Manitoba's Water Protection Handbook

Everyone's Responsibility

Manitoba

About This Handbook

This Water Protection Handbook is intended for use by individual cottagers, cottage associations, non-governmental environmental organizations, and all other Manitobans living and working in urban and rural areas with an interest in keeping our waters clean. Manitobans value clean waters both for our own enjoyment and for the benefit of our children and future generations.

This handbook is comprised of four sections:

"A Valuable Resource"
provides background facts and figures on Manitoba's water environment;

"A Matter of Quality"
provides information specifically on water quality;

"Protecting the Water"
provides detailed guidance on how Manitobans can protect and improve local water quality;

"For More Information"
includes a *"Give us a Call"* telephone list along with a *"Glossary of Terms"*.

Each section also includes highlighted areas that provide information on *"What You Can Do"*.

We hope that you will keep this handbook as a valuable reference for use by you and your family for many years to come.

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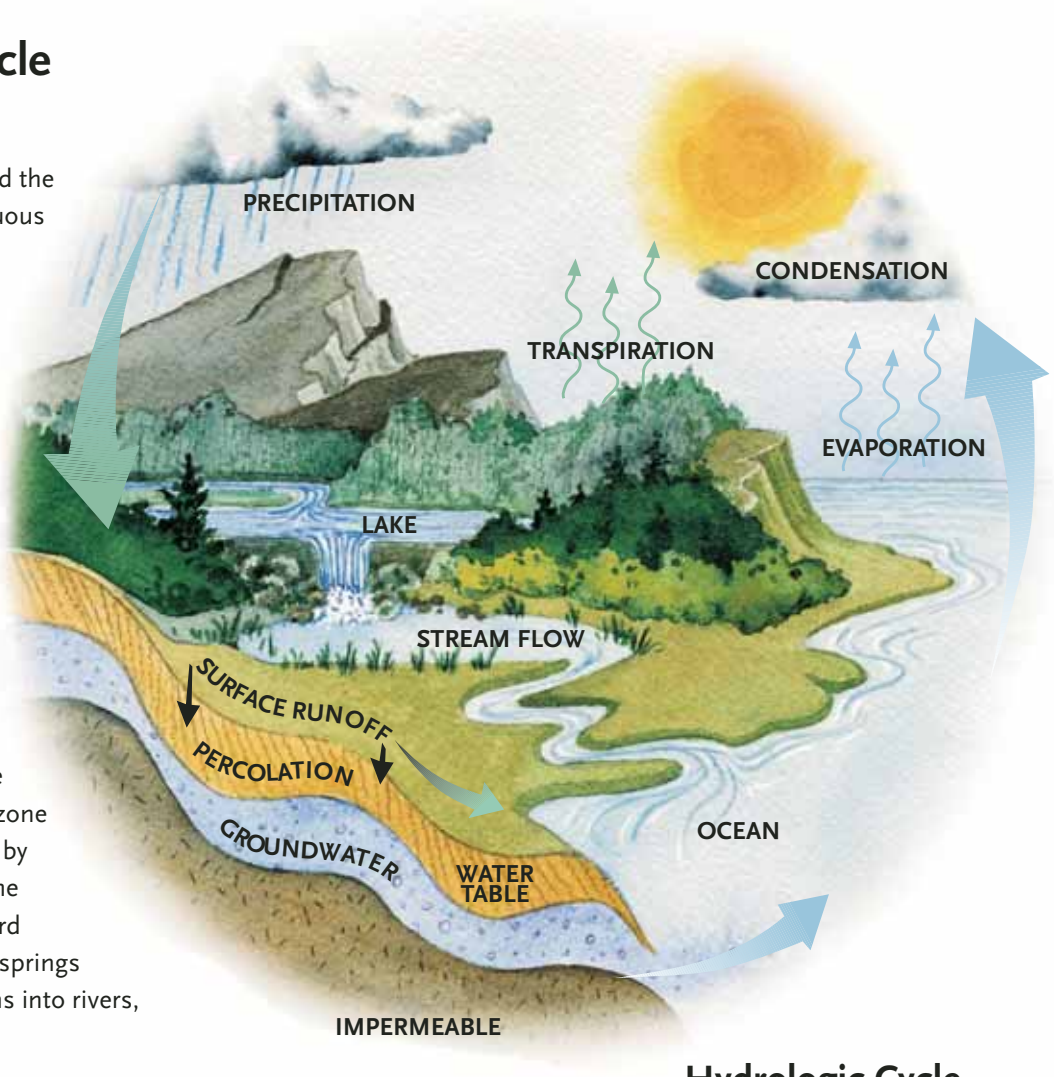
A Valuable Resource

The Water Cycle

A Continuous Cycle

The earth's water cycle, called the hydrologic cycle, is the continuous circulation of water between the earth and the atmosphere. Radiation from the sun evaporates water from oceans, lakes, rivers, soil and plants. Water vapour rises and collects as clouds. Cloud moisture condenses and falls back to the earth as rain, hail, snow or sleet. Some of this precipitation runs over the earth's surface to collect in lakes, rivers or marshes. Other precipitation is absorbed into the soil where it can be taken up by the root-zone and drawn back to the surface by plants. The rest soaks below the root-zone and moves downward into the groundwater. Natural springs release groundwater that drains into rivers, lakes and eventually, oceans.



Hydrologic Cycle

The time it takes for one water molecule to pass through the cycle can range from hours to months to thousands of years. A water molecule evaporated from the oceans could be carried into the polar regions and fall as snow. It could remain frozen within a glacier for centuries before returning to the ocean as part of an iceberg or as melted outflow from the glacier. This means that we could be drinking the same water once consumed by dinosaurs.

Many Processes Contribute to Weather

The water cycle is just one of the climatic processes that contribute to our weather. Other processes include water currents, air movements and volcanoes. Over the course of time, long-term weather patterns have created extremes - from ice covered continents to vast deserts. Climatic fluctuations lasting days, months, or a few years can result in local droughts and floods.

Distribution of the Earth's Water Supply

Supply/Source	Volume *(in thousands of cubic kilometres)*	Percent Total
Oceans	1,310,302	97.3
Ice	29,492	2.2
Groundwater	6,733	0.5
Inland Lakes	242	0.02
Soil Moisture	740	.005
Atmospheric Water Vapour	140	.001
Rivers	1.30	.0001

Source: Environment Canada

Did You Know?

- Only 2.7 per cent of the earth's water is freshwater - 2.2 per cent is locked up in glaciers and polar ice caps. This leaves about 0.5 per cent distributed as groundwater, soil moisture, atmospheric water vapour, lakes and rivers.
- Average annual precipitation in the province ranges from 400 millimetres in northern Manitoba to 600 millimetres in the southeastern corner.
- Two-thirds of Manitoba's precipitation falls between May and October.
- Manitoba's average snowfall ranges from 1,200 millimetres in the south to 1,700 millimetres in the north.
- Each year, an average of 300 to 350 millimetres of water is evaporated in the north while 450 to 500 millimetres evaporates in the warmer southern half of the province.
- Manitoba's large lakes have a moderating effect on climate - they act as heat sinks making the fall and early winter milder and the summer cooler.
- Winter snowfall serves as water in storage. When the snow melts in the spring, Manitoba's rivers and streams carry large amounts of water and many serve as important spawning grounds for fish.
- All life depends on water. Two-thirds of the human body is composed of water. In fact, water is so important to our bodies that we can only survive for a few days without it, but more than 30 days without food.
- Heavy rains result in more runoff while light steady rains generally soak into the soil.

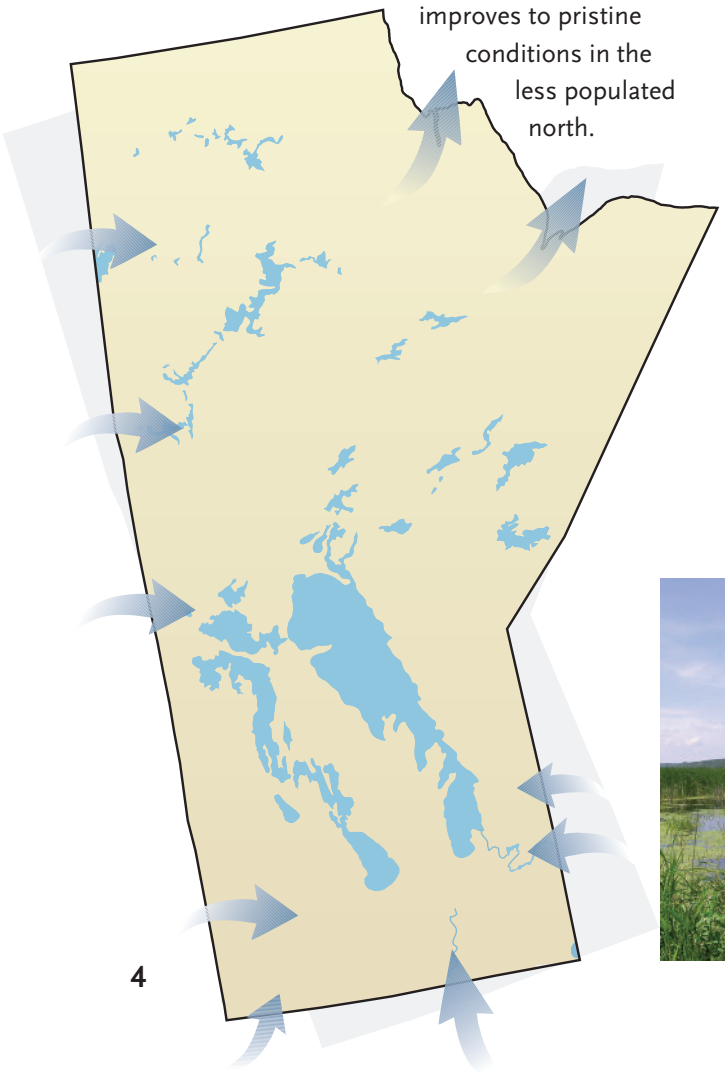
A Valuable Resource

Surface Water

Manitoba: Land of 100,000 Lakes

All visible above-ground water, including ice and snow, is called surface water. Our vast, virtually untouched reaches of water - an intrinsic part of our daily lives - are admired by people all over the world. A lakeside cottage epitomizes the dream vacation or ideal retirement home for many of us. However, it is essential that we preserve pristine aquatic areas in the province for their ecological and intrinsic value.

Surface water quality varies in the province. It is generally poorest in the more densely populated south and improves to pristine conditions in the less populated north.



Lakes, Bogs and Streams

Surface water is present in a variety of forms - lakes, ponds, bogs, sloughs, marshes, streams and rivers. Flow is the primary feature that distinguishes still waters such as lakes, ponds and sloughs, from flowing waters such as rivers, creeks and streams.

Large permanent bodies of still water are called lakes; smaller bodies that dry up occasionally are called ponds or sloughs. Marshes and bogs are semi-permanent and shallow but quite extensive in surface area. They have deep layers of partially decomposed vegetation that act like a sponge - soaking up water in times of abundance and slowly releasing it during drier conditions.

Still waters act as sinks, allowing pollutants to settle to the bottom. They also act as production factories where algae and other organisms convert nutrients and raw substances to biological material.

Rivers as Report Cards

Flowing waters transport water and nutrients across the landscape. Rivers are distinguished from creeks by their flow volume and channel width. Rivers have been called the “report cards of communities” because the quality of water in our rivers reflects our land management practices.

Surface Water Quality Monitoring

Manitoba Water Stewardship has a network of surface water quality monitoring stations across the province. The department monitors about 50 sites on a routine basis and has water quality data available for over 200 bodies of water. These data, along with water quality standards, objectives and guidelines, are used to evaluate the suitability of water for important uses such as household consumption, irrigation, recreation and habitat for aquatic life and wildlife. This information is also used to help evaluate the impacts of new and existing developments such as farm chemical warehouses and sewage treatment plants, and provide a measure of trends in provincial water quality conditions.

The City of Winnipeg conducts surface water quality monitoring on rivers and streams in Winnipeg. This data, along with long-term data collected by Manitoba Water Stewardship has been used to evaluate the effectiveness of Winnipeg's sewage treatment plants and sewer discharges on water quality in, and downstream, of the city. Environment Canada also monitors water quality, focusing their efforts on inter-provincial and international boundary sites. In addition, there are a number of other agencies involved in collecting water samples in Manitoba such as local volunteers, conservation districts, agricultural organizations, river groups and special interest groups.

Did You Know?

- **Manitoba has 900 trillion litres of surface water which covers approximately 16 per cent of the province.**
- **Three of Canada's 15 largest lakes are found in Manitoba - Lake Winnipeg, Lake Manitoba and Lake Winnipegosis.**
- **At 115 metres, West Hawk Lake is the deepest lake in Manitoba.**
- **About 12,000 years ago, glacial Lake Agassiz covered five-sixths of Manitoba. It drained 7,500 years ago.**
- **Manitoba is the only province in Canada where all water in the rivers eventually flow north.**
- **More than 70 per cent of the flow in our streams originates outside of Manitoba.**
- **Lake Winnipeg - the largest lake in Manitoba and the tenth largest in the world - covers 24,389 square kilometres.**
- **The Nelson, Churchill, Seal and Hayes rivers carry more than 99 per cent of the water flowing from Manitoba into Hudson Bay. The Nelson River alone carries over 60 per cent of this flow.**
- **Global warming is expected to influence Manitoba's water resources. For example, warmer air temperatures are likely to increase water temperatures and reduce the length of time of ice-covered conditions.**
- **Like most of the rivers in southern Manitoba, the Red River carries three quarters of its annual runoff between April and June.**
- **As of 2006, Manitoba had four of Canada's 40 designated or nominated heritage rivers under the Canadian Heritage River System – the Seal River, the Bloodvein River, the Hayes River and the Red River (nominated).**

Manitoba's Wetlands - A Precious Resource

Wetlands are one of the province's most precious resources. Some wetlands contain water year-round; others contain water only after the snow melts in the spring. Marshes, bogs, fens, swamps, sloughs and prairie potholes are all considered wetlands.

Wetlands are valuable because of the diverse functions they perform. For example:

- **Aquatic plants and insects thrive in wetland environments. Wetlands are a valuable habitat for many animal species, providing food, breeding sites, resting areas, nesting materials and sites, molting grounds and protection from weather and predators.**
- **Wetlands provide natural flood control without dams and dikes. Wetlands collect and retain seasonally high waters, common in the spring and after heavy rains, providing a natural buffer against flooding. Water collected by wetlands may also recharge groundwater supplies.**
- **Wetlands improve water quality by collecting soil suspended in runoff and reducing the amount of soil ending up in streams and lakes. Nitrogen, phosphorus, heavy metals and pesticides are also removed by wetlands. Because of their natural purification qualities, artificial wetlands are now being used to treat wastewater from municipal, agricultural and industrial sources.**
- **Wetlands are scenic and are recreationally valuable providing areas to view and enjoy wildlife.**

Wetlands have tremendous economic value to us. It is hard to attach a dollar value to improved water quality, diverse wildlife habitat and groundwater recharge. Despite this, it is estimated that the economic benefits derived from Canadian wetlands are worth more than $10 billion annually.

Historically, wetlands have been unappreciated and undervalued. At one time, they were seen as wastelands which needed to be drained and developed. In Canada alone, over one-seventh of the original pre-settlement wetland area has been converted to other uses. Southern Manitoba has lost approximately 70 per cent of its wetlands since the early 1900s.

Fortunately, recent conservation efforts and increasing awareness of the value of wetlands has led to the maintenance and enhancement of many wetlands in Manitoba.

Wetland Facts

Forty-one per cent of Manitoba is covered by wetlands and peatlands.

Approximately 24 per cent of the world's wetlands are found in Canada.

Between 1986 and 2003, the North American Waterfowl Management Plan spent $110 million to enhance wetlands and waterfowl.

Through the North American Waterfowl Management Plan, over 1.3 million acres of habitat in Manitoba has been protected through land title transfers, binding long-term conservation agreements or restrictive covenants.

Wetlands provide homes for about 45 species of waterfowl, 115 species of marsh birds and at least 50 animals such as grouse, rabbit, deer, beaver, mink and muskrat. Private sector initiatives have resulted in the protection of at least one million hectares of wetlands in Canada.

A Valuable Resource

Groundwater

In Manitoba, groundwater is an essential resource. Many rural and urban residents rely on this resource for all of their domestic needs. Groundwater is also used for livestock watering, irrigation, industrial processing, heating and cooling.

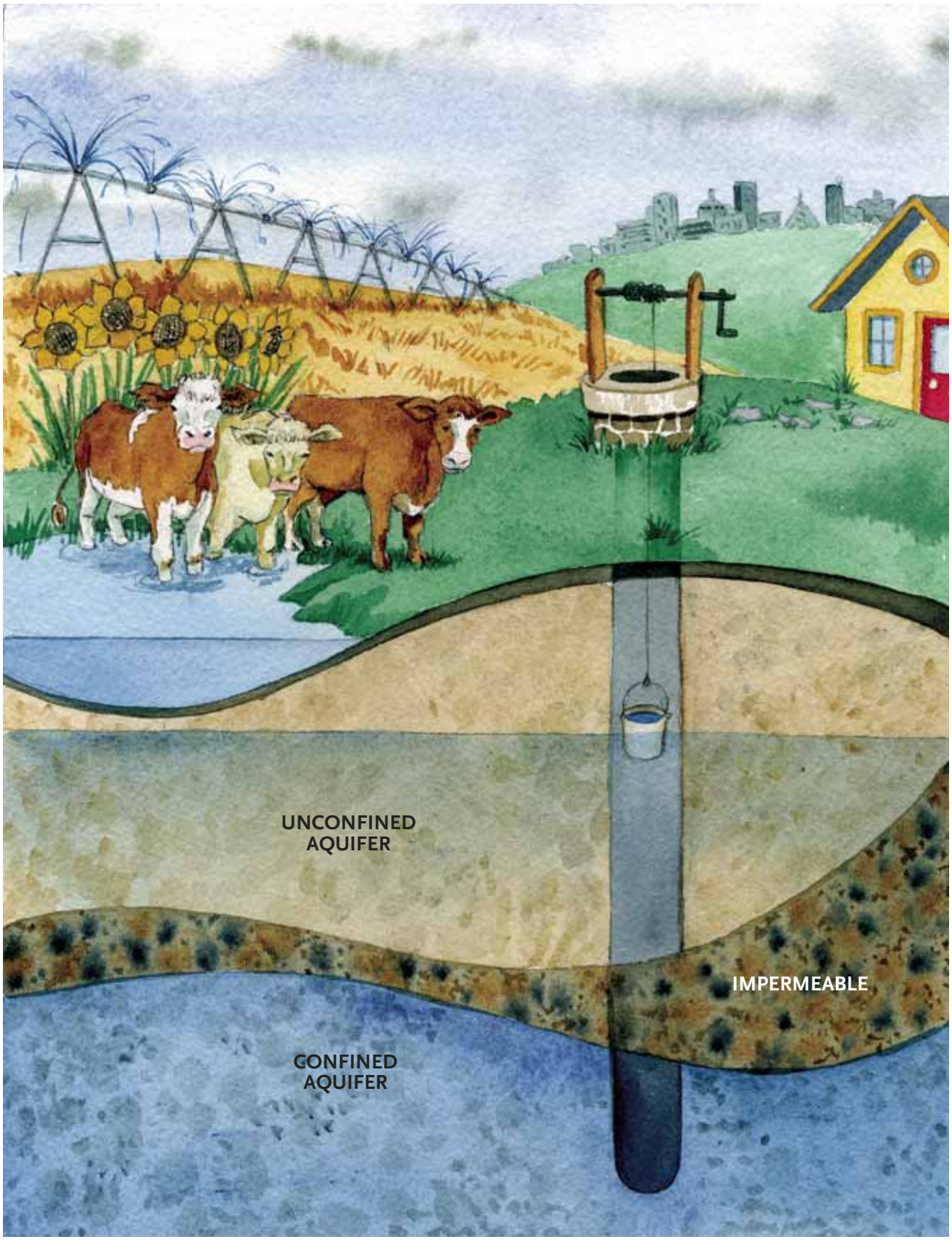
Groundwater Movement

Water percolates into the ground through spaces between grains of sand or silt, or in cracks and crevices in solid rock, then may continue to move down into an underlying aquifer. Areas where groundwater moves downward into an aquifer are termed recharge areas; areas where ground water moves out of an aquifer as seepage or springs are termed discharge areas. Groundwater moves from recharge areas to discharge areas over a period of weeks or months but may take thousands of years or longer where recharge and discharge areas are seperated by tens or hundreds of kilometres. The rate of ground water movements varies – in a year, water may move hundreds of metres in fractured limestone, tens of metres in coarse sand or only a few centimetres in heavy clay.

Recharging an Aquifer

Groundwater recharge occurs primarily in the spring when winter snows melt and spring rains begin. Less frequently, groundwater recharge occurs in the fall after plant growth has stopped or after heavy rainfalls in the summer. Most recharge occurs in areas where sand or gravel is found at the surface or where bedrock aquifers are found at shallow depths. Recharge rates are very low in areas underlain by thick clays. Groundwater often makes its way back up to the surface, discharging into rivers, lakes, or marshes through natural springs or seepages.

Groundwater resources can be depleted if the rate at which the water is used is greater than the rate of natural replacement. This can result from overpumping or a reduction in the recharge rate during drought periods. Water levels in some smaller aquifers in Manitoba, that were low from the drought conditions of the 1980s, were recharged at normal or above normal rates after heavy rains in the mid-1990s.


UNCONFINED
AQUIFER
IMPERMEABLE
CONFINED
AQUIFER

Drinking Water Source

Some of Manitoba's groundwater is too saline or salty to be used for drinking water or irrigation. Other aquifers are low in salts and provide excellent drinking water such as the Oak Lake Aquifer, south of Virden, and the Assiniboine Delta Aquifer, in the Carberry area.

Although the quality of Manitoba's groundwater is generally good, local water quality problems are present. In some areas of the province, the concentration of uranium, fluoride, boron, arsenic, radium, iron, manganese and nitrates in groundwater exceeds drinking water quality guidelines. Taste and odour problems in groundwater can sometimes be related to high iron content or to the growth of iron-loving bacteria in the well. Bacteria that thrive on sulphur can produce odorous gases in some groundwater.

Man-Made Water Quality Problems

Many groundwater quality problems are natural, but some have been caused by human activities. Some sources of contamination include leaching underground petroleum storage tanks, holding tanks and sewage lagoons. Industrial waste disposal, municipal landfills, and septic fields may, in some cases, pose problems. Spills of fertilizers and pesticides near groundwater wells and leaks from intensive livestock holding areas can also cause contamination. Poor well construction or maintenance may be a contributing factor to groundwater contamination.

High nitrate concentrations have been found in groundwater at a number of sites across the province. Manure and chemical fertilizer are two potential sources of nitrate contamination in groundwater. The *Canadian Drinking Water Quality Guidelines* recommend that water should not contain more than 10 milligrams of nitrate-nitrogen per litre of water. Infants under six months are susceptible to nitrate poisoning - a condition called blue baby syndrome. Nitrates reduce the ability of the blood to carry oxygen, causing infants to develop a bluish skin colour.

Monitoring Groundwater Quality

Manitoba Water Stewardship monitors groundwater quantity and quality in the province. Data are used to determine the suitability of water sources for domestic consumption and the availability of groundwater for withdrawl, and to evaluate the impacts of land activities on groundwater quality. Recently, non-governmental agencies have participated in these programs. Landowners participating in these studies have benefited from knowing the quality of their water supplies.

Did You Know?

- **About 27 per cent of Manitobans rely on groundwater for their domestic needs. Of the 387 public water systems in Manitoba, 215 rely on groundwater sources.**
- **To help protect groundwater, Manitoba Conservation enforces legislation controlling the installation, operation, removal and abandonment of petroleum storage tanks.**
- **Two-thirds of the world's freshwater is found underground. However, more than half of Manitoba's water is found on the surface.**
- **Boiling will not remove nitrates from your drinking water supply. Have your groundwater tested. The maximum acceptable concentration in drinking water is 10 milligrams of nitrates (nitrate-nitrogen) per litre.**
- **In Manitoba, groundwater regulation and management are carried out by Manitoba Water Stewardship.**
- **Groundwater is an important source of irrigation water for rural Manitoba, particularly over the Assiniboine Delta Aquifer in the Carberry area.**

What You Can Do

- Follow label instructions and use fertilizers and pesticides at a safe distance from wells.
- Locate livestock holding pens far away from wells and in areas where seepage into groundwater will not occur. Wells should be properly cased and the surrounding land graded in such a way that water drains away from the well. Livestock should not have access to wells.
- Promptly repair faulty septic fields.
- Repair leaks from home heating oil tanks.
- Repair and clean up petroleum spills. Report spills to your nearest Manitoba Conservation office.
- When constructing a new well, select a well-drained location far away from septic fields, outhouses, livestock holding areas or manure piles. Use a licensed driller and ensure there is an effective casing grout to prevent seepage of surface runoff between the well casing and borehole.
- Properly seal all abandoned wells.

A Valuable Resource

Water Use

Manitoba has an abundance of water and it plays an important role in our daily lives. Water uses include drinking water, recreation, irrigation, industrial operations and aquatic life and wildlife habitat.

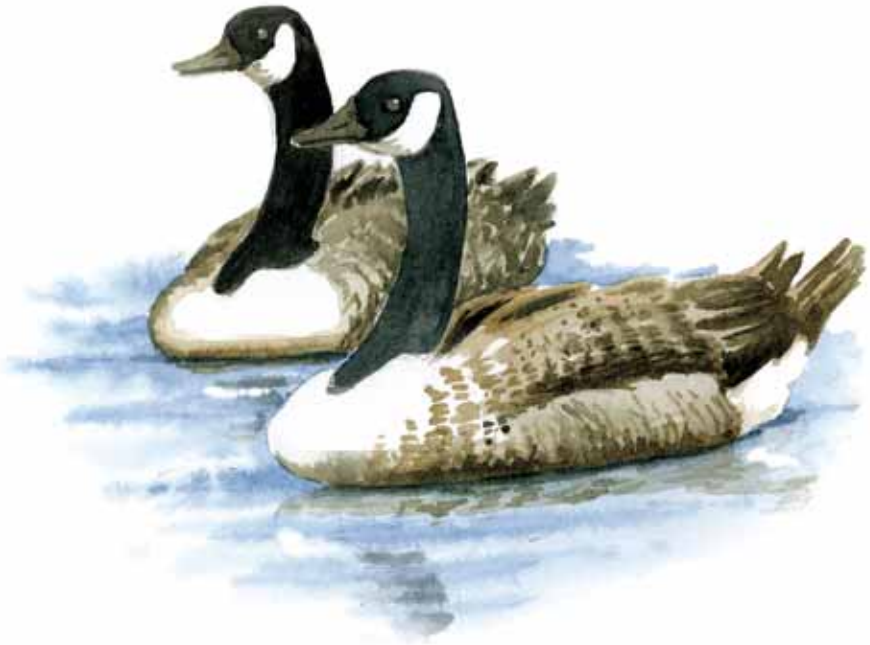
Many Economic Uses

Surface water is a vital element for a wide variety of economic uses. About 73 per cent of Manitobans rely on surface supplies for their drinking water. Most of Manitoba's electrical energy is generated from surface waters. Most of the province's other industrial water needs are also provided by lakes and rivers. Dugouts, ponds and streams are used extensively by Manitoba farmers for watering livestock, irrigating crops and drinking water. Though much less significant today on a province-wide basis, surface water is still an essential mode of transportation of goods and raw materials for many communities along the northeast shore of Lake Winnipeg. In addition to providing an essential raw material for our economic needs, surface water across the province is used to absorb our domestic, municipal and industrial wastes.

Ecological Value Important Too

Economic interests often cause us to forget about the significance of surface water for its ecological value. Surface water provides vital habitat for a wide range of aquatic life including fish, insects, aquatic plants and algae. Ponds, streams and other surface waters also provide drinking water and habitat for wildlife.

Many of our economic uses rely indirectly on vital ecological processes that occur in surface water. For example, our surface water supports over $30 million in commercial fishery, a domestic fishery that provides a major protein source for remote aboriginal communities, and a recreational fishery valued at many tens of millions of dollars.



Major Water Uses

- **Domestic consumption** - is the use of water for drinking, food processing and other household uses. About 73 per cent of Manitoba's population consumes surface water for drinking purposes; the remaining 27 per cent use groundwater.
- **Habitat for aquatic life and wildlife** - about 16 per cent of Manitoba's surface area is covered by lakes, streams, wetlands and other waterbodies, providing valuable habitat for aquatic life communities such as fish, rooted plants, algae, aquatic insects and shellfish. Habitat is also provided for semi-aquatic wildlife and waterfowl, muskrats, beavers, ducks and geese.
- **Industrial consumption** - both surface water and groundwater are used by various industries in Manitoba: pulp and paper, mining, food processing, smelting, manufacturing and distilling. Water is required in numerous industrial applications as boiler feed, cooling water and process water.
- **Irrigation** - surface water and groundwater are used to irrigate field crops and greenhouse plants. Irrigation demand is increasing as Manitoba's agricultural community diversifies to meet ongoing economic challenges, including growing potatoes and specialty crops. Lawns, gardens, golf courses and park areas in urban and rural regions also require irrigation water.
- **Livestock watering** - surface and groundwater are used by the agricultural sector for watering livestock and poultry. Good quality water is crucial to the livestock industry for the proper growth and development of cattle.
- **Recreation** - surface water in Manitoba is used for primary and secondary recreation. In primary recreational activities - swimming and water skiing - immersion is likely. Contact with the water is limited and usually incidental in secondary recreational activities, like boating.

Manitoba Water Quality Standards, Objectives, and Guidelines

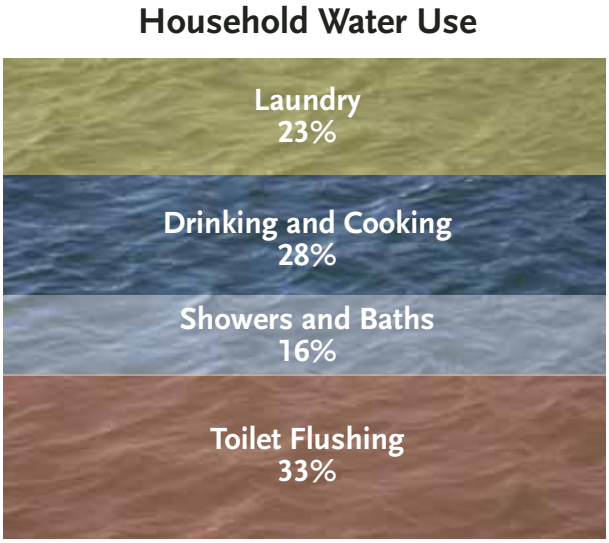
Manitoba Water Quality Standards, Objectives and Guidelines are used in Manitoba to protect the quality of water for domestic consumption, aquatic life and wildlife, industrial consumption, irrigation, livestock watering and recreation. The standards, objectives and guidelines specify the acceptable concentrations of over 80 substances - including mercury, fecal coliform bacteria, organochloride pesticides, phosphorus and dissolved oxygen - for specific water uses. For example, the objectives state that drinking water should contain no fecal coliforms while water for recreational activities should have fewer than 200 fecal coliforms per hundred millilitre sample. The province ensures that water is protected for specific uses by setting enforceable limits for the quality of industrial and municipal discharges under *The Environment Act.*

The *Manitoba Water Quality Standards, Objectives and Guidelines* document is available on Manitoba Water Stewardship's website: **www.manitoba.ca/waterstewardship**

A Valuable Resource

Household Water Use

Water conservation should be practiced at home and at the cottage. Every day, the average Manitoban uses about 227 litres of water in their home. A recent study from the Rural Municipality of St. Andrews suggests that in households, 33 per cent of the water is used to flush toilets, 16 per cent for baths and showers, 23 per cent for laundry and 28 per cent for drinking, cooking, dishes, water softener regeneration and lawn and garden watering.



Using Water Wisely

Water is wasted in many ways and can be used more wisely by reducing, repairing and retrofitting. You can reduce your water use by making a conscious effort to use less whenever possible. Repairing leaks in taps, toilet tanks and pipes can save water and money. Replacing older and inefficient toilets with efficient six litre per flush or dual flush toilets could reduce the water you use indoors by up to 25 per cent. If you are replacing your appliances, consider purchasing water and energy efficient washing machines and dishwashers.

Did You Know?

- **When sewage systems become overloaded with excess water, poorly treated or untreated water enters and contaminates Manitoba's lakes, rivers, streams and aquifers.**
- **Not all water efficient toilets are created equal. Manitoba Conservation contributed to a study to determine which toilets flush the most material.**
- **During the summer, lawn watering can increase water use by 50 per cent or more.**
- **One drip per second wastes 10,000 litres of water per year – enough to fill 200 bathtubs per year.**
- **A leaking toilet can waste up to 200,000 litres of water per year - enough to fill 4,000 bathtubs per year.**

What You Can Do

In General

- Turn taps off tightly so they do not drip.
- Repair tap, faucet, pipe and hose leaks promptly.
- Plant native drought-tolerant plants in areas you normally water around your house and cottage to reduce outdoor water use and provide habitat for birds and butterflies.

In the Kitchen

- Only use a dishwasher when full; use the cycle that requires the least water.
- Hand-wash dishes in a partly filled sink. Instead of using running water to rinse dishes, fill a separate sink or use the faucet spray attachment.
- Keep a container of drinking water in the refrigerator instead of running tap water until it is cold.

In the Bathroom

- Check for toilet tank leaks and repair promptly. Toilets use the largest proportion of household water. Use toilets only for their intended purpose.
- Do not flush paper towels, cotton swabs or cigarette butts. Never flush paints, solvents, pesticides, or other chemicals since these are hazardous to the aquatic environment - the eventual recipient of all those toilet flushes.
- Water efficient six litre or dual flush toilets are available and are practical for home and cottage use. Check the Canadian Water and Wastewater Association website **www.cwwa.ca/** for the latest list of water efficient toilets that work well.
- Use a partially filled sink rather than running water continuously while washing your hands.
- Short showers use less water than full baths. For bathing, fill only half the tub with water.
- Use a water efficient shower head.

Laundry

- Front loading washing machines tend to be more water and energy efficient.
- Only use the washing machine when full; use the cycle that requires the least water.
- Adjust the water level if smaller washes are necessary. If you have a septic system, limit the number of loads per day to avoid overloading it.

Water Softeners

- Regenerate water softeners only when needed. Consider a softener system that regenerates based on water quality not on the number of days since the last regeneration.
- Only use softened water where necessary. Consider using unsoftened water for drinking and cooking.

Outdoors

- Water your lawn only when it needs it. Lawns require only 2 - 3 centimetres of water per week. Some sprinklers have an attached measuring well to determine the volume of water used. You can determine it yourself by collecting water in a pan. Be sure to include rain in your weekly calculations.
- Plant drought-tolerant flowers, grasses, shrubs and trees in areas of your yard that you would normally water. Consider letting your lawn go naturally dormant during hot periods of the summer by not watering.
- Drip irrigation or soaker hoses are the best methods for conserving water while watering vegetables and herbs.

- A low-level sprinkler is the best type to use for watering the lawn; an oscillating sprinkler loses up to 50 per cent of the water to evaporation.
- Cut your grass to a height of 5 - 8 centimetres and leave the grass clippings on the lawn. This shades their roots during hot weather and will help retain moisture.
- Shrubs and young trees usually require watering only once a week while becoming established.
- Transplanted or young garden plants should be watered deeply and more often to help plants establish deep root systems.
- Use organic mulch around flowers, shrubs, and trees and incorporate compost into your garden soil to help retain moisture.
- Washing your car with running water can use up to 400 litres of water. Use a bucket, a sponge and a trigger nozzle on the hose to reduce water consumption.
- Instead of washing leaves, soil, and debris off a driveway or sidewalk, use a rake and broom.

A Matter of Quality

Pollution Source

A combination of natural factors and human activities contribute to the varying quality of surface water and groundwater in the province. Salts, arsenic, uranium and wildlife waste are some of the natural substances that can pollute water. Human contributions include contamination from leaking septic fields, municipal wastewater facilities, petroleum storage tanks, fertilizers, pesticides, pharmaceuticals and livestock waste.

Non-point Source Pollution Harder to Control

Pollution is commonly referred to as either point source or non-point source. Point source pollution is direct, concentrated discharge such as sewage effluent. On the other hand, non-point source pollution is usually less concentrated and diffuse in its entry to a waterbody, and therefore much more difficult to control and regulate.

Although point source discharges from industrial and sewage plant operations were thought to be the largest contributors to water pollution, it is now widely recognized that non-point source pollution is equally, and sometimes more significant. Rainwater and snow-melt water pick up nutrients, oil, grease, litter and soil and carry them to rivers and lakes. Soil may carry fertilizers, pesticides and heavy metals. These pollutants may harm aquatic life and make the water unsuitable for other uses such as recreation or drinking.

How Non-point Source Pollutants Affect Manitoba's Water Quality

Persistent Pollutants Remain in Water for Years

Pollutants that reach Manitoba's waterways and affect water quality are classified as either non-persistent or persistent. Sewage, fertilizers and some household cleaning products are examples of non-persistent or degradable pollutants. Non-persistent pollutants can eventually be broken down and their damaging effects can often be reversed or mitigated.

On the other hand, persistent pollutants degrade slowly and remain in the water for years. They may bioaccumulate up the aquatic food chain, exposing animals, birds and people who eat fish to unacceptably high concentrations of chemicals. This can result in animal and human health risks and serious environmental damage. Persistent pollutants include some pesticides, oil, or specific compounds of oil and metals such as cadmium, lead and mercury.

Did You Know?

- **Manitoba's abundant freshwater supplies are among the cleanest in the world. Sometimes people waste this valuable resource because of its low cost and abundance.**
- **The province has few industrial facilities that release effluents into rivers and streams.**
- **Trash, old bed springs and used tires look unsightly in our waterbodies and cause public concern, but are not generally considered a human health risk. However, it is illegal to dispose of items like this in surface water.**
- **In Manitoba, local interest and river stewardship groups have played a large role in cleaning up rivers and removing unnatural, physical barriers to fish migration.**
- **As of 2005, there were 200 contaminated sites in Manitoba where groundwater or surface water was contaminated. These represent approximately 10 per cent of all contaminated sites in the province.**

A Matter of Quality

Bacteria and Other Pathogens

Disease-causing organisms in water include bacteria, viruses and protozoa. Examples include *Salmonella,* Norwalk virus, *Giardia* and *Cryptosporidium*. These pathogenic organisms can be discharged directly to waterbodies or can be transported with surface runoff. Sources are numerous and include wildlife waste, discharge of treated and untreated sewage and runoff from agricultural activities.

Illnesses Contracted by Swimmers

The most common illnesses contracted by swimmers are infections of the eyes, ears, nose and throat. These infections can be caused by bacteria, such as *Pseudomonas aeruginosa* and *Staphylococcus aureus* which are most frequently transferred from one bather to another in crowded swimming areas.

The second most common group of illnesses is stomach upset, or gastroenteritis, typically caused by *Salmonella* bacteria or intestinal viruses. As the number of fecal bacteria increases, so does the frequency of illness. Symptoms of gastroenteritis include mild fever, vomiting, diarrhea and stomach cramps.

Escherichia coli - Recreational Water Quality Indicators

In Manitoba, water quality objectives have been adopted for *Escherichia coli (E. coli)* bacteria to ensure safe levels for recreational water. *Escherichia coli* belong to a group of bacteria called fecal coliforms that originate in the digestive tract of warm-blooded animals, waterfowl and humans. *Escherichia coli* do not normally cause illness themselves, but when present in large numbers are often associated with more harmful disease-causing organisms. They are known as indicator bacteria.

The allowable maximum number of indicator bacteria in recreational water is 200 *E. coli* per 100 millilitres of sample. A number of scientific studies have been undertaken to examine the relationship between illness rates of bathers and water quality. When the guideline is exceeded, swimmers who frequently immerse their head in water have a slightly higher probability of contracting gastroenteritis compared with other bathers. Extensive studies have been undertaken by Manitoba Water Stewardship to determine the source of occasionally high *E. coli* counts on Lake Winnipeg

beaches. Studies have shown that large numbers of *E. coli* are present in the wet sand of beaches. During some periods of high winds, when water levels are rising in the south basin, these bacteria can be washed out of the sand and into the swimming area of the lake. Research has shown that less than 10 percent of the *E. coli* at Lake Winnipeg beaches is from human sources, with the remaining numbers from birds and animals.

Manitoba Water Stewardship, in conjunction with Manitoba Health, has developed the *Manitoba Clean Beaches Program* to provide valuable information for you and your family on how to protect our beautiful beaches and reduce health risks.

Protect the Beach

The following beach hygiene tips will help keep our beaches clean:

- Please don't feed the shore birds. Gulls can quickly become accustomed to eating and residing on the beach.
- Don't litter or discard food on the beach. Dispose of trash in proper receptacles.
- Don't bring your pets. Pets are not allowed on provincial park beaches and on most beaches in rural municipalities.
- Change diapered children frequently and away from the water's edge.
- Never bury waste in the sand.

Protect Yourself and Other Bathers

The following personal hygiene tips are recommended:

- Wash your hands before handling food. The simple action of washing your hands before touching food will reduce your risk of ingesting harmful organisms that may be on the beach.
- Avoid swallowing lake water when playing or swimming.
- Stay away from the water if you are experiencing digestive or intestinal problems.

Drinking Water Quality

All surface water sources must be disinfected prior to use as drinking water. Disinfection is a key step included at all municipal water treatment facilities. However, cottagers, hikers, canoeists, wilderness travellers and private homeowners with their own water source need to ensure that all water consumed is safe and free of disease-causing organisms. Like other jurisdictions, Manitoba routinely recommends that untreated surface water not be used for drinking purposes. Disinfection is the minimum treatment required. Consumption of untreated water may pose unacceptable health risks.

Did You Know?

- **Boiling is one of the oldest, safest, and most effective methods of disinfecting water. Water should be held at a slow, rolling boil for at least one minute to ensure parasites such as *Cryptosporidium* and *Giardia* are killed.**

- **Each year, more than 60 major beaches across Manitoba are monitored for recreational water quality. Results are available on the Manitoba Water Stewardship website: www.manitoba.ca/waterstewardship.**

- **Water quality data collected from major beaches in Manitoba since the early 1980s indicate that water quality is generally excellent. Slightly elevated indicator bacteria densities are occasionally detected at some beaches and at a slightly increased frequency at Lake Winnipeg beaches. Upon re-sampling, densities have quickly returned to below the guideline.**

- **Beaver fever is an ailment sometimes contracted by campers, hikers, and others when untreated surface water is consumed. It is caused by the parasite *Giardia lamblia*. Symptoms include mild to severe diarrhea, cramps and a lack of appetite. Symptoms may take 10 - 15 days to appear and persist for six to seven weeks.**

What You Can Do

- Most water can be successfully treated to produce safe drinking water regardless of its quality. However, preventing contamination is the best way to protect the existing good water quality in many of our lakes, streams, rivers and dugouts.

- When you are out in the wilderness hiking or canoeing, take along a container of clean drinking water instead of using potentially contaminated surface water. If you use surface water, boil it for one minute or treat it with a water disinfectant. Household bleach is an effective disinfectant for bacteria and most viruses in drinking water. Add two drops (0.1 millilitres) to one litre of water, shake, and then let stand for 30 minutes. Four drops of bleach in each litre of water may be required to effectively disinfect water that is cloudy or odorous.

- Wise watershed management practices include ensuring your holding tanks and septic fields are operating properly, controlling contaminated runoff from your property and forming watershed stewardship groups with your neighbours.

A Matter of Quality

Nutrients in Water

Aquatic plant life, an essential component of the aquatic food chain and a healthy aquatic environment, generally depends on the availability of nitrogen and phosphorus. An excess of these nutrients can lead to an over-abundance of plants which can have a progressively detrimental effect on our lakes and rivers.

Sources of Nitrogen and Phosphorus

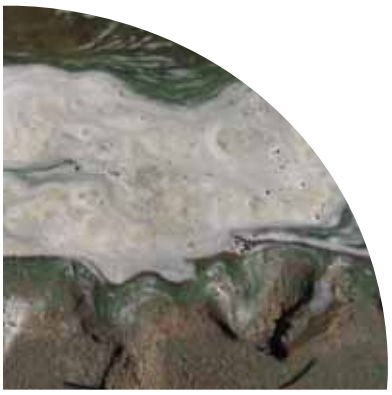
Nutrients are commonly found in:

- human sewage
- drainage from bog areas
- greywater
- pet and livestock feces
- lawn and garden fertilizers
- cleaning products
- agricultural fertilizers
- leaching or weathering of rock
- industrial effluent
- soil erosion

How Nutrients Affect the Aquatic Ecosystem

Water temperature, clarity, depth, the amount of dissolved oxygen, available nutrients and plant growth are all interrelated. The growth of aquatic plants and algae requires the penetration of sunlight through the water in combination with sufficient nutrients. In turn, the dissolved oxygen produced by these plants is essential for fish and aquatic insects. A progressive increase in nutrients causing excessive plant and algal growth can eventually have a profound effect on the physical, chemical and biological characteristics of the lake or river. Often, different plant and fish species begin to appear while those less tolerant to changing conditions begin to disappear.

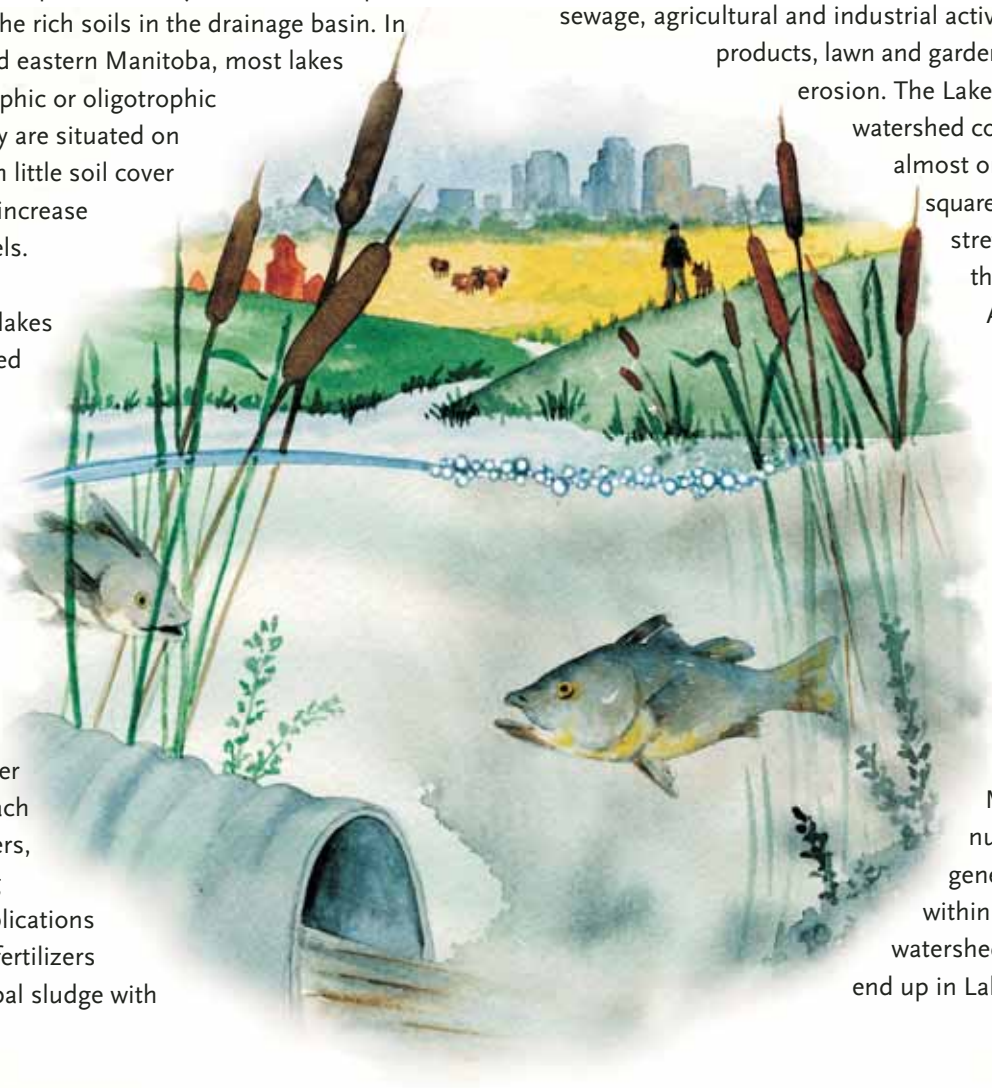
Lakes are categorized as either oligotrophic, mesotrophic, or eutrophic, depending on the concentration of nutrients. Clearwater Lake and West Hawk Lake are oligotrophic - they are deep and cold, and have low concentrations of nutrients. Mesotrophic lakes, like Barren and Brereton lakes, are warmer with enough nutrients to support weeds and occasional algal blooms. Eutrophic lakes are usually shallow and enriched with an overabundance of nutrients. The south basin of Lake Winnipeg is eutrophic and may have dense algal blooms because of excess nutrients.



Eutrophication -
A Natural Process

Eutrophication is the natural aging process for all lakes. Under normal conditions, this process takes thousands of years. Enriching our lakes with nutrients from municipal wastes, industrial wastes, poor land-use and fertilizer practices and faulty septic systems can artificially accelerate the process of eutrophication to a few short years. A nutrient-enriched or eutrophic lake will have frequent algal blooms and excessive weed beds along the shoreline. Fish kills are more frequent in these lakes because the low oxygen content is further depleted as excess plant material is decomposed, especially during winter.

On Manitoba's prairies, many lakes are eutrophic because of the rich soils in the drainage basin. In northern and eastern Manitoba, most lakes are mesotrophic or oligotrophic because they are situated on bedrock with little soil cover to naturally increase nutrient levels. Although Manitoba's lakes are influenced by naturally occurring processes, we can help protect and enhance water quality by ensuring our sewage and greywater does not reach surface waters, by matching nutrient applications of manure, fertilizers and municipal sludge with nutrient residuals in soil and crop uptake needs, by limiting the use of fertilizers on land adjacent to waterbodies, by improving land-use practices and by using phosphate free cleaning products.



Nutrients in Lake Winnipeg

Excessive concentrations of nitrogen and phosphorus in Lake Winnipeg are causing gradual changes to occur in the lake's water quality and biological communities. Nutrients are directly associated with the production of nuisance growths of algae - affecting fish habitat, recreation, drinking water quality and clogging fishing nets. Some nuisance growths of algae can also produce toxins. Nutrients are contributed from virtually all of our activities across the watershed – human and animal sewage, agricultural and industrial activities, cleaning products, lawn and garden fertilizers and erosion. The Lake Winnipeg watershed covers an area of almost one million square kilometres and stretches from the Rockies in Alberta to northwestern Ontario and south into four American states. The watershed is home to eight million people and 20 million livestock. Many of the nutrients generated within this large watershed eventually end up in Lake Winnipeg.

Manitobans need to work together to reduce nutrients in Lake Winnipeg. Industries and municipalities such as the City of Winnipeg are reducing nitrogen and phosphorus released from wastewater treatment plants. Agriculture is improving land use practices and applying manure and inorganic fertilizers based on crop requirements, soil type, slope and proximity to surface water. The Manitoba Government is working with Saskatchewan, Alberta, Ontario and the United States to reduce nutrients that enter Manitoba. We can all help to reduce nutrients to Lake Winnipeg by protecting riparian zones, choosing phosphate-free soaps, keeping septic tanks and fields in good working order, limiting the use of lawn and garden fertilizers and using water efficiently.

Some Nutrients are Toxic

Ammonia, in its un-ionized form, is toxic to fish and other aquatic organisms, depending upon ambient temperature and pH. Groundwater quality is affected by the concentration of available nitrates. High concentrations of nitrate in drinking water can result in nitrate poisoning, a condition known as blue baby syndrome in infants. Nitrate is very soluble in water and can move readily through the soil to the groundwater. Potential sources of nitrate in groundwater include leaky septic systems, animal wastes, industrial wastes and fertilizers applied to home, cottage and agricultural crop land.

Did You Know?

- **Only laundry detergents must limit phosphate content to less than five per cent under federal legislation. Other household cleaning products often contain high amounts of phosphates.**
- **If phosphorus levels exceed 0.025 milligrams per litre, a lake may experience periodic algae blooms. Typical concentrations of phosphorus can range from less than 0.001 milligrams per litre, as is generally found in West Hawk Lake, to more than 1.0 milligram per litre, found in some prairie lakes.**
- **Excessive amounts of the nutrient ammonia (un-ionized) is toxic to aquatic life. Sources of ammonia include animal and human waste.**

What You Can Do

- **Since most of the water used for household purposes in Manitoba is returned to surface water, use phosphate-free soaps and detergents. Ask your local store to stock these products.**
- **Don't use fertilizer on lawns or gardens within 30 metres of the shoreline.**
- **Ensure that your septic system is operating properly and is serviced on a regular basis.**
- **Keep your shoreline in a natural state - don't remove natural vegetation from the water's edge. Near shorelines, use softer and more permeable surfaces (gravel or wood chips) instead of concrete and asphalt.**
- **Prevent shoreline erosion to ensure that soil nutrients do not contaminate surface water supplies.**

A Matter of Quality

Algae

Algae range extensively in size and shape, from microscopic single cell organisms to giant seaweed several metres long. They are an important part of the aquatic ecosystem, providing food and oxygen to many aquatic organisms. Sometimes algae make drinking and recreational water supplies unusable when they reach nuisance proportions.

What are Algal Blooms?

When algae become very abundant and form floating clumps or scums along shorelines, they are called algal blooms. The water looks like thick pea soup and may emit a strong odour. *Aphanizomenon, Microcystis* and *Anabaena* are common types of nuisance blue-green algae found in Manitoba surface waters.

Causes of Algal Blooms

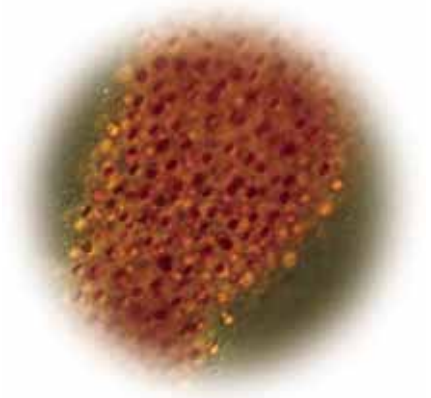
Algae occur naturally in all surface waters. Algal blooms are common in many of Manitoba's lakes, rivers and streams. Nitrogen and phosphorus - found in sewage, greywater, animal feces, fertilizers, or silt from land erosion - can lead to excessive algal growth. Heat, a lack of wind and plenty of sun create optimum conditions for algal growth. Clear water transmits more light and can support more algae when available nutrients are present.

Potential Problems

Extensive algal blooms can cause a number of problems:

- **reduced recreational appeal** - water with a large algal bloom looks murky and smells foul, making it undesirable for swimming, wading and water-skiing.
- **degraded aquatic habitat** - too much algae can result in low oxygen levels in the water when the algae decays, leading to winter and summer fish kills.
- **toxic algae** - some species of blue-green algae produce liver and nerve toxins that can cause illness or death in livestock or pets drinking the water. People have reported incidents of skin irritation from swimming in waters with toxic algae. In addition, drinking water containing toxic algae can cause gastroenteritis, or stomach upset and diarrhea. More serious long-term health effects may result from long-term exposure through drinking water. Because they are likely to swallow water while swimming, it is best to keep small children out of the water where algal blooms are present.
- **drinking water problems** - excessive algae in municipal drinking water supplies can affect the taste and odour. Algal blooms can also increase water treatment costs by clogging water filters.

Aphanizomenon



Microcystis

Anabaena

Prevention is the Best Control

Chemical treatment of surface waters for control of algae can be expensive and is not always practical, successful or legal. Copper-based herbicides (Ex: bluestone) are registered for use in dugouts. It is illegal to apply bluestone to public water without a permit from Manitoba Conservation. Treating water with chemicals may have a negative effect on aquatic life. Prevention is the preferred method for control of algae in surface waters. The most effective long-term control is to minimize the quantity of nitrogen and phosphorus entering the water.

Did You Know?

- **Manitoba Water Stewardship tested a number of surface waters in the province and found liver toxins produced by blue-green algae in many lakes and farm dugouts. Levels in treated drinking water have, at times, exceeded guideline levels.**
- **Evidence suggests that the use of copper sulphate (bluestone) to control algae in reservoirs used for drinking water may lead to formation of nuisance algae that are resistant to this pesticide and difficult to remove by conventional water treatment processes. In addition, copper can accumulate in lake sediments where it could cause harm to bottom-dwelling organisms. Copper levels in Killarney Lake sediments were found to be 50 times higher than other lakes in the area due to bluestone use over the years.**
- **The frequency and intensity of algal blooms can be reduced by minimizing the concentrations of nitrogen and phosphorus in surface waters. When nitrogen and phosphorus are applied to land surfaces in higher amounts than can be used by growing plants in a season, they can runoff into surface water with heavy rainfall, floods and melting snow. Some *Environment Act* licenses for dischargers to surface waters – for example food processing facilities and the City of Winnipeg – contain limits for the amount of nitrogen and phosphorus that can be discharged to rivers, streams and lakes. Regulations are also in place (or in some cases being proposed) to protect water from nutrients that may arise from the over-application of fertilizers, animal manure and municipal wastewater sludge.**

Did You Know?

- **Increased ultraviolet radiation resulting from the thinning of the ozone layer can significantly affect the growth of algae and may affect freshwater and marine food webs. The long-term ecological consequences of this are not well known.**

- **The water quality history of a lake can be determined by looking at the algae and their pigments (chlorophyll) in lake-bottom cores. The cores can be dated to determine whether or not conditions have changed as a result of natural or human influences.**

- **Black algae (*Lyngbya wollei* - also known as *Plectonema wollei*) - a species of algae not normally found in Manitoba - was first found in Betula Lake in the mid-1990s. It has since been found in White Lake. Black algae forms thick carpets or mats on the lake bottom or floating in the water near the shore. The dense, coarse texture of this algae species give it the appearance and feel of wet wool or dog fur, with an earthy smell. It tends to be very dark green or black in colour and is sometimes called "coarse black algae". Abundant masses of black algae growing up from the lake bottom are unpleasant for swimmers and boaters. Black algae also produce a chemical called geosmin which gives a distinct earthy taste and odour to water. Black algae collected from reservoirs in the southern United States have also been found to contain neurotoxins that have similar effects to shellfish poisoning. Neurotoxins may affect humans or animals that directly consume the algae in large quantities - simply touching black algae usually does not expose people to sufficient quantities to be harmful. No toxins from black algae have been found in Manitoba.**

What You Can Do

You can help reduce algal blooms by minimizing the amount of sewage, greywater, fertilizers and silt that reach surface waters.

- **Dispose of domestic sewage and greywater properly.** Build your outhouse or septic field at least 30 metres from surface waters - further if the soil is sandy or rocky. If you have waterfront property with water under pressure, consider installing a holding tank instead of a septic system. Always use low-nutrient cleaning products and keep greywater and sewage from entering lakes and rivers.

- **Use fertilizers carefully.** Do not use fertilizers on land adjacent to a lake or river. Heavy rains or lawn watering can wash fertilizers off the land into the water where algae will use them to grow.

- **Protect and enhance your shoreline vegetation.** Shorelines with little vegetation are easily eroded and allow nutrient-rich runoff water to reach surface waters. Do not mow, let it grow.

Aquatic Plants

Aquatic macrophytes are plants that require a water environment to complete all or most of their life cycle. There are three main types - emergent, floating and submerged.

Types Based on Growth Form

Emergent plants extend above the water surface in shallow areas of lakes, ponds and ditches. They have relatively rigid stems and do not rely on the water for support. Cattails and bulrushes are among the most common types in the province.

Floating aquatic plants may be rooted or free-floating. Free-floating plants obtain their nutrients directly from the water. Rooted floating plants lack stem rigidity and depend on the water for support. Pondweed and yellow pond-lily are common rooted types. Duckweed, a small plant often mistaken for algae, is the most common free-floating aquatic macrophyte in Manitoba.

Some plants, such as bur-reeds, water plantains and arrow-heads share characteristics of both emergent and floating aquatic plants. These plants usually extend out of the water like emergent plants but have floating leaves similar to floating aquatic plants.

Submerged aquatic plants have flexible stems and leaves, are rooted in the sediments and are completely covered by water - although some species have flowers that extend above the surface. Common plants include water buttercups, water milfoils and bladderworts.

The Importance of Aquatic Plants

Aquatic plants are a natural and important part of the aquatic ecosystem. They provide excellent habitat for fish, aquatic insects and terrestrial wildlife. They are an important constituent in the diet of muskrats and moose and are a source of food and nesting material for waterfowl. Aquatic plants help prevent turbidity - cloudy, silty water - by stabilizing lake sediments. They also protect shorelines from excessive erosion by absorbing the force of wave action. These plants use up large amounts of nutrients, reducing the amount available for algal growth and they absorb potentially toxic substances - like mercury and lead - improving water quality.

What You Can Do

- **Disrupt as few aquatic plants as possible - remember that they provide essential habitat for fish and waterfowl.**
- **Don't use herbicides in lakes and rivers - it is illegal.**
- **Consider the role that aquatic plants play as home to waterfowl, fish, amphibians and aquatic insects.**

Did You Know?

- **Aquatic plants do not attract leeches or act as breeding grounds for mosquitoes. Leeches prefer soft sediments in shallow, calm water and will be in these areas whether or not plants are present. Mosquito larvae cannot survive the intense predation by fish and aquatic insects in aquatic plant stands.**
- ***Utricularia* or bladderworts, are common in Manitoba waters. These submerged carnivorous plants trap and consume small insects and aquatic animals that they trap in their tiny bladders.**

Problems Caused by Too Many Aquatic Plants

Excessive growth of aquatic plants in recreational waterbodies and drinking water reservoirs can create a number of problems, including:

- **swimming nuisances** - excessive aquatic plant growth in shallow water discourages swimming and interferes with activities along shorelines and beaches.
- **boating difficulties** - plants clog motorboat propellers and interfere with sailboat centreboards.
- **less appealing drinking water** - aquatic plant decomposition can lead to foul odour, taste and discolouration of drinking water, making more advanced water treatment necessary.
- **less dissolved oxygen in the water for fish** - a result of the decomposition of excessive amounts of aquatic plants. Artificial water aeration has been used in Silver Beach Lake, Oak Lake, Gull Lake and others, to alleviate this problem.
- **dense aquatic plant growth in small streams and drains** - can impede water flow and contribute to flooding.

High densities of aquatic plants may be an indicator of water quality problems. If your lake or river has too many plants, it may mean that there is too much nitrogen and phosphorus entering the water. Check to see which of the following nutrient sources you can control: fertilizers, sewage, greywater, pet feces, cleaning products or shoreline erosion.

A Matter of Quality

Aquatic Insects

Most of us have come in contact with insects such as mayflies, mosquitoes, water boatmen and diving beetles, which spend some or most of their life cycle in the aquatic environment. They can be found in lakes, rivers, streams, dugouts, wetlands and even in the water-filled leaves of the carnivorous pitcher plant.

Aquatic insects occupy a variety of habitats. They live in bottom sediments, swim freely through the water column, attach themselves to submerged rocks and vegetation or walk on the water's surface. Although extremely well adapted to water, they depend directly on the terrestrial environment for at least part of their life cycle.

All aquatic insects require oxygen to survive. Those spending their immature stages as larvae or nymphs in the water must obtain oxygen through their skin or gills. Once these insects develop into adults, they breathe surface air through respiratory tubes at their posterior end or by capturing and swimming with an air bubble under their body, similar to SCUBA divers.

Some aquatic insects, like mayflies, midges, horseflies and caddisflies, emerge as adults in enormous abundance usually because of appropriate environmental conditions (such as temperature and light), foods that are seasonally available (such as plants or other insects), and/or to avoid adverse physical conditions (such as drought or low oxygen levels).

Aquatic insects are essential in the food chain, both in the water and on land. They are food sources for predatory insects, invertebrates, fish, bats and birds. They also help decompose vegetation.

Insects as Indicators of Aquatic Health

The abundance and diversity of aquatic insects are an important indicator of the health of the aquatic environment. Generally, the greater the number of insect and invertebrate species in a particular area of a lake or reach of a river, the healthier the environment. For example, if too much sediment enters the aquatic environment, invertebrate species unable to tolerate these conditions will disappear. This information has been used to develop indices that can reflect ecosystem health. These are being used by Manitoba Water Stewardship to evaluate site-specific conditions.

Did You Know?

- **In Manitoba, there are about 90 families (large groupings of organisms with similar characteristics) of insects with at least one aquatic or semi-aquatic species.**
- **The open seas and oceans are the only habitat where aquatic insects are virtually non-existent.**
- **There are over 300 species of midges in Manitoba, most of which have aquatic larvae. Midges sometimes resemble mosquitoes in size and body-form, but do not bite. On the other hand, there are only 45 species of mosquitoes in Manitoba, most of which will bite humans.**
- **Giant swarms of midges which look like grey smoke, can sometimes be seen along the shores of Lake Winnipeg and Lake Manitoba. These swarms provide food for local and migrating birds.**
- **Only female mosquitoes, blackflies, horse flies and deer flies take a blood meal. They require the protein from blood to produce eggs.**
- **Some biting flies (horseflies, deer flies and stable flies) have a more painful bite than others because of the structure of their mouth parts and how they obtain a blood meal.**
- **Dragonflies are predators as adults and nymphs. The adults hunt and capture their prey on the wing, scooping-up other insects with their front legs. The nymphs stalk their prey along the water bottom. When disturbed, the nymphs 'jet propel' themselves through the water by contracting large muscles forcing water out of their rectum.**
- **The larvae of hover flies (those flies that seem to suspend themselves in air and resemble a bee) can live in polluted water because they breathe surface air through a long retractable siphon. These larvae are commonly called rattailed maggots.**
- **There are at least 150 species of caddisflies in Manitoba. The larvae of some species construct cases around their bodies from materials like sand grains, sticks, leaves and stems, held together with silk. Caddisflies can frequently be seen walking on submerged plants or rocks, carrying their cases.**
- **Although they are not insects, water fleas act as 'water lawn mowers' often controlling the abundance of algae in surface waters.**

What You Can Do

Aquatic insects rely on relatively undisturbed aquatic habitat. You can provide a diverse habitat for the insects by maintaining a healthy population of aquatic vegetation, putting rocks in riffles and leaving some fallen tree stumps in the water.

A Matter of Quality

Sediments and Erosion

Water Wears Away Sediments

Moving water has considerable potential to cause erosion - the gradual wearing away of surfaces. Generally, the faster the water moves, the faster the rate of erosion. Erosion rates also depend upon the nature of the soil. Soils from sloping lawns and fields, stream banks and stream beds are all susceptible to erosion by flowing water.

The products of erosion include tiny particles of silt, clay and sand. The settling of these particles is known as sedimentation. It occurs in locations where slow-moving water loses its ability to transport heavier particles.

The natural rate of erosion can be accelerated by any human activity that increases the rate of water movement or decreases the physical stability of stream beds and shorelines. Obstructions placed in streams - boat docks, piers and dams - speed up water flowing around them and increases the energy that can erode the stream bed or bank. Removing trees, shrubs and rocks from stream banks and shorelines, and tilling fields or gardens close to the water's edge can also increase the risk of erosion.

Land drainage is often necessary but the design of the project must fully incorporate all hydrological considerations. Construction techniques to reduce erosion of the drain include the use of in-stream baffles or rapids made with rocks to reduce erosive energy that might develop, and grass-covered drains to remove sediments from runoff water.

Physical and Biological Impacts of Erosion

Eroded materials that are deposited in waterbodies range in size from very fine silts and clays to coarse sands and gravel. The results of these deposited materials include increased turbidity or murkiness, the formation of deltas, clogging of channels, impairment of flows with an increased risk of flooding and the premature infilling of lakes and ponds. These physical impacts can sometimes be remedied, but dredging and other forms of channel clearing are costly.

Erosion of waterfront properties can mean substantial losses for more than just the property owner. As erosion reduces the value and productivity of land, sediments reduce the value and change the biological productivity in water.

Biological impacts on fish and other aquatic life are more subtle than physical ones. Less sunlight penetrates turbid waters, reducing the growth rate of aquatic plants and algae - the food source for all aquatic organisms including fish. Northern pike and trout - which rely on their vision to feed - are less able to find food in turbid waters. Erosion of stream beds and banks and adjacent yards and fields, directly and indirectly, affects the amount of food available to fish and other aquatic organisms.

What You Can Do

Here are a few things to keep in mind when you are building a boathouse or dock at the water's edge:

- **Fisheries and Oceans Canada has produced a cottagers guide containing helpful information on how to protect your shoreline and build a dock that meets your needs. Information is also provided on the approvals that might be required before you begin to build.**
- **Place only clean gravel - free from fine materials and organic matter - along the lakeshore or riverbank.**
- **When constructing docks, minimize interference with the natural movement of water and sediment by supporting the structure with piles or floats.**
- **Use rip-rap (large rocks) to protect banks from erosion.**
- **Leave as much natural vegetation as possible. When natural disturbances occur, immediately stabilize and revegetate shorelines. Contouring the shape of the shoreline or using untreated logs or timber with rocks will encourage plant life to become established.**

Sedimentation Can Destroy Aquatic Habitats

Sedimentation, especially if erosion occurs on a large scale, or in a very short time period, can physically affect aquatic organisms. For example, benthic or bottom-dwelling organisms, such as clams and caddisfly larvae, can be buried deeply by sediments. Deposited material may also be unsuitable for habitat. Gravel and pebble bottoms - habitat required by stoneflies and some species of mayflies - can also be buried by sediments, making them unsuitable for these organisms. Many fish species, such as walleye, trout, and bass, require coarse sands and gravel for spawning purposes; such spawning sites are destroyed by sedimentation.

Human uses of water can also be affected by erosion. Treatment costs for drinking water escalate when turbidity increases. Also, turbid waters with sediment build-up in beach areas are less attractive to people for swimming, water-skiing and boating.

Did You Know?

- Flood-reduction drainage projects can be a major source of sedimentation in lakes and other waterbodies.
- Erosion of the Edwards Creek drain near Dauphin, constructed more than 40 years ago, has deposited millions of tonnes of sediment into Dauphin Lake creating a new delta.

A Matter of Quality

Contaminants in Fish

Fish are one of the most nutritious low-fat protein sources consumed by people. Although high levels of contaminates in fish flesh have been reported from other Canadian waters (Ex: the Great Lakes), contaminates in fish from Manitoba lakes and rivers have been relatively low.

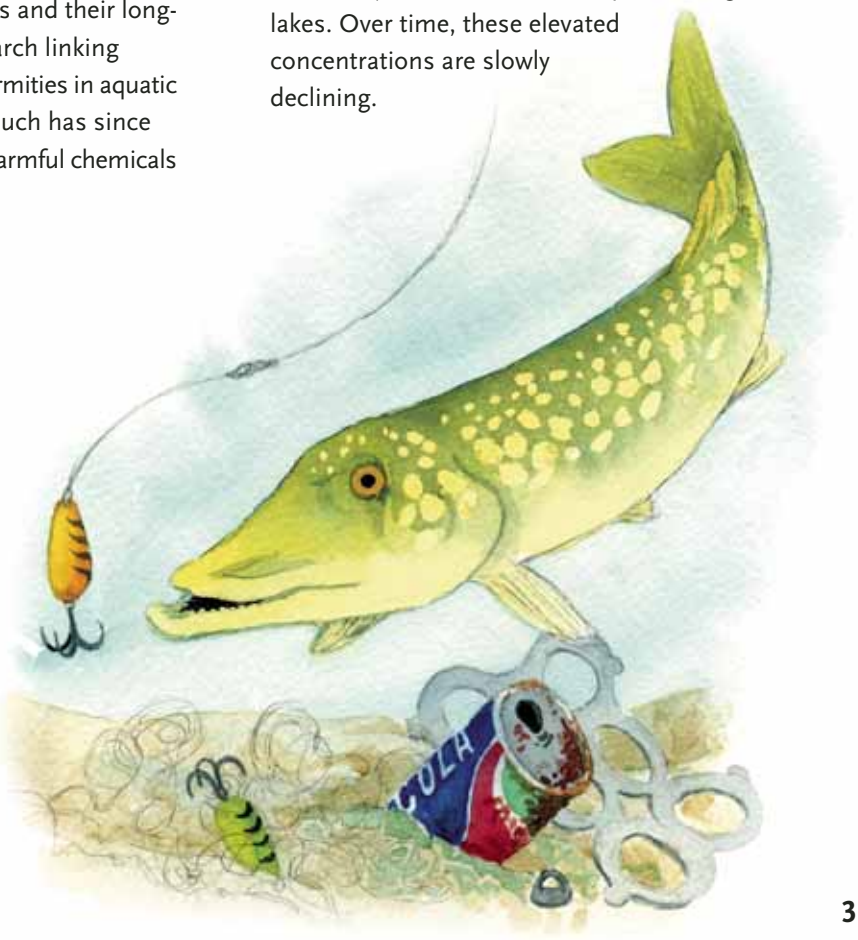
Chemicals in Our Water

In the mid-20th century, the increasing world-wide use of chemicals and resulting health problems brought attention to the possible environmental impacts of toxic chemicals. Impacts on the environment around heavily industrialized sites, such as the Great Lakes, added to public concern about chemical releases and their long-term effects. Thanks to scientific research linking environmental contamination and deformities in aquatic life, and increasing public pressure, much has since been done to eliminate many of these harmful chemicals from reaching aquatic environments.

Mercury in Fish

In Minimata Bay, Japan in the 1950s, mercury in fish was identified as a problem. Many people developed serious neurological disorders and some eventually died from mercury poisoning after eating contaminated fish. In 1969, contaminants in fish became a concern in Manitoba with the discovery of elevated mercury residues in fish from the English-Wabigoon River System in Ontario and in fish from the south basin of Lake Winnipeg. At the same time, mercury contamination was discovered in fish from the Saskatchewan River. This led to the temporary closure of commercial fishing on the Saskatchewan River and Lake Winnipeg in Manitoba. Studies attributed the mercury contamination mainly to discharges from some pulp and paper mills. Controls on the use and release of mercury from industry during the 1970s helped reduce the level of mercury pollution in these areas.

Increased mercury levels were discovered in fish from lakes flooded by the Churchill River hydroelectric diversion in northern Manitoba during the late 1970s and early 1980s. In the newly flooded land, bacteria altered the form of naturally occurring mercury, making it more readily taken-up by fish. This resulted in elevated levels of mercury found in some fish species caught in flooded lakes. Over time, these elevated concentrations are slowly declining.



The Fishing Line

Manitoba is one of the North American leaders in fish conservation. The summer and winter angling opportunities in Manitoba are endless and continue to improve, thanks to good fisheries management and conservation-minded anglers. Manitobans have been fishing barbless since 1990 when new regulations were passed. Barbless hooks help decrease the stress on fish by reducing handling time.

Many Manitobans enjoy fishing for both food and recreation. Whether angling from shore or boat, anglers can do their part to ensure a healthy water environment. Here are a few tips:

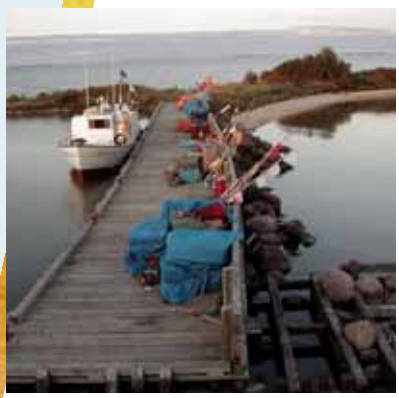
- **Use only live bait that has been obtained from a licensed Manitoba bait dealer or catch your own in designated areas.**
- **Clean fish in a designated area and discard fish remains in the trash.**
- **Always discard fishing line in the trash. Most lines do not decay and can injure fish, birds and other wildlife that get tangled in the line.**
- **Ensure that six-pack plastic rings and metal drink can tabs are placed in the trash-these can also injure fish and other wildlife.**
- **Practise selective harvest and catch-and-release fishing.**

Fish Consumption Guidelines Developed

During the late 1970s, the Government of Manitoba began collecting samples of fish tissue from some of the major river systems in southern Manitoba to determine if there was a problem with the accumulation of metals or persistent chemical residues in fish flesh. Mercury was the only residue found at elevated levels in some fish species from a few of Manitoba's waterbodies. Consequently, a sport fish consumption guideline for mercury in fish was prepared recommending consumption limits for certain sizes and types of fish. For example, according to the most recent guide, fish caught from southern waters can be consumed within certain limits. However, larger northern pike from some flooded northern lakes are not recommended for consumption.

Did You Know?

- **Manitoba surface waters support more than 90 species of fish.**
- **Lake sturgeon - Manitoba's largest fish - have been around for thousands of years. Female sturgeon reach sexual maturity after about 25 years and can live up to 150 years.**
- **If you wear wet wool gloves while handling fish, you can help reduce the damage to the fish's protective slime layer.**
- **The Red River supports a world class channel catfish fishery.**



What You Can Do

- Limit your use of pesticides (insecticides, herbicides, fungicides) as much as possible. Follow the label instructions carefully and dispose of used containers in a safe manner.
- Do not flush chemicals down sinks or storm drains. Take unwanted or unused chemicals to a hazardous waste disposal facility.
- When fishing in Manitoba, refer to the consumption guide for recreationally angled fish to determine allowable limits for eating due to mercury. Those fish not recommended for consumption should be released unharmed.

Did You Know?

- **Mercury is a naturally occurring element that is generally found in low concentrations in air, water and soil. Consequently, mercury residues are naturally present to some degree in plant, fish, animal and human tissues.**
- **The long-term flooding of land, due to natural circumstances or human developments like hydroelectric or flood-protection dams, often leads to elevated mercury levels in the water. Naturally occurring mercury released from soils and rocks is converted by microorganisms to a form more easily absorbed by fish and other aquatic life.**
- **Consumption guidelines have been developed for mercury in fish from some of the major southern and northern lakes and rivers. Southern waters include the Assiniboine, Little Saskatchewan, Pembina, Plum, Red, Souris and Winnipeg river systems. Northern waters include the Churchill, Nelson, Rat and Saskatchewan river systems. This information may be obtained from Manitoba Water Stewardship.**
- **Predatory fish, such as walleye and northern pike, will usually have higher mercury residues than bottom or insect feeding species, such as whitefish or goldeye. Lower mercury residues usually occur in the smaller and younger fish of a species.**
- **Other metal residues in fish - arsenic, chromium, cadmium, copper, lead, nickel, zinc and selenium - are found to be within normal ranges in Manitoba fish and do not pose a health risk to people.**
- **Contaminants, such as PCBs and residues from insecticides like DDT, have not exceeded existing guidelines for commercial sale of fish for human consumption in Canada. Since the banning of PCB production in North America in 1978, traces of PCB residues have declined.**
- **Children under 15 and women of child-bearing age should only eat fish with a mercury concentration of 0.5 micrograms or less per gram of fish flesh and follow advice from the consumption guidelines on acceptable amounts.**
- **Mercury may continue to be found in products such as thermometers, mirrors, batteries, electrical switches and fluorescent light bulbs.**

A Matter of Quality

Invasions of Exotic Species

A Form of Biological Pollution

Exotic species are organisms accidentally or intentionally introduced into habitats where they are not naturally found. World-wide, they have caused damage to aquatic habitat, loss of species diversity and costly damage to drinking water supplies and recreational waters. Approximately 90 per cent of those organisms that are accidentally introduced do not survive. However, the surviving 10 per cent often thrive in the new habitat because of ample food supplies, limited competition for space and other resources, few natural predators and limited natural parasites and diseases.

Exotic species intentionally introduced - like the common carp and purple loosestrife - often have unexpected detrimental impacts. Bottom-feeding carp have stirred up sediments in the Delta Marsh, on the south shore of Lake Manitoba, reducing aquatic plant growth. Purple loosestrife has choked out much of the natural shoreline vegetation along portions of the Assiniboine River. Exotic species are a form of biological pollution, and can be as disruptive to ecosystems as chemical pollution.

While zebra mussels have not invaded Manitoba, they have caused millions of dollars of damage in the Great Lakes including clogging water intakes, severely reducing recreation at beach areas, and reducing species of algae and microscopic aquatic animals that are important in the food web.

Species Threatening to Invade

A number of exotic species have already invaded Manitoba or are located in nearby waters and have the potential to invade and thrive in Manitoba. Exotics already in Manitoba include the wetland plants purple loosestrife and flowering rush, and the fish species common carp and rainbow smelt. Exotic mollusks, crustaceans, fish and aquatic plants poised to invade Manitoba include zebra and quagga mussels, spiny water flea, rusty crayfish, round goby, tubenose goby, white perch, ruffe, curly-leaf pondweed and Eurasian water-milfoil, and others.

What you can do

Boats are the major mode of transportation for zebra mussels and other exotic aquatic species. Boaters, anglers, water-skiers, scuba divers, sailors, float plane pilots and canoeists need to take the following important precautions to prevent the accidental transport of exotic species from one lake or river to another or from neighbouring jurisdictions to Manitoba:

- Inspect your boat, motor, trailer and boating equipment, such as anchor, centreboards, rollers and axles. Remove all visible zebra mussels and other plants and animals before leaving any waterbody. Drain water from the motor, live well, bilge and transom wells onto land before leaving the area.
- Wash or dry your boat, tackle, downriggers, trailer, and other boating equipment to kill harmful species that were not visible at the boat launch. Since some aquatic species can survive more than two weeks out of water, it is important to:
  - rinse your boat and any equipment that normally gets wet, with hot tap water, 40°C or more.
  - spray your boat and trailer with high pressure water - at least 250 pounds of pressure per square inch.
  - dry your boat and trailer in the sun for at least five days before transporting them to another body of water.
- Learn to recognize zebra mussels and other exotic species. If you suspect that zebra mussels or other species have spread to a new location, report it to your local Manitoba Water Stewardship or Manitoba Conservation office.
- Never release live bait or unwanted aquarium fish into lakes or rivers and never release aquatic animals from one waterbody into another.

Did You Know?

- **One female zebra mussel can produce up to one million eggs each year.**
- **The rainbow smelt was first found in Lake Winnipeg in 1990. It has now spread throughout the Nelson River and as far as Hudson Bay.**
- **The zebra mussel was first introduced into Lake St. Clair in the Great Lakes around 1986. Within 10 years, zebra mussels had invaded the Hudson River in New York, the St. Lawrence River near Quebec City, the Mississippi River at New Orleans and a tributary of the Arkansas River in Oklahoma.**
- **Live zebra mussels have been found attached to boats at inspection stations in California. The boats were being transported from the Great Lakes - a distance of over 1,000 kilometres. Zebra mussels can live out of water for up to 12 days, depending on the temperature and humidity.**
- **Results of a survey conducted at Manitoba and northwestern Ontario border crossings showed 93 per cent of the vehicles with boats came from places with zebra mussels. Although five per cent of the boats had been in waters with zebra mussels in the previous five days, no zebra mussels were found on them. Ninety-three per cent of the boaters knew that zebra mussels were present in their jurisdiction of origin.**
- **Since the 1800s, at least 136 exotic species have been introduced into the Great Lakes. About 37 per cent were unintentionally released and 32 per cent were brought in with ship ballast water.**
- **Float planes and scuba divers' wet suits can also inadvertently transfer zebra mussels.**
- **Until a few years ago, plant nurseries were still selling hybrid cultivars of purple loosestrife. Purple loosestife is a weed that chokes out native wetland vegetation, creating a dense purple landscape inhospitable to many species of wildlife. Recent research has shown that the hybrids will cross-pollinate with wild strains and cause further spread.**

A Matter of Quality

Swimmer's Itch

The swimmer's itch parasite is found naturally in many Manitoba lakes. It causes a temporary skin irritation or rash in swimmers who accidentally get involved in its life cycle.

As water droplets evaporate from the skin, the tiny trematode larvae enters a swimmer's pores and dies, leaving an itchy elevated red spot that may last from four to fourteen days. The allergic reaction to swimmer's itch can be extremely annoying but it is not a dangerous infection.

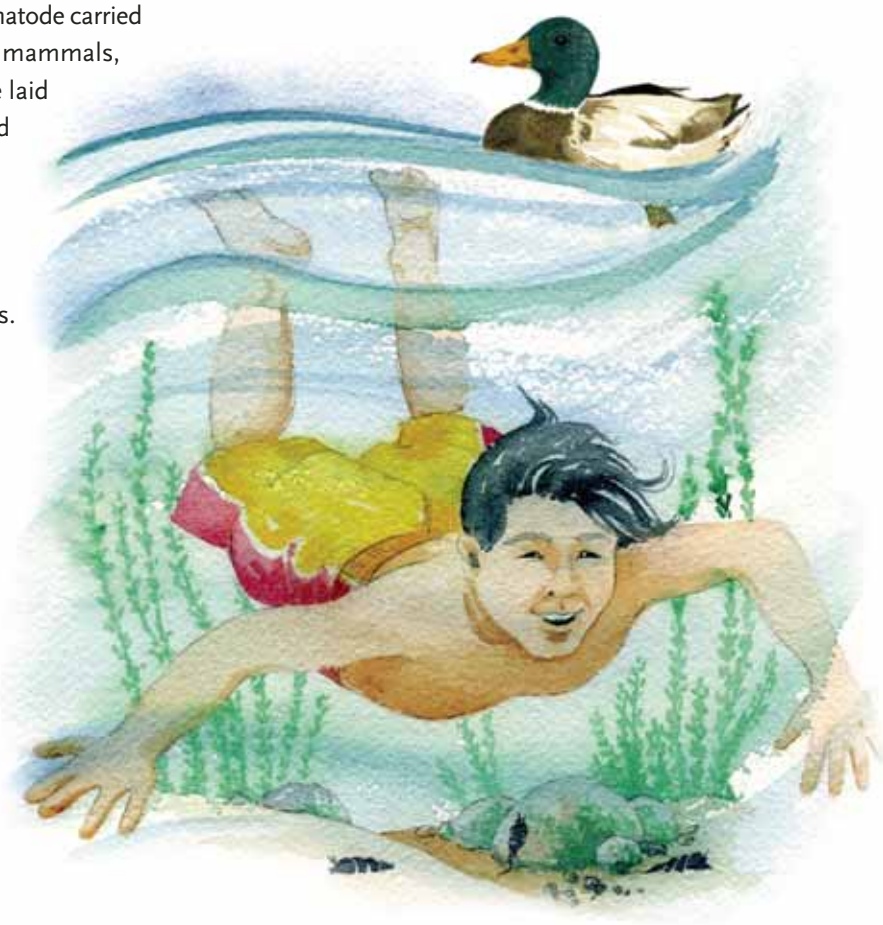
Life Cycle

The swimmer's itch worm is a parasitic trematode carried in the intestines of waterfowl and aquatic mammals, such as muskrat and beaver. The eggs are laid in the host by adult worms and are passed into the water through the host's feces.

While in the water, these eggs hatch into microscopic miracidia (pronounced mir-a-si-dea) that enter the tissue of snails. To complete their life cycle, miracidia develop into cercariae (pronounced sir-care-e-ay) or swimmer's itch worms, that leave the snail and search out a suitable host such as waterfowl and aquatic mammals. Swimmer's itch occurs when the cercariae accidentally penetrates human skin rather than their natural hosts such as waterfowl and aquatic mammals.

Symptoms of the Itch

The first signs of swimmer's itch are noticeable soon after you get out of the water. Once dry, you will detect tingling sensations on exposed parts of your body. The next sign is the development of small red spots where the organism has penetrated through your skin. Hours later, the tingling sensation will cease and the red spots will enlarge and become itchy. The degree of discomfort varies with the individual, the severity of the infestation, and prior exposure. If these symptoms develop, anti-itch medications, such as lotions and some antihistamines will provide relief. Your family physician or pharmacist can recommend the best treatment.



What You Can Do

- If you get swimmer's itch from a Manitoba lake, report it to the Water Quality Management Section of Manitoba Water Stewardship at 945-7100 or 1-800-282-8069 ext.(7100).
- To see if swimmer's itch has been reported at your favourite lake, check the Manitoba Water Stewardship website.
- Avoid swimming in areas known to have swimmer's itch. Check for warning signs posted on beaches.
- Towel down briskly right after leaving the water to help remove the parasite.
- Take a shower immediately after leaving the suspected area.
- Avoid areas with large numbers of aquatic plants. These are ideal habitats for snails and swimmer's itch parasites.
- Although not scientifically proven, some people believe the use of a fragrant suntan oil may reduce the risk of getting swimmer's itch.

Did You Know?

- **Swimmer's itch shows up in some Manitoba lakes every summer. Manitoba Water Stewardship receives reports of swimmer's itch from about three to seventeen lakes per year.**
- **Swimmer's itch usually starts showing up in Manitoba lakes in June - warm water accelerates its development.**
- **Wind can concentrate swimmer's itch parasites in shallow beach areas.**
- **Where outbreaks have been confirmed, the provincial departments of Water Stewardship, Health and Conservation work co-operatively to ensure that swimmer's itch advisory signs are posted to warn beach users.**

What You Can Do

- **Confirm that it is pine pollen - run your hand over other flat surfaces to check if they are also covered in a fine yellow dust.**
- **Do not be alarmed. Pine pollen in water does not present a health concern.**
- **If you are bothered by the sometimes unsightly appearance or odour, avoid using the water until the pollen has dissipated. The pollen should disappear in about a week.**

Did You Know?

- **Pollen production and release is a natural process and its presence will not affect the overall water quality of a lake.**
- **The grains are produced in enormous numbers and the process in forests is referred to as pollen rain.**
- **Pine pollen is a source of food for a number of fungi and microscopic animals.**
- **When a pollen grain is viewed under a microscope, tiny wing-like structures can be seen protruding from its sides. These wings aid in wind dispersal and provide buoyancy in water.**
- **Pollen deposited on lakes can sometimes form dense floating mats, trapping algae and other debris along shorelines.**
- **Since pollen grains float on the water surface they rarely enter submerged water intake lines.**
- **Pine pollen is sometimes mistaken for chemical spills or atmospheric fallout of sulphur from smelters.**
- **Fossilized pollen grains in lake sediments have been used to determine pre-historic climatic conditions and plant communities in an area.**

A Matter of Quality

Pine Pollen
Unsightly but Harmless

Manitoba Water Stewardship has received many calls about a mustard-yellow substance floating on the surface of some lakes, streams and ponds. Although this substance may look like an oil or chemical spill, it is more than likely pine pollen. On surface waters, pollen may look unsightly and even give off a foul odour as it decomposes, but it is not harmful. Pollen usually dissipates within a week, as the grains are consumed by aquatic organisms, are washed up on shore, sink to the bottom or decompose.

You can quickly check for pollen by running your hand over other outdoor flat surfaces - your car, a lawn chair, a composting bin lid. If you pick up a fine yellow dust, you can be fairly certain it is pine pollen you see in the water.

Pollen Producers

Manitoba is home to three species of pine trees - jack, white and red pine. Jack pine is by far the most numerous and produces most of the pollen grains. Generally, pollen is released in early June in southern Manitoba and towards the end of June in northern parts of the province. Although spruce and poplar trees also produce pollen, their contribution is generally much less than that of pine trees.

Pollen and the Pine Life Cycle

In the jack pine, microscopic pollen grains are produced in the small, yellow, male cones (microsporophylls) found in clusters at the end of branches or twigs. These are not to be confused with the larger, curved and less numerous female cones (megasporophylls), which contain the egg cells. Several hundred male cones, each capable of producing hundreds or even thousands of pollen grains, are commonly found on a single pine tree.

Pollen production and dispersal are necessary stages in the pine tree life cycle. Pollen grains are borne by the wind after their release from male cones. A chance meeting with a female cone results in pollination and fertilization of egg cells and the eventual formation of pine seeds. The entire reproductive process - from pollen release to seed production - can take up to three years depending on the species. Pines produce an enormous amount of pollen to ensure an adequate number of pollen grains come in contact with female cones.

Natural Foam

Each year, foam is seen on some Manitoban surface waters. In some cases, foam is the result of man-made pollution, but often the presence of foam can be a completely natural phenomenon. Lakes and rivers with large amounts of organic plant material can produce foam under turbulent water conditions.

How Foam is Produced

When aquatic organisms such as algae die and begin to decompose, fatty acids are produced. These fatty acids are very similar to those found in common soap products. Wave action or river currents cause the fatty acids to form foam, often accumulating along shorelines and river banks, coves and eddies. On some lakes, the foam can form long streaks, called Langmuir streaks.

Is It Natural or Man-made Foam?

Foam is generally white in colour, breaks down relatively quickly and smells like fish or earth. Foam from silt or erosion is usually a dirty brown colour. In contrast, foam from detergent will have a noticeable perfume smell from the additives which give your wash a fragrant scent. Foam caused by detergent pollution suggests there could be a serious pollution problem.

Did You Know?

- **Large amounts of natural foam have been observed on Sturgeon Creek during periods of heavy rains. Both the agitation of the water by rainfall and the addition of organic material with runoff probably contributed to the foam production.**
- **Small streams often have pools of foam where fish hide from predators.**
- **In Manitoba, foam is more likely to form in the softer water of the Precambrian Shield - for example, Caddy Lake in the Whiteshell Provincial Park and Black Lake in Nopiming Provincial Park.**
- **Natural foam has a somewhat earthy or fishy aroma and it breaks down quite quickly.**
- **Isolated tundra ponds near Churchill often have natural foam along their shoreline caused by the breakdown of plant material and high winds.**
- **Natural foam is often seen in early morning and is usually gone by midday.**

Protecting the Water

Shorelines

Shorelines are one of the most attractive features of Manitoba's lakes and rivers. In addition to the view, shorelines offer people a place to swim, tie a boat or build a dock. Shorelines also provide essential habitat for numerous plants, fish and animals.

Causes and Effects of Shoreline Erosion

Owners often remove rocks, trees, and other vegetation from the shoreline to build structures or pathways or provide access to water for livestock. This can result in shoreline erosion. Excessive wave action created by using power boats and personal water craft too close to the shoreline also causes erosion.

Water quality deteriorates when the shoreline is eroded. The addition of soil and plant material to surface water increases the amount of phosphorus and nitrogen in the water, leading to increased plant and algae growth. Increased silt affects aquatic life and creates murky waters. When silt settles, it collects between rocks and pebbles reducing the spawning success of fish. Silt also makes it more difficult for fish to find aquatic insects to eat.

Vegetative Buffer Reduces Erosion

A vegetative buffer of trees, shrubs and grasses extending 30 - 50 metres from the waterline provides water quality protection. It prevents erosion by holding soil, provides a wildlife corridor and habitat and shades and cools the water for aquatic life during the summer months. In addition to stabilizing the shoreline, a well-maintained vegetative zone will filter out sediments, nutrients, pesticides and heavy metals carried by rain and snow-melt runoff.

You can reduce erosion on your property by maintaining a vegetative zone through grading, planting a permanent vegetative cover and improving soil stability. Removing vegetation to improve access or the view, leads to erosion, gullies and bank slumping. The short-term gains from tilling to the water's edge are lost when more land disappears during a heavy rain or snow-melt, or from large waves during storms.

Livestock with direct access to the water's edge can damage or destroy the vegetative zone. Stream banks and shorelines become trampled, destroying vegetation and exposing bare soil to wind and water erosion. In addition, fecal material is introduced directly into the lake or river, increasing health risks to drinking water or recreational users.

What You Can Do

- **Maintain or enhance the vegetative zone. Allow natural vegetation to grow or plant more trees and shrubs with deep root systems along your shoreline. This will slow down nutrient rich runoff and help prevent shoreline and bank erosion.**
- **Reduce the accessibility of surface water to livestock. Instead, pump water to troughs.**
- **Leave large boulders along your shoreline to stabilize it and provide habitat for terrestrial and aquatic organisms, like turtles, waterfowl and fish.**
- **Re-establish vegetation on steep slopes by holding groundcover seedlings in place with mulch and loose-weave mesh or burlap.**
- **Build steps or a ramp for access between the top and bottom of the bank.**

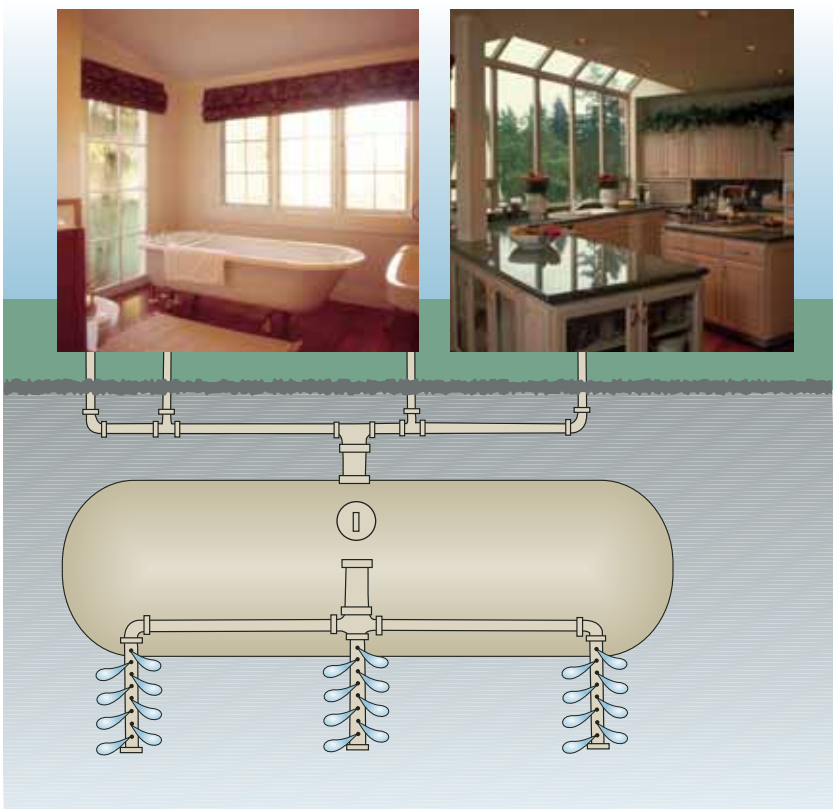
Did You Know?

- **Root systems of grasses, shrubs and trees hold soil and help prevent erosion from wind and water.**
- **Access points to stream crossings by cattle, all terrain vehicles and other large machinery exposes the stream to land runoff, carrying silt and pollutants, like herbicides, pesticides and fertilizers.**
- **Altering your shoreline will affect water quality for downstream users.**

Sewage

Holding Tanks Best for the Environment

Proper treatment and disposal of sewage is essential for the protection of water quality. Most urban Manitobans are serviced by municipal wastewater treatment plants. Rural residents use septic fields, holding tanks or ejectors for sewage disposal. Outhouses may be found on cottage properties. Pump-out systems - like holding tanks - generally provide the highest level of protection to surface water and groundwater. The sewage is hauled to a wastewater treatment plant or sewage lagoon and treated before being discharged to the environment. Holding tanks must be checked regularly for leaks.



Septic Systems Safe if Used Properly

A septic tank and leaching field is a subsurface system. Household sewage and greywater flow by gravity or are pumped into the septic tank. In the tank, heavier particles settle to the bottom, while grease and oil rise to the top. Solids, oil and grease remain in the tank while the liquid effluent flows out into the leaching field. Microscopic organisms begin to break down the waste before it leaves the septic system. Once it filters into the ground, the sewage effluent is further broken down by bacteria and organisms in the soil.

Septic systems are effective when they are located in the proper soil type - one that allows the effluent enough time for treatment before it reaches groundwater or surface water. When the system is improperly installed or used, it can become a public health and environmental hazard.

Outhouses should be used only for sewage disposal and should be located at least 30 metres from the shoreline. Greywater should be disposed of in a septic field or holding tank. Composting toilets that meet National Sanitation Foundation (NSF) international standards are another safe alternative.

Septic System Problems

Failure to pump out the tank - if your septic tank is not pumped out regularly, the solids may flow into the leaching field, clogging the bed or backing up into your house.

Overloaded systems - septic fields are often too small for the volume of waste generated, having been designed before the addition of dishwashers, extra washrooms, or other high water-use appliances. Sewage may pool above the leaching bed of an overloaded system because the soil is saturated.

Improper installation - when the water table is high or when a field is built with improper fill, the saturated soil conditions can cause pipes to break or to become blocked.

Treatment failure - septic fields built in coarse, sandy soils may appear to be functioning properly but the effluent may be passing through the soil too quickly for treatment. Contaminants like phosphorus and nitrates will then enter the groundwater or nearby lakes or rivers, leading to contamination of domestic groundwater supplies or proliferation of algae and other aquatic plants in nearby surface waters.

What You Can Do

The life expectancy of a septic system under optimum conditions is about 15 to 25 years. Regular maintenance will keep your system operating properly.
Follow these steps:

- **Have your septic tank pumped out regularly by a qualified hauler. Keep a sketch of the location of your septic system handy for service and repairs.**
- **Do not drive or park vehicles or erect buildings or decks over the system.**
- **Plant grass, trees and shrubs downhill from your system - these plants will absorb nutrients, preventing them from reaching surface waters.**
- **Practice water conservation to keep from overloading your system. Install water-saving devices, such as low-flush toilets and low-flow faucet aerators.**
- **Dispose of oil, grease and cigarette butts in the garbage and place vegetable scraps and coffee grinds in your compost. Solid material will clog the field, resulting in costly repairs.**
- **Keep paint, paint thinners, drain cleaners, pesticides and other chemicals out of your septic system to protect beneficial microorganisms that break down wastes.**
- **Use only environmentally sensitive products in your home (see *Environmentally Sensitive Choices* on page 52). Locate your septic field at least 15 metres from a well and 30 metres from an uncased well.**
- **Harmful bacteria, viruses, and nitrates from your field could render your drinking water unfit for consumption. Have your drinking water tested if in doubt.**
- **If your system shows symptoms of failure call a qualified service contractor immediately. This will save you money in the long run and protect the environment.**

Did You Know?

- **A Gull Lake water quality study found that septic fields were a significant source of nutrients, causing severe algal blooms, extensive aquatic weed growth and fish kills. The Gull Lake Basin Management Board worked co-operatively with the local municipal government to pass a by-law requiring cottages to convert from septic fields to holding tanks. The cost of a pump-out is less than a hundredth of the cost of a septic system replacement.**
- **Manitoba Conservation has regulations in place controlling the location, installation and operation of septic systems, holding tanks and outhouses. Call the nearest Manitoba Conservation office for more information or a copy of the regulations.**
- **Manitoba Conservation has a sewage system inspection program in provincial parks.**

Signs of Failing Systems

Common symptoms of failing septic systems include:

- unusually green or spongy grass above the leaching field
- offensive odours, particularly after a rain
- slow-draining sinks and toilets, sludge back-up into the house
- sewage pooling above the field

Protecting the Water

Lawn and Gardens

Many a cold winter's night is spent planning the dream yard - lush green lawns, beautiful flower beds and well-stocked vegetable gardens – all free of weeds and insects. Unfortunately, we often assume the perfect yard requires the continual application of chemical fertilizers and pesticides.

Whether you own a large rural acreage or a small city lot, what you put on your lawn has a great impact on the quality of surface water and groundwater in the surrounding watershed. As well, the continuous use of chemicals can eventually result in unhealthy lawns and gardens that become dependent on the chemical fix. By using traditional or alternative fertilizers and pesticides properly, you can create a beautiful, healthy, environmentally-friendly yard.

Responsible Fertilizer Use

Most commercial fertilizers are man-made and easy to use because the amount of nutrients being applied is known; however, they do not enhance the organic content of the soil. Most synthetic fertilizers are water soluble and may leach out of the soil. Organic fertilizers, such as manure, are beneficial because they increase the organic matter and help hold moisture in the soil. However, too heavy an application of any fertilizer, synthetic or natural, can burn plants. Applying more nutrients that can not be absorbed by the plant may result in excess fertilizer entering surface water or leaching to groundwater.

Soil composition is an important consideration when applying fertilizers to enhance plant growth. Heavy clay soils will retain more fertilizer than sandy, silty soils. Homeowners with lawns on the edge of a stream, river or lake need to take special care to prevent fertilizers from entering surface water where they will encourage nuisance plant growth and may cause fish kills. In Whiteshell Provincial Park, the thin layer of soil covering the bedrock cannot hold much fertilizer, therefore it eventually leaches to surface waters.

Various landscaping techniques are available to keep fertilizer from draining off your property into surface waters. A vegetative buffer of trees, bushes, shrubs and natural grasses will minimize natural disturbance of soil, slow surface runoff and filter sediments and nutrients before they reach the lake or stream.

Use Pesticides with Care

Pesticides are toxic chemicals used to eliminate or control unwanted insects, plants or other organisms. Indiscriminate pesticide use can be toxic to both beneficial and nuisance insects and plants. Pesticides can also leach through the soil and end up in groundwater and surface water. Once in lakes and streams, they may become a threat to aquatic life. Some chemicals bioaccumulate or become more concentrated through the food chain, resulting in long-term negative effects to animals such as an inability to successfully reproduce. In addition, fish and wildlife may accumulate concentrations of toxins making them unsuitable for human consumption.

Alternative Fertilizers and Pesticides

Fertilizers:

- Well-rotted manure - livestock waste adds organic material, opens up soil to air and helps retain water.
- Compost - rotted plant material adds rich organic material to soil and planting beds.
- Mulch - bark chips, straw, leaves or grass clippings smothers weeds, helps retain soil moisture and maintains warm soil temperature.

Pesticides:

- Companion planting of marigolds with tomatoes and potatoes will ward off nematode worms. Planting garlic and onions throughout the garden will reduce insect pests.
- Bacterial insecticide - biological pesticides that kill specific insects without harming non-target species are available. For example, *Bacillus thuringiensis,* diluted in water and sprayed on plants, controls cabbage loopers and other leaf-eating pests.
- Mechanical or manual maintenance - for example, consider removing Colorado potato beetles by hand.

What You Can Do

- Keep areas along lakeshores and stream beds naturally vegetated; minimize the removal of rocks, grasses, shrubs and trees along the shoreline.
- Use fertilizers and pesticides sparingly; use fertilizers in multiple applications rather than one large application; use alternative fertilizers and pesticides whenever possible. Compost leaves or other organic matter to prevent debris from entering lakes or rivers.
- If you live in Winnipeg, and have too many leaves to compost in your back yard, take part in the city of Winnipeg's *Leaf It With Us* program. The city composts leaves and the resulting compost is used for landscaping.
- Compost kitchen and garden wastes to provide a natural supplement to yards and gardens.
- An inexpensive and easy-to-construct composter can be made from chicken wire and two-by-fours. The two-by-fours should be coated with a non-toxic protector such as linseed oil.
- Xeriscape your yard - it requires less pesticide, fertilizer, water and maintenance. Put plants with similar water needs together, use compost and manure to improve water retention and percolation in soil, irrigate efficiently, reduce lawn area; choose native plants or those from similar zones and use mulches to reduce surface evaporation of water.
- Avoid using railway ties for landscaping or dock construction. Railway ties are generally treated with creosote, which is a mixture of toxic chemicals. These chemicals can leach into the soil or water and are toxic to plants and people. As an alternative that is less damaging to plants, wildlife and people, use lumber or timber treated with chromated copper arsenate.

Did You Know?

- **A typical garden hose can use 180 litres of water in just five minutes.**
- **Organic or natural fertilizers, such as manure and sewage sludge, are beneficial only if used properly; over-application can be just as detrimental to groundwater and surface water as the over-application of inorganic or man-made fertilizers.**
- **Manitoba Water Stewardship has been monitoring surface water in the province for pesticide residues since 1972. Concentrations of lindane, atrazine, simazine, bromoxinil and 2,4-D have occasionally exceeded levels for protecting aquatic life. Drinking water guidelines in treated water have not been exceeded. Levels of 2,4-D are slightly elevated in the Red River north of Winnipeg, which could suggest over-use of this pesticide by homeowners and commercial applicators.**
- **Composting is the natural decomposition or breakdown of organic material, like vegetable scraps and grass clippings, into a dark, soil-like substance called humus.**
- **Up to 30 per cent of the waste produced by each householder can be composted in the backyard, reducing domestic waste and extending the lives of landfill sites.**
- **Decomposition is accomplished by soil microorganisms, such as bacteria and fungi, that produce enzymes to digest organic materials in compost piles.**

Protecting the Water

Household Hazardous Waste

There are many products used in, and around our homes, cottages, garages, boats and cars that may not look hazardous, but can injure people or damage the environment if improperly used or disposed. Hazardous products are those that contain chemicals considered toxic to humans, aquatic life, wildlife, or have other harmful properties, like high flammability.

Examples of Hazardous Household Products

- household bleach, drain cleaners, oven cleaners, furniture polishes, aerosol spray cans
- oil-based paint, wood stains and preservatives, turpentine, paint strippers, solvents
- pesticides - weedkillers and bug sprays
- gasoline, diesel fuel, motor oil, antifreeze, transmission and brake fluid, car batteries
- photographic chemicals

The Damage They Do

Products containing lye, phenols, petroleum distillates and trichlorobenzene are toxic. These products should never be poured down drains, storm sewers, nor placed in the garbage. When they reach our streams, rivers, and lakes, they can kill or cause chronic problems, such as cancers, lesions and infertility in aquatic wildlife.

Hazardous household cleaners can disrupt the natural biological processes taking place in a septic system. In addition, not all of the toxins in sewage hauled from a holding tank or flushed down the toilet into a sewer system will be removed at a sewage treatment facility. Proper disposal can minimize the amount of contaminants reaching our rivers, lakes, streams and groundwater.

Antifreeze should never be poured on the ground where it can poison pets and wildlife and potentially contaminate surface water and groundwater.

Proper Disposal

Many hazardous household products can be disposed of at hazardous household waste depots or are now being accepted in recycling programs. If you throw them in the garbage, toxic waste accumulates at landfill sites.

Product Label Tells The Story

If you want to know if a product is hazardous, read the label. Labels may include the words DANGER, POISON, CAUTION, and WARNING or the following danger symbols:

Corrosive substances, like battery acid and drain cleaners eat away at many materials.

Toxic materials are poisonous to you, your children, your pets and wildlife. Examples include rat poison, bleach, pesticides, cleaning fluids, antifreeze and some medications.

Reactive bleach and pool chemicals can explode or produce deadly vapours.

Flammable substances, like lighter fluid, turpentine, and gasoline, ignite easily.

What You Can Do

- **Avoid purchasing products that are toxic and hazardous.**
- **If you must purchase toxic products, buy only the amount you need, read the label carefully and use the product only as directed.**
- **Keep unused products in their original containers so the label can be referred to for product use and disposal.**
- **Store hazardous products in a safe place and handle them with care.**
- **Recycle items such as old batteries and used oil whenever possible.**
- **Keep sawdust, cat litter or another absorbent material handy in case of an accidental spill.**
- **Use hazardous chemicals far from wells, cisterns or waterbodies.**
- **Never pour household chemicals down the drain, storm sewer or on the ground.**
- **Find out if your community has a program for the disposal of hazardous materials; if it does not, suggest your local government start one.**
- **See if your neighbour can use your leftover hazardous household products or exchange those products at community events, like paint swaps.**
- **Some used building supply stores will also accept partial cans of paint and other products.**
- **Miller Environmental Corporation, a hazardous waste company, holds Hazardous Household Waste Days for Winnipeg homeowners to discard unwanted toxic chemicals.**
- **Some municipal waste disposal grounds recycle hazardous materials. Miller Environmental Corporation holds over 10 recycling events in rural Manitoba every year. Check with your local recycling program or municipality for events planned in your area.**
- **Organize a Storm Drain Marking event with your classroom or neighbours to inform people that water from the street enters storm drains and ends up in our lakes, rivers and streams.**

Environmentally Sensitive Choices

Consumers have many choices, including a wide range of environmentally friendly products. Whenever possible, choose those less likely to harm the environment. In most cases, reading the product label will help determine whether or not the product contains hazardous substances.

Is it Really Biodegradable?

Purchase biodegradable products - those that are broken down in the environment by micro-organisms. Substances can also be degraded by light, heat and chemicals naturally found in the environment. Some or all of these processes can act together to degrade or decompose a substance. Examples of biodegradable material include sewage, fertilizers and some household cleaners. Be cautious of the product claims - as of 2006, in Canada there are no legal requirements to substantiate that a product is biodegradable, environmentally friendly, green or non-polluting.

Look for the EcoLogo

Environment Canada's Environmental Choice Program ensures that products or services carrying the EcoLogo are leaders in environmental responsibility. This is not only true for the product itself, but can apply to the packaging or to the end product. EcoLogo products and services can improve energy efficiency, reduce hazardous by-products, contain recycled materials or may be reused. When you see the EcoLogo, it is an indication that the product or service has been rigorously examined or tested to ensure that it is a better environmental choice.

Explore the Alternatives

There are thousands of commercial products to clean, remove, eliminate or kill unwanted substances or pests. There are also many cheaper and less harmful methods to achieve the same result. For example, instead of using an insecticide, sprinkle chili pepper or borax across ant entrance trails to discourage and repel them.

Keep in mind that much of what you flush, rinse and dispose of down the drain will likely end up in rivers, lakes or groundwater. Many of these products are cleaners. Check your local library or the Internet and explore the alternatives. Consumers buying environmentally friendly products will encourage manufacturers to produce more environmentally sensitive products.

Safer Household Cleaners

Elbow grease: probably the most reliable and dependable

Baking soda: a good scouring and deodorizing agent that can be used for cleaning appliances, vinyl, stainless steel sinks, toilets, deodorizing rugs and drains

Vinegar: in water, it is a great glass cleaner - undiluted, it removes mildew

Pure soap: a good all-purpose cleaner for anything from clothes to dishes to boats

Borax: sodium borate or borax is a natural mold inhibitor and can be used to deodorize and clean floors, walls and tiles

Natural oils: mixtures of lemon oil, mineral oil and even olive oil can be used for furniture and wood polish, including wooden floors

Did You Know?

- **Manitoba is committed to reducing the amount of solid waste produced in the province.**
- **The two cents environmental charge on all non-deposit non-dairy beverage containers sold in Manitoba is helping finance recycling programs across the province.**
- **Over 90 per cent of Manitoba's municipalities now have recycling services available.**

What You Can Do

- **Phone the company if you cannot find the information that you need on the product label - some companies now have 1-800 numbers listed on their products.**
- **Buy phosphate-free detergents for laundry and dishes.**
- **Purchase products with the EcoLogo stamp of approval.**
- **Buy biodegradable products.**
- **Purchase products with minimal packaging. Buy refills and reuse your containers. Call suppliers if you feel they are using too much packaging.**
- **Reuse grocery bags, or better still, use cloth bags while shopping.**
- **Carry your own coffee mug to avoid using disposable cups.**
- **Consider reusing before recycling.**
- **Try the following alternatives to household insecticides: to remove food sources store cereals in air-tight containers, store excess flour in the freezer, clean crumbs and sticky spills and use fly paper rather than bug spray. Remove clutter, especially in damp areas of your basement, to eliminate hiding and breeding areas for unwanted pests.**
- **In your garden, pull weeds and pick harmful insects off your plants.**
- **Use diatomaceous earth or plant chrysanthemums for their natural insecticidal qualities.**

Protecting the Water

Boating

Whether for water sports, fishing or a pleasant ride on a sunny summer day, boating is a large part of recreational water activities. However, boats can have a negative impact on the aquatic environment. Good boating practices can ensure water quality is protected in the province's lakes and rivers.

Fuel Spills Toxic

Small spills of fuel in the water can be toxic to aquatic life and render the water unusable for drinking. To avoid spills, carefully fill fuel tanks using a funnel and check tanks and motors regularly for leaks. Whenever possible, fill fuel tanks on shore. It is a good idea to carry rags on board to soak up fuel spills, oil leaks and other substances that could end up in the bilge, and eventually, the lake. There are absorbent devices that can be placed in the bilge to help clean oil and gas spills.

Sewage and Greywater Contamination

Sewage and greywater from boats should always be pumped out into proper disposal facilities. Human waste contains disease-causing organisms (e.g. *Salmonella*) that can contaminate water or beaches and cause illness.

Most large boats are equipped, and older boats can be retrofitted, with holding tanks. Find out where pump-out facilities are available in your area. Remember, greywater typically contains nutrients. Avoid discharging greywater overboard.

Maintaining Your Boat

Boat cleaning and maintenance can introduce toxic chemicals to our lakes and rivers. Washing your boat with phosphate-free soaps and detergents on dry land is recommended. Paints and paint removers are toxic to the aquatic environment. Keep paint chips out of the water by scraping your boat away from the water's edge on a tarpaulin. Dispose of paint chips safely. A well-maintained motor and boat will help keep our water clean.

Use these environmentally safe cleaners instead of the traditional harsh ones:

- **baking soda** - can be used as a scouring agent for shower areas and toilets. To clean stains on fibreglass, use salt and baking soda.
- **vinegar and water** - can be used to wash windows and decks. Use vinegar, salt and water to clean brass and chrome and to remove mildew.
- **olive oil** - can be used as a natural wood polisher.
- **hydrogen peroxide** - can be used in place of bleach as a disinfectant and whitener.

Rusted Pop Cans an Eyesore

No one likes to canoe into a calm little cove during a wilderness adventure only to see a pop can nestled in the cattails. One of the most visible effects of careless boating on water quality is the garbage left behind by boaters. Not only is garbage unsightly, but some items, in particular six-pack plastic rings, can trap, injure or kill wildlife.

Styrofoam containers are easily blown overboard. Pack a garbage bag or use reusable containers.

What You Can Do

- **Handle oil, gasoline, transmission fluid and antifreeze carefully on your boat. Avoid over-filling the fuel tank.**
- **Stop passengers from throwing garbage overboard; collect garbage and discard it in the trash.**
- **Use a non-toxic antifreeze for winterizing your boat since this gets discharged on your first launch.**
- **Avoid driving motor boats in shallow water. Propellers can damage spawning areas, disturb aquatic vegetation and stir up mud, clouding water and recirculating nutrients.**
- **Wash your boat on dry land only; avoid using harsh cleaners, soaps, or detergents.**
- **Do your part and pick up any garbage you see in or around your lake.**
- **Reduce your speed when driving your boat close to shore.**
- **Power boats can be environmentally sensitive if maintained and operated properly. However, as an alternative, consider using manual powered boats (sailboat, canoe, paddle boats). It is good for your health and the environment.**

Did You Know?

- **In Manitoba, regulations under *The Canada Shipping Act* make it illegal to discharge sewage from a boat in designated waterbodies. These designated waterways include the Red River from the United States border to Lake Winnipeg, the Assiniboine River from the St. James Bridge to the Red River and all of Shoal Lake that lies within the Manitoba boundary. More designated waterways are planned for the future.**
- **The Transport Canada Boating Restriction Regulations require a 30-metre band along shorelines where power boats are limited to a speed of 10 kilometres per hour. This protects both shorelines and swimmers.**
- **The Mid-Canada Marine Dealers Association Inc. has installed sewage pump-out stations on the Red River and on Lake of the Woods.**
- **Boats may affect nesting waterfowl by driving adult birds from their nests, exposing eggs or young to predators.**
- **In Manitoba, it is illegal to litter.**

Reduce Your Speed

There is nothing like going full throttle in a motor boat on a hot summer's day. That is, until you consider the negative impact this activity could have on the lake environment such as; shoreline erosion, increased turbidity and plant growth and destruction of fish spawning sites and waterfowl nests.

Increased wave action from motor boats and personal water craft, especially in areas where waves do not naturally occur, will erode shorelines. Eroded sediments may reduce depth, cloud water and introduce nutrients into the water. The nutrients will increase the growth of algae and aquatic weeds, reducing the recreational appeal of the lake.

Power boats, including personal water craft, can stir up bottom sediment in shallow water, causing murky waters and increasing the release of nutrients into the water. Fish often spawn in the shallow shoreline areas of lakes. Operating these craft too close to shorelines can destroy spawning areas and disturb waterfowl nests. Out of respect for your neighbours and wildlife, reduce your speed appropriately.

Protecting the Water

Pet Waste

All streets, sidewalks, parking lots and other paved surfaces act as direct pipelines to surface waters. Whatever your pet leaves behind will be washed into the nearest waterbody.

Stoop'n Scoop the Poop

Most urban dwellers have likely seen, and perhaps even smelled, a winter's accumulation of pet feces in popular walking areas such as parks, railway tracks and riverbanks. Pet feces on sidewalks, streets and parks will be washed into surface waters during rainstorms or snow-melt. Like human waste, animal waste may contain harmful bacteria and viruses, rendering the water unfit for irrigation, recreation, or other uses. In addition, pet waste contains nitrogen and phosphorus - nutrients that will accelerate the growth of nuisance algae and aquatic weeds. Pet waste can also destroy grass, flowers and shrubs.

Did You Know?

- **In the City of Winnipeg it is illegal to leave pet wastes in public areas.**
- **Runoff from residential areas is usually contaminated with animal feces.**
- **Concerned residents tested the water at four storm sewers that drain the streets surrounding Truro Creek in Winnipeg. Fecal coliform levels from the one-time test were greater than 2,000 fecal coliforms per hundred millilitres of water. This is much higher than levels recommended for recreational water.**
- **Fecal bacteria can survive for extended periods of time in lake and river sediments.**

What You Can Do

- **Always clean up your pet's feces and dispose with your trash.**
- **Carry a pooper scooper and plastic bags whenever you walk your dog.**
- **Ask your local government to post signs in parks reminding people to pick up after their pets.**
- **Consider supplying plastic bags and trash cans for easy disposal.**

For More Information

Give Us a Call

Manitoba Water Stewardship's web site at **www.manitoba.ca/waterstewardship** has more information on all of the topics discussed in this handbook. Web sites for other government departments such as Manitoba Conservation **www.manitoba.ca/conservation** may have information on programs that can impact water quality such as the petroleum storage program.

Brochures, pamphlets, and reports on the topics discussed in this handbook are often available electronically on the Manitoba Water Stewardship web site or can be obtained in paper copy from the Conservation and Environment Library **www.manitoba.ca/conservation/library/**.

More information can also be obtained by calling Manitoba Water Stewardship or other Departments responsible for specific program areas. Addresses for these departments are on the next page.

Topic	Phone #	Section/Department
24-Hour Emergency Response Assistance (spill reporting)	**944-4888 (call collect)**	**Manitoba Conservation**
Surface Water Quality Data	945-7100	Water Quality Management Section, Manitoba Water Stewardship
Recreational Water Quality and Escherichia coli	945-7100	Water Quality Management Section, Manitoba Water Stewardship
Algae	945-7100	Water Quality Management Section, Manitoba Water Stewardship
Swimmer's Itch	945-7100	Water Quality Management Section, Manitoba Water Stewardship
Mercury-Fish Consumption Guidelines	945-7100	Water Quality Management Section, Manitoba Water Stewardship
Water Quality Standards, Objectives, and Guidelines	945-7100	Water Quality Management Section, Manitoba Water Stewardship
Nutrients in Water	945-7100	Water Quality Management Section, Manitoba Water Stewardship
Fish Kills	945-7100	Water Quality Management Section, Manitoba Water Stewardship
Aquatic Invasive Species	945-7100	Water Quality Management Section, Manitoba Water Stewardship
Office of Drinking Water	945-5762	Manitoba Water Stewardship
Groundwater	945-7420	Groundwater Management Section, Manitoba Water Stewardship
Petroleum Storage Program	945-2458	Manitoba Conservation
Environmental Assessments and Licensing	945-8321	Environmental Assessment and Licensing, Manitoba Conservation
Contaminated/Impacted Sites Program	945-7009	Manitoba Conservation
Onsite Wastewater Management Systems Program	945-2970	Manitoba Conservation
Conservation and Environment Library	945-7125	Manitoba Water Stewardship/Conservation

Where are we located?

Water Quality Management Section
Manitoba Water Stewardship
Suite 160, 123 Main Street
Winnipeg, Manitoba R3C 1A5

Groundwater Management Section
Manitoba Water Stewardship
200 Saulteaux Crescent
Winnipeg, Manitoba R3J 3W3

Office of Drinking Water
Manitoba Water Stewardship
1007 Century Street
Winnipeg, Manitoba R3H 0W4

Office of Drinking Water Regional Offices:

Swan River, The Pas, Flin Flon, Snow Lake, Grand Rapids, Easterville Area
Box 2550
3rd & Ross Ave.
The Pas, Manitoba R9A 1M4
Telephone: 627-8361

Selkirk, Gimli Area
75 7th Avenue
Gimli, Manitoba R0C 1B0
Telephone: 642-6134

Thompson, Churchill Area
Box 32
59 Elizabeth Drive
Thompson, Manitoba R8N 1X4
Telephone: 677-6704

Whiteshell Park Area
Box 4000
Lac du Bonnet, Manitoba R0E 1A0
Telephone: 345-1489

Bissett, Berens River, Manigotagan, Nopiming Area
1007 Century Street
Winnipeg, Manitoba R3H 0W4
Telephone: 945-6279

Killarney, Morden, Winkler, Morris Area
555 Main Street
Winkler, Manitoba R6W 1C4
Telephone: 325-1752

Portage la Prairie, Neepawa, Dauphin Area
25 Tupper St. N.
Portage la Prairie, Manitoba R1N 3K1
Telephone: 239-3186

Winnipeg, Steinbach Area
1007 Century Street
Winnipeg, Manitoba R3H 0W4
Telephone: 945-0215

Brandon, Virden, Russell Area
1129 Queens Avenue
Brandon, Manitoba R7A 1L9
Telephone: 726-6563

Conservation and Environment Library
Manitoba Water Stewardship/Conservation
Suite 160, 123 Main Street
Winnipeg, Manitoba R3C 1A5

Environmental Assessment and Licensing
Manitoba Conservation
Suite 160, 123 Main Street
Winnipeg, Manitoba R3C 1A5

Petroleum Storage Program, Contaminated/ Impacted Sites Program, Onsite Wastewater Management Systems Program
200 Saulteaux Crescent
Winnipeg, Manitoba R3J 3W3

For More Information

Glossary of Terms

Anabaena:
A species of blue-green algae which is common in lakes and reservoirs with enhanced nutrient concentrations. The presence of *Anabaena* in a water body often contributes to poor water quality because it can impart noxious odours and disagreeable tastes to the water. *Anabaena* may secrete poisonous toxins into water which can be lethal to wildlife and livestock, and cause skin irritations and nausea in humans.

Aphanizomenon:
A species of blue-green algae which is often a nuisance in water supplies. It resembles lawn mower clippings and floats in dense mats at the surface of the water. Intense sunlight kills *Aphanizomenon*, discolouring the water and releasing foul odours. Some studies have suggested this species produces toxins.

Aquifer:
A permeable subsurface zone capable of yielding quantities of groundwater to wells and springs.

Benthic organism:
Organisms which live on the bottom of a lake, river, stream, or ocean, such as clams or caddisfly larvae.

Biodegradable:
A product which can be broken down in the environment by microorganisms.

Cercariae:
A developmental stage in the life cycle of the swimmer's itch worm. This stage can penetrate human skin and cause irritation.

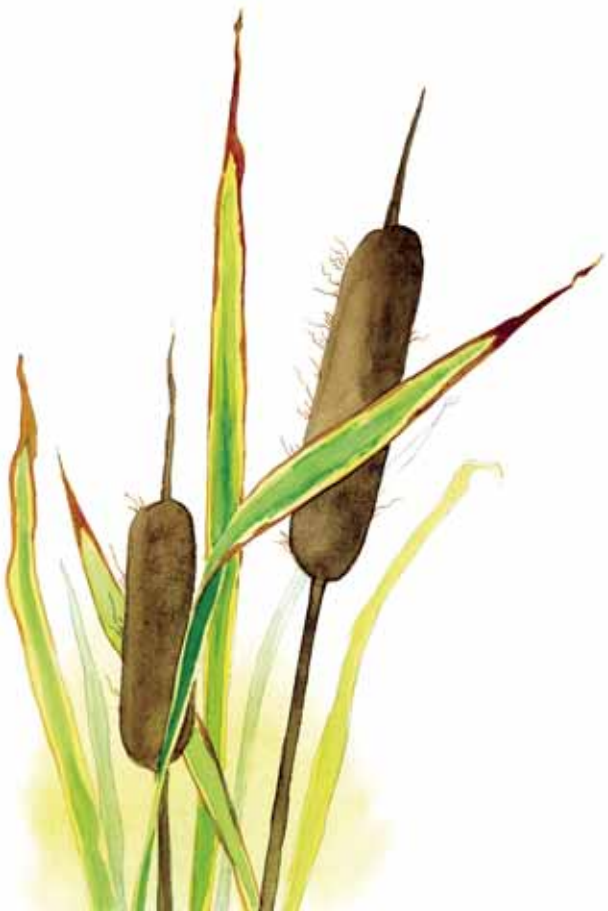
Chlorophyll:
A pigment found in algae and other aquatic plants that is used in photosynthesis. The most common chlorophyll pigments are chlorophyll a and chlorophyll b. The amount of chlorophyll a in a water sample is often used to assess the amount of algae or the biomass of algae present in a water body.

Composting:
The natural decomposition or breakdown of organic material by bacteria and other soil organisms to produce humus.

Confined aquifer:
An aquifer that is bounded above and below by an impermeable layer.

Copper sulphate (also called bluestone):
A water soluble salt which is toxic to algae and other aquatic organisms. It is often used to control algae in swimming pools, but its use in natural waters may not be practical, successful, or legal.

Cryptosporidium:
A microscopic parasite found in the feces of mammals which can be transmitted through water. Ingestion of *Cryptosporidium* causes cryptosporidiosis, a disease characterized by nausea, diarrhea, and cramps.



Deposition:
The laying, placing, or throwing down of any material.

Diatomaceous earth:
A light-colored porous rock composed of the shells of diatoms. Diatoms are microscopic algae that grow in marine or fresh water and secrete silica skeletons.

Drain:
A channel which carries away surface water.

Ecosystem:
A group of plants or animals together with that part of the physical environment with which they interact.

Effluent:
The liquid waste from sewage or industrial processing.

Emergent plant:
Aquatic plants found in shallow waters which extend above the water surface and have relatively rigid stems, (Ex: cattails).

Erosion:
The gradual wearing away of land surfaces due to wind, water, or wave action.

Eutrophic lake:
A lake with a high concentration of nutrients. Eutrophic lakes are often shallow and exhibit periods of oxygen deficiency.

Exotic species:
A species which is accidentally or intentionally introduced into habitats where it is not naturally found.

Fecal coliform bacteria:
Bacteria which originate in the intestines of all warm-blooded animals, including humans and livestock. The presence of these bacteria in water often indicates contamination by human or animal feces.

Fish kill:
The partial or complete destruction of the fish population generally due to low oxygen concentrations or heat stress.

Floating plants:
Aquatic plants, rooted in the sediments or free-floating, with leaves which float on the surface of the water. Their stems lack rigidity and the plants rely on the water for support. Duckweed is a floating plant found in Manitoba waters.

Food web:
A way of showing how plants and animals in a habitat, such as a freshwater lake or in the ocean, depend on each other.

Gastroenteritis:
Stomach upset caused by bacteria or enteric viruses leading to mild fever, vomiting, diarrhea, and stomach cramps.

Giardia:
A microscopic intestinal parasite of humans and aquatic mammals which can be transmitted through water. Ingestion of *Giardia* causes giardiasis, or Beaver Fever, an intestinal disorder characterized by nausea, diarrhea, and fatigue.

Greywater:
Kitchen, shower, and bath water, excluding toilet water.

Heavy Metals:
Metals such as mercury, lead, zinc, copper, etc.; that when present in high concentrations, can possibly be toxic to living organisms and may bioaccumulate in the food chain. Heavy metals can occur naturally in soils, or may be introduced into aquatic ecosystems through the discharge of municipal and industrial effluents.

Herbicide:
A chemical agent that kills or inhibits plant growth.

Hybrid:
The offspring of genetically different parents.

Hydrological considerations:
Considerations which deal with the occurrence, circulation, distribution, and properties of water and its reaction with the environment.

Hydrologic cycle (or water cycle):
The complete cycle through which water moves-from the oceans, through the atmosphere, to the land, and back to the oceans.

Inorganic material:
Chemical substances of mineral origin not containing carbon to carbon bonds.

Langmuir streaks of foam:
A linear formation resulting from Langmuir circulation, a wave phenomenon which occurs due to steady wind action on the surface of a water body.

Leaching:
The separation of constituents from the soil by the movement of water through the ground. The soluble components are carried down by the moving water where they may enter groundwater aquifers.

Macrophyte:
A large aquatic plant which is visible to the naked eye.

Microcystis:
A species of blue-green algae which is common in lakes and reservoirs with enhanced nutrient concentrations. *Microcystis* often contributes to poor water quality because it can impart noxious odours and disagreeable tastes to the water and produces toxins which may be toxic to wildlife and livestock.

Miracidia:
The immature, microscopic stage of the life cycle of the swimmer's itch organism.

Mesotrophic lake:
A lake of intermediate amounts of nutrients as compared with eutrophic and oligotrophic lakes.

Nematodes (or roundworms):
The worms are common in the bottom sediments of water bodies. They are most often found in oligotrophic lakes and their numbers decrease drastically in eutrophic lakes presumably because of low oxygen concentrations.

Non-point source pollution:
Originating from diffuse sources, non-point source pollution is caused by rainfall or snow-melt moving over and through the ground picking up natural or manmade pollutants and depositing them into ground or surface water.

Non-persistent pollutant:
A pollutant which is degradable. The damaging effects from the pollutant can usually be reversed.

Oligotrophic lake:
A lake low in nutrients and usually containing abundant amounts of dissolved oxygen. Oligotrophic lakes are generally deeper than eutrophic lakes.

Organic material:
Substances containing carbon.

Organochloride pesticides:
Organochlorides or chlorinated organic chemicals are persistent and tend to build up or bioaccumulate in the food chain.

Pathogen:
A disease-causing organism.

Pathogenic:
Causing or capable of causing disease.

Peatland:
A type of wetland which forms under acidic conditions leading to the partial decomposition of organic material such as mosses, sedges, trees, and other plants. The partially decomposed material becomes compacted and carbonized, and contains less than 20 per cent mineral material.

Persistent pollutant:
A pollutant which degrades very slowly and remains in the environment for years.

Pesticides:
Toxic chemicals used to eliminate or control unwanted insects, plants, or other organisms. Pesticides include insecticides, herbicides, and fungicides.

Point source pollution:
A stationary location from which pollutants are discharged. An example of point source pollution is direct, concentrated discharge such as sewage effluent discharging from a pipe into a river.

Predation:
The killing and eating of an individual of one species by an individual of another species.

Protozoa:
A single-cell organism, such as *Giardia*, that can only divide within a host organism.

Rate of recharge:
The rate of inflow into a groundwater aquifer.

Retrofit:
Modification of existing equipment.

Riparian zone:
An area of vegetation including trees, shrubs and grasses extending upland from the waterline of rivers, streams, and lakes.

Sedimentation:
The deposition of silt, soil, or sand particles in locations where slow-moving water loses its ability to hold heavier particles in suspension.

Species diversity:
The variety of species within a region or a given area.

Submergent aquatic plant:
Plants with flexible steams and leaves, rooted in the sediments, and completely covered by water, such as pond weed.

Subsurface:
Below the surface.

Terrestrial:
Adapted to living on land. Not aquatic.

Total annual sustainable yield:
The total annual sustainable yield for groundwater is that total quantity of groundwater which can be extracted annually without exceeding the recharge rate.

Trematode:
A parasitic flatworm that lives as a parasite in the liver, gut, lungs, or blood vessels of vertebrates, attaching itself by suckers or hooks and sometimes causing serious disease.

Turbidity:
A measure of the amount of material suspended in water including clay, silt, organic and inorganic chemicals, as well as small aquatic organisms. Turbidity affects the amount of light which is able to pass through the water column.

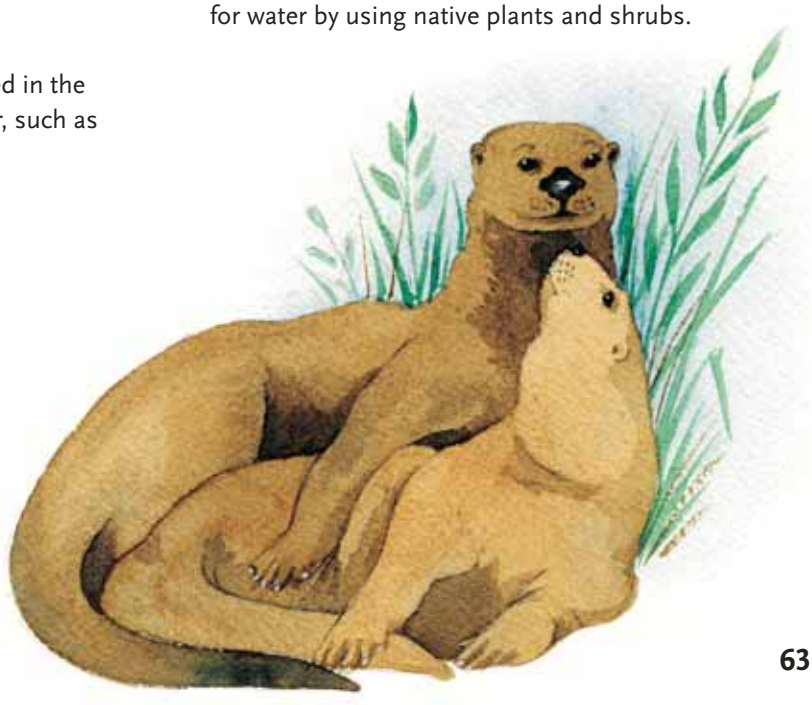
Water column:
A vertical slice of a waterbody.

Watershed:
The area which supplies water to a stream and its tributaries by direct runoff and by groundwater runoff is the drainage area or watershed for the stream.

Water table:
The upper portion of the part of the ground that is completely saturated with water.

Wetlands:
Areas inundated and saturated by surface or groundwater often and long enough to support vegetation adapted for saturated soil conditions.

Xeriscape:
A landscape technique which has reduced requirements for water by using native plants and shrubs.



Quiz

Are You a Water Protector or Contaminator?

Take this quiz to see how well you are protecting our water resources:

1. Do you use phosphate-free detergents?
2. Do you put all your trash in a bag and dispose of it on land after your boating trip?
3. Do you use fertilizers sparingly and responsibly, to avoid contaminating surface water and groundwater?
4. Do you limit your use of pesticides, use them only as directed, or use alternatives?
5. If you own a waterfront home or cottage, do you protect and enhance your shoreline?
6. Do you avoid flushing chemicals down sinks or storm drains?
7. Would you partipate in a local Clean Water Day?
8. Do you inspect your boat for zebra mussels and other aquatic plants, drain the bilge, and wash or dry your boat before you leave a waterbody?
9. Do you empty your bait bucket on land before leaving any waterbody?
10. Do you protect fish habitat by retaining aquatic vegetation along the shoreline?
11. Do you have regular maintenance done on your septic field or holding tank?
12. Do you practice water conservation in your household – use low-water use appliances and fixtures, water your lawn sparingly, and repair leaks in pipes and faucets?
13. Do you compost kitchen and garden wastes and use these instead of inorganic fertilizer?
14. Do you purchase environmentally friendly alternatives in place of hazardous household products?
15. Do you recycle old batteries and used oil?
16. Do you purchase products with the Ecologo stamp of approval?
17. Do you buy biodegradable products?
18. Do you clean up you pet's feces and dispose with your trash?
19. Do you avoid overfilling your boat's fuel tanks?
20. Do you reduce your speed when you navigate your motor boat close to the shoreline?

If you answered YES to:

18 to 20 of the questions:

You are a **WATER PROTECTOR**! You are an excellent role model for your community. Keep up the good work!

13 to 17 of the questions:

Good work, but there is room for improvement!

Less than 12 of the questions:

You are a **WATER CONTAMINATOR**!
We need your help in protecting our water resources for present and future users. Read this guide to find out what you can do to help!