Shoreline Stewardship Information Resources

Table of Contents

The Importance of Healthy Shorelines

Healthy shorelines are vital to maintaining the overall health of lakes and other bodies of water. Healthy shorelines help filter pollutants, protect against erosion and provide habitat for fish and other forms of wildlife.

Shorelines are some of the most ecologically productive places on Earth. They support plants, microorganisms, insects, amphibians, birds, mammals and fish. The first 10-15 meters (30-50 feet) of land that surrounds lakes and rivers are responsible for 90% of lake life which are born, raised and fed in these areas. Sometimes called the "Ribbon of Life", shorelines are up to 500% more diverse than upland areas.

The Functions of a Healthy Shoreline

1. **Help Maintain Clean Water/Water Quality**
   The shoreline vegetation on your property is vital in retaining, treating and filtering surface runoff before it can reach the water. Runoff is rain and melted snow that run along the surface of the ground. Runoff can contain pollutants such as fertilizers, pesticides, sediment, manure, pet feces, trash, motor fluids (oil, grease, gas), and road salt, all of which are damaging to our waterways. Some are nutrients which act as fertilizers stimulating algae and plant growth; others are pathogens which can contaminate drinking water. Sediment impacts fish habitat and nursery areas.
2. **Prevent Soil Erosion**
   Shoreline vegetation and plants help keep soil in place with their underground root systems. They prevent topsoil from being exposed and washed away into water bodies.
3. **Reduce Impacts of Flooding**
   Well-vegetated shorelines provide barriers against moving water by slowing the movement of water downstream, and by reducing the force, height, and volume of floodwaters. This allows water to spread out horizontally across a floodplain, reducing the potential for damage to your property.
4. **Provide Wildlife with Food and Habitat**
   Shorelines are vital to many different animals throughout their development and life cycle. Healthy shorelines protect wildlife from harsh weather conditions and predators. Woody debris, such as tree trunks or roots in the water provide cover for fish to hide, basking areas for turtles, and resting sites for waterfowl.

Shoreline Zones

Within a shoreline there are three overlapping, but distinct zones that contribute to the overall health of a property.

1. **Upland Zone**
   Generally, this higher and drier ground will be home to various trees, shrubs and animals that prefer shoreline habitat. This area, depending on when your home or cottage was built, is often the zone where the residence is located.
2. **Riparian Zone**
   This zone is the transitional area between dry land and water. Here you will find a wide variety of plants and wildlife species, because water provides organisms with food and shelter. The vegetation here helps reduce runoff and soil erosion. It also shades and cools shallow water.
3. **Littoral Zone**

The littoral zone extends from the water's edge to the area in the lake where sunlight no longer penetrates. It is home to organisms such as algae and aquatic plants, fish, reptiles, amphibians, insects and waterfowl.

Healthy vs. Unhealthy Shorelines

Common Signs of a Healthy Shoreline

- Lots of native vegetation
- Different levels of vegetation from taller trees to smaller shrubs and plants
- Dead tree snags and stones
- Birds, fish and other wildlife

Unhealthy Shorelines

Common Signs of an Unhealthy Shoreline

- Area(s) cleared of all or most vegetation
- Lawn that extends right to the water's edge
- The natural shoreline replaced by a hardened structure such as a breakwall or gabion baskets
- Problems such as shoreline erosion and poor water quality
- Prominent algae blooms and excessive weed growth

An unhealthy shoreline can result in accelerated runoff, increased erosion, and increased nutrients entering the water, particularly nitrates and phosphates. Large amounts of these nutrients are harmful to aquatic environments, triggering a process known as cultural eutrophication. Cultural eutrophication occurs as follows:

1. Large nitrate and phosphate supplies released from the land stimulate massive algae blooms. The result is algae so thick that it competes with other plankton species and blocks light to bottom-dwelling plants.
2. As the algae blooms die, the bacteria that break them down multiply and consume large amounts of oxygen in the water body.
3. Without enough oxygen the remaining animal species die off (sometimes drastically – for this reason, some newly eutrophic lakes have many floating fish carcasses).
4. The final result is a water body that is polluted and impoverished (capable of supporting very few types of plants and animals).

Shoreline Buffers

A buffer is a permanent strip of trees, shrubs, grasses and ground cover alongside a watercourse that help to protect or 'buffer' the water body from human actions or natural processes. The ideal buffer size is unique to each property. The most effective buffer strip is one that is at least 30m (100 ft) deep, extending upland from the lake. A buffer strip of this size is not feasible in all areas, but the closer to 30 meters, the better, and any size buffer is better than none at all.

The Benefits of Buffers

Depending on their design and location, buffers:

- Protect and improve air and water quality
- Reduce soil erosion caused by wind and rain
- Stabilize the banks of streams, rivers and lakes
- Trap water-borne sediments that pollute streams, rivers and lakes, diverting up to 80 per cent of sediment
- Trap fertilizers, pesticides, organic chemicals, heavy metals, salt and other contaminants that pollute ground and surface water (reducing phosphorous loading by 40 per cent and removing a significant amount of nitrate)
- Trap bacteria and other pathogens that cause water-borne diseases in people, livestock and wildlife (removing up to 60 per cent of pathogens from runoff)
- Provide habitat for fish and wildlife by providing corridors for movement
- Help prevent flooding
- Make the landscape more beautiful and properties more valuable

Why Plant Buffers?

By planting and maintaining buffers, you can help to prevent some of our most serious environmental problems.

Water Pollution

Despite improvements in managing chemicals and waste in homes, our ground and surface water remains at risk of being polluted. Harmful viruses, bacteria and other pathogens can migrate into waterways from livestock operations and septic systems that are located too close to waterways. The consequences are deterioration in the quality of drinking water and a degraded, potentially dangerous environment. Buffers help by trapping pollutants before they reach waterways.

Soil Erosion

When soil particles and other sediments erode into water bodies, they clog the gills of fish, and produce turbid water which obscures their vision. These particles also cover areas where fish feed, hide from predators and lay eggs. Because they fill water channels, sediments also cause permanent physical changes in waterways that affect aquatic life and contribute to flooding.

Destruction of Natural Shorelines
Shoreline development and unnatural approaches to landscaping destroy natural shorelines, leading to the problems described above.

Destruction of Habitat and Loss of Biodiversity
The decline in forest areas along streams, rivers and lakes has led to the decline of many land and aquatic species, some of which are now listed as "at risk". Buffers provide travel corridors between larger areas of natural habitat and sheltered areas along waterways where wildlife need to drink and feed.

How to Create a Buffer

Before planting a buffer strip, consider the layout of the lot, how the property is used (e.g. paths, recreation), the budget, how much time you want to spend on it, the look you want to achieve, the size (the bigger the better!) and privacy issues. Three approaches to establishing a buffer are:

Natural

- Stop mowing and let nature take over. Dormant seeds, as well as seeds brought by birds and other wildlife species, will start to grow
- Leave natural debris such as fallen trees, stumps and boulders in place (when not hazardous)
- Weed out competing non-native species, especially in highly developed areas

Enhanced

- Plant a few trees or shrubs to help nature along. This allows the buffer to be established more quickly than by natural processes alone. This works well in areas where natural seeds are likely to grow.

Landscaped

- Combine the important functions of a natural shoreline with the visual appeal of plants, incorporating well-defined and pleasing curves with other accents like benches, stepping stones, etc. This approach requires considerably more time and money.

Sources of Expertise and Assistance
There are sources available to help you plant buffers on your recreational property or farm. Some offer funding support or may be able to direct you to funding sources: (see the Contact List page 56-59 for full contact information):

- Your local municipality
- Your local conservation authority
- Your local stewardship council
- Local Ontario Ministry of Natural Resources office
- Ducks Unlimited
- Ontario Ministry of Agriculture, Food and Rural Affairs; inquire about The Ontario Environmental Farm Plan

Shoreline Planting Tips

When naturalizing your shoreline there are several tips that you can follow to help increase the survival rate of your plants:

1. **Plant Native Species of Plants**
   Survey the areas around your property and take note of the plants and trees that are abundant and healthy. This will give you an indication of what type of vegetation will have the best chance for success on your property in similar conditions.

2. **Plant a Variety of Species and Ages**
   Planting a variety of native species and species of various ages will help minimize the chance of a disease being transferred from new plants to those already existing on your property.

Where to Obtain Plants and Trees?

There are several nurseries in the area where you can obtain plants and trees of various ages and species. For a list of these locations refer to the Contact List, page 56-59.

Where and When to Plant?

When setting out new plants try to mimic how they grow in the wild. Plants prefer to be in groups of their own kind; for example, instead of planting cedars every 2 metres; plant them in clumps of three, spaced out with groups of other species. The position (low wetlands, mid-slope, lakeshore, etc.) of plants already on your property can indicate where the same species is most likely to succeed. Observe the spacing of wild plants: some cluster together, while others need more space.

Aquatic plants should be planted in the spring after the water levels have fallen. This allows them to establish root systems capable of keeping them alive over the winter. Upland plants can be planted in the spring or autumn while it is cool. Note that a permit may be required if you are planting below the high water mark. Contact your local Conservation Authority for more information.

Native Plant Examples and Growing Conditions

There are a number of native plants that are suitable to plant on most shorelines. Note that different species prefer certain light, soil and moisture conditions. Online resources (such as The Evergreen Foundation's Native Plant Database) can help you find the right plants for your shoreline. Some examples are listed below of growing conditions and corresponding plants.

- **Full Sun:** Silver Maple, White Birch, Gray Birch, Common Juniper, White spruce, Common Elder, Stiff Goldenrod, High Bush Cranberry
- **Sun to Partial Shade:** Balsam fir, Red maple, Prairie Milkweed, Silky Dogwood, Common Strawberry, Virginia Creeper, White Pine, Black Eyed Susan, Balsam Poplar
- **Partial Shade to Full Shade:** Wild ginger, Marsh marigold, Blue Beech, Gray Dogwood, Wood Poppy
- **Full Shade**: Sugar Maple, Wintergreen, Red Osier Dogwood
- **Dry Soils**: Red maple, Common juniper, Eastern red cedar
- **Moist To Dry Soils:** Nodding Onion, Gray Birch, White Pine, Black Eyed Susan, Stiff Goldenrod, Eastern white cedar
- **Dry to Well Drained Soils:** Bearberry, Gray Birch, Prickly Wild Rose
- **Moist Soils**: Red Maple, Silver Maple, Yellow Birch, Wintergreen, White spruce, High Bush cranberry, Eastern Hemlock

- **Moist To Wet Soils:** Sugar Maple, Silver Maple, Marsh Marigold, Buttonbush, Winterberry, Tamarack, Common Elder, Sweetgale
- **Moist To Well Drained Soils:** Balsam Fir, White Birch, Ironwood, Black Spruce, White Pine, Bellwort
- **Rocky Soils:** Red Maple, Black Huckleberry, White Pine, Staghorn Sumac
- **Sandy Soils:** Thimbleweed, White Birch, Canada Wild Rye, Wintergreen, Nannyberry
- **Drought Tolerant:** Creeping juniper, Eastern Red Cedar, White Spruce, Blue-eyed Grass
- **Salt Tolerant**: Bearberry, Common Juniper, Red Cedar
- **Deer Resistant:** Silky Dogwood, Gray Dogwood, Red Osier Dogwood, Winterberry, Wild Geranium, Common juniper, Eastern Red Cedar, White Spruce, Black Spruce
- **Plants for Ground Cover:** Wild Ginger, Common Strawberry, Wintergreen, Virginia Creeper, etc
- **Plants for the Septic Bed:** New England Aster, Lady Fern, Canada Wild rye, Black Eyed Susan, Stiff Goldenrod, Prairie Dropseed

Preparing the Site

To maximize the chances of survival, you should remove any nearby invasive species that might crowd out the new arrivals. Purple loosestrife, garlic mustard, crown vetch, reed canary grass, and common buckthorn are examples of the type of species that should be removed before the start of planting. Aside from removing invasive species, no other preparation is needed. If the plants are selected and placed well, they will not need purchased soils, peat moss, or fertilizers – the site will already have everything they need. In fact, such soil amendments may cause the plantings to grow too fast and then flop over, or encourage weeds to compete with them. Dig a hole at least 2 times the size of the root ball, pot or root system if bare-rooted. Break up the soil you have removed from the hole as much as possible.

Planting Techniques

Live Staking or Cuttings

Live stakes are approximately metre-long sections of woody branches or stems cut from live shrubs. The cuttings are taken in the spring or fall and are cut flat on top and at an angle on the bottom (about 45 degrees). The stakes should be taken from hardy species that root easily. The most common choices for live stakes are native willow and dogwoods. If the stakes are being used on their own they should be placed in groups of five and arranged like the dots on a die. They should be inserted perpendicular to the slope to promote better root growth. Drive about 70% of the stake underground to force the stake to root. In order for roots to form, it is important that the stakes have good contact with the soil, so tamp the soil down around the stake after it has been planted.

Container Plants

Container plants should be soaked thoroughly before planting them (a dry root ball can repel water even when the ground above it is being watered). The plants should be gently removed from the containers. Support the root ball to keep it intact. Cut away only the roots that cannot be worked out of the container holes or any that are damaged. If there are roots wound around the circumference of the root mass, they should be combed out to keep the plant from strangling itself. The plant should be buried so that the top of the root ball is flush with the surrounding soil. After planting, the new arrival should be watered very well to encourage deep root growth. If the plant is in a dry or upland area, it will need regular watering for the first few months. Soak the plant deeply each week that there has not been substantial rainfall; avoid frequent shallow waterings.

Ball-Root Plants

Some nurseries cover larger plants with a burlap wrap around the root ball. This gives the root ball limited protection. The wrap should be handled gently and supported while carrying the plant. When planting, it is a good idea to remove the burlap, if it can be done without the root-ball disintegrating. This is best done by placing the plant in its hole, undoing the bindings on the wrapper, then having one person lift the plant slightly while another slides out the wrapper.

Bare-Root Plants

Occasionally larger plants can be purchased with bare roots. They may have been rescued from construction sites and are usually quite inexpensive. They should be planted as quickly as possible – the same day is best. If bare-root plants must be stored for a short time, the roots must be kept moist by covering the roots with damp straw, compost, soil, or wet burlap. However if stored for a longer time and the plant is dried, ensure the roots are kept dry. Planting suggestions are the same as for container plants.

Mulching

Mulching is the process of spreading out a layer of some kind of shredded protective material (cardboard, bark mulch, wood chips, etc.) over a site. It is usually a good idea to mulch around any freshly planted site – particularly one with water nearby. Mulch prevents the freshly turned soil from eroding, discourages competing plants and holds moisture in the soil. Avoid dyed mulches since they may contain harmful additives.

Mulch should not be used right at the water's edge where wave action can wash it away; a biodegradable erosion control mat should be used instead. Mulch needs to be coarse enough to stay in place and light enough to allow the plants to grow. Bark mulch and shredded hardwood work very well. Clean straw works well with quickly-growing plants that can establish themselves before the straw rots away. Cardboard and shredded newspapers are too light and thus prone to getting blown or washed away. Manure and compost should be avoided near any water body, since their nutrients will wash into the water and act as nutrients.

Mulch can be laid down before or during planting. The mulch can be brushed aside from the individual planting holes and replaced afterward. Ensure you are planting into the soil (not the mulch), and keep the mulch away from the plants' stems. Mulch can be laid down up to one inch deep for herbaceous plants and three inches deep for shrubs and trees.

Erosion

Shoreline erosion is a common and natural process. Natural erosion occurs at a very slow rate, much slower than we would notice; lakes naturally accumulate sediment at an average rate of about 1mm/yr. However, non-natural causes (human disturbances) can greatly accelerate erosion. Sediments deposited by erosion are considered pollutants when excessive levels occur due to human activities. By volume, sediment is the greatest water pollutant in North America.

Shoreline erosion results in the actual loss of waterfront property, which may result in safety problems and deterioration of the natural shoreline environment. By taking preventative measures you can control erosion on your property and help create and maintain a strong and healthy shoreline.

Natural Erosion

- **Wind** – Wind can pick up loose soil particles that have been exposed after the removal of vegetation and blow them away
- **Ice** – As ice shifts and expands over a watercourse, it can loosen and displace shoreline soil
- **Water** – Wave action, currents, fluctuating water levels and runoff can wash away soil along the shoreline
- **Gravity** – Gravity can move loose soils down a slope or pull them through sink holes. Steep slopes are especially prone to erosion.

Human Induced Erosion

- **Removal of Shoreline Vegetation** – Without vegetation to grip the soil with its roots, forces such as wind, rain and water erode soil into the water at an accelerated rate.
- **Runoff** – When the vegetation of a shoreline is replaced by a hard surface like patio stones or pavement, water flows along these surfaces rather than soaking into the ground.
- **Boat Wake** – Motorized watercraft create waves which wash onto the shoreline and erode the soil bit by bit.
- **Construction** – Construction along or near the shoreline can contribute to erosion if proper precautions aren't taken; cleared lots and freshly exposed soil are particularly susceptible to erosion.
- **Foot Traffic** – When you travel the same routes on your property to access an area, the vegetation ends up trampled, creating areas of bare soil. If the soil isn't covered up by gravel, mulch or wood chips, it becomes very susceptible to wind, rain and other causes of erosion.
- **Shoreline Alterations** – Alterations to a watercourse can cause significant erosion; when vegetation along the shoreline is replaced by hard structures such as break walls, wave energy is no longer absorbed; instead it is deflected onto neighbouring shorelines where it can cause erosion.

Impacts of Erosion

Shoreline erosion has the following negative effects:

- **Loss of Property** – Gradually the shoreline of your property can erode into the water.
- **Unsafe Areas** – Erosion can produce or aggravate unstable slopes.
- **Loss of Habitat for Wildlife** – When shoreline vegetation is lost, habitat and food sources for fish and other wildlife are lost.
- **Altered Characteristics of Water Bottom** – As soil erodes into the water, the lake bottom becomes covered in a layer of soft sediment.
- **Reduction of Water Clarity** – Erosion impacts water clarity since water becomes cloudy when soil washes into it; this means that less light penetrates the water and aquatic plants end up with degraded growing conditions, which in turn can impact fish spawning.
- **Increased Water Temperature** – Water from overland runoff picks up a significant amount of heat, which raises the temperature of any water body into which it flows.
- **Chemical Pollutants** – Soil particles often have chemicals or heavy metals bound to them. Once suspended in water, the chemical bond breaks and the chemical is released.
- **Nutrient Loading** – Nitrates and phosphates are frequently carried into water bodies, leading to eutrophication (discussed above).
- **Stress on Fish and Wildlife** – Turbid water (clouded by sediments) may hinder the ability of fish to catch prey by reducing their ability to see, thereby lowering feeding rates and slowing growth. In addition, sediments can clog the gills of young fish, with fatal results.

Signs of Erosion

Here are some signs to watch for to determine whether erosion is occurring on your property:

- **Exposed Soil** – Large areas of exposed soil, especially on steep slopes and high banks
- **Rills and Gullies** – Narrow channels carved by overland runoff.
- **Slumping** – Occurs on hillsides where material slides down the slope
- **Undercut Banks** – Water movement (wave action or energy from currents) washes away soil beneath the shoreline .
- **Cloudy Water** – Extremely cloudy or turbid water can also be an indicator that excess sediment is entering the water.
- **Receding Shorelines** – This is more obvious to landowners on their own properties when the shoreline recedes past familiar landmarks
- **Leaning or Downed Trees, and Exposed Roots** – Trees along the shoreline do fall naturally as a result of storm winds and decay, but sometimes healthy trees will fall along the shoreline because there is insufficient soil for their roots. In these cases, the entire tree can lean or fall over, exposing its root mass.

How to Prevent Erosion

Here's what you can do to protect your shoreline by preventing erosion on your property:

Protect the Natural Shoreline

The best insurance policy against erosion is to retain the natural characteristics of the shoreline. This means keeping lots of natural vegetation, maintaining a good buffer strip (never mow close to the water's edge) and leaving in place stones, boulders, snags and dead branches found along the shoreline. These materials absorb the energy from erosive forces and keep the shoreline glued together.

Reduce Runoff

In general, try to plant and retain native vegetation wherever possible; this will prevent large amounts of runoff from entering the lake. In addition, encourage rainwater to infiltrate the soil rather than traveling over it. To encourage infiltration, minimize the amount of paved or hard surfaces on your property (i.e. driveways, decks, patios). Runoff from a driveway can be directed into a settling area, and runoff from the roof should go into a rain barrel or soaking area. This will allow for the natural, gradual movement of water rather than allowing large volumes of water to enter the river or lake at one time.

Minimize Wake from Motorized Watercraft

Boat wakes not only erode the shoreline, they also disturb aquatic ecosystems, swamp the nests of loons and other waterfowl, damage docks and boats, and may even upset canoes and small boats and endanger swimmers. The best way to reduce the effects of boat wash and wake on shorelines is simply to slow down. In Ontario, by law, boats must slow down to 10km/hr within 30m (100 ft) of shore. If the boat doesn't have a speedometer, remember that at 10km/hr there will be little or no wake.

Take Precautions during Construction

If you are starting a new building project on your property, plan to control erosion and to keep the disturbed area as small as possible. Ask your contractor to be aware of potential erosion and provide him or her with a copy of the protection plans. Insist on the use of erosion control equipment such as filter cloths, hay bales, and silt fences. Piles of fill dirt should be covered with tarps to prevent soil from being carried away by runoff. If possible, construction should be avoided during wet seasons since softer soil is more prone to damage by heavy equipment.

Limit Impacts of Foot Traffic

Foot traffic can trample vegetation – especially on steep slopes – causing soils to loosen and fall from the shore. Depending on the degree of the problem, you might control or omit access to that portion of the shoreline. Fences, hedges, brush, terraces, boardwalks, or stairs (open-back stairs with one inch gaps between boards are best) can prevent access and reduce the impact.

Contour & Cover Pathways

Pathways that extend from a building to the water's edge tend to take the shortest route to the water, which is often a direct downward route. This encourages erosion, since gravity pulls soils and runoff straight down the path toward the water. A better option is to position (or if necessary, re-route) pathways to follow the contours of the slope, following an 'S' curve pattern. Any exposed soil on pathways and heavy traffic areas should be covered up with wood chips, straw, or pine needles, which prevent soils from being blown or washed away.

Dealing with Erosion

If you believe that there is some erosion of your property there are several steps that you can take to determine the best course of action.

1. **Identify Areas of Erosion**
   Examine your property to identify all areas of erosion. See **Signs of Erosion** above
2. **Identify the Cause**
   It is crucial to try to identify the cause of the problem. Trying to fix an erosion problem may be a waste if the cause of the problem is not addressed. Look around your property for features that typically cause erosion, both human disturbances and natural forces. (See above.) Bear in mind that a combination of factors could be causing the problem.
3. **Site Conditions**
   There are certain site conditions such as steep slopes and aggressive water movement that require more aggressive control measures and extra consideration and care during project work.

Control Methods

Many methods can be used to control soil erosion. Sometimes the best course of action is a combination of methods. There are three main erosion control methods to consider:

1. Allow natural vegetation to grow (the 'buffer' technique).
2. Apply soil bioengineering techniques.
3. Use hard structural controls.

1. Natural Buffers

Allowing natural vegetation to grow along upland slopes and shorelines is a great way to control and prevent soil erosion. As mentioned earlier, vegetation grips the soil with its roots and keeps soil from blowing or falling away.

2. Soil Bioengineering

In areas where the erosion problem requires a more active approach, a control measure that can be used is soil bioengineering. This approach uses erosion control structures, usually made with living plant material, which eventually takes root. Soil bioengineering works immediately to control erosion and becomes more effective over time as plants take root.

Soil bioengineering often uses native plants collected or purchased within the immediate area of a project site. This ensures that the plant material is well adapted to site conditions and will have better growing success. While a few selected species may be installed for immediate protection, the ultimate goal is for the natural invasion of a diverse plant community to stabilize the site through development of a vegetative cover and a reinforcing root matrix. Plants that are most often used in soil bioengineering are willow species, dogwood species, and other plants with extensive root systems.

Bioengineering Techniques for use Above Water

Live Staking – Willows, dogwoods, viburnums, and poplars can be established with cuttings taken from new growth. The minimum size of cuttings should be at least a foot long and a half-inch in diameter. Bigger cuttings will work very well; the extra height gives them an advantage over competing plant species.

Fascines – Fascines, also known as wattles or bundles, are bundles of branch cuttings made from live plant material tied together in a roll. Once they are placed along the ground the cuttings will begin to root and take hold of the soil.

Brush Layers – Brush layers are similar to fascines in that cuttings are used and trenches are dug. However, instead of tying the cuttings together, they are placed loose in the trench with the bottom end pointed into the ground and the top (the growing end) sticking out of the trench.

Brush Mattresses – Brush mattresses are constructed from branches wired together to form a mat-like covering. They are used to cover large open soil areas. With a secure, firmly anchored base (toe), they can withstand considerable waves and strong currents. The shoreline armouring effects of brush mattresses make them the natural equivalent to riprap,(large stones placed at the water's edge).

Maintenance of Bioengineering Structures

In the case of all of these living structures, the brush or live cuttings should start to root within 6 weeks. The first year of growth is critical since the vegetation is just getting established and is subject to many different stresses. The soil should be kept moist while the brush starts to take root. The structures need to be carefully monitored and repaired as needed. In particular, you need to watch fluctuations in water levels. High water can uproot and kill new plantings. It may be necessary to place hay-bales or fascines in front of plantings to protect them from high water and wave action until they can get established.

Bioengineering Techniques in the Water

Fibre Rolls - Fibre rolls (also known as fibre bundles or fibre logs) are a common material used in soil bioengineering. Fibre rolls are simply rolled up mats made up of coir (the fibre from the outer husk of coconuts) or jute (a vegetable fibre). These rolls are generally staked into the toe of the slope or slightly off shore. They absorb and deflect wave and current energy, sheltering a vulnerable shoreline. They can be purchased from a landscaping company.

Brush Bundles - Another way to reduce wave energy before it hits the shore is the use of bundled brush. Brush bundles are constructed by stacking and tying a cylindrical pile of branches together. Like fibre rolls, they create areas where vegetation can grow and eventually form a barrier against erosion.

Plant Anchors - When planting in the water, it is necessary to anchor new plants until they take root and can hold themselves in place – otherwise, wave energy can scour them away. In some cases, you may need to use both wave breaking devices and plant anchors to successfully establish vegetation in the water. There are two main methods of anchoring aquatic plants: fibre mats & fibre bags.

Fibre Mats - The same fibres (coir and jute) used to make fibre rolls are also woven into mats or blankets. These can be rolled out, staked in the water, and then planted with native aquatic plants like cattails, bulrushes and water lilies.

Fibre Bags - Some aquatic plants can be anchored to the bottom by placing a rooting plant in a fabric bag weighted with rocks. The roots are able to grow through the fabric and into the soil. The fabric biodegrades and eventually the plants hold themselves in place. This method will not work with aquatic plants that require a great deal of sunlight.

3. Hard Structural Controls

Structures made out of rock, concrete, metal and other materials were commonly used when it was thought that the only way to combat erosion was to take a hard and aggressive approach. Examples include concrete break walls, gabion baskets (large stones contained in wire baskets), and riprap (loose stones along the shore). These structures prevent erosion well in the short term– but a further examination reveals that ultimately they often do much more harm than good.

What Happens when you Harden your Shoreline?

Hardened shorelines deflects wave energy instead of absorbing it – the energy is deflected to the sides, passing the erosion problem on to neighbouring sites, and down, scouring away any sediment or plant life near the base of the wall. These structures completely obliterate the natural shoreline environment – eliminating food and habitat for all kinds of creatures. Installing these structures also requires the use of heavy machinery which is both costly and environmentally damaging. Worst of all, these structures will eventually fail.

Types of Hardened Structures

Retaining Walls/ Breakwalls – Also known as bulkheads or seawalls, these are completely solid structures generally made of concrete, metal or wood. No breakwall will last in the long term because it, in effect, self-destructs by promoting erosion of the very soil that supports it. The wall deflect waves, which end up scouring the bottom right in front of the wall, undercutting it and causing it to eventually fail. Also, the flat rigid face of the wall is hammered by each wave impacting it, which, over time, will crack and fracture the wall. In addition, the inside (landward) face of a breakwall is very vulnerable to surface erosion. Any overland runoff will carry away soil from the inner face, digging channels and robbing the wall of support.

Gabion Baskets – These are wire baskets filled with large stones. The baskets are linked together to form a wall along the shoreline. Like concrete retaining walls, this erosion control technique works well in the short term and is often used in high-energy situations or when erosion needs to be stopped immediately.

Riprap – Riprap consists of large stones placed in the water and up the slope of the shoreline. Of all the hardened control structures, riprap is probably the most common, economical, as well as the most effective. Riprap works well in areas of high water and aggressive water movement. It is also effective against ice movement. Because riprap is made up of many smaller pieces, the movement of a few pieces does not compromise the effectiveness of the overall structure. If the shoreline or bottom soils shift, the main structure will still function (as opposed to other hardened control techniques). The rough surface of the riprap breaks up wave action so waves don't travel as high up the slope. Riprap can be an effective solution for undercut banks because it provides protection at the toe where water action erodes the soil. However, like other hardened control structures (although to a lesser degree than retaining walls) riprap still deflects wave energy causing erosion problems for neighbouring properties and elsewhere. It also replaces vegetation along the shoreline, taking away natural habitat as the rocks alone do not provide food or shelter

for most wildlife. And, in addition to creating a rather unnatural looking shoreline, the rough surfaces of the rocks also make it hard to access the water for recreation. It is recommended that riprap be complemented with other bioengineering techniques and plantings. If you have riprap along your property, adding vegetation above or between the rocks where possible will help create a more natural environment and will help further control erosion (see below).

Retiring or Softening Hardened Structures

Approvals – Before beginning any restoration work, you will need to look into permits and approvals required for your project. See the Permits section below.

Retiring a Breakwall – If there is currently a failing breakwall on your property, there are several steps you can take to retire it. This will provide you with a much better solution for erosion control – not to mention a much more visually appealing shoreline. Note: you will need a permit to retire the wall.

1. First dig out the soil from behind the wall.
2. Re-grade the slope of the shoreline to a slope of 25 degrees or less.
3. Place a geotextile filter cloth along the slope. This permeable fabric cloth can be purchased at a landscaping supply store. It will protect the soil and secure the slope.
4. Tear down the wall in sections so that the pieces of the wall lay back on the slope; this can be done with the use of a sledge or jack hammer.
5. The gaps should then be filled with cobble-sized stones or riprap.
6. The final step is to plant some native vegetation to help hold the soil together; plants such as willows or dogwoods are good choices.

Softening a Breakwall – There are a few ways to soften the wall:

- Restore or plant a strip of deep-rooted vegetation along the top of the wall; this will help filter runoff and reduce the risk of erosion by holding the soil together.
- Plant overhanging native shrubs to help shade and cool the water. You can also drill planting holes into the wall and plant cuttings or container plants.

Breakwalls Below the High Water Mark - With approval, there are several things you can do with these walls:

- Anchor a log or two against a retaining wall to provide wildlife habitat and help break the force of waves and undercurrents. This will help reduce the scouring action of waves breaking against the wall.
- Add rock riprap to the base of a retaining wall at a forty-five degree angle to help break the force of waves and improve habitat for fish and wildlife. Gradually sediment may start to be deposited among rocks, and aquatic plants may grow.
- Create shore ladders, or steps, of riprap from the base of the wall to the top. These will allow wildlife, such as amphibians, to access from the water to the land

Softening Riprap – You can plant shrubs in open spaces among the rocks, moving rocks if necessary to create space.

Wells

Water Sources

Surface Water

Surface water is water from lakes, streams, and rivers; this water source runs the highest risk of contamination from outside sources. Contamination can originate from manure storage, landfills, mishandled fuels, pesticides, solvents, and other chemicals.

Ground Water

Ground water is water that originates from the water cycle. It starts with precipitation such as rain or snow which is then filtered through the soil and rock, ending up in the water table. The depth of the water table fluctuates due to the amount of precipitation received and the demand placed on it by users. As with surface water, ground water is subject to contamination from many sources, including improperly handled fuels, oils, chemicals, pesticides, faulty wastewater treatment systems, manure storage, wastewater storage, faulty well caps and landfills.

Types of Wells

There are two main types of wells: dug or bored wells and drilled wells.

Dug or Bored Wells

A dug or bored well has a relatively wide opening (45 - 90cm) and can only access the top levels of the water table. It relies heavily on rainwater for replenishment. Dug wells are usually used in areas where the water table is close to the surface, so this type of well is susceptible to contamination.

Drilled Wells

Drilled wells are relatively small in diameter (10-20cm) and are sunk to a much greater depth than a dug well (up to several hundred meters). This makes them less susceptible to contamination, since water at that depth has usually been thoroughly filtered. Drilled wells have a watertight casing which may extend quite deep below the surface to prevent surface water from entering the well unfiltered. Drilled wells are low-maintenance and typically stay watertight over extended periods of time.

Well Placement

Regulation 903 of the Ontario *Water Resources Act* specifies all requirements for any type of well construction, including minimum well distance requirements as follows:

- 10m (33 ft.) from a watertight septic tank
- 15m (50 ft.) from a sub-surface weeping tile effluent disposal field or evaporation mount
- 50m (165 ft.) from sewage effluent discharge to the ground
- 100m (329ft.) from a sewage lagoon
- 50m (165ft.) from above ground fuel storage tanks
- 3.25m (11 ft.) from existing buildings
- 2m (7ft.) from overhead power lines if the line conductors are insulated or weatherproofed and the line is operated at 750 volts or less
- 6m (20 ft.) from overhead power lines if the well:
  - Does not have a pipe and sucker rod pumping system
  - Has a PVC or non-conducting pipe pumping system
  - Has well casing sections no greater than 7m (23 ft.) in length
- 12m (40 ft.) from overhead power lines for all other well constructions
- 500m (1,641 ft.) from a sanitary landfill, modified sanitary landfill or dry waste site

Regulations may vary according to region; check with your local township office for the specifics.

Well Maintenance

All wells must be properly maintained to prevent contamination. There should be a raised area around the top of the well casing. This allows runoff to flow away from the well casing and reduces the risk of contamination.

- A visual inspection of the well should be carried out at least once a year in order to ensure the well cap is secure and that no wildlife or dead plant material have entered the well. Such material can be a source of contamination.
- Check for erosion around the well cap or well casing, which can allow runoff to enter the well.
- The well casing should be checked by an inspector every two years for defects (i.e. leaks).
- Well water should be tested at least three times a year (the best time is after a heavy rainfall) to ensure that there is no contamination; the local health unit will test the water free of charge, but will only tell whether there is any bacteria (*E. coli*) or the total coliforms present in the water.
- If problems are found, some examples of treatment include: the use of filters, uva/uvb light filters, distillers, ozonators, reverse osmosis or activated carbon filters.

Plugging an Abandoned Well

Ontario Regulation 903 under the *Ontario Water Resources Act* states that all wells that are not being properly maintained must be plugged. Landowners should never attempt to plug an abandoned well on their own. Instead they should hire or consult a drilling contractor. A reputable contractor will know pertinent legislation, as well as which materials are acceptable in the plugging process.

Well Pollutants

Why and How Often to Test Your Water

It is recommended that you have your well water tested three times per year. Groundwater quality may change for many different reasons. The most common cause of change is human activity – agricultural activity, chemical spills or faulty wastewater treatment systems. In many cases well water may taste, smell, and look normal, but microorganisms or other contaminants may be present. If so, your well may need to be treated in order to provide safe drinking water. Below is a list of the more common water contaminants that may be found in well water. Please be aware that this list is not exhaustive. Contaminants not listed may also be harmful.

Pathogens (bacteria, viruses, protozoa)

Storm water runoff is one of the biggest sources of contamination. When rainwater runs into lakes and streams, it can carry with it fecal matter from cats, dogs, cows, and other mammals. Contamination also occurs through inadequately treated wastewater (municipal sewage, leaky sewage lines or malfunctioning septic systems). Birds, in particular gulls, domesticated ducks, and geese have also been found to be sources of pathogens. Coliforms are bacteria found in the large intestine of humans and other animals. Most coliforms are not harmful, but a few strains of *E. coli* produce serious toxins. Measures of *E. coli* or fecal coliform are often used as indicators of possible contamination by fecal matter, and the *potential* for contamination of other pathogens.

Nitrates

A Nitrate (NO_3) is composed of nitrogen and oxygen. Nitrates are found naturally in the environment, in the air, soil and water as a bi-product of the decomposition of plants and animals. Fertilizers, failing septic systems and runoff passing through barnyards and feedlots all leach nitrates into water sources. Shallow wells, dug wells with casings and wells with damaged, leaking fittings or casings are more susceptible to nitrate contamination. Excessive nitrate levels in drinking water can result in serious health problems for infants, such as Blue Baby Syndrome. The Ontario Safe Water Drinking Act (2002) recommends that nitrate levels be below 10mg/L in drinking water.

Lead

Lead usually leaches into water from plumbing pipes and solder joints. Lead can also be present in the standing water within the pipes themselves. It is good practice to allow water to run for a minute before drinking, if the system has not been used for several hours. Lead poisoning causes severe, irreversible health effects. It affects various organs in the body and the nervous system. It is associated with blood and brain disorders and has been found to cause mental retardation in young children. Where possible, it is recommended that drinking water pipes and joints be lead-free.

Water Treatment Methods

The type of contamination will determine the most appropriate treatment system. In addition to removing contaminants, purification systems are added improve taste and clarity, reduce odour or hardness. The most common water treatment methods are:

Ultraviolet radiation treatments

Ultraviolet radiation treatments are used to eliminate bacteria, viruses, moulds and other living microbiological elements. Water passes through a cylinder where it undergoes ultraviolet radiation exposure. Depending on the amount of suspended solids in the water, some microorganisms can be shadowed from the light and therefore remain active in the water system. Even though most bacteria are killed by exposure to ultraviolet rays, the cryptosporidium cyst (also known as giardia or beaver fever) is resistant to UV radiation. For this reason, a UV system is usually combined with another treatment method.

Reverse Osmosis

Reverse osmosis is used to improve water odour, taste and clarity and to remove most inorganic minerals and contaminants such as nitrate, salts and calcium as well as microscopic parasites. This process involves filtering water through a membrane, which traps most of the particles. The treated water is then separated from the rejected water and passes through a chamber where it is then available for consumption. Reverse osmosis tends to be costly.

Chlorination

This system involves adding chlorine to the water, which kills most bacteria. This method must be precise, because if the system fails, the addition of too much chlorine to the water supply could render it toxic. Although inexpensive, chlorination can potentially form dangerous organic chemicals produced by chlorine reacting with certain metals found in the water. For this reason, carbon filters are normally added, which reduce excess chlorine and eliminate most chlorine by-products.

Carbon Filters

Carbon filters remove most pesticides, mercury and radon gas, as well as many vaporizing organic chemicals. Within the filter, water passes through cellulose fibres before being filtered through carbon granules. The filtered water then tunnels through additional cellulose fibers before reaching the outlet port. Activated carbon filters are very porous, absorbing most organic compounds. They also reduce odours caused by iron and hydrogen sulfide.

Ozonation

Ozonation is used to remove inorganic minerals, bacteria, most pesticides, and improve water colour and odour. Ozonation is a filtration process that exposes water to artificially produced ozone gas. Even though ozone gas is one of the strongest disinfectants, it doesn't remain in the water for a long period of time. For this reason chlorine is normally added to the distribution system to protect the water quality. Although expensive, this water filtration method kills all microbiological contaminants effectively.

Distillation

Distillation involves the evaporation of water, which leaves most particles and impurities behind. The water vapour is then cooled, producing very pure distilled water. This treatment process removes most pesticides, salts, nitrates, fluoride and most heavy metals from the drinking water. Although effective, this purification method is time consuming and costly.

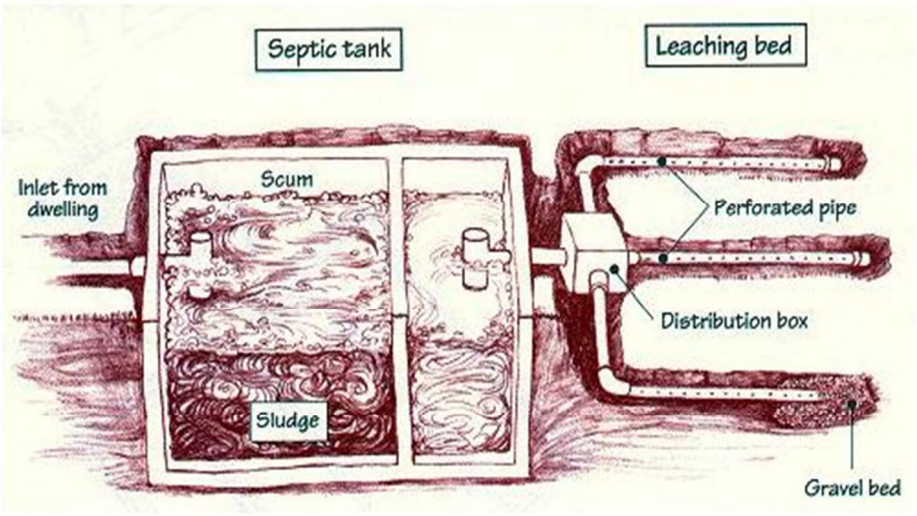
Septic Systems

In Ontario there are over 1.2 million on-site wastewater treatment systems. This term describes the various types of systems that treat wastewater, with the vast majority being conventional septic systems.

Septic systems are a good way to treat waste – as long as they function properly. Faulty septic systems can be extremely hazardous, since improperly treated effluent can harm both your health and the health of the environment.

What Is a Septic System?

Because wastewater contains bacteria, viruses and other contaminants, it needs to be treated before it is released back into the environment. A properly functioning septic system uses natural processes to treat contaminants. Septic systems have two main components: the septic tank and the leaching bed. Both components use a combination of physical, chemical and biological processes.



Septic System Diagram
(Living by Water Workshop In A Box Presentation)

Waste to Water: How it Works

Step 1: Raw sewage moves from your house or cottage into the septic tank.
Step 2 & 3: In the tank, the sewage flows through a series of chambers where it separates into solid portions, which remain in the tank to break down, and liquid portions (effluent), which move to the leaching bed. Beneficial bacteria work to break down the solid portions (known as the scum and sludge layers).
Step 4: The partially treated effluent leaves the septic tank when new wastewater flows into the tank.
Step 5: The effluent moves through a distribution system to the leaching bed (tile bed).
Step 6: The effluent reaches the leaching bed and flows through a series of perforated pipes.
Step 7: Some of the effluent is drawn upward and is absorbed by the vegetation covering the leaching bed. Gravity then carries the rest into the soils, which filter the remaining pollutants from the effluent. Bacteria found in the soil then break down the toxins remaining in the effluent. The effluent travels down from the soil until it reaches the groundwater and is reconnected with the water cycle.

Approval Process

The design, construction, operation, and maintenance of septic systems are regulated by the Ontario Building Code (O.B.C.). This regulation requires that you obtain a building permit for a septic system. If you are planning to install or replace a septic system it must meet the requirements outlined in the Ontario Building Code. You must obtain approval from your township prior to the installation of the system. Once completed, it must be inspected before back-filling takes place. Refer to the Contact List for information on how to contact your municipality.

Classes of Sewage Systems

The Ontario Building Code designates five classes of sanitary sewage of Sewage disposal.

- **Class 1:** A chemical toilet, an incineration toilet, a recirculation toilet, a self-contained portable toilet, and all forms of privy including a portable privy, an earth pit privy, a pail privy, a vault privy, and a composting toilet system, all of which can receive only human waste.
- **Class 2:** A greywater system, which can receive only greywater waste (such as dirty dishwater).
- **Class 3:** A cesspool, which can receive waste only from a Class 1 System.
- **Class 4:** A leaching bed system, which can accept both human body waste and greywater waste.
- **Class 5:** A sanitary sewage system with an on-site holding tank for sanitary sewage produced on-site, then removed by a haulage service provider; it can accept both human body waste and greywater.

Building Permit Required

A building permit must be obtained from the Health Unit before any installation, extension, or alteration of a sanitary sewage system can take place. Permit applications are typically associated with:

- New construction on a vacant lot
- Alteration or additions to an existing building
- Construction of a new system for an existing building
- Corrective work or repairs to an existing system
- Upgrade of an existing system

The Health Unit provides a permit application package to the property owner. It typically contains an information package with sewage system worksheets, a property description and applicant information sheet, a site description, calculations and intended system type sheet, a site plan and applicant or agent signature sheet, a completion notice and a sewage system fee schedule. See the Contact List for information on contacting the Leeds and Grenville District Health Unit.

Capacity and Locations of Septic Systems

Because of the hazardous contents of wastewater, there are regulations that govern the components of septic systems, their installation, and their location on the site. The legislation that governs septic systems is the Ontario Building Code. For further information you should contact your local municipality (see the Contact List).

Septic System Location

The Ontario Building Code also sets out minimum distance requirements for the installation of a system. Most new septic systems on new building lots are required to be installed a minimum of 30m from most water bodies. Some lakes have greater setbacks. Systems must be a minimum of 15m (50ft) from your drilled well and 30m(100ft) from a dug well. They must also be at least 5m (16ft) away from a swimming pool or vegetable garden.

How do Septic Systems Cause Problems?

In areas near shorelines it is particularly important to maintain your septic system properly, because soil and water conditions near shore may make the system less efficient in treating wastewater. Incomplete treatment can result in health risks and water quality problems. Hepatitis, dysentery, and other diseases are spread by bacteria, viruses, and parasites in wastewater. These disease-causing organisms, called pathogens, make near shore water unsafe for recreation. Inadequate treatment also allows excess nutrients to reach lakes and streams, promoting the growth of algae and aquatic vegetation. The result can be a water body unpleasant for swimming and boating. As aquatic vegetation dies, it settles to the bottom and decomposes, using up oxygen that fish need to survive.

Types of Septic Tanks

Steel Tanks

Steel tanks are only present in systems 35 years or older and are no longer legal to install. They have a simple structure: a single one-chambered tank with inlet and outlet pipes. Since they have no special mechanisms to slow the water down, they tend to allow many more suspended solids to escape than do tanks with a more modern design. Steel tanks eventually rust out, allowing effluent to leak into the ground.

Concrete Tanks

Concrete tanks are the most common tank type and have been in use for about forty years. They usually have a more sophisticated design than steel tanks and use several components to slow water movement:

- A partition wall dividing the tank into two chambers with small openings halfway down to allow water to pass through
- 'Baffles' which are concrete slabs suspended from the roof of the tank hanging halfway to the bottom
- 'T' shaped entry and exit pipes

The weakness of concrete tanks is their tendency to deteriorate over time. The action of the water slowly breaks down the concrete; the baffles often fall in after approximately thirty years; the tank may start to leak, and even the partition wall may eventually collapse. The use of harsh cleaning chemicals, such as chlorine bleach and harsh plumbing products can accelerate this process.

Plastic and Fibreglass Tanks

Plastic and fibreglass tanks are usually two-chambered, and have a similar structure to concrete tanks. They are relatively light and are often used in remote locations where the tank has to be transported in. However, they are more fragile than other tank types and can break if the ground shifts.

Effluent Filters

Effluent filters are strainers installed into the outlet pipe from the tank. They are not present in every tank, but are strongly recommended since they result in less stress on the leaching bed. Filters remove 90% of the suspended solids that would have otherwise moved to the leaching bed. The filters can be added to new systems, or retrofitted to older systems.

Effluent filters are easy to maintain. Once a year, slide the filter out and wash it off with a garden hose over the tank. Some filters even come with an alarm that sounds when they need cleaning. Effluent filters are highly recommended in order to prolong the life of septic systems.

Zabel Effluent Filter
(Living by Water Workshop In A Box presentation)

The Importance of Soil

The role soil plays is vital: 40% of the wastewater treatment occurs in the septic tank, but the remaining 60% occurs in the soil. The soil filter is the last line of defence for breaking down any remaining bacteria, viruses, and other contaminants in the wastewater before it reaches ground and surface water. As the effluent moves through the soil, the solid particles and bacteria in the effluent are caught in the soil pores. The effluent passes through the soil, moistening and adding nutrients under the leaching bed. Soil bacteria then colonize this area. These 'good' bacteria are hard at work throughout the soil removing harmful bacteria, viruses and other contaminants.

Maintaining Septic Systems

The maintenance and care of your septic system is your responsibility. You control what goes into it and how well it is maintained. If a septic system is not properly maintained, it is more susceptible to malfunction. Because the wastewater from a failing septic system can contaminate your well, your neighbours' wells and the shoreline environment, it is not just your concern, but a concern for the community. Prompt attention to problems may prevent health and environmental problems for everyone.

Maintenance Tips

The first step is to be familiar with your system. You need to know where the tank and bed are, what type of a system it is, it is helpful to keep a written history of when it was installed, pumped, inspected, etc.

Aside from knowing your system, there are four main things you can do to properly maintain it:

1. Regular Pump-Outs

The easiest and most important thing is to have the tank pumped out on a regular basis. The majority of system failures occur because the tank wasn't pumped often enough. You should have your system pumped every 3 to 5 years depending on the use and size of your septic system.

2. Regular Inspections

It is important to inspect a septic system regularly. A good opportunity is when the tank is being pumped out. At this point you or a professional*should:

- Check the scum and sludge depth
- Inspect the structure of the tank and baffles: look for any large cracks or deterioration
- Check the fit of the access lids and arrange for repairs as necessary. The lids should fit firmly into the receiving grooves of the tank and should not be cracked or chipped
- Listen for water running into the tank once it's been emptied. If you hear water entering the tank from the house, when all water is turned off, it indicates leaks or a running toilet.
    - Water running into the tank from the sidewalls or the top of tank indicates cracks or breached seals.
    - Water running into the tank from the outlet pipe can reveal substantial problems with the leaching bed. The problem could be as simple as a blocked leader or header pipe, or as complicated as a malfunctioning, saturated bed.

*If you are unsure or unable to inspect your septic system yourself, hire a professional such as a septic inspector, a licensed contractor who installs or repairs septic systems, or a representative of a firm that pumps out septic tanks.

3. Protect the Leaching Bed

The leaching bed is a sensitive area of the septic system. The breakdown process in this area involves both bacteria and soil. When these components are compromised or removed, the system does not completely treat the wastewater running through it. To protect the leaching bed you should:

- Not allow heavy machinery (like cars) and heavy foot traffic on the leaching bed. Compacting the soil can crack the distribution pipes, which causes greater volumes of effluent to be released into the bed, saturating and ultimately clogging it.
- Not water the lawn over the bed – this will saturate the bed.
- Keep trees away from the septic system, especially ones with creeping roots such as Willows, Birches, Poplars and Cedars. It is recommended that a distance of 5m (16ft) around the tank be kept clear of trees and shrubs (at least 10m (32ft) from Poplar and Willow trees).
- Create or maintain a vegetated buffer between your leaching field and any water body.

4. Control Inputs

To reduce stress on the septic system and the environment, it is important to control the volume of both liquids and solids put into the system. Canadians are among the world's biggest wasters of water, using on average 340L of water per day. You can reduce your water footprint with the following actions:

- Install water saving devices (i.e. water saving taps, showerheads, toilets and appliances) which will significantly reduce the amount of wastewater entering the system. This will greatly reduce the chance of the system becoming overloaded and contaminating ground and surface water.
- Practice water saving techniques: don't leave the tap running unnecessarily (e.g. shaving, brushing teeth, doing dishes). Use dishwashers and washing machines only when fully loaded, and spread loads out over the week.
- Fix leaky taps or running toilets right away; a tap that drips can waste up to 55 litres in 24 hours.
- Avoid using commercial cleaners and opt for environmentally friendly alternatives. Chemical cleaners, solvents, antifreeze and cigarette butts all contain toxins that will kill the beneficial

bacteria in a septic system. These bacteria are required throughout all of the stages of the treatment process. Without them, your system becomes useless.

- Reduce the amount of solids that have to be broken down. Items that normally go in the garbage should not be added to wastewater; a good rule of thumb is, 'if you didn't produce it, it shouldn't be going down your system'. Fats, oils and greases may clog pipes and cause the system to back up. Garburators and other systems that add solids should be avoided in favour of composting.

Additives

Many property owners wonder if they should use septic additives in their systems. The answer is no; they are not effective. Common additives such as starters, which claim to help 'restart' bacteria after a pump out, feeders which help feed bacteria, and cleaners said to clean the tank and pipes are all unnecessary.

To summarize: to maintain a healthy septic system, watch what goes down the drain, inspect your system and pump out the tank regularly.

How to Tell if There is a Problem

Unfortunately it isn't always easy to tell when there is a problem with a septic system. Since most of the components are underground, it is common to discover a problem long after the breakdown has occurred. However, there are a few symptoms that may indicate a problem:

- Patches of abnormally healthy looking grass or vegetation on the leaching bed. These patches may be doing well because of wastewater nutrients sitting in soil just below the surface. This is a sign that the leaching bed is full. Normally these nutrients should filter down through the soil with the effluent, making room for more effluent to move through.
- The ground over the leaching bed is soft or spongy, which may indicate that the leaching bed is saturated (full).
- Pools of dark water on the surface point to the same problem.
- Toilets and drains start backing up or make gurgling noises and take a long time to drain. This indicates that there is a blockage in the system or that the system is full.
- Foul odours. When the beneficial bacteria that break down contaminants in the soil are drowned out or suffocated by a saturated leaching bed, another bacteria group takes over. These (anaerobic) bacteria work in the absence of oxygen and produce a strong odour when breaking down contaminants. Odours can also be produced by a tank cover that is not completely sealed or buried.
- Foul smells in the house can indicate that wastewater is backing up into the house, or that the house-to-tank pipe is broken, which can cause wastewater to leak around the foundation.

Why Septic Systems Fail

It is estimated that over half of all septic systems in Ontario are failing to some extent. Regardless of the type or age, all systems can malfunction, even new ones. There are a number of reasons why this happens and most are preventable.

If after following the maintenance procedures listed above difficulties persist, there may be a structural problem with the system:

Improper Siting or Installation
Many failed systems in Ontario result from having been incorrectly sited or from improper installation.

Therefore, before installing a new septic system, ensure that the contractor is certified to do this work. The local Health Unit carries a list of qualified contractors. Throughout the installation process, an official septic system inspector must inspect the work; he/she will visit the site a number of times to ensure that the system is up to code before issuing a permit. The inspector will insure that:

- The system is the proper size for the load
- The system is far enough away from any wells, and complies with all other distance restrictions
- The distribution box is working
- The leaching bed is composed of the appropriate layers of filter material (gravel, etc.)
- The pipes are laid into the leaching bed properly (level surface-no angles)
- The leaching bed soil is covered in sod or planted with grass seed to prevent soil erosion
- The leaching bed is not buried too deeply (the backfill over a leaching bed cannot be deeper than 0.6m and must be permeable to allow oxygen to reach the bed. The soil bacteria which break down the effluent require oxygen to live)

Undersized Tank or Leaching Bed Area
If the tank is too small for the volume of wastewater, the solids and scum layers in the tank build up too quickly, flow out into the bed and clog it. A leaching bed too small for the load placed on it will clog within a few years.

The larger the volume of waste water, the bigger the tank and bed need to be. If you have plans to build a new bathroom or bedroom, purchase additional water-using appliances, or convert a seasonal cottage into a full-time residence, in most cases you will need additional septic capacity. If the tank is too small, you can make some improvements such as adding on an extra tank, adding an additional filtering unit, or expanding the leaching area.

High Groundwater Table
The importance of establishing the high groundwater table before the installation of a septic system cannot be overemphasized. If there is not at least 0.9m of unsaturated soil between the base of the absorption trench and the high groundwater table, the effluent may not be adequately treated before it rejoins the water cycle. Once it reaches the water table, viruses and bacteria like *E. coli* – not to mention any chemicals put down the drain – can move great distances and contaminate aquifers.

The water table may rise due to changing environmental factors and prevent the leaching bed from working properly. For these situations, purchasing a composting toilet to remove sewage is an effective solution. The existing septic system will probably be sufficient to treat the household grey water (wastewater from sinks, showers, etc.).

Distribution Box or Header is off Level
Sometimes the distribution box can settle differentially to the rest of the system (systems with pumps are especially prone to this). This is typically the result of poor compaction of the bedding material directly beneath the distribution box.

A distribution box that is off level will cause effluent to flow unevenly to all parts of the bed so that often only one part of the bed receives effluent. When this happens the soil under the section receiving all the effluent will clog prematurely. In these situations the distribution box will need to be reset by a licensed septic installer.

Physical Damage

The tile bed can be damaged or crushed if vehicles are driven over or parked on it. The roots of trees and deep-rooted shrubs such as willow and dogwood can also cause significant damage. It is recommended that a distance of 5m (16ft) around the tank is kept clear from trees and shrubs and at least 10m (32ft) from Poplar and Willow trees.

The Dangers of a Failing Septic System

There are a number of dangers associated with faulty septic systems and the incomplete treatment of wastewater.

Excessive Weed Growth
(Living by Water Workshop In A Box Presentation)

One of the biggest concerns is bacterial contamination of drinking water. Often, only a small amount of contaminated water can be extremely harmful. When ingested (through drinking water or when swimming), bacteria such as *E. coli* and Fecal Streptococci can cause serious health problems, and some strains are even fatal.

Nutrients like phosphorus get into the septic system through detergents and cleaners used in the house, as well as through regular waste. If the nutrients are not properly absorbed by the septic system soils, they reach surface water such as lakes and rivers. Once this happens, a whole host of lake-wide problems can ensue, including algal blooms and the depletion of oxygen in the water.

Alternative Wastewater Treatment Technologies

Conventional septic systems don't meet everyone's needs. Some sites are too small or otherwise unsuitable for a 'regular' septic system. You might want to take some stress off your old leaching bed, or significantly increase the use of a smaller bed. Fortunately, there are alternatives to septic systems. These alternatives give you more options when building or retrofitting. For example composting toilets remove human waste from the wastewater equation entirely, while advanced treatment systems process wastewater very thoroughly, making it much easier to dispose of. Some of the cases where you might consider alternative systems are:

- Cottages that are being converted to full-time residences
- Old or abused leaching beds
- Homes or cottages that are close to lakes and rivers
- Areas where there is shallow bedrock or a high groundwater table
- Areas where there are clay soils
- Heavily sloped sites

Note: Any alternative wastewater treatment system to be installed must be either a type approved by the Ontario Building Code, or specifically approved by the Municipal wastewater inspector.

Composting Toilets

Composting toilets work by breaking down pathogens (organisms that can be dangerous to human health) and converting human waste into a stable soil material that is not unlike the soil found in outdoor composters. These toilets look good, don't smell, and require very little maintenance. Depending on the capacity of the toilet, costs range from $1000 to $3000. There are several different types of composting toilets. For more information, contact the Centre for Sustainable Watersheds to determine what type is right for you.

Sanitary Sewage Systems (Privies/ Outhouses)

Outhouses are generally used for seasonal cottages in remote areas, or for temporary purposes such as construction sites. They are regulated by the Ontario Building Code.

Sanitary Sewage Systems (Greywater)

Greywater is waste water that does not include human waste and comes from sources such as dishwater, laundry tubs, washing machines and bathtubs. The Ontario Building Code states that Class 2 greywater system installations are permitted when the amount of the water being released into the soil does not exceed 1000 litres/day, or in an area without pressurized water.

You should contact your local Health Unit to obtain the proper approval and your local township for the minimum horizontal clearance distances for the various systems (see the Contact List).

Advanced Treatment Systems

Typically, a traditional septic tank treats raw sewage only partially and produces a primary quality effluent. An advanced treatment unit will treat wastewater to a higher standard. These systems may be added on to an existing septic tank, or may replace the tank completely. The unit will still be hooked up to a leaching bed of some kind, but because the effluent is cleaner, the leaching bed carries a lighter sediment load. For this reason it can legally be much smaller than a standard system.

Advanced treatment types depend on aerobic (with oxygen) bacteria to break down the waste. Aerobic bacteria break down waste faster than the anaerobic (without oxygen) types in a conventional septic system. This results in a much faster 'turn around time' in the system. Aerobic bacteria also produce fewer odours.

***ECOCYCLET* (Evapotranspiration Bed)**

In addition to the use of advanced treatment technologies, some groups are rethinking the way we treat our waste entirely. For instance, a small group of organizations (including Centre for Sustainable Watersheds) has been researching the use of water gardens to treat wastewater.

ECOCYCLET is a patented bio-engineered system that uses plants for wastewater treatment from residential and small commercial sites. In this system, the effluent from septic tanks is passed into an enclosed bed where microorganisms convert the wastewater into nutrients for plant growth. High-transpiration plants are chosen to maximize the ability of the system to remove the water. Water is also lost through evaporation from the soil. A greenhouse or solarium allows year-round treatment.

ECOCYCLET has zero discharge, meaning that no nutrients or pathogens are released into the environment. The system is fully lined, and designed for plants to consume the entire load of wastewater. Water that is not removed by evapotranspiration is fed back to a pumpable holding tank for recirculation. This system has been found to prevent damage to lakes and rivers.

For information on specific types of alternative treatment systems, check the Ontario Building Code website www.obc.mah.gov.on.ca.

Docks

If you need to replace your existing dock or install one for the first time, you will require a permit prior to construction. Keep in mind that you are more likely to get permission if the type of dock you want to install is environmentally friendly and located away from wetlands and fish spawning grounds.

Note: Docks running between islands (floating bridges in other words) and rafts fall under Transport Canada's authority. To obtain approval prior to the start of these projects Transport Canada must be contacted.

Permanent Dock Types

Some docks remain in place year round and may be used in conjunction with floating docks to accommodate changes in water levels. These docks are stable and can last for years, but have negative environmental implications. Supports made from cribs or concrete piers damage fish habitat and prevent water flow through and underneath the dock. In general, permits are no longer issued for permanent dock types.

There are three types of permanent docks:

Crib Docks

A "crib" is used as the foundation for this type of dock. A crib is generally made of square cut timber that is assembled in opposing pairs, one pair laid out on top of the next to create a box-like shape. The box is then filled with rocks. From an environmental point of view, crib docks are less damaging when the crib is located above the high water mark. The crib is then used as an anchor for more environmentally friendly docks such as floating docks, cantilever docks or pipe docks.

Permanent Pile Docks

A permanent pile dock is similar in appearance to the more environmentally friendly pipe dock (see below) but instead of resting on the surface of submerged land the poles (piles) are sunk into the sediment in pre-drilled holes. The poles can be made of wood, tubes of steel, or plastic. Flow-through underneath the dock is still permitted, and there is limited contact with the bottom of the water body.

Concrete Piers

A concrete pier is a huge block of cement. This type of dock is very expensive to construct and is the most environmentally destructive. Concrete piers restrict the flow of water and consequently destroy aquatic habitat. They usually cover a large area and smother habitat beneath them.

Environmentally Friendly Docks

These docks are a more environmentally friendly option. They can be taken out of the water for the winter season and cause minimal disturbance to fish and shoreline habitat. There are three types of environmentally friendly docks:

Cantilever Docks

Generally, a cantilever dock's frame stretches from the shore out over the water. A cantilever dock sits completely out of the water, so that water levels do not affect installation. Having no contact with the water, cantilever docks do not disturb river or lake bottoms, do not restrict the natural movement of water, and do not disrupt fish habitat.

Note: Picture Taken from DFO http://www.dfo-mpo.gc.ca/regions/central/pub/dock-quais-on/05-eng.htm (July 6,2009)

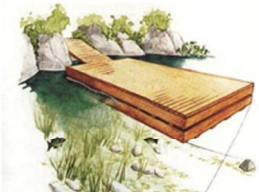
Advantages

- More protection from winter ice which increases the dock's life span
- No disruption to water or water body floor
- Can be used in shallow water

Disadvantages

- May be made out of wood, but may need steel reinforcement if on a large body of water with heavy wave action
- Often expensive to buy or build
- May not be suitable for sites with large changes in water levels

Floating Docks



Floating docks cause minimal disturbance to fish and shoreline habitat by having minimal contact with the shoreline and water body bottoms. Floating docks are relatively inexpensive, easy to build and are very versatile in sites with fluctuating water levels or where installation is difficult.

Note: Picture Taken from DFO http://www.dfo-mpo.gc.ca/regions/central/pub/dock-quais-on/05-eng.htm (July 6,2009)

Advantages

- Usually considered an acceptable choice by regulatory agencies
- Relatively easy to build and inexpensive
- Distance between the top of the dock's deck and water surface remains constant

Disadvantages

- Can lack stability if too small; a minimum size of 2m x 6m is recommended
- Blocks sunlight to aquatic plants
- Heavy; pulling ashore may not be practical; may damage banks

- Can be pulled to shore in fall to protect from ice damage
- Create cooler/ shaded areas for fish
- Adaptable to many types of shorelines

- May not last as long as others, since most of its surface is in constant contact with the water
- Higher maintenance cost (for replacing floats, anchors and moorings)

Pipe Docks

Typically, simple pipe docks are the least disruptive to the aquatic environment. They have minimal contact with the lake bottom, are smaller in size than other dock types, and sit out of the water.

Note: Picture Taken from Department of Fisheries and Oceans http://www.dfo-mpo.gc.ca/regions/central/pub/dock-quais-on/05eng.htm (July 6, 2009)

Note: Pipe docks are not suitable for muddy lakebed conditions, since the pipe legs will sink into the mud. However, a few inches of mud (silt) or blue clay generally cause no problem if concrete patio slabs or large base plates are placed under the legs for support.

Advantages

- Generally the least costly dock option and easiest to construct
- Least environmental impact with minimal damage to submerged lands; sunlight can penetrate the water below
- Usually considered an acceptable choice by regulatory agencies
- Being light weight, they can easily be removed for the winter

Disadvantages

- Maximum water depth is 2m or 6ft
- Distance between dock surface and water surface varies due to fluctuations in water levels; adjustable legs may be possible
- Very sensitive to ice pressures; should be removed for winter
- In an unprotected shore area, pipe docks are vulnerable to wave action damage

Shoreline Access

As a waterfront property owner, you probably need access to your shoreline for various activities. There are several low-impact solutions for accessing the shoreline which support the environmental health of your property. Any kind of regular access through the buffer zone to the water's edge can have an impact on the sensitive soils and fragile banks typical of shorelines. You can minimize these effects by following these recommendations:

- Avoid a steep path that cuts straight down a bank or bluff to the water; such a path can be difficult or even dangerous to navigate and can create a source of erosion which flushes sediment into the water. Use gentle S-curve switchbacks instead.
- On steep slopes, build open-back stairs with one or more landings instead of a trail to access the waterfront. Stairs make shoreline access easier and safer and decrease erosion; strategically placed landings also give you a place to rest and enjoy the view.
- Add a step or two on a trail where the slope is greater than 10%.
- When constructing trails, place them in areas where they will not interfere with runoff.

Stairs, Decks and Other Structures

When constructing stairs, decks, gazebos or other structures, consider some structural procedures to make them environmentally friendly as well as functional.

- Place your support stringers on concrete pilings to keep the wood from contacting the ground; this approach reduces the amount of cutting into the slope or bank.
- Build boardwalks, stairs or decks 10 – 50cm (4-20in) over vegetation, with spaced boards and no backs on stairs. This will allow sunlight and rain to penetrate between the boards, and vegetation to grow underneath. The vegetation will keep soils intact and protect against erosion.
- Leave 1 inch between planks to allow water to drain, and leaves and needles to fall through.
- When constructing stairs, place them in areas where they will not interfere with runoff. This will also diminish winter ice damage from flowing water that freezes.
- Avoid removing plants from areas that may easily erode, such as areas beside structures.
- Plan structures so that they use only the necessary space.
- Try to use materials that are environmentally friendly. (See below.)

Alternative to Treated Wood

Cedar is a naturally durable wood that lasts 15-25 years untreated. It contains oils that act as natural preservatives, enabling the wood to resist insect attack and decay. Using cedar eliminates the need for toxic, pressure-treated wood. It is the best choice for docks and rafts. Wood treated with Ammoniacal Copper Quaternary has been advertised as an alternative to pressure-treated wood; however, even in minute quantities, Copper is toxic to invertebrates. Pressure-treated wood will be approved, provided it is dry before it is placed in the water. However, pressure treated wood does leach hazardous chemicals into the water. Creosote treated wood (railway ties) will not be approved for use on any shoreline structure and should not be used anywhere on your property

Composite Lumber

Composite lumber is an option for low-load, structural applications, such as decking planks used for docks and walkways. It is not intended for primary structural load-bearing elements, such as beams and posts. Before installing composite lumber, it is important to consider the effect temperature fluctuations will have on the expansion and contraction of the product.

Beaches

In the Rideau-St. Lawrence region there are very few natural beaches. Beaches are sometimes viewed as a desirable feature for a waterfront property, but there are several things that you should consider if you are thinking of creating a beach on your property.

- An artificial beach will disappear; waves, currents, ice and other erosive forces remove sand over time. Even pulling up your boat or walking repeatedly on sloping sand will push sand from an artificial beach downhill and into the water.
- By adding sand to an eroding beach, you risk gradually filling in the waterway, silting the habitat of fish and other animals and possibly damaging the quality of your drinking water. Drifting sand can inflict these problems on your neighbours as well.
- Imported sand, especially unwashed building sand, may introduce unwanted seeds and insects that are not natural to your watershed.
- By clearing shoreline vegetation to create space for a beach, you lose one of your critical tools for runoff and erosion control, as well as habitat for wildlife.
- The creation of new beaches is not permitted by approval agencies in many areas. Most land below the high water mark or 'natural boundary' of a water body belongs to the Crown and is public land. If you alter it without prior approval you can be fined.

Permits

Before you embark on a project on or near a shoreline, you may require a permit. Depending on the exact type of activity, the permit may be needed from a federal, provincial, or municipal government department (or sometimes a combination). See the Contact List for how to reach these organizations.

Obtaining a Permit for Marine Work, Construction, or Repair

Permit requirements vary among jurisdictions, since local environmental factors must be taken into consideration. Your local Conservation Authority is the first place to contact for information or referrals.

Jurisdiction

Any marine work, including the construction, repair or modification of any structure on, over, or in a lake requires written approval from your Conservation Authority (CA). Any dock or boathouse built at or below the high-water mark also needs a work permit from your local CA. The CA may forward you to the local Ministry of Natural Resources office.

In some circumstances your application may need to be reviewed by other government agencies such as the Department of Fisheries and Oceans or Ministry of the Environment.

Note: Because of fish spawning activity, no in-water work is permitted between March 15th and June 30thin any year. (Such regulations may vary in different regions).

In an attempt to conserve as much of the remaining natural shoreline as possible, the Conservation Authority generally stipulates that no more than 25% or 15m (50ft) (whichever is less) of a shoreline can become developed – this amount combines all marine works and structures such as docks, boat ramps, etc.

Conservation Authority Permit Process

The Conservation Authorities regulate areas within the flood plain boundary, both below and above the high water mark. Contact your local CA for the flood plain boundary measurements on your waterfront property.

In 1998, Conservation Authorities in Ontario began to assist the Department of Fisheries and Oceans in its implementation of the Fisheries Act, Section 35. Therefore, most Conservation Authorities now review permit applications for the construction of all buildings or structure within the regional flood plain boundaries. Permits are also required for any project which places or dumps fill within flood plain boundaries, as well as any project which straightens, changes, diverts, or interferes with the existing water body.

Keep in mind that other approvals may be necessary. Approval from one government agency does not guarantee approval from another agency.

Shoreline Stabilization

Shorewalls or 'seawalls' generally don't receive approval because they are usually detrimental to fish habitat. Contact the local Conservation Authority if you are considering construction of a vertical wall above the high water mark. If mechanical stabilization is necessary, rip-rap is the preferred method. However, repairs on existing vertical walls are often allowed, if the repairs are limited to 25% or less of the wall, and no further encroachment into the lake is involved beyond the outside face of the original wall. In some cases, a collar of rip-rap at the base of the wall may be required.

Septic Systems

Design, construction, operation, and maintenance of septic systems are regulated by the Ontario Building Code (O.B.C.) and are enforced under municipalities. This regulation involves issuance of building permits for septic systems. Please see the septic system section for more information.

Jurisdiction for Aquatic Plants

The beds of most water bodies in Ontario are legally public land. In order to remove aquatic plants by hand or using mechanical methods, a work permit from the applicable authority is required. To obtain approval for in-water and shoreline works in these areas, you should contact the Ministry of Natural resources.

Regulations for Aquatic Plants

If your project involves in-water dredging (removal of rocks or sediment from the bottom) or filling, you will require approval from the Conservation Authority.

Note: Anyone proposing to apply herbicide for the control of aquatic plants must first obtain a permit issued by the Ministry of Environment under the Pesticides Act. Because the application of pesticides, including herbicides, can be very harmful to fish it is a practice that is generally not approved.

Control Methods for Aquatic Plants

- Raking
- Removal by hand
- Mechanical harvesting
- Cutter-bar devices
- Bottom barriers (mats or blankets)
- Chemical methods (herbicides)

To protect fish habitat, hand removal and raking of aquatic weeds are the preferred methods. If disturbance of the lake bottom is minimized, cutter-bar devices or mechanical harvest methods are acceptable.

How Much to Remove

The amount of plant material that can be removed depends on the conditions of the waterfront. Factors include which fish species are present, the abundance and distribution of plants, and the reasons why you are controlling the plants.

Removal permits may be granted provided that the proposed area for plant removal is not within a sensitive habitat. A sensitive habitat includes fish spawning, nursery, and feeding areas as well as areas of important aquatic vegetation. Also included is cover for fish, and fish migration routes.
The permit will also specify the exact time of removal.

Note: The Ministry of Natural Resources will determine if the proposed area of removal is considered 'sensitive habitat'.

Dredging
Dredging, which involves removing sediments from the lake bottom, will only be approved under certain conditions and usually only on already existing lots.

Storage
If you are storing the removed plants before disposing of them permanently, they should be temporarily placed in a holding site distant from the shoreline. This prevents leaching of nutrients back into the water. The land above the high water mark but still within the 100-year flood plain line is under the jurisdiction of the local Conservation Authority. All disposal of plant material must be above this mark. This includes plant material removed using any method, as well as any dredged material. The CA can provide the location of flood plain boundaries.

Note: Warm-water fish species spawn during spring and early summer. Removing aquatic plants at this time could kill eggs and young fish. It is recommended that vegetation only be removed after the second or third week in June.

Lawns

In North America, lawns now account for more than 20 million acres of land use. Often chemical fertilizers are applied to these lawns, and it is not uncommon for a typical, chemically manicured lawn to have between five to ten times the concentrations of chemical fertilizers and pesticides per unit area than in agricultural settings. One of the main problems with using chemicals on shoreline properties, especially lawns, is that over 55% of precipitation runs off short lawns. On a shoreline property, the runoff goes directly to the adjacent water body, where it can upset the natural ecosystem. If you choose to have a lawn, it should be placed well back from the shore, and natural lawn care methods should be used. (See below.)

Chemical Pesticides

Chemical pesticides collectively are designed to kill organisms considered to be undesirable, such as insects, certain types of plant, and fungi. Among them are herbicides, insecticides, fungicides, nematocides, rodenticides and even algaecides (for pools). Pesticides are composed of active ingredients, which often include carcinogens and/or toxic substances. The active ingredients include all chemicals found in the pesticide that kill, disperse, attract or control the targeted pest. The remaining ingredients (i.e. water, solvents, propellants etc.) are called non-active or inert ingredients and are not used to kill or harm the targeted species. This does not however, imply that these inert ingredients are safe.

It is now illegal in Ontario to use pesticides for cosmetic purposes. There are over 6000 pesticide products registered for use in Canada today. The long-term impacts these pesticides have on humans and wildlife are generally unknown. Even less is known about the long-term effects of combinations of chemicals (synergistic effects.)

Human Health Risks

Pesticides can be absorbed through the skin, inhaled, or ingested where they attack various organs, aggravate existing health problems or even cause new ones. Evidence is building on the negative and previously unknown side effects of these chemicals. The risk in children is a growing concern. Some behavioural and learning disorders have been linked to pesticide exposure.

For more information on the effects of pesticides on human health, please visit the website of the Canadian Association of Physicians for the Environment: **www.cape.ca/toxics/pesticides.html**

Health Risks to Flora and Fauna

Pesticides also have a great impact on flora and fauna. Wildlife faces many of the same threats as humans. For example, pesticide use has been linked to abnormalities in frogs and fish.

As with humans, wildlife is affected by two processes that occur with pesticides: Bioaccumulation and Biomagnification.

Bioaccumulation
Bioaccumulation is a tendency for some pesticides to build up in tissues of living organisms over a period of time. The concentration of chemical products in living tissue increases and reaches a concentration that is much higher than the surrounding environment. Pesticides increase in concentration as they move up the food chain, thus increasing in toxicity. When referring to bioaccumulation in regards to the food chain, the term biomagnification is often used.

Biomagnification
Biomagnification is the capability of some pesticides to accumulate as they advance through the food chain. Concentrations of chemicals are amplified in each step of the food chain and tend to affect most the organisms at the top.

Fish are very sensitive to certain pesticide residues. Their flesh becomes contaminated with pesticides that persist for years after their exposure. Higher pesticide levels are found in larger, older fish that have large amounts of body fat. Pesticide bioaccumulation occurs within humans or other species that eat such fish.

Natural Lawn Care

Since more and more people are becoming aware of the negative impacts pesticides and fertilizers have on wildlife and humans, alternative natural methods of lawn care have been developed. The best defenses against lawn pests and diseases are to:

- Leave your lawn approximately 10 centimeters high to encourage the growth of stronger and deeper roots
- Leave grass clippings on the lawn, which returns nitrogen naturally to the soil
- Do not overwater, since fungi and diseases often prosper in these conditions; if you choose to water, water deeply once a week only in weeks where there has not been 1 inch (2.5 cm) of rainfall
- Scald weeds with hot water to help remove them

Alternative Methods for Control of Garden Pests

- Remove insects with pressure sprayers of air or water, or pheromone traps, baits & lures
- Repel insects from flower beds and gardens using hot pepper wax (which can be found at most garden centres)
- Prevent weeds from growing using physical barriers around plants (such as mulch)
- Use natural weed killers (such as corn gluten) which can feed turf grass while eliminating weeds
- Remove weeds by hand
- Prevent further weed growth after removal by covering the weeded area with a blend of compost and grass seeds; this natural mixture will also help the soil regain a healthy composition

Retiring a Lawn

Transforming your lawn to a more natural planting will help protect both your lake and the groundwater. In areas close to shorelines, grass is not a good choice of ground cover. Turf grass has a short root system and does not bind to the soil; this can cause erosion along the shoreline. Turf grass along a shoreline also permits much more runoff and pollutants to pass over it toward the surface water. By retiring areas of your lawn that are not actively being used and establishing a buffer, you will reduce maintenance and protect your shoreline from erosion.

How to Retire a Lawn

You can naturalize your lawn in manageable sections by adding or increasing wildflower gardens, shrub borders, adding a rockery, or expanding forest and meadow habitat.

Note: It is important to minimize the amount of disturbance that is caused by site preparation, since digging can sometimes liberate weed seeds that have been buried and dormant in the soil of your property.

The first step in lawn retirement is to simply stop mowing. There should still be enough dormant native seeds in the soil to regenerate the site naturally. If this option does not produce the desired results, planting native plants and shrubs is recommended.

Note: Native plants have co-evolved with the pests and pathogens in this region, and therefore do not require applications of pesticides to survive.

Living with Wildlife

Throughout Ontario most wildlife species are beneficial to you and your property. But some species can cause problems if proper precautions are not taken. Some recommendations for minimizing wildlife problems include:

Block Access

- Block all means of entry for insects, rodents and bats via foundations, porches and steps; through doors and windows; through holes in roofs or eaves; through cracks in floors, ceilings, and walls; and through access points for wire and pipes
- To avoid trapping animals or their young inside, be sure that all possible intruders have left before sealing up entrances; early fall is a good-time for pest proofing
- Seal with caulk, weather-stripping, expandable foam, crumpled heavy-duty aluminum foil, metal flashing and/or steel wool
- Use fine wire mesh screens on all doors, window openings and vents. Don't forget attic and under-floor vents

Discourage Contact

- Trim tree limbs that touch your roof or the walls of your home or outbuildings
- Store firewood and lumber away from main buildings
- Minimize outdoor light use. If light is required outside, use yellow light bulbs to reduce the number of flying insects

Keep Food Away

- Use animal-proof garbage cans, and if feasible, keep garbage cans in a shed or garage until garbage can be removed. If there are bears in your area, and you can't safely store your garbage indoors, construct a very sturdy container and remove your garbage often
- Keep pet food inside to avoid attracting wildlife; if you must feed pets outdoors, remove food dishes and any leftover food after feeding
- Keep all food (including pet food) in sturdy rodent and insect-proof containers; remember that rodents can chew through some plastics
- If you have orchards or berry bushes, fence your orchard and harvest the fruit (including the windfalls) to discourage bears
- Maintain your compost; turn it regularly and cover with dirt or leaves; improperly maintained compost piles and bins attract many animals, including skunks and raccoons
- If there are bears in your area, consider indoor (worm) composting
- Keep barbecue equipment clean, and store it in a secure area; many animals are attracted to meat odours
- Prevent bird feed from accumulating on the ground; use feeders with large trays or add a higher lip around the platform to prevent spillage; keep feeders away from decks where it can be hard to clean up spilled seeds
- Avoid using suet in feeders since it can attract other wildlife; fill feeders only when bears are in hibernation; when bears are active there are plenty of natural food sources for birds

Species at Risk

What are Species at Risk?
A species at risk is any plant or animal that is at risk of extinction or of disappearing within the province. To determine whether a species is at risk, first it is considered by the Committee on the Status of Species at Risk in Ontario (COSSARO). Next, a group of experts conducts an assessment using a variety of tools including scientific data, traditional knowledge, and community knowledge. Once a species is determined to be at risk it is immediately placed on the Species at Risk in Ontario (SARO) list. In Ontario there are currently 185 species of plants and wildlife classified as Species at Risk.
Within the classification of Species at Risk there are several levels that are used to determine the severity of concern for a species. These levels are as follows:

- **Extirpated –** a native species that no longer exists in the wild in Ontario, but still exists (e.g. Greater Prairie Chicken)
- **Endangered** – a native species facing extinction or extirpation (e.g. Cucumber Tree)
- **Threatened** – a native species at risk of becoming endangered in Ontario (e.g. Fowler's Toad)
- **Special Concern** – a native species that is sensitive to human activities or natural events which may cause it to become endangered or threatened (e.g. Monarch Butterfly)

Why Are Species Becoming at Risk?

Both human and natural factors cause species to become at risk. Human factors include habitat degradation, climate change, over harvesting, changing land uses, landscaping, invasive species introduction, persecution and pollution. Natural factors include specialized needs in the animal or plants' life, disease, small geographic range, large territory size and rarity of habitat.

The most common factor that contributes to a species becoming at risk is a loss of habitat. Healthy habitat is essential to maintaining healthy wildlife populations.

Habitat is the key to the continued existence of each species; habitat provides shelter, food and breeding ground for wildlife.

What You Can Do

You, as a landowner, play a significant role in the protection of Species at Risk by:

- Maintaining a healthy shoreline,
- Allowing wildlife habitats to form on your property and maintaining them (for a host of good ideas on how, see page 47), and
- Reporting sightings of Species at Risk

Ministry of Natural Resources Stewardship Approach

The Species at Risk Stewardship Program is the key piece in the Ontario's Endangered Species Act of 2007. It contains several features that promote the protection of Species at Risk:

- Education and outreach
- Incentive programs to support private landowners, and
- Funding for stewardship activities

The Ontario Species at Risk Stewardship Fund aims to create public involvement and provide support for private landowners to obtain help and resources to protect Species at Risk.

If you are interested in participating in a Stewardship Program related to Species at Risk, contact the Leeds and Grenville Stewardship Council (see the Contact List).

For further information on the Species at Risk Stewardship Fund, guidelines for eligibility criteria and more information about Species at Risk in Ontario visit the website www.mnr.gov.on.ca/en/Business/Species/2ColumnSubPage/STEL01_131229.html

Wildlife Habitat

The following features on your property help to create and enhance habitat and attract wildlife:

Cavity Trees: Large trees with hollow cavities are a vital source of food, shelter, and safety. In Ontario, more than 50 species of birds and mammals (including Pileated Woodpeckers and Barred Owls) depend on cavity trees for nesting, rearing young, roosting, feeding, storing food, escaping predators and hibernating. By retaining cavity trees on your property, you provide important habitat for wildlife.

Fallen Logs: Fallen logs are essential habitat for small mammals, such as moles, woodpeckers, toads, and many insects. As the log rots, the trunk becomes damp and spongy encouraging the growth of fungi (such as mushrooms) and mosses. Reptiles and amphibians will lay their eggs in the moist wood. A decaying log is also great habitat for beetles and ants that burrow under the bark or lay eggs.

Cedar Stands: Cedar stands provide potential habitat for deer yards. Deer yards consist of a core area of mainly coniferous trees (pines, hemlock, cedar, spruce) with a canopy closure of more than 60% which provide shelter, ease of movement, and protection from predators. The land surrounding the core area is usually mixed or deciduous forest.

Dense Coniferous Forests: These forests provide winter habitat for wild turkeys because they offer minimal snow accumulation on the ground and protection from cold and predators. Coniferous stands used by turkeys are usually on valley floors or lower slopes.

Mast Producing Trees: Mast is fruit and seeds produced by maple, elm and ash, and nuts from oak, black walnut and beech. Mast is the primary fall and winter food for most forest wildlife species for building fat reserves for hibernation.

Vernal Pools: These are temporary wetlands formed in depressions by rain and melting spring snow. Short-lived, they last anywhere from a few days to three to four months before drying up. They are an important breeding habitat for amphibians since they lack predators such as fish and reptiles found in permanent water bodies. Fairy shrimp and Water Striders also use vernal pools as habitat.

Reptile Hibernacula: These sites have rocky outcrops with crevasses. An ideal habitat site has a forested corridor adjacent to the rocky site. Rocky habitats also provide nesting, den sites and cover for many other species of wildlife, including birds, amphibians, snakes and small mammals such as foxes, skunks, squirrels and rabbits. A male Ruffed Grouse may also find this an attractive drumming site.

Brush Piles: Brush piles can be constructed with the cut materials from trail clearing or woodlot management (pruning). Pile the brush, approximately waist-high, on a stump, log, boulder, or along fencerows. These provide habitat for snowshoe hare, cottontail rabbits and others. For added benefit, train climbing vines, such as Virginia Creeper onto the brush pile.

Dying Material Left in Place: When safe, you can help attract wildlife by leaving dead standing trees, fallen logs and the mast fallen off of trees on your property. However, note that dead elm trees should be removed, since they can provide habitat for elm bark beetles, carriers of Dutch Elm disease.

Invasive Species

Within the local area there are a number of invasive species of plants, trees and aquatic vegetation. The following is a list of selected invasive species that may be found in this area. For a complete list refer to the Contact List for a website address.

Acer platinoides (Norway Maple)
Norway maple was introduced from Europe for use in urban landscaping in 1778 and escaped from planted areas into open woods and floodplains in southern Ontario. It is able to colonize and dominate almost any forest habitat, shading out many native species.

Alliaria petiolata (Garlic Mustard)
Garlic mustard was introduced deliberately to North America from Europe for its medicinal value. It grows in disturbed and natural sites, forming dense monocultures. It prefers partial shade and thrives in soils high in lime. It has endangered native Wood Poppy, American Ginseng and White Wood Aster.

Alnus glutinosa (European/Black Alder)
European Black Alder was introduced to North America long ago from Europe, northern Africa and western Asia and has escaped from cultivation. It is sometimes seen along bodies of water, where it may successfully self-seed and form pure stands. The preferred habitat is shady, moist to wet areas.

Butomus umbellatus (Flowering Rush)
Flowering rush first appeared in Canada in 1897 from Europe. Flowering Rush reproduces by both seed and vegetative spread of its rootstocks. Its seeds are also long lived, which increases the opportunity for spread. Once established, flowering rush forms dense colonies and grows mainly in marshes and shallow water. It can out-compete willows and cattails.

Hydrocharis morsus-ranae (European Frog-bit)
European Frog-Bit is a floating aquatic plant. It was intentionally introduced for horticultural purposes at an experimental farm in Ottawa. It escaped from the experiment farm in 1936, moving into the Rideau Canal. Since then it has continued its spread into many lakes and rivers in Ontario, forming dense mats and limiting light penetration for native aquatics.

Lonicera tatarica (Tartarian Honeysuckle)
Tartarian Honeysuckle was planted as a wildlife shrub by government agencies and as an ornamental in gardens. It quickly spread to colonize open woods, fields, and shorelines. These large shrubs displace native understorey and ground covers as well as changing vegetation structure, and impeding forest tree regeneration.

Lythrum salicaria (Purple Loosestrife)
Purple Loosestrife was imported by settlers from Europe for flower gardens and also was present in soils used for ballast in ships. It degrades wetland habitats, chokes out fish-spawning grounds and competes with wild rice (a valuable food plant for wildlife) and other important native species. Purple Loosestrife is very difficult to eradicate once established. To help control the spread of this plant, remove the flower spikes prior to seed set and cut stems off at ground level to inhibit growth. Any cuttings should be bagged and burned.

Myriophyllum spicatum (Eurasian Milfoil)
Eurasian Milfoil thrives in areas of disturbance. Because new plants grow from each joint on existing plants, it quickly forms dense mats of floating vegetation that prevent light from penetrating down to other aquatic plants. Milfoil spreads when stem pieces break off and are carried away by currents. It moves from lake to lake via boats, trailers and fishing gear. Once Eurasian Milfoil has established itself, it is impossible to eradicate.

Phalaris arundinacea (Reed Canary Grass)
Reed Canary Grass is an aggressive spreading grass that develops dense monocultures that are able to displace native species. It is commonly found growing in areas with Purple Loosestrife populations.

Phragmites australis (Common Reed)
Common Reed is quite aggressive and very resilient. It is adaptable to periods of flooding and drying and tolerates a wide range of temperatures. It can spread at a fast rate and often out-competes native vegetation. Common Reed occupies open areas, preferring the moist soils of marshes, shore areas and ditches.

Poa pratensis (Kentucky Bluegrass)
Kentucky Bluegrass was introduced as a cultivator used in lawns and pastures. It has quickly spread to meadows, fields, and semi-open woods. This species of grass grows early in the season while most plants are still dormant. It grows rapidly and leaves little room for other more desirable plants to grow, since they cannot compete.

Polygonum cuspidatum (Japanese Knotweed)
Japanese Knotweed was brought to North America as an ornamental plant in the late 1800's. This highly invasive plant is found along roadsides and wetland areas, where it out-competes native vegetation. It is extremely difficult to control once established because of its deep, complex root system.

Potamogeton crispus (Curly Leaf pondweed)
Curly Leaf Pondweed was introduced accidentally with fishery stock. It forms dense mats of vegetation on the surface of the water, blocking sunlight and increasing water eutrophication.

Rhamnus frangula (Glossy Buckthorn)
Glossy Buckthorn was imported to North America as horticultural stock from Europe in the 1800's. It became naturalized via bird dispersal. Its growth can be dense enough to exclude other species and is one of the most aggressive invasive species of wetland habitats. To control this plant, you must regularly cut it.

Syringa vulgaris (Lilac)
Lilac was introduced to Canada from Europe as an ornamental shrub and quickly spread to roadsides and abandoned land. It is a hardy shrub that can withstand cold, harsh temperatures and can grow just about anywhere.

Vinca minor (Periwinkle)
Periwinkle is widely planted as ground cover in ornamental gardens and has since spread to roadsides, waste places, and open woods. Periwinkle excludes all other species and prevents re-growth. It can completely wipe out the understory of forests.

Cabomba caroliniana *(Fanwort)*
Fanwort is a submersed, perennial, freshwater plant native to the southeastern temperate climates of North and South America. Fanwort is a common aquarium plant, sold in pet stores across North America, which poses a serious threat to Ontario waters. Once present in a waterbody it crowds out native plants and blocks the natural flow of water.

Zebra Mussels

Zebra Mussels were first discovered in 1988 in the Great Lakes and have since spread rapidly throughout fresh water lakes and canals in Canada and the Northern United States. Zebra Mussels are native to the Ponto-Caspian region of Europe but were introduced to the St. Lawrence Seaway through the discharge of ballast water from ships. Zebra Mussels spread very quickly; their eggs are transferred through bilges and bait wells that are not emptied and cleaned before being placed into a new water body. Zebra mussels negatively affect the environment and our economy by:

- Killing native mussels by fastening themselves to their shells and preventing them from breathing, feeding and moving
- Introducing toxins to any waterfowl that feed on them (Zebra Mussels have high concentrations of toxins)
- Clogging water pipes which costs millions of dollars to repair
- Increasing hazards on docks by attaching to surfaces (Zebra Mussels can cut and tear your skin)
- Filtering algae from the water which will cause many species to disappear as the ecosystem changes radically
- Increasing water clarity and light, which increases growth in bottom-dwelling aquatic plants

With the variety of problems that Zebra Mussels cause, it is essential that you try to control and stop the spread of this destructive species.

- Use hot water to kill zebra mussels in your boat, but this is only effective on a small bilge or when cleaning live wells and bait buckets
- Potassium, bromide, ozone and ultraviolet light are other alternatives that will kill Zebra Mussels, but are difficult to apply
- Drain water from bilge, live wells, bait buckets, trailers and wheels; wash bait wells with hot water
- Do not transfer bait from and infected water body; rinse the hull with hot water, high-pressure washer or dry in the sun for 5 days
- Flush the engine coolant system with hot water (140F)
- Carefully inspect screens, water intakes and drain pipes for mussels
- Leave your boat out of the water for 3+ days in hot, dry weather to kill mussels and larvae

Zebra Mussels are a growing problem in Canada that will not abate until people become aware of their destructive effects and take steps to help stop their spread.

Lyme Disease

Lyme disease is a bacterial infection caused by the spirochete Borrelia burgdorferi. This bacterium has been in North America for over a century. The spirochetes are maintained in the bodies of wild animals and are transmitted through the bite of an infected tick. It can take up to three days for the bacteria to enter the body of the new host, including humans and their pets. The body does not always maintain a natural immunity to the disease and thus, some people have been re-infected.

The best prevention for Lyme disease is being well-covered while walking through fields or forests and carefully inspecting yourself (especially around collars and ankles) and pets, to find ticks quickly.

West Nile Virus

In recent years the concern over West Nile Virus in Ontario and throughout Canada has grown. As a waterfront property owner you need to be aware of the potential danger that West Nile Virus presents to you, your family and guests.

West Nile Virus is mainly transmitted to humans through the bite of an infected mosquito. The chance of becoming infected is low, but people with weak immune systems or chronic diseases are at a greater risk for developing serious health problems from infection.

What can I do to protect myself and others?

First, protect yourself and others from mosquito bites. You can also eliminate potential breeding grounds for mosquitoes on your property by:

- Regularly (twice a week) draining standing water from items like pool covers, saucers under flower pots, recycle bins, garbage cans, etc.
- Removing unused items from around your property (i.e., old tires) which have a tendency to collect water.
- Changing the water in wading pools, bird baths, pet bowls and livestock watering tanks twice a week.
- Covering rain barrels with mosquito proof screens.
- Cleaning out eaves troughs regularly to prevent clogs that trap water.
- Purchasing an aerator or ornamental pond, this will keep the surface water moving which will make the water inhospitable to mosquito larvae.

Lighting and Light Pollution

When installing lights, remember that they may also shine on your neighbours' property and on to the surface of nearby water bodies. Light reflects off the water, which can affect the night vision of boaters.

Light pollution occurs when excessive amounts of light and undirected light are present or when light levels exceed requirements. You can reduce undirected lighting by placing lights closer to their intended location. For instance, pathways can be easily lit by solar lights that are placed in the ground.

Artificial light outdoors at night is harmful to humans. A lack of darkness been shown to:

- Disrupt sleep patterns, perhaps lowering important protective hormones
- Increase disease

In wildlife it has been shown to:

- Disrupt reproduction
- Disrupt feeding patterns, since animals can no longer hide from predators
- Disrupt migration, leading birds to crash into lit buildings for example.

You can find an excellent article in the November 2008 National Geographic in an article called The End of Night: Why We Need Darkness. Another interesting document discussing light pollution can be found at www.darkskiesawareness.org/files/LP%20cards_v17-04-09.pdf.

Five Easy Steps to Responsible Lighting

1. Determine what lighting is needed to illuminate targeted areas. Determine if you really need each light for safety, as a marker (such as low-voltage garden path lights) or for aesthetic reasons.

Note: An easy way to judge whether you have appropriate lighting or not is to determine whether the light source is more apparent than what it is illuminating. If so, then your lighting methods could be improved.

2. Use the right amount of light. More is not always better. Too much light wastes energy and reduces visibility by creating glare and forming dark shadows. By creating smooth transitions from light to dark areas, one's eyes can adjust more easily.
3. Avoid letting lights shine sideways or upwards. Use full cut-off, shielded fixtures and aim light to the area where you need it.
4. Use infrared and motion detectors that turn lights on and off as needed. This improves security and reduces electricity consumption. Use timers to control when lights come on.
5. Use efficient lamps: Remember, shielded fixtures with good reflectors waste little light, so you can use lower wattage bulbs.

Noise Pollution

Noise pollution is excessive sound that harms human health, the environment and wildlife. Noise pollution comes from human activities such as aircraft, trucks, recreational vehicles, and heavy machinery.

Noise pollution can harm wildlife by causing physiological and behavioural responses such as:

- Altered growth and reproductive patterns characteristics
- Altered species distribution
- Altered seasonal activities
- Altered physiological responses including
    - Increases in heart rate
    - Damage to metabolism and hormone balance
    - Excessive stimulation of the nervous system causing damage to reproductive fitness and
- Behavioural responses such as:
    - Head-raising

- Body-shifting
- Unusual panic/ escape behaviour
- Energy loss
- Decrease in food intake
- Habitat avoidance
- Abandonment of young
- Reproductive losses
- Hearing loss

For more information on the effects of noise pollution, please read the following document, a literature review from the University of Oregon, found at the following link:
interact.uoregon.edu/medialit/wfae/library/articles/radle_effect_noise_wildlife.pdf

Burn Barrels

Burn barrels are not illegal in rural Ontario, despite their dangers. But when you burn garbage, you are negatively affecting your health and that of neighbours and wildlife.

Environmental Effects of Burning Garbage (with thanks to the Wisconsin Department of Natural Resources)

What is given off when garbage burns?
Pollutants vary depending on the type of garbage burned, but typically emissions include dioxins, ash, furans, halogenated hydrocarbons, carbon monoxide, lead, barium, chromium, cadmium, carbon dioxide, sulfur dioxide, arsenic or mercury.

What are the effects of ash from burn barrels?
Ash (particulates) can irritate the eyes and throat and can restrict visibility. Ash can damage the lungs, cause bronchitis, emphysema, and lung cancer, and can seriously affect people with asthma or certain allergies. Ash also contains heavy metals that may seep into the ground water.

Backyard burning vs. municipal incinerators
Burn barrel temperatures rarely exceed 500 degrees F so combustion is incomplete. Municipal incinerators operate at 2,200 degrees F to insure complete combustion and they use efficient filters to reduce harmful emissions.

Pound for pound-garbage burned in a burn barrel, gives off twice as many furans, 17 times as much dioxin, and 40 times as much ash as a municipal incinerator. A 1997 EPA study shows that two to forty households burning garbage produce as much dioxin as a 200 ton/day municipal incinerator.

How can exposure affect me and my family?
In a municipal incinerator, stacks that emit smoke are designed for maximum dilution and are high above activity, therefore resulting in a low dose. Burn barrels are less efficient at combustion, and are concentrated close to the ground, therefore resulting in direct exposure to harmful pollutants.

How can you avoid using a burn barrel? All the municipalities in the Gananoque River Watershed have recycling programs. Contact your local municipality to find out how to participate (contact information on page 59). For food waste other than meat scraps and bones, use an outdoor composter or an indoor worm composter (not practical for seasonal dwellings, since they aren't heated in the winter, and the worms will die.) Anaerobic composting can also be done, usually underground, making it somewhat more secure from animals. For more information on composting go to

Most materials you can neither recycle nor compost are landfilled. Each municipality runs one or more landfill sites, often in the same location where recyclables can be taken. Check with your municipality to see whether certain types of bags must be used, and whether a tag purchased from the municipality must be placed on non-recyclable garbage.

Some materials are toxic, such as paints, paint thinner, bug sprays and batteries. Municipalities hold Toxic Waste Days. Contact your municipality to find out how to dispose of toxics so that they never come in contact with the water body you live on, or with pets or wildlife.

Learn more about effects of burn barrels by downloading the document fount at www.wecf.eu/cms/download/2004-2005/homeburning_plastics.pdf

Project Partners

Algonquin to Adirondacks Conservation Association (A2A)

A2A works for and with local people to enhance and connect wildlife habitat in the unique area between and including Algonquin Park in Ontario and Adirondack Park in New York.
The A2A region is home to a vast number of different plants and animals, many at risk of extinction. Preserving and enhancing their habitat is key to their survival, resulting in healthier air and water for us all.

In connecting and enhancing habitat, A2A helps maintain wildlife biodiversity and the peace and beauty of nature. These are all a part of our rural heritage. A2A works respectfully with landowners, partnering organizations and governments at all levels to achieve our goals.

The A2A Vision is of an Algonquin to Adirondacks region that preserves the rich mosaic of interconnecting habitats which sustain and enhance ecological integrity in a way that respects the people who live here and a region which functions as the critical link in maintaining connectivity in Eastern North America.

The A2A Mission is to provide leadership and facilitate collaboration among partners to restore, enhance, and maintain ecological connectivity, ecosystem function, and native biodiversity, while respecting sustainable human land uses in the Algonquin to Adirondacks region. We will work at international, national, regional, and local levels to develop strategic and site-specific initiatives to achieve connectivity.

Learn more about A2A at our website a2alink.org

Centre for Sustainable Watersheds (CSW)

Incorporated in 2002 CSW is a national environmental charitable organization that works toward a more holistic approach to water resource management across Canada that promotes sustainability, conservation and economic prosperity. The Centre's mission is to enhance the ability of individuals, groups and governments to work cooperatively toward shared water protection goals by providing channels of communication, improving information exchange and building capacity. To this end, in recent years CSW has engaged in a range of initiatives within the following programs:

- Water Connections – a unique national portal providing a centralized access site to Canada's wealth of water information
- Watersheds InfoXchange (WIX) – a clearinghouse for community water quality data that facilitates exchange among organizations and government agencies
- The Water Trust – a national program designed to provide sustained and accessible core funding to grassroots organizations
- Living by Water – CSW is the Ontario Coordinator for this national stewardship outreach program with a focus on riparian areas
- ECOCYCLET – zero discharge wastewater technologies that are engineered natural systems that grow away pollution, with no impact on ground or surface waters

CSW will continue to partner with organizations and agencies from coast to coast to coast to celebrate Canadian's most precious resource…our water. Please visit www.watersheds.ca for more information.

Cataraqui Region Conservation Authority

The Cataraqui Region Conservation Authority (CRCA) is one of 36 conservation authorities in Ontario. A Conservation Authority's jurisdiction is based on a watershed, an area of land drained by one stream or river. The CRCA is actually made up of 11 watersheds.

Managing the regions watershed resources is a major undertaking that calls upon CRCA's staff members, foresters, engineers, wildlife experts, ecologists, geologists, economists, planners, local municipal members, and volunteers to work together with farmers, developers, educators, lawyers and ordinary citizens. CRCA delivers a wide range of services, activities and facilities which include:

- Watershed strategies and management
- Mapping and development of a natural resources information database for our watershed
- Agriculture and rural landowner assistance
- Environmental education and information programming
- Land acquisition
- Outdoor recreation
- Environmental land use planning
- Habitat protection
- Reforestation
- Flooding and erosion protection
- Sensitive wetlands, flood plains and valley land protection
- Water quality and quantity monitoring

For more information, please visit the CRCA website at www.cataraquiregion.on.ca.

Gananoque River Waterways Association

The Gananoque River Waterways Association (GRWA) was founded in 1963 and has evolved to enable its members to participate in a community along the waterways from Lyndhurst Dam to Marble Rock Dam, including such tributaries as South, Fodey and Grippen Lakes. The 2004 GRWA constitution states:

The mission of the Gananoque River Waterways Association (GRWA) is to stand for the River.

The GRWA is committed to:

maintaining and enhancing the vitality of ecosystems within the area served by the Association;

providing environmental education for the community along the waterways;

Promoting and providing research which contributes to the sustainability of the Gananoque River waterways system.

For more information, please visit the GRWA website at www.grwa.ca.

Contact List

Government Organizations

Fisheries and Oceans Canada (DFO): (613) 925-2865 www.dfo-mpo.gc.ca

Ontario Ministry of Agriculture, Food and Rural Affairs: www.omafra.gov.on.ca

Ontario Ministry of the Environment (MOE): (Kingston) - (613) 540-6899 www.ene.gov.on.ca

Ontario Ministry of Natural Resources (MNR): (800) TIPS-MNR (613) 531-5700 www.mnr.gov.on.ca

Parks Canada: St Lawrence Islands National Park (613) 923-5261 www.pc.gc.ca

Transport Canada: (613) 990-2309 www.tc.gc.ca

Ontario Stewardship Councils

Ontario Stewardship: c/o Ministry of Natural Resources (705) 755-3278 www.ontariostewardship.org

Frontenac Stewardship Council: (613)531-5714 www.ontariostewardship.org/councils/frontenac

Leeds and Grenville County Stewardship Council: (613) 342-8526
www.ontariostewardship.org/councils/leeds

Conservation Authorities

Conservation Ontario: (to access all Conservation Authorities) (905) 895-0716
www.conservationontario.ca

Cataraqui Region Conservation Authority – (613) 546-4228, 1(877)956-2722
www.cataraquiregion.on.ca

Local Municipalities

Township of Leeds and the Thousand Islands: (613)659-2415 1(866)220-2327 www.leeds1000islands.ca

The Township of Athens: (613)924-2044 www.athenstownship.ca

Township of Elizabethtown-Kitley: (613)345-7480 1(800)492-3175 www.elizabethtown-kitley.on.ca

Township of Rideau Lakes: (613)928-2251 1(800)928-2250 www.twprideaulakes.on.ca

The Town of Gananoque: (613)382-2149 www.gananoque.ca

Municipal Property Assessment Corporation: (866) 296-6722 enquiry@mpac.ca , www.mpac.ca

Local Health Units

Kingston, Frontenac and Lennox & Addington Public Health: (800) 267-7875 www.kflapublichealth.ca

Leeds, Grenville and Lanark District Health Unit: 613-345-5685 www.healthunit.org/

Septic System information

Ontario Onsite Wastewater Association (OOWA): (905) 372-2722 www.oowa.org

Sewage Systems and Land Control: See contact information for local health units

Natural Resources and Native Plant Sources

Ferguson Forest Centre: (613) 258-0110 www.seedlingnursery.com

Gardens North: (613) 489-0065 www.gardensnorth.com

Nature's Way Landscaping: (613) 382-1207, (866) 382-1207 www.natureswaylandscaping.net

Old Field Garden and Wildflower Nursery: (613) 258-7945 www.oldfieldgarden.on.ca

Rideau Nursery: (613) 322-2912, (866) 870-5088 www.rideaunursery.com

Trees Ontario: www.treesontario.on.ca

Wildflower Farm: (866) 476 9453 www.wildflowerfarm.com

Environmental Partners

Algonquin to Adirondacks Conservation Association (A2A): (613) 659-4824, www.a2alink.org

Canadian Parks and Wilderness Society (CPAWS): (613) 232-7297 www.cpaws.org

Canadian Wildlife Federation (CWF): (800) 563-WILD, (613) 599-9594 (Ottawa Area) www.cwf-fcf.org

Centre for Sustainable Watersheds (CSW): (613) 272-5136 www.watersheds.ca

Ducks Unlimited Canada (DUC): (800) 665-DUCK (3825) www.ducks.ca

Eastern Ontario Model Forest (EOMF): (613) 258-8241 www.eomf.on.ca

ecoPerth: www.ecoperth.on.ca

Federation of Ontario Cottagers' Association (FOCA): (705) 749-FOCA (3622) www.foca.on.ca

Kingston Field Naturalists: (613) 389-8338 kingstonfieldnaturalists.org

Landowner Resource Centre (LRC): (800) 387-5304 ext. 1128 or 1132 www.lrconline.com

Lake Networking Group: Karen Hunt - khunt@ripnet.com

Rideau Environmental Action League (REAL): www.realaction.ca

Ontario Federation of Anglers & Hunters (OFAH): (705) 748-6324, (800) 563-7711 www.ofah.org

Ontario Woodlot Association: (888) 791-1103 www.ont-woodlot-assoc.org

Rideau Valley Field Naturalists (RVFN): (613) 326-0106 www.rvfn.ca

Rideau River Roundtable: (613) 284-8338 www.rideauroundtable.ca

Financial/ Technical Assistance

Cataraqui Region Conservation Authority: (613) 546-4228 http://www.cataraquiregion.on.ca/

Ontario Environmental Farm Plan (EFP): www.omafra.gov.on.ca/

Community Based Environmental Monitoring

Bird Studies Canada: (888) 448-2473 www.bsc-eoc.org/

The Great Backyard Bird Count: www.birdsource.org/gbbc

Invading Species Watch: (800) 563-7711 www.invadingspecies.com

Lake Partners Program: (800) 470-8322 www.ene.gov.on.ca/en/water/lakepartner/index.php

Marsh Monitoring Program: (888) 448-2473 www.bsc-eoc.org/mmpmain.html

Ontario Hummingbird Project: www.ontariohummingbirds.ca

Ontario Turtle Tally: www.torontozoo.com/adoptapond/TurtleTally.asp

Project Feeder Watch: (888) 448-2472 www.birds.cornell.edu/pfw

Watershed Watch: (800) 267-3504 www.rvca.ca/programs/wwatch/watershed_watch.htm