mouth.

Temporary relief immediately outside the cottage, in small areas such as yards or patios may be achieved by using insecticides with mist-type sprayers or foggers when mosquitoes are flying (usually one hour before to one hour after sunset).

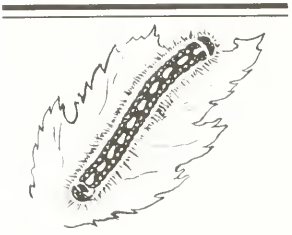
On exposed surfaces where mosquitoes are likely to rest, residual sprays may be applied, usually with a compressed-air garden-type sprayer. Look for products labelled for mosquito and blackfly control. Use only as directed.

For use indoors, insecticides are available in various forms — aerosols in pressurized cans, strips of embedded plastic and coils. All are effective for mosquito control if used according to the instructions. Blackflies are rarely a problem indoors because they spend their energy trying to get outside.

Blackflies can be particularly bothersome in the early weeks of summer. They breed in fast-flowing watercourses, so the most effective way of fighting them is by using a larvicide over a large area. However, this kind of project is best managed by a community or provincial government agency.

For further information, consult "Controlling Mosquitoes and Blackflies in Ontario," published jointly by the Ministries of Natural Resources and the Environment. Copies are available from the Public Information Centre, Environment Ontario, Suite 100, 135 St. Clair Ave W., Toronto, Ontario M4V 1P5

Eastern Tent Caterpillar



Forest Tent Caterpillar

Controlling Other Pests

What other insects may need control? The following section discusses the most common ones — with tips on keeping their numbers down.

Eastern Tent Caterpillars

Although this native insect prefers to feed on apple and cherry, it also attacks a wide variety of deciduous trees and shrubs.

The larvae or caterpillars are about 50 mm long; they are clearly marked with a white stripe down their back and have tufts of long, light-brown hair.

This caterpillar rarely causes extensive economic damage. The trees they attack are of little commercial value, and trees are rarely killed.

Control without pesticides can be achieved by:

1. Pruning and destroying egg masses during the winter when they are easily collected; and
2. Pulling the tent from the branch with a gloved hand, or cutting the branch off and burning it.

When the caterpillars begin to appear in mid-May, insecticides can be used. For detailed information, write Public Information Centre, Environment Ontario, Suite 100, 135 St. Clair Avenue West, Toronto M4V 1P5 or contact your regional or district ministry office.

Forest Tent Caterpillars

This is a widely distributed insect that feeds on poplar, sugar maple, oak, ash and birch trees. Its life cycle is similar to that of the eastern tent caterpillar.

Although this species is referred to as a tent caterpillar, it does not make a tent. Instead, it makes a silken mat on a branch of the tree where many caterpillars congregate to rest or molt.

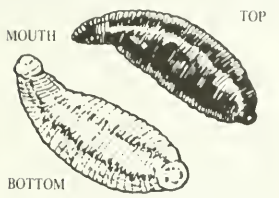
Full-grown caterpillars are quite attractive, with long tufts of hair, a blue stripe running the length of each side and a row of white diamond-shaped spots along the middle. After six weeks of feeding, the caterpillar finds a sheltered place in which to spin a cocoon and then pupate. Eggs are laid in rings around twigs.

Control without pesticides is achieved by removing branches where eggs have been laid, and removing and burning branches where caterpillars congregate.

Leeches (Bloodsuckers)

A common nuisance to swimmers, leeches (better known as "bloodsuckers") are flattened worm-like animals. They normally feed on worms, snails, insect larvae and other small aquatic animals, but, if given the opportunity, will also feed on human blood.

They are typically found in shallow, protected waters, concealed among aquatic plants or under stones, logs and other debris. They are strong swimmers and attracted to water disturbance around docks and swimming areas. They are most active on hot summer days, but in winter they bury themselves in mud just below the frost line.



Common Leech

The best control for leeches is to keep your beach clean by removing all vegetation and debris which harbor the large number of aquatic animals upon which they feed. Control of aquatic vegetation with herbicides (see Chapter II) and the removal of stones, logs and other debris from warm, shallow water should keep the immediate swimming area relatively free from this nuisance.

Several alternative methods may help reduce a leech population. Freezing leeches in their winter homes may be possible if the infested area is a pond. When the first thin ice starts to form, the water should be drawn off as rapidly as possible until the level has been lowered at least 1.5 m.

This low level must be maintained for at least five to six weeks during the coldest part of the winter. The exposed flats will freeze to a considerable depth, a circumstance that is fatal to the imprisoned leeches. This is, however, a drastic measure that affects other life in the pond and should not be considered lightly.

A second measure, which has proved successful, is bait trapping. A metal can with a reclosable lid drilled with small holes (depending on the size of the nuisance species) and baited with raw meat may trap very large numbers of leeches from a heavily infested area.

After feeding, the leeches will have difficulty leaving the can. Destruction of the can and its contents will obviously help considerably in reducing the size of the leech population.

Swimmer's Itch

Swimmer's itch is a temporary infection caused by penetration of tiny, colorless flatworm larvae (schistosome cercariae) into the skin.

These are the larvae of parasitic flatworms of freshwater snails and waterfowl. They penetrate bathers' pores and die leaving an infected, itching, raised red spot that lasts a few days.

The best way to control swimmer's itch is to destroy the snails in which the larvae develop or the snails food source — vegetation.

Some simple measures may help to protect bathers from the swimmer's itch:

- On emerging from the water, always rub down briskly with a towel. Larvae penetrate the skin only when water evaporates. A fresh water shower taken immediately after leaving the water is also effective.
- Try to swim in deeper water as onshore winds tend to concentrate the larvae in the shallows.

Carpenter Ants

In natural surroundings, carpenter ants are beneficial insects since they accelerate the decomposition process of dead trees and also feed on other insects. Unlike termites, they do not eat wood as a food source. Carpenter ants excavate damp wood to create a nest site. The worker ants forage several hundred metres for food sources.

Several precautions should be taken to prevent infestation, beginning with removing decaying and infected wood from around the house. Provide good ventilation in the house and drainage around it so that any wood used in the buildings stays dry.

To locate a colony, look for sawdust-like debris that has been ejected from the nest. Also, the sound they make while excavating their nest is audible to humans when absolute silence is maintained.

Carpenter ants are effectively controlled by placing a residual insecticide directly into the nest site. A simple crack and crevice treatment to the site areas will rarely be sufficient to destroy the colony.

For further information, consult the fact sheet "Carpenter Ants."

Powder Post and Furniture Beetles

These beetles are widespread in Ontario and may cause serious damage to buildings, hardwood floors, furniture and wooden equipment. Species of furniture beetle (Anobiidae) infest softwood and hardwood but powder post beetles (Lyctidae) infest seasoned hardwood.

The first evidence of an infestation by these insects is usually the appearance of small holes — each the size of a pin's head — where the adult beetles have emerged through the surface. The presence of fine, sawdust-like material also indicate infestation.

Successive generations of larvae gradually reduce the wood to an intricate network of tunnels, until the timber is a fragile honeycomb. Ultimately, the structural value of the timber is destroyed, although the surface may appear to be sound, apart from the exit holes.

Floor and other surfaces kept well waxed, painted, varnished or sanded are less liable to attack, as the adult beetles will not lay eggs on finished surfaces. Infested wood should not be used for construction or repairs unless it has been treated to kill the insects. This may be done by fumigation by a licensed operator, by kiln drying, or by chemical treatment.

Where possible, timber should be treated with chemicals before the adult beetles emerge in late May and June.

For further information, consult the fact sheet "Powder Post Beetles and Furniture Beetles."

Bees, Wasps and Hornets

Bees, wasps and hornets are beneficial insects, but when they make their nests close to homes or other human-occupied buildings, a hazardous situation may develop.

Honeybees are the most social of the group. Yellow jackets are seen quite frequently around a house since they are scavenger wasps that feed on any discarded food available. Other species of bees, wasps and hornets that feed on pollen or rotten fruits can also be found around buildings.

Many of these insects can sting, so extreme caution should be taken when approaching their nests. The honeybee can sting only once, since the stinger and venom sac remain fixed to the victim, continuing to pump venom. That is why the stinger should be removed quickly; however, avoid pinching the venom sac as this will inject more venom. Carefully scrape beneath the venom sac to remove the stinger. Other bees, wasps and hornets can sting more than once.

Control measures begin with removing debris to discourage nest building. Proper containment and disposal of garbage is also important.

Boiling water poured on ground nests at dusk will effectively destroy small bumblebee nests, but this method is hazardous if not handled properly.

A residual insecticide in aerosol form can be used to blast most nests. These chemicals remain active for several days to provide a complete kill. The spraying should be carried out at night when all foraging insects are in the nest.

For further information, consult the fact sheet "Bees, Wasps and Hornets."

House Mouse

During the summer, the house mouse may nest outside, but it prefers shelter in buildings, where it may be found anywhere from the basement to the attic. It uses the space between double walls, floor joists, and concealed, enclosed space in cupboards or under counters in which it can locate its small nest.

The house mouse can jump a vertical distance of 30 cm, can pass through holes 13 mm in diameter, and climb rough-textured walls to enter a building.

Although it prefers cereal grains and seeds, the house mouse will eat any available foods. Rodent proofing by means of structural barriers to close off access to buildings and food is a necessity.

The house mouse is easily trapped with spring traps. These traps should be placed at frequent intervals along baseboards, boxes and other sheltered areas or possible runways and should be inspected daily to remove dead mice.

Rodenticides can also be used. Some anticoagulant rodenticides are cumulative and must be consumed over a period of several days to be effective.

Remember that rodenticides are poisons. Make sure to keep bait away from children or pets. All poison and unused baits should be kept in a safe place, locked and labelled "POISON." A record should be kept of all poison baits used and where they are placed.

Always read the label carefully and follow the directions fully.

For further information, consult the fact sheet "House Mouse."

Rats

Rats and their parasites can carry serious diseases which are transmittable to humans. Moreover, they eat stored food and contaminate much more with their urine and feces. If left to breed unchecked, in three years, there would be 20 million rats descending from only one pair.

Rats live in burrows just below ground level inside or outside close to buildings. Dumps and sewers are other major habitats. The rat can swim and jump very well and is found everywhere, including the country and the city.

Controlling rats begins with eliminating their shelter and food sources. Rat proofing features should be installed in food storage rooms and warehouses, on utility lines, pipes, roof vents, windows and doors. Double walls, spaces between floors and ceilings, ground basement floors, piles of lumber, heaps of equipment and furniture should also be checked frequently.

Attention to garbage handling and disposal is vitally important since garbage provides rats with food, water and shelter.

Baiting with rodenticides can also be considered a rodent control feature. It is advisable to place baits in protected and sheltered areas because rats avoid open places where they do not feel safe. Non-chemical control is also possible with:

- snap traps baited with food;
- glue boards.

For further information, consult the fact sheet "Rats and Their Control."

Pesticide Safety

CHAPTER VIII

Supposing you've tried insect control without pesticides, but the nuisances are still around. So you've decided to consider using pesticides.

The following pointers will help you use these chemical compounds and ensure that they have no adverse effects on you or the environment.

To use pesticides to the best advantage, inform yourself about their safe and correct handling and use. Observe the following precautions.

Purchasing

Always carefully choose the pesticide. Check the label to ensure the product is effective against the insect you wish to control it should be listed on the label.

If the product you choose is a spray, note whether it is a crack and crevice, surface or space spray. Crack and crevice treatments are applied to the hiding places of the pest. Surface sprays are applied to floors, baseboards, shelving, etc., and leave a residue of active pesticide to attack crawling insects. Space sprays are more diluted, short-lived pesticides that are sprayed into the air to kill flying insects.

Pesticides are sold at garden centres, hardware stores and exterminator's outlets. If you have a small problem to overcome, purchase only a small quantity of pesticide. This avoids later storage or disposal problems.

Storage

As soon as you arrive at the cottage with the pesticide (whether it is mothballs, resin strips, weedkiller or insecticide), find a secure place to store it — if possible, in a locked compartment.

Choose a place out of the reach of children or pets. Be sure it is away from food, medicine, housekeeping supplies or garden supplies (seeds, fertilizers) to avoid any possibility of accidental contamination. Also, check the label for any special precautions. If the pesticide is flammable, do not place near a heat source.

Keep the pesticide tightly closed in its original labelled container. If the label falls off, glue it back onto the container. If an unlabelled container is discovered, discard it. Don't guess about the contents.

Application

Read the label on the pesticide container every time the pesticide is used. It is easy to forget an important caution or application method.

Never allow children to assist with a pesticide application. Be sure all pets and their feeding dishes are removed from the treatment area — this includes cats and dogs, birds and their cages, and aquaria.

If treating cupboards (or table areas), remove nearby food, dishes or utensils first. After treatment, cover the shelving with foil or new shelf paper before replacing these goods. (And thoroughly wash the table areas.)

When applying pesticide, be careful; if you spill pesticide on your skin, wash it off immediately with soap and water. If you accidentally spill some liquid pesticide, mop it up with absorbent material — such as sawdust or garden soil — which can be discarded safely by putting it in a garbage bag. While doing this, your hands should be protected by rubber gloves.

Work efficiently so as to limit inhalation of the pesticide spray or dust. Never smoke while working with pesticide since it may be carried to your mouth on the cigarette. In any case, many pesticides are flammable.

If you must dilute the pesticide or mix it with a solvent, do not work in the kitchen sink or use eating utensils that could be accidentally placed back in service. Make up only enough pesticide for the present use. Mix outdoors or in a well-ventilated area.

Use insecticides outside only on calm days for safety and minimal annoyance to neighbors.

When you have completed the application of the pesticide, clean up. Wash your hands and face with soap and water. Remove clothing and launder separately from other family clothing before wearing again. If a residual pesticide has been applied, leave the cottage for several hours to allow the pesticide solvent to disperse. Occasionally, this solvent may be irritating.

Disposal of Empty Containers

An empty pesticide container — cardboard box, tin or bottle — should never be used again. Dispose of it safely by wrapping it in newspaper or a plastic bag and placing it in the garbage can. Never burn empty pesticide containers — the smoke or fumes produced may be toxic. Aerosol containers should never be punctured.

CHAPTER IX

In An Emergency

For first aid treatment, read the label on the pesticide container.

If possible, immediately call your doctor or one of the only two Poison Control Centres in Ontario:

1. Hospital for Sick Children
   1-800-268-9017
   (416) 598-5900
2. Children's Hospital of Eastern Ontario
   Emergency Department
   (613) 737-1100

Read details of the label to the doctor — name the product, active chemical ingredient, antidote — and ask the doctor what to do. If you go to hospital, take the label with you.

Hazardous Wastes

Some common household products like barbecue starters, old paints, unlabled pesticides, and toilet bowl cleaners become hazardous wastes if they are released into the environment.

So don't throw them away! Environment Ontario makes dangerous wastes easy to dispose of by providing your municipality with a grant to collect them through the Household Hazardous Waste Collection Program.

If your municipality does not provide for household hazardous waste collection and disposal, you may wish to encourage it to do so.

But you can dispose of these wastes safely yourself too.

What You Shouldn't Do

1. DON'T POUR hazardous wastes down the drain. Doing that may corrode plumbing, release toxic fumes, damage sewer systems and contaminate surface and groundwater.
2. DON'T PUT hazardous wastes out for garbage collection. That may result in injury to sanitation crews.
3. DON'T BURY it. That may contaminate the soil and eventually local surface and ground water.

What You Should Do

1. Buy only as much as you need.
2. Store securely for Household Hazardous Waste Collection Day.

Safe Handling

Follow these tips on safe handling and disposal.

1. Do not buy more than you need to do the job.
2. Keep various products separated.
3. Do not mix hazardous wastes.
4. Store in safe, well-ventilated place away from children and pets.
5. Make sure containers are not broken and are securely capped or sealed.
6. Keep bleaches and ammonia away from acids.
7. When pesticides, bleaches and ammonia, etc., are all used up, rinse the container three or four times and dispose of containers in garbage. Disperse the rinsings on your area of application.
8. Keep unused pesticides, bleaches, ammonia, etc., until the special collection day, or give to neighbors.
9. Do not use chemical containers for other purposes.
10. Do not burn, crush or puncture aerosol cans.
11. Deliver waste oil to a service station which participates in an oil recycling program.
12. In some cases, weak acids and alkalis can be neutralized and flushed down the toilet; however, this should not be done before getting advice from Environment Ontario.
13. Car batteries can be traded in or given to service stations or recyclers.
14. Medicines can be flushed down the toilet to prevent misuse by children.
15. As much as possible, try to exchange or give unwanted materials to neighbors who will use them. This, of course, excludes medicines and other personal items.
16. When a special collection day is in place, bring your wastes to the collection depot.

Try Composting Cottage Wastes

Many cottage areas are simply not equipped to dispose of vast quantities of garbage. So anything you can do to reduce the garbage volume will help.

When you shop, avoid heavily packaged items. Buy returnable bottles. And return them!

At the end of your stay at the cottage, consider taking your garbage back to the city (especially in winter when garbage pick-up may not be as frequent). Also, consider composting.

Many cottagers are becoming avid compost gardeners. In this way, you can recover tangible benefit from your garbage and thus reduce the volume of solid waste requiring disposal.

The humus material from a compost heap has long been accepted as an inexpensive soil additive and mulching agent. When added to the top soil, it improves texture, porosity and water holding capacity, and increases the organic content of the soil.

How to Compost

Generally speaking, composting involves taking organic waste material and placing it in a soil culture rich in natural organisms.

The following steps provide a simple, inexpensive approach to constructing a compost heap.

Locate Away from Water

You can locate your compost heap in an inconspicuous corner of your cottage property, or you can choose a central site and decorate it to suit the landscape.

Be sure, however, that the spot is airy and sunny. Also be sure that it is away from waterways and wells and at least 30 cm above the water table.

Construction

Composting is best done in some form of enclosure. Choose a size convenient to your needs, whether it's a 1-m square box or an enclosure 3 m per side. The pile can be as shallow as 30 cm or as deep as 1.5 m.

Simple Enclosure

For small-scale, easy composting, the simplest approach is to take a large garbage can, a barrel or a wooden box. Knock out the bottom and set it up to receive your organic wastes.

Custom Enclosure

A composting enclosure can also be tailor-made in any size. These directions show how to build an enclosure 1 m square rising 30 cm above ground level.

- Mark off a 1-m square on the ground and dig a pit 30 to 50 cm deep. The pit provides some warmth in winter and keeps the compost damp in summer.
- Drive four stakes 60 cm long into the ground at the corners, leaving 30 cm of the stake above ground. From a sheet of 6 mm aspenite plywood, cut four 30 cm by 1 m rectangles and nail them to the stakes, forming a 1 m by 1 m enclosure. Leave a small space, about 2.5 cm around the bottom so that air can circulate up through the heap. The remaining half of the sheet will be used as a cover for your heap during the winter. In summer, a sheet of heavy-gauge plastic placed on 1 m square frame will be used as a cover. This keeps your compost heap from becoming a breeding ground for insects — and will also help retain moisture.

Your composting bin is now ready to receive organic wastes.

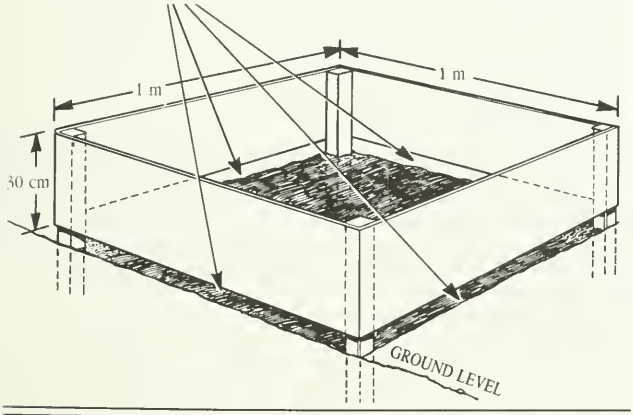
Composting Methods

Many methods for adding waste material to compost heaps are used. The simplest is to add material as it becomes available. Be sure not to add thick layers of finely ground material such as sawdust. These materials will pack tight and prevent adequate circulation of air.

Another method is to arrange your compost heap into layers by placing a thin layer of a commercial starter (or fertilizer) between each 15 to 20 cm of garbage. The starter is used to increase the bacterial count, and the fertilizer will increase the nutrient content of your pile.

Whichever method you choose, remember that for your compost to function adequately, the heap must be kept moist, but not soggy. Every two or three weeks the pile should be turned to mix and aerate the raw compost.

While the garbage is decomposing, heat is produced which should be contained by covering the pile. Heat is essential to keep the compost functioning effectively and decompose the waste.



m– Metre	3′3″ – 1 metre	
cm– Centimetre	1″	– 2.5 centimetres
mm– Millimetre	1″	– 25 millimetres

After every turning of the heap, heat again builds up in a matter of hours. When the heat production finally stops, your compost is ready to be used as low-grade fertilizer and soil conditioner.

When Is Your Compost Ready?

Experts suggest that your compost should be ready after one full year. If you complete filling in the fall, you may be able to set it aside for use in the spring. Much will depend on the composition of your heap and how often the pile is turned.

And in Winter?

If you use your cottage all year, maintain two compost heaps. One can be kept in use during winter while the other matures.

What to Compost

Organic wastes are the main source of material for a composting heap. These are typical everyday household ingredients, including:

kitchen garbage
vegetable and fruit peelings
coffee grounds
*egg shells
peanut and nut shells
leaves
*sawdust
*torn-up newspaper
barbecue grill residue
straw and hay
garden residues
grass clippings

*acceptable in small quantities.

With a little time and effort, and minimal expense, you can successfully reclaim some of your cottage wastes.

What Not to Compost

All glass, china and tin cans.

About Open Burning

Open fires cause air pollution. Their smoke and odors can aggravate respiratory conditions, soil property, reduce visibility and generally lessen enjoyment of property. In rural areas, the effects are less noticeable; however, if at all possible, do not open burn leaves, grass, stumps, fallen trees, trash, crop stubble and other materials.

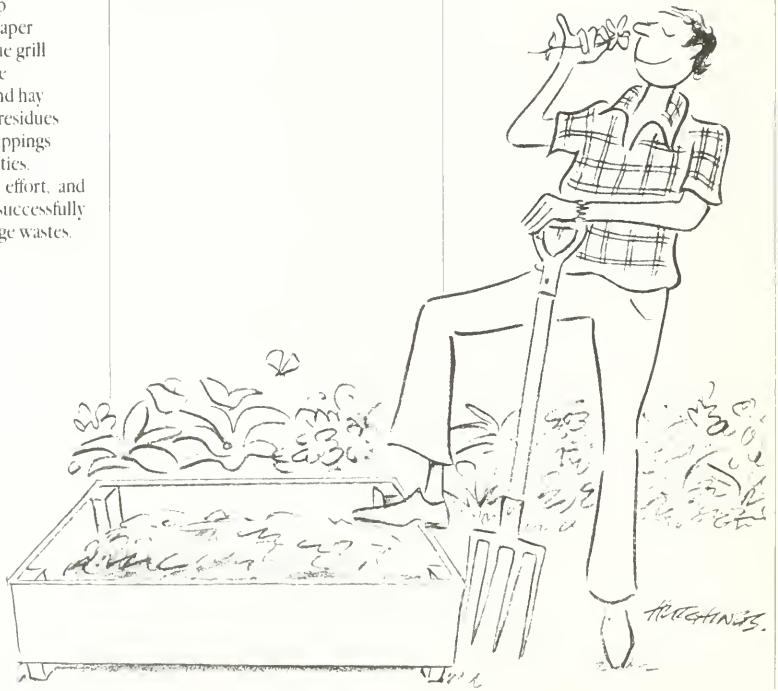
There are alternatives. Depending upon the nature of the materials involved, they can be buried, composted, set out for municipal collection or taken directly to a local dump or sanitary landfill site.

If you must burn, follow these guidelines to keep your fire from becoming an air pollution problem — not to mention a forest fire problem.

Remember all air pollution complaints received by Environment Ontario are investigated, and corrective action can be taken under *The Environmental Protection Act, 1971.*

- Burn only dry materials. Don't burn petroleum products, plastics, rubber or anything else that will cause excessive smoke or fumes.
- Keep your fire at least 150 metres from a dwelling.
- Burn less than a cubic metre of material at a time.
- Stay with your fire at all times.
- Don't burn where smoke will bother your neighbors or blow across roadways and hamper driving visibility. Smoke from open burning has caused several serious traffic accidents in Ontario.
- Check local bylaws enforced by your fire or police department. If burning above Ontario's Fire Line, follow regulations enforced by the Ministry of Natural Resources. (The Fire Line runs east from Lake Huron across the bottom of Georgian Bay and the top of Lake Simcoe down to Gananoque, then north and west to meet the Ottawa River north of Renfrew.)

For further information on open burning, contact the nearest regional or district office of Environment Ontario.



CHAPTER X

A Look at the Environmental Issues

The use of high-speed power boats has become one of the most maligned activities in cottage country.

Is this really justified? Just how much of a problem are they?

The following key environmental issues are discussed: sewage contamination, gasoline and oil contamination, noise, and wash.

What to Do with Sewage

To help protect lakes and rivers from pollution, it's required by Ontario law that sewage (and garbage) from all pleasure craft — including houseboats — be retained in suitable equipment (i.e., you don't just dump wastes overboard. You retain them for disposal at an approved pump-out facility).

If you equip your boat with toilet facilities, the equipment shall be:

1. non-portable;
2. constructed of structurally sound material;
3. of adequate capacity for its expected use;
4. properly installed; and
5. 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 diameter National Pipe Thread is commonly used.)

It is your responsibility to ensure that your vessel is properly equipped.

Environmental Tips for the Boat Operator

1. Wastes should be retained and disposed of on shore.
2. Always keep engine tuned. An untuned one wastes fuel, so adjust (and keep clean) the plugs, ignition points, fuel systems and carburetors.

3. Use correct gas and oil mixture. Use lead-free or low-lead gas if your motor will run on it.
4. Avoid spillage.
   (a) Fill portable tank away from the water.
   (b) Don't overfill fuel tanks. Leave space for expansion if the fuel warms up.
   (c) Fill your gasoline tank carefully to avoid blow-back.
5. Don't run the motor if not necessary. If waiting at a dock for someone, turn your engine off.
6. Reduce speed near shore or in narrow channels. (Under federal legislation, the Ministry of Natural Resources has the authority to restrict the operation and speed of pleasure boats.)
7. When buying an engine, insist on a quiet one.
8. When a tank is used for outboard motor testing, the contents should not be emptied into the water.
9. If the bilge is cleaned, the waste material should not be dumped into the water.
10. Empty oil cans should be deposited in the leak-proof receptacle.

Fuel Spills — The Major Problem

Exhaust gases and oil discharges from boats can pose minor problems, but more damaging are fuel spills caused by careless handling.

Their effects on water are both short and long-term. Gasoline has an immediate effect on the microbiota (small life in water), while oil has adverse effects on the phytoplankton and zooplankton. Although the oil does not kill these organisms, it does hinder their reproduction.

Since phytoplankton and zooplankton are a source of food for other aquatic life, their absence would upset the ecological balance in lakes and rivers.

Studies have also shown that oil in water has adverse effects on both the lifetime and growth of fish.

Fuel spills can be prevented. So you can do something.

What about oil discharges?

Fortunately, newer outboard motors are designed to prevent the discharge of crankcase drainage. As the use of these motors increases, less unburned fuel will be emitted into the water.

Normally, lead should not be a serious problem. Most marine fuels sold in Ontario are low in this metal and can efficiently operate most outboards.

Of note is the possible effect of exhaust products on water, altering its odor and tainting fish flesh in high traffic lakes.

Marina and Yacht Club Requirements

An Ontario regulation requires that marinas and yacht clubs must provide or arrange pump-out service for customers and members who have toilet-equipped boats.

In addition, litter containers must be conveniently available.

Visitors Must Comply Too!

Visiting pleasure boats, including foreign-owned vessels maintained in Ontario, must comply with Ontario regulations.

Visiting pleasure craft, equipped according to out-of-province regulations requiring non-portable sewage holding or incinerator systems, must comply with the Ontario regulations.

CHAPTER XI

How to Protect a Finite Resource

The tremendous pressure for development exerted on our cottage country is 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."

We in Ontario are realizing that lakes, like all ecosystems, have limits. For some large, deep southern Ontario lakes with ample soil, the capacity is high. However, for more fragile Precambrian lakes with little soil cover over bedrock, the capacity is quite low.

If a lake's development capacity is exceeded (i.e., overdeveloped), the combined effects of pollutants and other pressures will cause a degraded environment from both an ecological and esthetic point of view.

If may take several years for the effect of overdevelopment to become obvious, but there's no escaping its inevitable results.

And it will be made worse by the trend towards winter cottaging.

Controlling Development

When cottagers see increasing development around their lake as a threat to their seclusion, their natural view and other aspects of the environment, they begin to oppose further development. This opposition increases when developers fail to take into account what cottagers regard as the environmental and social limits of the lake.

But who decides these limits and how can they be maintained?

A large part of this question depends on the water quality of the lake. Cottagers and cottage associations can help Environment Ontario tackle the water quality problems in their lake by providing information through self-help programs.

Valuable protection can be provided to wildlife, fish and the scenic value of the lake. Many of these recommendations are not enforceable by law, but must rely on alert and concerned cottagers to practice conservation and pass the message to their neighbors.

Some cottage associations have taken their concern for increasing development on a lake to their local municipality. A Lake Plan would require detailed study of the lake's characteristics, including how much development has occurred to date. The plan, once adopted by the local municipality or planning board, would establish guidelines for any future development. By following the precautionary measures described in the Lake Plan, any new cottage development allowed should have minimal impact on the lake and its residents.

Keeping the View Natural

The view of forested hills, peaceful farm lands or undisturbed shoreline from a cottage or boat is a valuable part of the cottaging experience. The view can be preserved, despite extensive cottage development, by using adequate building setbacks from the lake and by preserving natural vegetation near the shore.

This requires the co-operation of cottage association members who realize that the view from the cottage is enhanced by looking through and at natural vegetation.

Keeping the Wildlife

Part of the attraction of lakeshore living is the opportunity to encounter wildlife in its natural state. But wildlife often moves away from areas developed by people, even lakeshores. However, cottagers can do something to encourage wildlife to stay.

Certain areas, such as marshes and swamps, forests which provide cover and food for deer, and other wildlife habitats, are protected by the Ministry of Natural Resources. The public can contribute to this habitat protection program by being concerned about unique species and by preserving areas used by furbearing animals, waterfowl, fish and other wildlife.

A cottage association should contact the Ministry of Natural Resources if members have a concern to preserve a unique species or area. The association can also help retain wildlife in its area by discouraging such activities as chasing wildfowl with power boats, disturbing nesting areas, and allowing dogs to run at large.

Shoreline alterations and the filling of wetlands can harm wildlife. The Ministry of Natural Resources will provide advice before work that might disturb wildlife activities is done around a cottage.

In some areas, cottagers have a problem with wildlife. For instance, beavers can build dams, which flood recreation areas or roads. The Ministry of Natural Resources can assist cottagers in dealing with these problems. In the case of beavers, the ministry can enlist a licensed trapper to control beaver populations.

Keeping the Fish

Sport fishing is an important and relaxing pastime for many cottagers. The quality of good sport fishing in a lake can be impaired by a number of factors: over-fishing, changes in water quality, and disturbances of spawning beds and nursery area.

A minimum number of adult fish must be retained in a body of water to spawn and maintain an abundance of fish for future seasons. This is why the Ministry of Natural Resources limits fishing pressures by reducing catch limits or shortening seasons.

It has already been explained how cottagers can reduce the flow into the lake of nutrients that fertilize algae and weeds, which use oxygen when they decompose, robbing fish of oxygen.

Cottage associations can also help retain fish populations by not disturbing the important spawning and nursery areas in the shallow parts of the lake. It is the shallow areas where much of the food and habitat for fish is provided, and these are very sensitive to human activities.

The effect of a large number of cottagers, each of whom makes a small "improvement" in his cottage shoreline, is cumulative and disrupts the natural aquatic life processes.

Reducing contaminant flow into the water with the shoreline vegetation and adequate setbacks for buildings does a great deal to maintain the productivity of the shallow areas. The following additional measures will also help:

Constructing Piers and Docks — Consider floating rather than permanent structures to avoid damaging the lake bottom.

Beaches — If there are rocks in front of your property, leave them. If you must remove rocks for better swimming, move them by hand, not with a bulldozer.

Boathouses — Keep the boathouse back from the shore and use a winch to bring the boat out of the water.

Boat Ramps — Use a community ramp rather than many individual ones.

Power Boats — Known fish spawning areas should be avoided by power boats. The disturbance of the lake bottom can cause eggs to be covered with sediments that prevent fish from hatching.

Before building any structures on a lakeshore, contact the Ministry of Natural Resources.

CHAPTER XII

Environment Ontario

Regional & District Offices

NORTHWESTERN REGION

Thunder Bay Regional Office,
P.O. Box 5000
3rd floor, 435 James St. S.
Thunder Bay P7C 5G6
Tel.: 807/475-1215

Kenora District Office,
808 Robertson St.,
Kenora P9N 1X9
Tel. 807-468-5578

NORTHEASTERN REGION

Sudbury Regional Office,
199 Larch St
Sudbury P3E 5P9
Tel.: 705 675-4501

Timmins District Office,
83 Algonquin Blvd. W.
Timmins P4N 2R4
Tel.: 705 264-9474

Sault Ste. Marie District Office,
445 Albert St. E.
Sault Ste. Marie P6A 2J9
Tel.: 705 949-4640

North Bay District Office,
1500 Fisher St., Northgate Plaza
North Bay P1B 2H3
Tel. 705 476-1001

Parry Sound Sub-Office,
74 Church St
Parry Sound P2A 1Z1
Tel. 705 746-2139

CENTRAL REGION

7 Overlea Blvd., 4th Floor
Toronto M4H 1A8
Tel. 416 424-3000

Barrie District Office,
12 Fairview Rd.,
Barrie L4N 4P3
Tel.: 705 726-1730

Muskoka Haliburton District Office,
Gravenhurst Plaza
General Delivery
Gravenhurst P0C 1G0
Tel. 705 687-3408

Peterborough District Office,
139 George St. N.,
Peterborough K9J 3G6
Tel. 705 743-2972

Halton-Peel District Office,
1235 Trafalgar Rd
Suite 401
Oakville L6H 3P1
Tel. 416 844-5747

SOUTHWESTERN REGION

London Regional Office,
985 Adelaide St. S.
London N6E 1V3
Tel.: 519/661-2200

Windsor District Office,
250 Windsor Ave., 6th Floor,
Windsor N9A 6V9
Tel.: 519/254-2546

Sarnia District Office,
265 Front St. N
Suite 109
Sarnia N7T 7X1
Tel.: 519/336-4030

Owen Sound District Office,
1180-20th St.
Owen Sound N4K 6H6
Tel.: 519/371-2901

WEST CENTRAL REGION

Hamilton Regional Office,
Ontario Government Building
119 King St. W., 12th Floor
Box 2112
Hamilton L8N 3Z9
Tel.: 416 521-7640

Cambridge District Office,
400 Clyde Rd., P.O. Box 219
Cambridge N1R 5T8
Tel.: 519/653-1511

Welland District Office,
637-641 Niagara St. N.,
Welland L3C 1L9
Tel.: 416/384-9896

SOUTHEASTERN REGION

Kingston Region Office,
133 Dalton St.,
Kingston K7L 4X6
Tel.: 613 549-4000

Ottawa District Office,
2378 Holly Lane,
Ottawa K1V 7P1
Tel.: 613 521-3450

Cornwall District Office,
205 Amelia St.
Cornwall K6H 3P3
Tel. 613/933-7402

Belleville Sub-Office,
15 Victoria Ave.,
Belleville K8N 1Z5
Tel.: 613/962-9208

Pembroke Sub-Office
1000 MacKay St.
Pembroke K8B 1A3
Tel.: 613 732-3643

Ministry of Natural Resources

Regional and District Offices

NORTHWESTERN REGION

810 Robertson St.
Box 5160
Kenora, Ontario P9N 3X9
Tel.: 807 468-3111

District Offices

Red Lake District
Box 5003, Hwy. 105
Red Lake, Ontario
P0V 2M0
Tel.: 807/727-2253

Kenora District
808 Robertson St.
Box 5080
Kenora, Ontario P9N 3X9
Tel.: 807 468-9841

Dryden District
479 Government Rd.,
Box 730
Dryden, Ontario P8N 2Z4
Tel.: 807/223-3341

Sioux Lookout District
Box 309, Prince St.
Sioux Lookout, Ontario
P0V 2T0
Tel.: 807/737-1140

Fort Frances District
922 Scott St.
Fort Frances, Ontario P9A 1J4
Tel.: 807/274-5335

Ignace District
Box 448
Hwy. 599
Ignace, Ontario P0T 1T0
Tel.: 807/934-2233

NORTH CENTRAL REGION

Ontario Govt. Bldg.
435 James St. S
Box 5000
Thunder Bay, Ontario P7C 5G6
Tel.: 807 475-1261

District Offices

Atikokan District
108 Saturn Ave
Atikokan, Ontario P0T 1C0
Tel. 807 597-6971

Thunder Bay District
435 James St. S.
Box 5000
Thunder Bay, Ontario P7C 5G6
Tel.: 807 475-1511

Terrace Bay District
Box 280
Terrace Bay, Ontario P0T 2W0
Tel. 807 825-3205

Nipigon District
Box 970
Hwy. 17
Nipigon, Ontario P0T 2J0
Tel.: 807/887-2120

Geraldton District
208 Beamish Ave. W.
Box 640
Geraldton, Ontario P0T 1M0
Tel.: 807 854-1030

NORTHERN REGION

140 Fourth Ave.
Box 3000
Cochrane, Ontario P0L 1C0
Tel.: 705 272-4287

District Offices

Hearst District
631 Front St
Box 670
Hearst, Ontario P0L 1N0
Tel.: 705 362-4346

Kapuskasing District
6-8-10 Government Rd
Kapuskasing, Ontario P5N 2W4
Tel. 705/335-6191

Moosonee District
Box 190, Revillon Rd.
Moosonee, Ontario P0L 1Y0
Tel. 705 336-2987

Chapleau District
190-192 Cherry St.,
Box 460
Chapleau, Ontario P0M 1K0
Tel. 705 864-1710

Cochrane District
2 Third Ave.
Box 730
Cochrane, Ontario P0L 1C0
Tel.: 705/272-4365

Kirkland Lake District
Box 129
Swastika, Ontario P0K 1T0
Tel: 705/642-3222

Timmins District
60 Wilson Ave
Timmins, Ontario P4N 2S7
Tel.: 705/267-1401

Gogama District
Box 129, Lowavenue
Gogama, Ontario P0M 1W0
Tel: 705/894-2000

NORTHEASTERN REGION

199 Larch St
Sudbury, Ontario P3E 5P9
Tel: 705/675-4120

District Offices

Sault Ste. Marie District
875 Queen St. E.,
Sault Ste. Marie, Ontario
P6A 5L5
Tel: 705/949-1231

Wawa District
22 Mission Rd.
Box 1160
Wawa, Ontario P0S 1K0
Tel.: 705/856-2396

White River Office
200 Winnipeg St.
White River, Ontario P0M 3G0
Tel: 807/822-2250

Blind River District
62 Queen St.
Box 190
Blind River, Ontario P0R 1B0
Tel: 705/356-2234

Espanola District
Box 1340, 148 Fleming St.,
Espanola, Ontario P0P 1C0
Tel: 705/869-1330

Sudbury District
Box 3500, Station "A"
Sudbury, Ontario P3A 4S2
Tel: 705/522-7823

Temagami District
Box 38, Lakeshore Dr.
Temagami, Ontario P0H 2H0
Tel.: 705/569-3622

North Bay District
Box 3070
North Bay, Ontario P1B 8K7
Tel: 705/474-5550

ALGONQUIN REGION

Brendale Square
Box 9000
Huntsville, Ontario P0A 1K0
Tel: 705/789-9611

District Offices

Algonquin Park District
Box 219
Whitney, Ontario K0J 2M0
Tel: 705/637-2780

Parry Sound District
4 Miller St.
Parry Sound, Ontario P2A 1S8
Tel: 705/746-4201

Bracebridge District
Box 1138
Bracebridge, Ontario P0B 1C0
Tel.: 705/645-8747

Minden District
Minden, Ontario K0M 2K0
Tel: 705/286-1521

Bancroft District
Box 500, Hwy. 28
Bancroft, Ontario K0L 1C0
Tel: 613/332-3940

Pembroke District
Riverside Dr.
Box 220
Pembroke, Ontario K8A 6X4
Tel.: 613/732-3661

EASTERN REGION

Provincial Govt. Bldg
Box 2002 Concession Rd.
Kemptville, Ontario K0G 1J0
Tel.: 613/258-8204

District Offices

Carleton Place District
10 Findlay Ave.,
Carleton Place, Ontario
K7C 3Z6
Tel: 613/257-5735

Cornwall District
Box 1749
113 Amelia St
Cornwall, Ontario K6H 5V7
Tel.: 613/933-1774

Napanee District
1 Richmond Blvd
Napenee, Ontario K7R 3S3
Tel: 613/354-2173

Brockville District
605 Oxford Ave
Brockville, Ontario K6V 5V8
Tel: 613/342-8524

Tweed District
23 Spring St. Box 70
Tweed, Ontario K0K 3J0
Tel.: 613/478-2350

CENTRAL REGION

10670 Yonge St
Richmond Hill, Ontario
L4C 3C9
Tel: 416/883-9203

District Offices

Lindsay District
322 Kent St. W.
Lindsay, Ontario K9V 4T7
Tel: 705/324-6121

Maple District
Maple, Ontario L0J 1E0
Tel.: 416/832-2761

Huronia District
Midhurst, Ontario L0L 1X0
Tel.: 705/728-2900

Cambridge District
Box 2186 Beaverdale Rd
Cambridge, Ontario N3C 2W1
Tel: 519/658-9355

Niagara District
Hwy. 20 Box 1070
Fonthill, Ontario L0S 1E0
Tel.: 416/892-2656

SOUTHWESTERN REGION

659 Exeter Rd
London, Ontario N6A 4L6
Tel: 519/661-2800

District Offices

Simcoe District
548 Queensway W.
Simcoe, Ontario N3Y 4T2
Tel: 519/426-7650

Chatham District
435 Grand Ave. W.
Box 1168
Chatham, Ontario N7M 5L8
Tel: 519/354-7340

Wingham District
R.R. #5
Wingham, Ontario N0G 2W0
Tel.: 519/357-3131

Aylmer District
353 Talbot St. W.
Aylmer, Ontario N5H 2S8
Tel.: 519/773-9241

Owen Sound District
611 Ninth Ave. E.
Owen Sound, Ontario N4K 3E4
Tel.: 519/376-3860

Ministry of Northern Development and Mines

Northern Development Offices

NORTHEASTERN REGION

Blind River
13 Lawton St., P0R 1B0
Tel: 705/356-2226

Chapleau
31 Birch St. E., P0M 1K0
Tel.: 705/864-1515

Cochrane
161 Sixth Ave. P0L 1C0
Tel: 705/272-4274

Elliot Lake
10 Brunswick Walk P5A 2A8
Tel: 705/848-7133

Espanola
Espanola Mall, Hwy. 6 S.
Box 1718 P0C 1C0
Tel.: 705/869-1532

Hearst
904 George St
Tel.: 705/362-4358

Iroquois Falls
Box 460, 253 Ambridge Dr.
P0K 1G0
Tel.: 705/232-4001

Kapuskasing
Model City Mall P5N 2E9
Tel: 705/335-6008

Kirkland Lake
32A Prospect Ave. P2N 3K1
Tel: 705/567-3291

Mindemoya
Box 128, King & Young Sts
P0P 1S0
Tel.: 705/377-5396

Moosonee
Box 307, Main St. P0L 1Y0
Tel: 705/336-2991

New Liskeard
310 Whitewood Ave. P0J 1P0
Tel.: 705/647-7391

North Bay
267 Main St. W., P1B 2T8
Tel.: 705/472-3911

Parry Sound
70 Church St.
Parry Sound, Ontario
P2A 1Y9
Tel.: 705/746-4296

Sault Ste. Marie
444 Queen St. E., P6A 1Z7
Tel.: 705/254-6623

Sturgeon Falls
191 Main St. P0H 2G0
Tel.: 705/753-2900

Sudbury
1st Floor, 199 Larch St
P3E 5P9
Tel.: 705/675-4451

Timmins
83 Wilson Ave. P4N 2S8
Tel: 705/267-1401

Wawa
27 Gold St. P0S 1K0
Tel.: 705/856-2354

NORTHWESTERN REGION

Atikokan
Box 940, 123 Marks St.
P0T 1C0
Tel.: 807-597-2701

Dryden
34A King St. P8N 1B3
Tel.: 807-223-5231

Fort Frances
Portage Ave. P9A 1Z1
Tel.: 807-274-5329

Geraldton
Box 69, 305 Main St.
P0T 1M0
Tel.: 807-854-0266

Ignace
Box 196, 100 Main St.
P0T 1T0
Tel.: 807-934-2260

Kenora
Box 5050, 12 Main St. S
P9N 3X9
Tel.: 807-468-5548

Marathon
Box 280, Penninsula Building
P0T 2E0
Tel.: 807-229-1153

Rainy River
Box 430, 408 Atwood Ave.
P0W 1L0
Tel.: 807-852-3287

Red Lake
Box 950, 242 Howey St.
P0V 2M0
Tel.: 807-727-2870

Sioux Lookout
Box 147, 42 King St.
P0V 2T0
Tel.: 807-737-1318

Thunder Bay
428 E. Victoria Ave.
P7C 1A5
Tel.: 807-475-1425

Ministry of Health

Public Health Agencies

Algoma Health Unit
6th Floor, Civic Centre
99 Foster Dr.
Sault Ste. Marie, Ontario
P6A 5X6
Tel.: 705-759-5287

Brant County Health Unit
194 Terrace Hill St.
Brantford, Ontario N3R 1G7
Tel.: 519-753-4937

Bruce County Health Unit
Box 248, 30 Park St.
Walkerton, Ontario N0G 2V0
Tel.: 519 881-1920

Borough of East York Health Unit
550 Mortimer Ave.
Toronto, Ontario M4J 2H2
Tel.: 416 461-8136

Durham Regional Health Unit
Community Health Services Centre
301 Golf St.
Oshawa, Ontario L1G 4B2
Tel.: 416-723-8521

Eastern Ontario Health Unit
1000 Pitt St.
Cornwall, Ontario K6J 3S5
Tel.: 613-933-1375

Elgin-St. Thomas Health Unit
2 Wood St.
St. Thomas, Ontario N5R 4K9
Tel.: 519 631-9900

City of Etobicoke Health Unit
Etobicoke City Hall
399 The West Mall
Etobicoke, Ontario M9C 2Y2
Tel.: 416/394-8300

County of Grey-Owen Sound Health Unit
920 First Ave. W.
Owen Sound, Ontario N4K 4K5
Tel.: 519/376-9420

Haldimand-Norfolk Regional Health Unit
365 West St.
Box 247
Simcoe, Ontario N3Y 4L1
Tel.: 519 426-6170

Haliburton, Kawarth, Pine Ridge District Health Unit
Box 337, 860 William St.
Cobourg, Ontario K9A 4K8
Tel.: 416/372-0175

Halton Regional Health Unit
1151 Bronte Rd.
P.O. Box 7000
Oakville, Ontario L6J 6E1
Tel.: 416-827-2151

Hamilton-Wentworth Regional Health Unit
25 Main St. W.
P.O. Box 897
Hamilton, Ontario L8N 3P6
Tel.: 416-528-1441

Hastings and Prince Edward Counties Health Unit
179 North Park St.
Belleville, Ontario K8P 4P1
Tel.: 613/966-5500

Huron County Health Unit
Court House, The Square
Goderich, Ontario N7A 1M2
Tel.: 519 524-8301

Kent-Chatham Health Unit
435 Grand Ave. W.
P.O. Box 1136
Chatham, Ontario N7M 5L8
Tel.: 519 352-7270

Kingston, Frontenac & Lennox and Addington Health Unit
221 Portsmouth Ave.
Kingston, Ontario K7M 1V5
Tel.: 613 549-1232

Lambton Health Unit
333 George St.
Sarnia, Ontario N7T 4P5
Tel.: 519/344-5293

Leeds, Grenville and Lanark District Health Unit
70 Charles St.
Brockville, Ontario K6V 1T3
Tel.: 613/345-5685

Middlesex-London District Health Unit
50 King St.
London, Ontario N6A 5L7
Tel.: 519/663-5317

Muskoka-Parry Sound Health Unit
Pine St.
Box 1019
Bracebridge, Ontario P0B 1C0
Tel.: 705/645-4471

Niagara Regional Area Health Unit
130 Lockart Dr.
St. Catharines, Ontario
L2T 1W4
Tel.: 416/688-3762

North Bay and District Health Unit
P.O. Box 450
200 McIntyre St. E., 5th Fl.
North Bay, Ontario P1B 8J1
Tel.: 705/474-1400

Northwestern Health Unit
15 Ocean Ave. W.
R.R. #1
Kenora, Ontario P9N 3W7
Tel.: 807/468-3147

North York Health Unit
5100 Yonge St.
Willowdale, Ontario M2N 5V7
Tel.: 416/224-6197

Ottawa-Carleton Regional Health Unit
495 Richmond Rd.
Ottawa, Ontario K2A 4A4
Tel.: 613/722-2328

The Oxford County Health Unit
410 Buller St.
Box 485
Woodstock, Ontario N4S 7Y5
Tel.: 519/539-6121

Peel Regional Health Unit
10 Peel Centre Dr.
Brampton L6T 4B9
Tel.: 416/791-9400

Perth District Health Unit
653 West Gore St.
Stratford N5A 1L4
Tel.: 519/271-7600

Peterborough County-City Health Unit
835 Weller St.
Peterborough, Ontario K9J 4Y1
Tel.: 705/743-1160

Porcupine Health Unit
169 Pine St. S.
Postal Bag 2012
Timmins, Ontario P4N 8B7
Tel.: 705/267-1181

Renfrew County and District Health Unit
P.O. Box 940
121 Pembroke St. E.
Highway 17
Pembroke, Ontario K8A 7M5
Tel.: 613/732-3629

City of Scarborough Health Department
Scarborough Civic Centre
160 Borough Dr.
Scarborough, Ontario M1P 4N8
Tel.: 416/396-7454

Simcoe County District Health Unit
County Administration Centre
Midhurst, Ontario L0L 1X0
Tel.: 705/726-0100

Sudbury and District Health Unit
1300 Paris Cres.
Sudbury, Ontario P3E 3A3
Tel.: 705/522-9200

Thunder Bay District Health Unit
P.O. Box 1024
999 Balmoral St.
Thunder Bay, Ontario P7C 4X8
Tel.: 807/625-5900

Timiskaming Health Unit
6 Tweedsmuir Rd. Suite 206
Kirkland Lake, Ontario
P2N 1H9
Tel.: 705/567-9355

City of Toronto Health Unit
7th Floor, East Tower, City Hall
100 Queen St. W.
Toronto, Ontario M5H 2N2
Tel.: 416/392-7401

Waterloo Health Unit
850 King St. W.
Kitchener, Ontario N2G 1E8
Tel.: 519/744-7357

Wellington-Dufferin-Guelph Health Unit
205 Queen St. E.
Fergus, Ontario N1M 1T2
Tel.: 519/843-2460

Windsor-Essex County Health Unit
1005 Ouellette Ave.
Windsor, Ontario N9A 4J8
Tel.: 519/258-2146

City of York Health Unit
2700 Eglinton Ave. W.
Toronto, Ontario M6M 1V1
Tel.: 416/394-2436

York Regional Health Unit
22 Prospect St.
Newmarket, Ontario L3Y 3S9
Tel.: 416/895-4511

CHAPTER XIII

The Ontario Ministries of the Environment, Health and Natural Resources have developed publications that provide general information about environmental practices, regulations and programs. With exceptions, publications are free upon request. Priced publications are marked with an asterisk.*

Write to the Publications Centre, Ministry of Government Services, 5th Floor, 880 Bay Street, Toronto, Ontario M7A 1N8

Environment Ontario

Legislation

The Environmental Assessment Act*

The Environmental Protection Act, 1971* (Bilingual)

The Ontario Water Resources Act*

The Pesticides Act*

Water

Water Management
Goals, Policies and Implementation
Procedures of the Ministry of the Environment
Marine Pump-Out Stations (Bilingual)
Drinking Water Objectives
Guide to Eating Ontario Sport Fish (Bilingual)
Septic Tank Systems
Countdown Acid Rain
Water Wells and Ground Water Supplies in Ontario

Air

Open Burning Guidelines
Introduction to Air Pollution in Ontario
How Air Pollution Affects Vegetation

Land and Waste Management

Be a Good Sort — Recycle

Be a Good Sort to Your Garden

Pesticides

Mosquito Control — What You Can Do
Pesticides and the Environment
Pesticides Safety in Your Home

Should you require further information on pesticides use or safety, please contact the Public Information Centre, 135 St. Clair Ave. West, Toronto, Ontario M4V 1P3 (416) 323-4322

Ministry of Health

General

Rabies. It's No Way for a Friend to Die
How to Handle an Emergency
Psittacosis. A Disease People Get from Birds.

Legislation

Health Protection and Promotion Act, 1983*
Recreational Camp Regulations*

Ministry of Natural Resources

All Ministry of Natural Resources publications can be obtained from our Public Information Centre located in Room 1640 in the Whitney Block at Queen's Park, or write to the Ministry of Natural Resources, Public Information Centre, Rm. 1640, 99 Wellesley St. W., Whitney Block, Queen's Park Toronto, Ontario M7A 1W3.

Forestry, Lands & Waters

Trees. A Handy Guide for People Who Want to Put Down Roots. . . Illus. 1985

Common Pests of Trees in Ontario. . . Identification and control of common insects, illus. 1985*

Water Quantity Resources of Ontario . . . Illustrated book reviewing the present supply, current use and future demand of our water resources 1984*

Wildlife

Hunting Regulations Summary Fall 85 — Spring 86 (bilingual)

Ontario Trapping Regulations (summary)

The Beaver in Ontario. . . Life history habits, habitat, numbers, management and importance 20 pp. illus.*

Ontario Turtles. . . Descriptions of eight species and their habits and habitats, plus hints on pet keeping 22 pp. illus.*

Ontario Snakes. . . Descriptions of 14 species and their habitats, 36 pp. illus.*

Wolves and Coyotes in Ontario . . . Life history, habits, relationships, 20 pp. illus.*

The Fisher . . . Descriptive booklet on life history and habits, 14 pp. illus.*

The Marten . . . Descriptive booklet on life history, food habits, habitat, 14 pp. illus.*

The Muskrat . . . Descriptive guide on life history, habits, habitat, illus. 20 pp.*

The Mink . . . Illustrated booklet on life history, habits and habitat, 20 pp.*

Wetlands in Ontario, 1984 . . . Illustrated pamphlet outlining the importance of wetlands (bilingual)

When Rabbits Become a Nuisance . . . pamphlet

When Snakes Become a Nuisance . . . pamphlet

When Groundhogs Become a Nuisance . . .pamphlet

When Bats Become a Nuisance . . . pamphlet

When Black Bears Become a Nuisance . . . pamphlet

Hunters Guide . . . An illustrated book for hunters outlining hunting ethics, wildlife management, identification, firearms, survival, etc., 301 pp. (bilingual)*

Wildlife Management Areas in Ontario . . . Location and description of 40 areas

Fisheries

Summer Fishing in Ontario . . . illus. pamphlet, 1985

Winter Fishing in Ontario . . . illus. pamphlet, 1985

Spring Fishing in Ontario . . . illus. pamphlet, 1985

Fishing Ontario's Quarter Million Lakes . . . illus. pamphlet, 1985

Fishing the Rivers and Streams of Ontario . . . illus. pamphlet, 1985

Fishing the Great Lakes . . . illus. pamphlet, 1985

Out of the Water . . . Report on Ontario's freshwater fishing industry and principal fishing waters, detail on 28 fish species and families, 72 pp. illus., 1972*

The Fisheries of Lake Simcoe . . . Report on an interesting lake, 140 pp. illus.*

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Ontario Angling Facts and Figures . . . detailed analyses of anglers' origins, fishing areas, catches by species, favored species and effort, and funds expended, 100 pp., 1970*

Fishing Regulations Summary 1985 (bilingual)

Fishing Maps (list of 502 surveyed lakes)*

Provincial Parks

Ontario Provincial Parks — 1985 Guide (bilingual)

Canoe Routes of Ontario . . . A guide to more than 100 canoe routes, includes a poster size map

Conservation Areas in Ontario . . . Map with locations, features and facilities of conservation areas (bilingual)

How to Survive in the Woods . . . Pocket size card that briefly offers basic survival tips (bilingual)

Mining and Geology

Ontario Minerals Poster . . . Guide for rockhounds, minerals shown in color*

Rocks and Minerals Information . . . Sources of geological and earth science maps and technical publications, 1984

Ontario Mineral Map*

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Geology and Fossils, Craigleith . . . 61 pp. illus.*

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