

Waterfront Living - Healthy Shorelines

(Web links updated May 2009)

The following pages expand information and issues that relate to waterfront living, water quality and wildlife habitat in our area. These topics were referenced in individual shoreline reviews, conducted by the Frontenac Arch Biosphere Reserve for FAB area lake, waterway and cottage associations from 2004 through 2007.

- ♣ A Stewardship Approach
- ♣ A Unique Ecosystem
- ♣ Applications and Permits
- ♣ Auxiliary Structures
- ♣ Bathing in Lakes and Rivers
- ♣ Beaches
- ♣ Biosphere Reserve
- ♣ Boating
- ♣ Composting
- ♣ Conservation Organizations
- ♣ Conservation Programs
- ♣ Cultural Landscapes
- ♣ Docks, Boathouses and Launch Ramps
- ♣ Drinking Water
- ♣ Environmentally Friendly Projects
- ♣ Government and Park Organizations
- ♣ Healthy Septic Systems
- ♣ Invasive and Exotic Species
- ♣ Landscaping—Habitat for Wildlife
- ♣ Light Trespass
- ♣ Lyme Disease
- ♣ New Home Environments
- ♣ Noise on the Water
- ♣ Old Growth Forests
- ♣ Shorelines – a Brief Primer
- ♣ Shoreline Buffer Plantings
- ♣ Shoreline Erosion
- ♣ Shoreline Erosion Control
- ♣ Species at Risk
- ♣ Swimming Pools and Hot Tubs
- ♣ Water Levels
- ♣ Water Quality
- ♣ West Nile Virus
- ♣ Wildlife Matters
- ♣ Zebra Mussels and Round Gobies

These are but a few of the topics relevant to waterfront living. At any time in the future, more information sheets may be produced, and the materials on any of these topics may be expanded to add to the body of knowledge. Therefore, topics are listed alphabetically, rather than by numbered pages.

A Stewardship Approach

In days gone by, there seemed to be a limitless amount of wilderness green space. Taking care of it was a job that fell to parks. Now, it's becoming clear that wild lands indeed have limits, and are slipping away. The remainder has become a resource stretched between resource harvesting and recreational use. Those of us who live either seasonally or year 'round in the countryside and on lakes and rivers, beyond city limits, are realizing a deeper appreciation of "what's left". And that's where stewardship is born. Joni Mitchell, in her song *Big Yellow Taxi*, pondered "Don't it always seem to go, you don't know what you've got 'til it's gone".

A steward takes it upon himself and herself to support, sustain and care for special interests or properties. Stewardship applies easily to the land we love. While that land may be our own, caring for the green space gives something of great value back to the community. Aesthetics, wildlife refuge, clean air and pure water are qualities which extend well beyond a property's borders.

Our relationship with the land may be a personal quest for its health and well-being, but we don't have to "go it alone". There are many sources of information out there, from internet searches right down to this very manual. There are as well many sources of support and help, from conservation groups, landowner associations and parks throughout this region. Many of these are listed in this manual.

Being a land steward makes all the difference in the world.

A Unique Ecosystem

Most everyone is familiar with the expression that “beauty is more than skin-deep”. That expression may apply better here than to most landscapes of the world. The foundation of this region’s sometimes subtle, sometimes stunningly dramatic beauty is the complexity of its geology and living environment.

The region discussed below, and elsewhere in this manual, is the same as the general area of the Thousand Islands-Frontenac Arch Biosphere Reserve. It refers to the length of the Thousand Islands, and north along the Frontenac Arch and the streams and lakes and rivers which flow south to the St. Lawrence River, to approximately the watershed of the Rideau Canal. Within this region is a landscape that is strong interconnected in terms of landform, geology and ecology.

Almost all of the forest regions of eastern North America intersect here, at a unique crossroads of landforms. At this small corner of the world, the ancient Canadian Shield reaches deeply south to the Adirondack Mountains, and is flanked by the far younger plains of layered rocks, and slashed across its narrowed, hourglass form by the St. Lawrence River. Plants and animals of the boreal northland, the Atlantic coast, the continental heartland, the Appalachian mountains and the Carolinian south migrate those landform corridors, and interact and intermingle here. As a result, the diversity of our biology, our ecology, is astounding. Not only are the simple numbers of species large here, in the top three in Canada, but the diversity in terms of the geographical ranges of these species is extraordinary.

A climate modified by the Great Lakes, a broad range of soil and rock types and chemistries, a diverse topography of hills, cliffs and valleys, and a range of land uses create a hugely complex physical landscape. This allows a tremendous number of habitats and niches to exist here, and in turn there are opportunities and the right conditions for the multitude of plants and animals that have populated the area from so many other parts of eastern North America.

The highlight of all this complexity of landscape and biodiversity is that a goodly number of the plants and animals here are at or near their natural range limits. For example, a southern blueberry, Deerberry, is now found only here in Canada. Almost all of the three-needled Pitch Pine, common on the New Jersey Pine Barrens, is found only here in Canada; and the same is said of our largest snake, the Black Rat Snake. Red Spruce and Wire Birch are typical trees in Atlantic coast forests, and reach inland just this far west. Balsam Fir, Sweet Gale and Barren Grounds Strawberry are boreal forest plants that have southern range extensions into our area. There are more and numerous examples of both animals and plants that add to the complexity here.

It is not surprising that because so many species are intermixed and near the ends of their extended ranges, the region hosts a high proportion of species that are designated rare, threatened and endangered. While we hear every day about dire situations for numerous plants and animals around the globe, we need look no further than our own forests and

wetlands for species that are equally precarious. These sometimes rely on very precise conditions for their habitat, and as habitats are compromised, species may be lost from that location, and from the region itself. Our stewardship of habitats, however small, can make a considerable difference in the continued diversity of this world recognized ecology.

The forests we enjoy in this region began developing the character we see today about 3,000 years ago. Prior to that time, the forests were evolving through successions of forest types as the continent adjusted to the climate changes following the last ice age. Sugar maple, beech, paper birch, hemlock, red oak and white pine are most numerous, with basswood, red maple, white ash, shagbark hickory, white oak, red pine and butternut being quite abundant as well.

West-facing points of land and exposed granite ridge tops host species that tolerate the dry and windy conditions. Ground covers of blueberries, sedges and tufts of moss grow on the thin, coarse soil, with pitch pine, juneberry and red oak overhead. Broader valleys between the ridges often cradle deeper pockets of clay, left from the old post-glacial lake bottoms. Here, deep-rooted trees such as sugar maple, American beech, Canadian yew and shagbark hickory cast deep shade over carpets of trilliums, dogtooth violets, gooseberry and myriads of other shrubs and wildflowers. Steeper north-facing slopes are cool and damp, favouring stands of hemlock, striped maple, elderberry and polypody ferns. Broad ridges with shallower soil, and often with rock outcrops, host savannahs of white oak, white pine, ironwood, coarse sedges and grasses and many fern species. There are several other community types as well. The waterways, all with their own complex variations of depth, bottom type, currents and slope lend to the vast array of aquatic habitats.

At the time this region was first settled by immigrants, the array of habitats was very similar to those of today. The size of trees in those ancient forests, though, were often immense. When the land was cleared, new elements of habitat, such as fields and then old, abandoned fields, made opportunities to new species of both plants and animals, while at the same time eliminating habitat for some that had been originally here. Animal life was perhaps most affected. Timber wolves, moose, woodland elk, eastern cougar, black bear, lynx and martin were among those that could not survive the more limited and fragmented habitats. On the other hand, eastern cottontail rabbits and coyotes expanded their ranges to the region, and whitetail deer and raccoons thrived. Interestingly, as some of the forests age and abandoned fields reforest themselves, there are again occasional sightings of some of the former wilderness residents. There is much to be learned about animal species here, as some of the smaller animals, including reptiles and amphibians, have not been surveyed or studied sufficiently to understand their presence and populations, as well, there are landscape connections and potential for reconnections that may actually see wildlife become more successful in living here.

Applications and Permits

There are many types of construction and work that one can undertake, and therefore a large number of sources of permits and approvals. The following sections attempt to break the work into subject areas. Note that it is the landowner's responsibility to seek those approvals, and where there are multiple permits required, especially as around water, approval from one does not necessarily mean that approval will be forthcoming from all. This listing may not be complete.

Building Permit

In the Township of Leeds and the Thousand Islands, building permits are required for almost all construction, new and replacement. Included are new structures, including out buildings such as for storage, garages or shelters, although a minimum size may be exempt. Included as well are repairs to decks, and not just new decks. As the Official Plan is being amended at the time of this writing, landowners are advised to visit or contact the township office for a list of works requiring or exempt from permits; and to obtain a copy of the Building Permit Application.

Note that building permits are required for the construction of boathouses and boatports, and that approvals are required for these from the Canadian Coast Guard, Fisheries and Oceans Canada and the Cataraqui Region Conservation Authority.

Accessory structures such as storage/garden sheds (containing no plumbing fixtures) that are less than 107.64 square feet in area will not require a building permit, however a building location drawing (site plan) must be submitted to the planning office in order to determine if the proposed project will comply with applicable zoning regulations.

Note that the Official Plan, and therefore zoning by-laws, are currently under revision, and some requirements may change.

Township of Leeds and the Thousand Islands
312 Lyndhurst Road
P.O. Box 160
Lyndhurst, Ontario K0E 1N0
613 928-2423
www.townshipleeds.on.ca

Township of Athens
1 Main Street
Athens, Ontario K0E 1B0
613 924-2044
www.athenstownship.ca

Sewage/septic Approval

Any new residential (year round or seasonal) requires approval of the location, siting and structural details of sewage systems. Any reconstruction or replacement of systems requires approval.

Leeds, Grenville and Lanark District Health Unit
458 Laurier Boulevard
Brockville, Ontario K6V 7A3
613 345-5685 www.uclg.ca

Entrance Approvals

Unless you are on a private lane, permission for access from the building lot to the roadway must be granted. The roads have a right-of-way corridor which you must seek permission to establish driveway entrance through, a process designed to control density of development, which also affects speed and driving conditions along the road; and to ensure that the point of entrance is safe, as not on hills or curves.

Municipal Roads:

Township of Leeds and the Thousand Islands
312 Lyndhurst Road
P.O. Box 160
Lyndhurst, Ontario K0E 1N0
613 928-2423
www.townshipleeds.on.ca

Township of Athens
1 Main Street
Athens, Ontario K0E 1B0
613 924-2044
www.athenstownship.ca

County Roads:

United Counties of Leeds and
Grenville
32 Wall Street, Courthouse
Square
Brockville, Ontario K6V 4R9
613 342-3840 www.uclg.ca

Provincial:

Ministry of Transportation
355 Counter Street
Kingston, Ontario
613 544-2220
www.mto.gov.on.ca

Burning Permits

Wherever possible, composting and recycling should be done. Full information on what can be burned, restrictions on timing and conditions, and containment must be found at the township office:

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Lyndhurst, Ontario K0E 1N0
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613 924-2044
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Docks, boathouses, launch ramps

In order to ensure that you are conducting your project with the appropriate approvals and permits you should contact your local Conservation Authority or Ministry of Natural Resources. It's noteworthy that although the wording speaks about fish, the Fisheries and Oceans Fisheries Act refers to fish in a very broad sense, including fish, invertebrates, crustaceans, and marine animals of all types, including eggs, larvae and spawn.

Cataraqui Region Conservation Authority & Department of Fisheries & Oceans

The local conservation authority has an agreement with the Department of Fisheries and Oceans to conduct fisheries reviews on all in and near shore projects. The Conservation Authority will assess your property on its potential to provide fish habitat, taking into account not only the property in question, but also the impacts its development might have on the overall water body. When applying for a permit be prepared to give specific details such as your address, waterbody name and location (include lot, concession, county, township, municipality, latitude and longitude), detailed description of work site (including site map, survey plan or sketch indicating building present, property lines, and high water mark), a copy of your plans (including description of construction details, timing, building techniques and materials), photographs of worksite and surrounding areas, and if possible, a description of the fish habitat in your area. Should the project be approved a letter of advice is issued to the landowner to outline project details, environmental issues, and the means to ensure that during the construction phase that no damage is done.

The Cataraqui Region Conservation Authority
P.O. Box 160, Glenburnie, Ontario K0H 1S0
613-546-4228 info@cataraquiregion.on.ca
www.cataraquiregion.on.ca

In circumstances where it is deemed that there is the potential for the Harmful Alteration, Disruption, and or Destruction of fish habitat (HADD), the proposal is sent to the Department of Fisheries and Oceans for consideration. Under the Fisheries Act, no one is allowed to carry out a project that could result in a HADD or deposit any detrimental substances into the water; this includes chemicals, sand, waste, etc.

Fisheries and Oceans Canada
Referrals, Prescott District
401 King St. West, Prescott, Ontario K0E 1T0
613 923-2865 http://www.dfo-mpo.gc.ca/oceans-habitat/index_e.asp

Ministry of Natural Resources

The beds of most waterbodies in Ontario are legally public land. In the past, any dock or boathouse built on this land needed a work permit from the Ministry of Natural Resources. Recent legislative changes removed the requirements for work permits for most docks and boathouses. Listed below are the types of docks and boathouses that do, and do not, require a permit from the Ministry of Natural Resources.

Keep in mind that if your property fronts onto the Rideau Waterway, these areas are under **Federal** jurisdiction. Approval for in-water and shoreline works in these areas will be granted by the Department of Canadian Heritage, Parks Canada.

1. Docks and boathouses which WILL NOT require an MNR work permit:

- * Cantilever docks
- * Floating docks and floating boathouses
- * Docks and boathouses supported by posts, stilts, or poles
- * Boathouses built above the high water mark
- * Crib docks and crib boathouses where the total supporting crib structure (including historical crib structures) does not exceed 15 sq. metres in surface area.
- * Any combination of the above (e.g. a floating dock with a crib <15 sq. metres).
- * Boat lifts and marine railways
- * Removal of an old dock or boathouse

2. Docks and boathouses which WILL require an MNR work permit:

- * Crib docks and/or boathouses where the total surface of all historical cribs and the proposed new cribs exceeds 15 sq. metres in surface area.
- * Docks with solid foundations (e.g. concrete), jetty docks, or docks constructed with steel sheeting
- * Boathouses with solid foundations (e.g. concrete)

Any of the structures described in section 2 will need approval under the Public Lands Act. You can obtain a work permit application form at your local MNR office. Projects that require a work permit, pose a significant risk to the environment. MNR may visit the site to assess the habitat in the area. This takes time, so submit your application early in the planning process.

Construction of any type of two story boathouse, or single story boathouse with living accommodations, on Crown land is not covered under the Ministry's free use policy. As a result, although you do not need a work permit, you will require land use occupational authority under the Public Lands Act, at an appropriate fee. If you are thinking about building any type of two story boathouse or a boathouse with living accommodation, contact your local MNR office early in the planning stage.

Keep in mind that you may need other approvals. Approval from one government agency does not guarantee that you will be able to obtain approval from another agency. The federal Fisheries Act provides for the protection of fish habitat. Under this Act, no one may carry out work that harmfully alters, disrupts or destroys fish habitat, unless there is clear authorization. Also, no one is permitted to deposit a harmful substance in water frequented by fish. Breaking these regulations can mean substantial fines of up to \$1,000,000, risk of imprisonment, and you may be required to cover the costs of returning the site to its natural state.

If you suspect your property is adjacent to a spawning or nursery site for species such as lake trout, brook trout, walleye, pike, muskellunge, talk to staff at your local MNR office, or have your project reviewed by an environmental consultant. These fish species often

have only one spawning/nursery site in the waterbody. Any structure placed near these sites could affect fish habitat and result in fewer fish.

The following best management practices will help to ensure that your dock or boathouse will not harmfully alter or destroy fish habitat. Following these practices will help to ensure that the terms and conditions of the federal Fisheries Act are not violated.

- * **Select a structure which minimizes disturbance to the river or lake bottom:** Cantilever, floating and post-supported boathouses and docks do not disturb river or lake bottoms or restrict the movement of water near the shore. These structures can actually improve fish habitat by providing fish with extra shelter from predators. From a fish habitat perspective, these structures are preferred. If the dock needs a concrete abutment, this should be located entirely on the upland property, above the high water mark.
- * **Limit the size of crib foundations:** Crib foundations for docks and boathouses are acceptable if there is bridging between them which enables water to circulate. Small cribs are preferred. Vertical planking is not recommended along the dock, because it can restrict water movement. Remember, if the total surface area of your cribbing exceeds 15 square meters, including existing or old cribs, you will need a permit from MNR.
- * **Use clean rocks taken from dry land:** If you are planning to build a crib dock or boathouse, use rocks that are clean and free of soil. The rocks must not be taken from the lake or river bottom, or the shoreline. Removal of rocks from these areas could destroy fish habitat and result in charges under the federal Fisheries Act.
- * **Avoid any solid structures without bridging:** Generally, MNR will not approve solid docks made from cement or steel sheeting. These structures are vulnerable to ice damage, destroy fish habitat, and can create stagnant backwater areas.
- * **Be careful with pressure-treated wood:** If you are planning to use pressure-treated lumber, all cutting, end sealing, staining, etc. should be done well back from the water. The wood should be completely dry before being placed in the water. These practices will help to reduce the amount of contaminants released into the waterbody.
- * **Avoid projects which involve in-water dredging and filling:** Dredging and filling may be harmful to fish and their habitat. If your project involves dredging or filling, you will need a permit.
- * **Do not work in the water during the spawning and nursery period for those fish species in your waterbody:** In-water construction activities during spawning and nursery periods could kill eggs and young fish. If you are planning intensive, in-water construction activities, contact your local MNR district office for details on timing your project to protect fisheries.

The Ministry of Natural Resources has a work permit that must be applied for when conducting in water alteration (below the high water mark). It is best to contact the local MNR office for details on what permits are required for your project. They can be reached at the Toronto office by calling 416-314-2000.

Navigation and Docks

The **Canadian Coast Guard** must be informed of any project that has the potential to interfere with navigation of the water body. They are responsible for many marine activities such as Search and Rescue, Boating Safety, Environmental Response, Icebreaking, Marine Navigation Services, Marine Communications and Traffic Services, and Navigable Waters Protection. To contact the Canadian Coast Guard communications branch in Ottawa call (613) 993-0999.

Auxiliary Structures at the Shoreline

As will often be said through these pages, the shoreline is a complex ecological, living structure. The shoreline above, at and below the water's edge, is in some way and at some time critical to most of the life of the river or lake and its upland areas.

In human terms, shorelines are the filters for the water that runs off the land into our water. When the filter system is damaged, in part or completely, it loses capacity or ceases to function. The underlying reason that recent official plans and zoning by-laws call for setbacks from the water to the house or cottage structure is to make provision for the filter, and life zone, to function.

It would seem that there are innumerable things that could be built along the water's edge that would make life at the water more satisfying. The number of potential projects could keep do-it-yourselfers or contractors busy for years to come. Gazebos, decks, dock showers, storage sheds, boathouses, boatports, dock boxes, stairways, walkways, ramps, path lights, spotlights, lifts, hoists, as well as docks and paths—all require clearing and leveling, if they are put in place. Each structure uses the space that takes away from the living, breathing, filtering functions along the shore.

Certainly what a landowner wishes to put in place, as long as it is done with the approval of the appropriate authority, is the landowner's right. Hopefully, though, the construction can be done with as much of the shoreline integrity left as is possible. There are a number of ways to go about projects and to minimize impact in the process:

- work with the landscape—place paths and structures where they won't interfere with runoff patterns, and where they'll have a low visible profile
- avoid removing ground cover from places that may easily erode
- leave ground cover and trees in place as close to the structure as possible
- size matters—plan the structure to use as little space as is practical
- integrate—use one structure to accomplish as many tasks as possible

Remember that you came to the waterfront for the view as well as the fun, and that what you build becomes a part of others' views. Will they see the living landscape, or gazebos, decks, dock showers, storage sheds, boathouses, boatports, dock boxes, stairways, walkways, path lights, spotlights, ramps, lifts, hoists, as well as docks and paths?

Bathing in lakes and rivers

As old as the lake and river is, it can get a lot older, very quickly. Nitrogen and phosphorus, as we all know from the use of fertilizer, makes plants grow. We apply these to lawns and gardens to increase the amount of growth, but would never think of putting them into the water to do the same thing. Unfortunately, it can happen very innocently.

Phosphates are salts of phosphoric acid, and are still used, despite the knowledge of how inevitably harmful they are, in some soaps and detergents. A phosphorus content of five percent is still allowed in Canada. It is a cheap way of manufacturing a softening agent for hard water, letting soaps clean faster. Once into the water, the phosphorus, one of the key ingredients in living tissue, accelerates growth of plant tissue. While other key ingredients—carbon, oxygen and hydrogen—are available in copious quantities in the water, the amount of phosphorus is normally and naturally very limited. Rapidly growing algae are quick to consume the extra amount of phosphorus and profusely bloom. Algae plants are short lived. The burst of growth is followed by massive die-offs, and as the bloom decays, bacteria levels rise and oxygen levels crash. Other organisms, such as plankton and fish, need large amounts of oxygen as well, but because it isn't available, they die. If the lowered oxygen levels are prolonged and severe enough, the makeup of species in the water changes. Carp, for example, can survive where trout, bass and perch cannot. In this very basic way, the lake or river ages. There is even a name for the process: it's called eutrophication.

Does one sudsy bath or hair wash at your waterfront hurt? Maybe just a little – but an avalanche is made of many tiny individual snowflakes.

There are now many phosphate free, environmentally friendly soaps and shampoos which have far less effect on plant growth. They are every bit as effective as the old-school products. Not long ago, these were found primarily in boutiques and specialty stores, but they've gone mainstream and can be found at major pharmacies as well.

A tip, and another level of prevention, is to drench yourself with a bucket of water back from the water's edge after you've lathered up. The suds will be trapped and absorbed by the healthy buffer of ground cover you've left to do just such filtering work.

Beaches

Even given thousands of years in which to work, nature has produced very few beaches in this region. The conditions and materials available just aren't there, except in a handful of places. While beaches may be the icon of many waterfront resorts, our natural waterfronts have a character all their own.

Legally, beaches are only allowed where they occur naturally. Beach creation is usually not possible for most property owners. By adding sand to an area, the lake fills in faster because sand will erode and wash away, adding to the natural sediments present. A waterbody naturally fills in over time to become a marsh and eventually land. Sand will not permanently stay; it washes away with waves and blows away with wind. Dumping sand on an area smothers beneficial algae, nesting sites of fish and frogs, and kills invertebrates. Also, the added sediment can clog and abrade the gills of fish species. Under the Federal Fisheries Act, no one can perform work that harmfully alters, disrupts or destroys fish habitat unless authorized by Fisheries and Oceans Canada; making it difficult to obtain a permit for this type of work. However, there are alternatives to sand beaches. A pea gravel beach actually provides habitat for small invertebrates and aids in duck digestion. Another alternative is to create



Pea Gravel

a dry beach; one that is above the high water mark away from the water. It should be somewhat contained so that sand is not transported towards the water. If a permit is approved for an in-water beach, it must be created when the water is low and there is no fish spawning taking place.

Biosphere Reserve

The Frontenac Arch Biosphere Reserve www.fabr.ca

The roughly triangular area from Brockville, through the Thousand Islands to Gananoque, north to the village of Westport, including all of the Township of South Frontenac was Canada's 12th Biosphere Reserve designated in 2002. In the program "Man and the Biosphere" from UNESCO (United Nations Educational, Scientific and Cultural Organization), such significant natural and cultural landscapes are celebrated to the world.

The map of this landscape is, compared to the rest of southern Ontario, quite green and blue. We have forests and fields and lakes and rivers of quality that has long since been consumed elsewhere. On top of that, the beauty is far more than skin deep. The five forest regions of eastern North America meet and mingle here on this highly variable area, giving us a diversity and richness of plants and animals like nowhere else.

Biosphere Reserves have two categories of protected lands: "core" and "buffer". Core areas are lands that have a formal status of protection, where ecological functions are mandated to be kept intact. There are two "core" areas to the Biosphere Reserve; St. Lawrence Islands National Park in the Thousand Islands, and Charleston Lake Provincial Park in the center of the area. Buffer lands are those places that have been noted to contain significant environments, but may not have the same level of active protection as core lands. Some of these in the area include Crown Land, lands under jurisdiction of the Cataraqui Region Conservation Authority, the St. Lawrence Parks Commission or Canadian Thousand Islands Heritage Conservancy. That is certainly not to say that there are special environments on other and private lands.

Since the Biosphere Reserve was designated by the United Nations in November of 2002, an oft-asked question is, does this affect private lands, or planning and regulations in the region? In a word: no. The designation is more like an honour, like winning a blue ribbon at the fair. It's recognition that the ecology, history and social community here is significant on the world stage. Then, hopefully, wise land use planning will follow, and in the development of the region, that special character will be enhanced, and not eroded. We are all fortunate enough to have this special landscape as a resource upon which the community can build.

Background on Biosphere Reserves

Special landscapes are at the heart of the [Man and the Biosphere Program of UNESCO](http://www.unesco.org/biosphere/). The "World Network of Biosphere Reserves" premise is that human and environmental issues need to be considered together in order to promote a balanced relationship between people and nature. The program strives to increase understanding of the natural environment and to improve the management and sustainability of the area's resources.

At its founding conference in 1960, the mission statement created was “to develop within the natural and social sciences a basis for the rational use and conservation of the resources of the Biosphere and for the improvement of the relationship between humans and the environment, and to predict the consequences of today’s actions on tomorrow’s world and thereby increase the ability to manage efficiently the resources of the Biosphere”. UNESCO describes Biosphere Reserves as “areas of terrestrial or coastal ecosystems which are internationally recognized within UNESCO’s Man and the Biosphere Program for promoting and demonstrating a balanced relationship between people and nature”.

Biosphere Reserves are created from the ground up. There is no master plan where landscapes are strategically selected for the program. Instead, nominations come from the community. This goes back to the fundamentals of the program, where there is not only a very significant natural environment, but that there is a mechanism already in place to protect key and core areas of it, and where the community has both the will and ability to maintain and sustain that area. In a very major way, the community is at the heart of every successfully nominated Biosphere Reserve because the community has to have demonstrated that it grows its economy and develops the region in ways that make it possible for the qualities of its very significant natural environment to thrive as well.

The Biosphere Reserve designation is symbolic and is completely non-regulatory. A Biosphere Reserve does not in any way change ownership or jurisdiction, or affect private or public rights. A Biosphere Reserve does not have any authority over land use or water use. Instead, it is a mechanism to work cooperatively with a broad network of partners to better understand and explore the potential of working as a community for improvements in economy and development in ways that sustain rather than diminish the natural environment. Individuals and organizations can opt into activities that are of interest to them and to measure progress toward the conservation, sustainable development and logistic support goals of the Biosphere Reserve.

The [Man and the Biosphere Program of UNESCO](#) is unknown to most Canadians. It usually comes as quite a surprise to people that there is a designation for special landscapes at such a global scale, and that yet there are now only twelve such places in Canada. After all, here is a country that we all consider rich in world-class landscapes. We have a system of national and provincial parks, historic parks and sites and special cultural sites that are individually and collectively remarkable. However, there are few places where Canadians have linked the economy, development and environment together, and celebrated all aspects together. Elsewhere in the world, those linkages have been made much more often. As of January 2008, there are 531 Biosphere Reserves in 105 countries and on every continent in the U.N. network.

Algonquin to Adirondack initiative www.a2alink.org

It happens that the Thousand Islands Frontenac Arch Biosphere Reserve is at the center of an ecologically unique, continental-scale landscape corridor. Upon examining maps, aerial photographs and satellite images of the area, there is an obvious connection between the two areas, Algonquin Provincial Park to Adirondack State Park. A broad ridge of ancient granite called the Frontenac Arch connects the Canadian Shield, as at Algonquin Park, and the granite dome of the Adirondack Mountains. It forms a north-south landbridge over which both short and long-term plant and animal migrations occur. The area has spared somewhat due to the difficulties related to agriculture and development of the land. In recent years there has been an increasing demand for leisure properties in these pristine settings, stressing the land and separating the natural communities within. During the early 1990's the Canadian Parks and Wilderness Society (Ottawa chapter) proposed that this "A to A" connection could be explored to see if there was a voluntary way that the corridor could be somehow maintained. Over 64% of the lands contained in this region are owned privately.

Figure 1: Algonquin to Adirondack Map



Boating

There are a number of topics about how boating relates to water quality and wildlife habitat. These would include boat care and maintenance, boat handling, and boat docking or mooring. This page touches on the first two; the third is discussed under a separate heading – docks.

Boat care and maintenance

It actually takes very little effort to convert a boat that is lethal to the lake or river to one that is far more benign. It starts, so to speak, with the engine, and the fact that oil and water don't mix. Fuel and oil float on the water, spreading out into a thin film. It kills and suffocates insects and plants at the surface of the water, and damages the gills of surfacing fish.

- A boat engine that is well-tuned is more fuel efficient, and leaves less residue exhausted into the water.
- Place an oil absorbing sock into the bilge of inboard and inboard-outboard engines to sock up leaks and drips. The sock can be replaced periodically, and disposed of properly. Avoid bilge cleaners that are pumped with their slurry of oil into the water from the bilge pump.
- In older 2 cycle motors, the oil in the gas isn't burned, but is sprayed onto the water in the engine exhaust. Consider replacing the old motor with a newer 2 or 4 stroke engine that meets a guideline EPA 2006. On top of everything else, they're much more fuel efficient and run far more quietly.
- Refuel your boat with care – don't spill a drop. Remove the outboard tanks and refuel on shore. Your aim may be good, but a funnel improves the odds.

Even though they sit in water, it's quite astounding how much dust and grime settles onto, into and along a boat. There is a broad range of products available, with some being extremely toxic but others far less so. Here too are ways that the process of keeping the boat clean can avoid damaging the water quality.

- Antifouling paints are lethal to algae and organisms that try to take up residence on the boat's bottom. Follow the directions to the letter to avoid contaminating the water.
- When a boat with antifouling paint is pulled from the water at season's end, avoid scrubbing the bottom until the boat is well back where the water won't run back to the lake or river. The same rule would apply if any bottom is cleaned with cleansers.
- Use non toxic cleansers for hulls and topsides. There are many now available at marine stores. Some are biodegradable and citrus-based.
- In the early morning, when the dew is still on the boat, or after a soaking rain, the surface grime comes off much more easily than in the heat of the midday sun. when nature is on your side, a cleanser or soap is often not necessary at all.
- Frequent scrubbing at the right time of day is, in the long run, less strenuous and less chemically demanding than one major blitz.

Boat handling

It's quite amazing how much solid force is delivered by something so liquid, but water is just the medium of the delivery. There are waves, and there is wake. Waves are oscillations in the water that are generated by wind flowing in waves of its own over the surface of the water. Waves have sculpted and formed that shape of shores for thousands of years. Their patterns of attack on the shore are regimented by the direction from which the winds can blow. As a result, some shore take the brunt of the attack most of the time, and the prevailing winds and waves have worn and tugged away all but the most resistant of materials. There are sheltered shores, where those winds seldom if ever deliver an attack of waves to shore. In these places, the forest creeps to the water's edge, and the shoreline seems far less defined.

Wake, on the other hand, is water set in motion by a force other than the wind: the effects of boats displacing the water through which they are propelled. As with wind-powered waves, wake size can vary depending on the amount of energy with which the boat is pushed, and with the efficiency of the design of the hull. Unlike waves, the directions from which wake can attack the shore are many, and "new" in the scheme of things. While many sections of shore have in effect armoured themselves by having nothing left to be carried away, there are others that are delicately vulnerable to the water's new direction of attack. In these cases, erosion is easy and easily evident. Toppled water's edge trees, undercut banks, and the silty flow of sediment are products of boat wake.

Wake is an enemy of the shore, and therefore an enemy of shoreline habitats, wildlife and water quality—as well as a threat to the investments of landowners.

Wake has three dimensions: size, force and direction. All boats displace water, and the amount of water they displace at rest is equal to their weight. Depending on the shape and type of hull, and on its speed, the amount of water displaced, or pushed out of the hole in which the boat sits, can vary. A boat's wake is actually biggest when the boat is being operated most inefficiently. When the boat is displacing as much water as possible, it is pushing all that water out of the way and so creates the maximum wake. This happens, in hulls that lift up or plane, when there isn't enough engine power applied to get the boat up to planning speeds. The stern squats and more wake is generated. There are boats that do not plane, but are always displacement craft, such as keel sailboats and many cabin cruisers. In this case, more power just generates larger wake, but efficiency of the hull design comes into play, with cabin cruisers being able to create far more massive rollers astern than the wind-driven boats.

Wake can have varying force, related to but not always a function of the wake size. While big wake can roll up far beyond the water's normal edge, smaller wake could be traveling at far greater speeds, generated by fast and powerful boats. The speed of the transverse wake—water pushed out of the way by the front and sides of the hull—is the same as the speed of the boat. Wake can travel considerable distance and still deliver strong attacks.

To a shoreline, the direction of the wake attack can be critical. Any wake on a sensitive shore is an issue. Some shores are simply too vulnerable to attack, and the system cannot withstand the choking clouds of sediment and the tearing of delicate roots and fibres. The best tool to control wake attack is the throttle, tempered with a little concerned common sense. Power up away from shore, avoid any travel in shallows and marshes and keep an eye on the size of the wake you're leaving behind.

Boating Safety (for more info) - 1-800-267-6687 or www.ccg-gcc.gc.ca

Speed Limits

- Speed limits may be posted in some areas, and are on white-background, circular signs. The speed is noted in kilometres per hour.
- The maximum speed within 30 metres of shore is 10 kilometres per hour.

Operator Competency Requirements

- All motorboat operators born after 1 April 1983, require a proof of competency.
- All operators of motorboats under 4 m in length, including PWCs, require a proof of competency.
- All motorboat operators require a proof of competency after 15 September 2009.

Age-horsepower Restrictions

- **Under 12** - cannot operate a boat powered by more than a 10 hp motor, unless accompanied by someone 16 or older.
- **12-16 years of age** - cannot operate a boat powered by more than a 40 hp motor unless accompanied by some one 16 years of age or older.
- **16 and older**- no power restrictions. Minimum age to operate personal water craft

Minimum Required Safety Equipment: craft type:

1. Canoes Kayaks Rowboats Sailboats
2. Paddleboats
3. Sailboards
4. Motorboats-Less than 6m
5. Personal Water Craft

Craft type:	1.	2.	3.	4.	5.
Flotation Device	x	x	x	x	x
Heaving Line	x	Note 1	Note 2	x	x
Paddle/Anchor	x	-	Note 2	x	Note 3
Bailer/Pump	x	-	-	x	Note 3
Sound Signal	x	x	x	x	-
Night Lights	x	x	-	x	-
Flashlight/Flare	-	Note 1	Note 2	x	x
Fire Extinguisher	-	-	-	x	Note 3

x = mandatory - = not required

Flotation Device - Canadian-approved personal flotation device or lifejacket of appropriate size for each person on board.

Heaving Line - Buoyant heaving line (polypropylene) not less than 15 m in length.

Sound Signal - Sound-signaling device (a pea-less whistle) or a sound-signaling appliance.

Night Lights - Applicable navigation lights if pleasure craft operated after sunset or in periods of restricted visibility

Note 1 - Not mandatory if all people on board are wearing a Canadian-approved flotation device of appropriate size.

Note 2 - Not mandatory if all people on the sailboard are wearing a Canadian-approved flotation device of appropriate size or engaged in an official competition.

Note 3 - Not mandatory if all people on the PWC are wearing a Canadian-approved personal flotation device of appropriate size.

Composting

From a nearly unknown concept just a little more than a decade ago, composting has become a mainstream practice. Even a majority of towns and cities compost their leaves, offering a prized garden commodity to residents rather than unnecessarily bulking up land fill sites. By composting much of our lawn and garden cuttings and much of the kitchen waste, there are two great results-natural fertilizers for gardens and less needless fill at the dump.

Plants need more than the three elements of commercial fertilizers. In addition to nitrogen, phosphorus and potassium, they need the trace elements of calcium, copper, magnesium and others, almost all of which are available from the compost. As well, soil condition improves with composting, by greater aeration and better drainage. Compost tends to hold nutrient in the soil, instead of releasing it to be washed into waterbodies where it causes excessive algae growth and then premature aging.

In composting, microbes break down the vegetable matter. Worms digest that matter further, and in the course of a year or two, the process is complete. Here are the steps:

1. Compost bins may be purchased or built. Bins should be at least a cubic metre in size, or larger depending on the volume it will receive. Double bins are handy, as they let each side to be used in alternating years, as two years is an ideal time to let the process work best. Bins are not solid-sided, but are made of slats so that air can circulate. Use sturdy lumber and deck screws as the damp contents will age materials too quickly otherwise. Place the bin on stones or bricks, to let air flow freely.
2. Layer the bottom with small branches, straw, hay or grass clippings.
3. Add a second layer of old compost, rotted manure or good garden soil, to start the process.
4. Add your kitchen waste, lawn clippings or weeds pulled from the garden. Do not include meat scraps, oil, bones or dairy products—these will attract raccoons, skunks and rodents. Egg shells and limited quantities of paper will compost.
5. Turn over or tumble the compost from time to time.
6. Serve to the garden in two years.

A few tips:

- Run over your leaves a couple of times with the mower before adding to the bin, otherwise layered mats of leaves tend to form barriers to air and moisture.
- Red worms, commercially available, eat compost for breakfast, lunch and dinner.
- Bank leaves around the bin's sides for winter, and add a good layers of well-chopped leaves to the top in fall, to protect the worms for winter.
- A screen top lets air in but keeps foraging critters out.
- While twigs will compost in the two year time frame, larger branches take too much time, and but be treated as a long-term compost process.

A well aerated composter is virtually odourless, and produces top quality compost.

Cultural Landscapes

Cultural landscapes are created by some form of use of the land. Examples we all know are farmland, settlement areas such as towns and villages, manicured parks, house sites and properties, and any other places where the natural environment has been developed by people. Even before Europeans arrived, native peoples created cultural landscapes with encampment sites and sections of forest burned to create agricultural sites for corn and tobacco.

Cultural landscapes, whether large or small, are now very much established into the mosaic of land use. We could say that we are very fortunate in this part of the province, as in southern Ontario terms, we have a broad and pleasant mix of natural lands, settlement and agricultural land. While the last 50 years have seen almost exponential growth and urbanization of much of the Great Lakes regions, our region has remained less urban-affected. Perhaps this is an ideal time to plan for the inevitable development here; a time when future land use can be managed and directed from sprawl to instead a quality blend of healthy environment and healthy community.

Wise land use and sensible development can have benefits for the region. The quality of ground water, soil conservation, clean air, recreational space and wildlife habitats hinge on planned and sensitive development. Cultural landscapes tend to be established on the “nest” land—that which has well drained, level land with good soil depth. Prime agricultural land, which was in turn the prime forested land with great reserves of cold, clean groundwater, were and remain the first land “to go”. The other hot-spots are waterfront properties, once for cottaging but more and more for year round living. Waterfronts are the “ribbons of life, where some 90 percent of wildlife depends on habitat conditions at some point in their lives, and where the vegetated strip between upland and water’s edge filters the runoff, preventing lakes, rivers and streams from becoming over-supplied with nutrient.

All land use has effect on environments and our lives, but that land use can have considerably more or less detrimental effects. An example is the Gananoque River, once one of the great inland salmon rivers, but where damming and excessive nutrient runoff have had staggering affects, in some portions of the waterway. On the other hand, the re-growth of swamp woods and reduced levels of pesticides have seen the return of osprey to the region. Today, best practices on farms are becoming the standard practices. Landfill sites and sewage disposal are getting treatments that vastly reduce impacts. While housing developments and road use have issues, there is technology that will potentially lend to the will power to make positive changes there as well.

Conservation Organizations

The **Biosphere Network** is a partnership of organizations within the **Frontenac Arch Biosphere Reserve**. The partnership includes over 70 groups, including residents groups, non-government organizations and government agencies that share common interests in the environment, history, economics and social fabric of the Biosphere Reserve.

The Biosphere Network
19 Reynold's Road
RR# 1 Lansdowne, Ontario K0E 1L0
613 659-4824
www.fabr.ca
info@fabr.ca

The **Charleston Lake Association**, founded in 1890, and with a membership that includes most of the lake's year round and seasonal residents, works to keep the lake environment clean and healthy. It provides membership services in many areas, as shoal-marking, water safety, communications events and lake monitoring programs.

Charleston Lake Association
P.O. Box 609
109 Charleston Road, Athens K0E 1B0

The **Charleston Lake Environmental Association** is the conservation arm of the CLA; at the same address. Leading the challenge to protect and sustain Charleston Lake's environment.

The **Thousand Islands Watershed Land Trust** is a volunteer, non-profit, registered charity dedicated to the protection of the natural and cultural resources of the Thousand Islands, for the benefit of present and future generations, by working with landowners and government agencies to find the best methods of heritage resource protection for the region.

Thousand Islands Watershed Land Trust
19 Reynolds Rd.
RR 1
Lansdowne ON K0E 1L0 www.tiwlts.ca

The **Leeds County Stewardship Council** serves the land, lakes and people of Leeds. Volunteers and partnerships...helping landowners to help themselves.

Leeds County Stewardship Council
P.O. Box 605, Oxford Avenue, Brockville, Ontario, Canada K6V 5Y8

The **Thousand Islands Area Residents Association** is dedicated to preserve and improve the present character of the Thousand Islands area with emphasis on the environment. Founded in 1975, TIARA is an association over 600 landowners in the Canadian Thousand Islands, both year round and seasonal, who are concerned about the future of this beautiful area.

The Thousand Islands Area Residents Association
RR 1
Lansdowne, Ontario, Canada K0E 1L0
www.tiara.on.ca

Conservation Programs

There are a great many ways to show our care of and commitments to the land we love. Some of these are as simple as everyday practices, and others could be more complex programs of conservation. This section deals with the latter; conservation programs.

Stewardship Programs are the most basic and least onerous. Essentially, they are non-binding agreements between landowners and various agencies, where both parties are interested in caring for a feature, habitat or landscape, but without putting that commitment to a formal agreement. Sometimes, these are called volunteer or “handshake agreements”. Some organizations have programs that offer advice, support and encouragement to landowners in this regard, and among these are the Leeds County Stewardship Council and the Canadian Thousand Islands Heritage Conservancy.

Landowner Agreements are usually a step more formal than Stewardship. Landowners and an organization or agency may have common long-term objectives that could be reached on the landowner’s property. For example, many rural landowners have agreements with the Ministry of Natural Resources for forest management. Ducks Unlimited works with landowners where there is strong potential to improve wetland habitat for waterfowl and other associated species. Some landowners have agreements for trails or right-of-ways for ski, hiking or snowmobile trails. Sometimes these agreements are written in the form of contracts, and may have a lifespan appropriate to the objectives.

Conservation Easements are formal and legal agreements between landowners and organizations that are recognized by Environment Canada and the Canada Customs and Revenue Agency as having qualified objectives of conservation. These organizations include land trusts, such as the Canadian Thousand Islands Heritage Conservancy or Nature Conservancy of Canada, and Conservation Authorities. Easements are used in conservation to protect land that remains in the ownership of the property owner. The easement specifies what sections of the property are to be kept from development and which activities are to be allowed in the future. These are permanent and binding agreements, and are something like setting out the terms of a will for the land. Very often, the easement reduces the value of property, because development rights may be decreased. If the land qualifies as being ecologically significant, and if there is a reduction in property value as supported by qualified appraisal, the difference in the before and after values can be used by the landowner in calculating income tax benefits. This program is more completely spelled out in the Environment Canada Ecogifts

Program, at www.cws-scf.ec.gc.ca/ecogifts or at Environment Canada, 4905 Dufferin Street, Downsview, Ontario M3H 5T4; or through the Canadian Thousand Islands Heritage Conservancy. Legal and accounting advice should always be sought.

Donations of Ecological Lands follows a similar route to easements, except in this case the ownership of the land is transferred to the appropriate and willing agency. Again, there can be income tax benefits from the gift to a qualified agency or organization, and this can include parks and municipalities. Always seek legal and accounting advice. Capital gains may be triggered and the benefits should always be weighed. Most gifts of this nature come from the individual's or family's desire to protect special landscapes. The process involves a survey of the property for certainty of boundaries, an ecological survey to verify the land does qualify as being ecologically significant—ultimately the decision of Environment Canada—appraised by an appraiser certified by the Canada Customs and Revenue Agency, and thoroughly described. Again, the best source of information is the Environment Canada office or website.

Docks, boathouses, boatports and rafts

In some ways, docks are a paradox. The “ribbon of life” is the section of shoreline and shallow water that borders every water body. It is the most productive and essential ecosystem in the entire aquatic environment. Anything below the high water mark on a lake is under the management of the Ministry of Natural Resources: the landowner’s property ends at the high water mark. Yet, this is also the area where docks are placed—on sensitive environments, owned and controlled by a government agency. In a sense, it is a privilege, and not a right, to place a dock in the lakes and rivers, and a responsibility that should never be taken lightly.

Through the partnership of the Department of Fisheries and Oceans, your local Conservation Authority also provides the fisheries review required for all in water works. Section 35 of the Fisheries Act states that “no person shall carry on any work or undertaking that results in the harmful alteration, disruption or destruction of fish habitat. At the same time, a subsection authorizes some latitude to fisheries officers where work must proceed, and some harm may be done. The tool used in this case is “No Net Loss”, meaning that a balancing amount of habitat restoration must be done to offset the harm from the project.

While there are several agencies that must all be approached for permits, there are some considerations for the shoreline and waterbody that will lead to responsible planning, and thus the better likelihood of approvals. These are not hard rules, but more environmentally ethical considerations:

- Docks should intrude as little as possible into the ribbon of life
- Docks should not cover or sit on the bed of the lake/river
- Docks should occupy less than about 10 per cent of the lot frontage
- Docks should not be placed in sensitive habitats, such as marshes
- Docks should not divert shoreline current flow
- Dock plans should be no larger than necessary for their purpose

Dock designs

There are a number of dock types and styles available for use along your shoreline. The following table will help to guide you in your selection.

Dock Designs and Impacts

Dock Type	Advantages	Disadvantages	Cost
Dry Land Boathouse	-winter storage	-involves building on shoreline	varies
Cantilever Dock	-do not impact watercourse -no in water work	-unattractive	moderate
Floating Dock	-low maintenance	-may block sunlight	low

	and long life -best dock design -low land impact	from plants -may cause erosion	
Post Dock	-minimal impact to substrate -limited impact to aquatic life	-severe wave action may damage lighter posts	low
Crib Dock	-may provide minimal fish habitat -provides solid foundation	-occupies bottom habitat -some diversion of shoreline currents	moderate to high
Concrete Pier	-permanent	-most destructive -unattractive -may cause erosion	high
Pile Dock	-permanent -limited impact to aquatic life (after put in place)	-heavy equipment involved in construction	moderate

Definitions/descriptions:

Cantilever dock

The structure is entirely on land, and projects over the surface of the water; sometimes fixed, and sometimes can be raised by cables. While they have lesser impact on the aquatic zone, they may involve alteration of the riparian zone, and are limited in the length of boats accommodated.

Concrete docks

Concrete is poured into forms in the water as large blocks to support a dock's deck, or as the entire dock structure. This is the most damaging form of dock, as it occupies bottom that would otherwise be habitat, and interrupts and diverts shoreline currents. Concrete is subject to deterioration from wave and ice, and will gradually crumble.

Floating docks

Built with metal or plastic tubes or floats that carry a decked surface, and usually have a point of attachment at the shore, with hinges and ramps to follow the seasonal water levels. While floating docks do not contact the bottom, they do have issues. Floaters can divert surface currents, collecting or redirecting flotsam into your waterfront, or someone else's. In shallow water, their rise and fall in waves and wake creates a pumping action that can disturb sediments and harm aquatic life. As well, floating docks are often larger in area than really needed because they must be wide and long enough to be stable. Commercially built steel-tube docks will have a life of about 25 years before they are perforated with rust; something partially aided if the interior surface is epoxy coated. Do-it-

yourselfers should note that drums which held chemicals may not be legal for use. There are sources of manufactured plastic floats.

Post docks

Usually placed in water that is relatively quiet in terms of wind and wave, post docks are lighter duty, for smaller craft, and sit on posts that form the support legs for dock decks. There are many commercially made post structures which have features like broad feet that help prevent sinking into softer bottoms; and adjustable length legs to keep up with seasonally variable water levels. As they are fixed in position, stability is not the factor as with floating docks, and the size can be minimized, which has both aesthetic and cost benefits.

Pile docks

Pile docks are similar to post docks in shape, but are more robust in construction for larger craft or more dock-hostile conditions. These have wood, but more often steel pilings driven into the bottom to carry the deck structure. They can be sometimes driven into bottoms with broken rock, with rock points. In shallow water, where freezing to the bottom can occur, or if the piles are not deeply enough driven, frost or ice can lift the pilings. There is a one-time need for heavy equipment, which can be a significant disturbance to the aquatic habitat unless carefully managed. However, s with post docks, stability and size is less an issue than with floating docks, and over-sizing can be prevented.

Crib docks

Cribs, in the dock sense, are square or rectangular boxes of stacked timbers, bolted or spiked together, and filled with broken rock. This creates a heavy, stationary structure to support the decks of docks. While the open weave of the timbers creates some refuge places for small fish and other organisms, crib docks do occupy a far amount of bottom, removing it from habitat and often diverting shoreline currents. Before the advent of floating and post or pile docks, these were the dock type generally used, especially in situations where a structure was needed that would provide some protection as well as dock space. Like most structures placed in water, crib docks have a limited life span. Cribs can sink into soft substrate and wind, wave and decay take their toll.

With any type of dock, plan carefully for the precise location, to avoid damaging any more habitat than necessary. There are a number of reasons to use as little length and size of dock than necessary, including less habitat damage and less bank account damage, remembering that no dock is permanent and will have to be repaired and replaced more often than one would care to imagine.

Boathouses and boatports

Boathouses and boatports must undergo the same approval process as docks. Boatports, essentially a fixed roof over parallel docks, can be built on most of the dock structure types listed above, and floating structures are becoming common. Boathouses, once very

common sights on lakes and rivers, have walls to enclose the structure. Some, in the past, had accommodations in a second story. There are municipal regulations in zoning bylaws that discuss boathouses. At the time of this writing, a new Official Plan is being drafted, and landowners would be advised to contact the Township of Leeds and the Thousand Islands for current interpretations at the time of the approval process.

Generally speaking, these larger structures have a bigger “footprint” than do docks, and can have more impact on the aquatic habitats.

Rafts

Rafts and floating trampolines are anchored off shores for swim and play platforms. Generally, they are situated in water that is deep enough to dive into, but shallow enough for anchors to effectively hold. This requirement usually keeps them in the littoral zone; where sunlight still penetrates to the bottom and where there is a growth of aquatic plants that feeds and shelters many organisms. Consequently, the location of the rafts is important. Wherever possible, place the anchors and the rafts where the life under water seems least complex, to lessen the impacts. have become a common occurrence on many lakes and rivers.

A basic introduction to types and techniques for docks is a publication called *The Dock Primer*. It is readable online at www.dfo-mpo.gc.ca/canwaters-eauxcan/infocentre/guidelines-conseils/guides/dock-primer.big_dock_e.asp

Drinking Water

Lake water is not considered safe for human consumption, without prior treatment. All surface water is open to contamination by humans, animals and birds, all of which can be carriers of disease. Only water that comes from a well, or that which has been subject to some kind of treatment, should be considered suitable for drinking. To determine the bacteriological safety of the cottage water it should be tested as soon as the cottage is opened up in the spring and the water should not be drunk without treatment before the tests are obtained. You can treat the water by boiling it for at least five minutes to destroy any bacteria. Never use water of unknown quality for drinking, brushing your teeth, washing dishes, or washing fruits and vegetables that are to be eaten raw. The water should be tested once or twice during the season, preferably after heavy rains.

For well water in general, three samples with acceptable results collected one to three weeks apart indicate a safe supply. Sterile sampling bottles for testing water are available free of charge from the local Health Unit. The water is tested for the presence of total coliform and fecal coliform bacteria. Total coliform bacteria are present in animal wastes, sewage in soil and on vegetation. Fecal coliform bacteria are only found in intestinal contents of humans and warm-blooded animals. Since fecal coliforms tend to die off more rapidly outside the body, their presence in water indicates relatively recent sewage contamination and a short distance of travel.

The safety of the water in terms of bacterial levels is tested at the Leeds, Grenville and Lanark District Health Unit, in Brockville. Chemical analyses of water samples can be obtained from commercial laboratories and water-conditioning companies listed in the Yellow Pages.

There are now many types, and abilities, of water purification devices on the market. These include ultra violet light units, chlorinators, filter systems and reverse osmosis systems. Many of the better plumbing supply stores routinely carry these, and are a source of advice on suitability and situations.

Environmentally Friendly Projects

Perhaps one of the most friendly things you can do for your environment is to purchase, install, and regularly test a hammock. Let the grass grow and the forest to invade the garden. With that, the view from the hammock only gets better. Wildlife wanders into view, the shade gets cooler and more plentiful and you'll see life on and around the water, and overhead, that you never knew existed.

If you can't sit still for those long stretches of precious summer, try these tips from the Savings Plan:

- **Save Money!** The Canadian Mortgage and Housing Corporation did a study on best landscape methods to save cash. Annual costs in materials were by far and away lowest in woodlands, meadows and low-maintenance lawns. The highest tickets were flowerbeds, ornamental trees and shrubs, and maintained lawns.
- **Save Labour!** The most time you'll spend in the forest and meadows is enjoying the view. All other options link you to the loppers, lawnmowers and landscapers.
- **Save Water!** Nature has the best water device on the planet - precipitation. Forests and meadows are prepared for the little irregularities in the schedule. Lawns, flower beds and ornamental shrubs and trees are a little less forgiving. They demand you attention, just when the sun shines and you were ready to go out on the water, or head for the hammock.
- **Save Fuel!** Forests and meadows don't run on gas. Lawns, flower beds and landscaped areas can run up a surprising fuel bill.
- **Save Fertilizer!** Your waterfront will repay you for not using fertilizer on lawns and gardens. Less algae and aquatic weed growth because of less fertilizer means clearer and cleaner water, with more fish.
- **Save Pesticides!** Healthy waterfronts, clean water, healthy forests and meadows don't need insecticides and herbicides. The exotic species in lawns and flowerbeds attract many other exotic insects and diseases to the table, and these generally don't have any native controls. Pesticides don't just go away when you apply them outdoors...

Still need something to do?

- Bat houses are like very rough, bottomless birdhouses tacked to the shady side of trees, and can be an investment in flying insect reduction.
- Specialty birdhouses for wrens, bluebirds and wood ducks are like of micro-habitat-in-a-box
- Wood-chip pathways absorb rainfall, reduce erosion and help keep sediment from reaching your waterfront, which would add nutrient and cause more algae growth.
- Eaves troughs collect water from the roof, which can be collected in mosquito-proof rainbarrels for watering needy shrubs and wildflowers in dry spells.
- Build a composter for kitchen veggie scraps.
- Make a viewing bucket to see what life at dockside is all about.
- Work on your collection of field guides, and get to know your furred and feathered neighbours.

- Make hammocks for your friends and guests.

Government and Park Organizations

Cataraqui Region Conservation Authority	613 546-4228
Canadian Coast Guard	866 290-3731
Charleston Lake Provincial Park	613 659-2065
Electrical Safety Authority Permits and inspection of work and installation	800 369-7536
Fisheries and Oceans Canada	613 925-2865
Leeds, Grenville and Lanark District Health Unit	613 345-5685
Municipal Property Assessment Corporation	866 296-6722
Ontario Ministry of Natural Resources	613 258-8204
Ontario Ministry of Municipal Affairs and Housing	800 267-9438
Ontario Ministry of Transportation	800 268-4686
Township of Leeds and the Thousand Islands	613 659-2415
Township of Athens	613 924-2044
St. Lawrence Islands National Park	613 923-5261

Healthy Septic Systems

One of the greatest pollution concerns when living by water are septic systems. Recognition that septic systems need space and the filtering properties of the soil to function fully is a primary reason for increased setbacks of the system and the building from the water. Although septic systems can be extremely useful, there are the malfunctions to consider. A buffer distance in the soil, and a buffer strip of vegetation, are vital to protecting the quality of lake and river water.

The septic system works mainly on biological processes. The septic tank biologically treats raw sewage and waste water in a low oxygen environment, and then the material is deposited into the tile bed. Underneath the tile bed, bacteria in the soil feed on the waste water, removing contaminants. The water eventually percolates downward and intercepts the groundwater. If everything is working properly, the water is clean before it gets to the ground water. That is very important, because that ground water is very often the source of supply of drinking water in rural areas, and cottages.

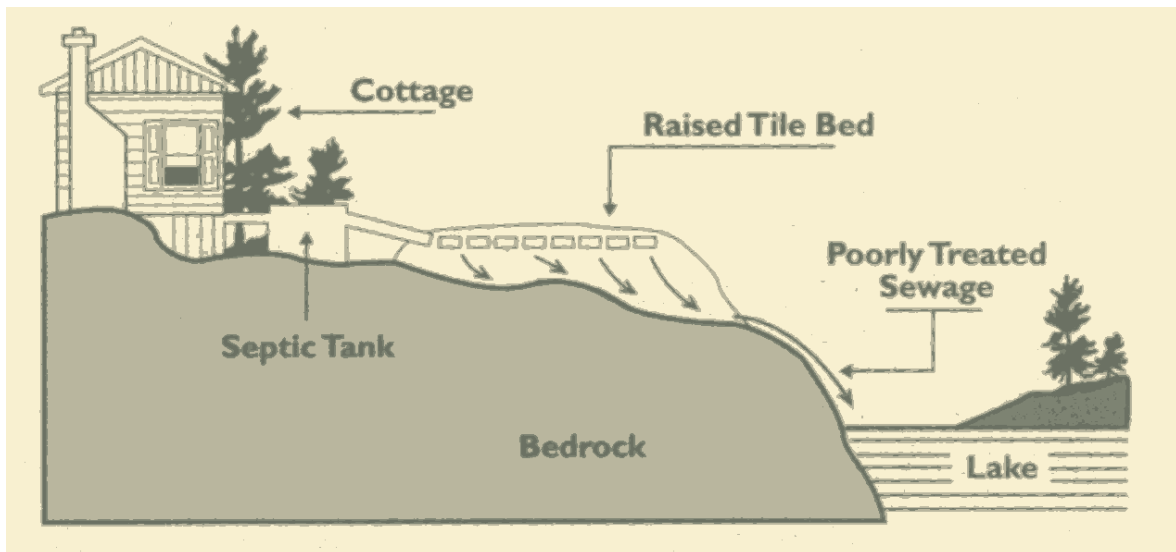


Figure 7: Septic System Pollution

Although this method does work, a tank may become too full and produce too much material for bacteria to treat. To ensure that you are not causing any detrimental effects on the lake system, have your septic system inspected regularly and pump your system on a routine basis as sludge builds up. Although the frequency of pump-outs depends on the size of the tank and the amount of people using the facilities, it is recommended that tanks be pumped out every 3 to 5 years. This will increase the lifespan of your septic system and will preserve the water quality in the ground, and in rivers and lakes.

Holding Tanks

Holding tanks do not treat wastes and other wastewater, but merely contain it until it can be pumped out and taken elsewhere for treatment. They are no longer common, as they are always at risk from damage and aging, and may develop leaks. Holding tanks are

simply 1500 gallon (or larger) water-tight tanks. The waste builds up inside the tank until it is 75% full and an alarm, which must be installed, sounds meaning that the tank needs to be pumped. If your tank is not suited with an alarm it must be pumped before the ground starts freezing. This can be a costly, as holding tanks need to be emptied as often as once per week, depending on the size of the tank and how much wastewater the household generates. New holding tanks are not usually permitted for this reason, and do not qualify for permits for new buildings on lots. However, there are still some used on existing, older lots too small for a septic system. In this area, the authority and source of information and advice is the Leeds, Grenville and Lanark Health Unit, 458 Laurier Boulevard, Brockville, at 613 345-5685.

There are new technologies being developed that require less space than the standard septic beds. Permission for their use again depends on the assessment of the County Health Unit. However, remember that waste disposal systems are only one part of the water quality issue, and that there is still nothing so effective in cleansing and purifying runoff to the water as nature's own buffer of native ground and forest cover.

Invasive and Exotic Species

Exotic species are those that are non-native. There are actually hundreds that have found their way or brought to North America, and our region, since the times of European explorations. Many inadvertently hitch-hiked their way in the bilges and rock and clay ballast of old sailing ships. Roadside and field weeds such as dandelion, plantain, thistles, and hundreds more were unintentional imports. Insects too were, and still are, undesirable aliens that slipped in. The species of mosquito, *Culex pipiens*, which is a principal carrier of the West Nile Virus, came from Europe first in the bilgewater of ships centuries ago. Gypsy moths escaped from a lab experiment in New England decades ago, and the American elm and chestnut trees—once the common forest species of the eastern half of the continent—have all but disappeared because of imported fungi and blights.

Exotic species can become invasive, as with zebra mussels and purple loosestrife, and take over the habitats of native species. This can in turn lead to loss of species diversity and widespread alteration of the native community. In any given area, the relationships between plants, animals and their environment became closely interdependent and complexly woven over millions of years of evolution. Something new injected into or invading the system doesn't often fit, and can throw the system out of balance. This isn't a problem within nature alone. These changes frequently have extensive economic and social effects on the human communities that depend on the system for food, water, or leisure activities.

Some exotic species in Ontario are:

Crustaceans and Mollusks- Rusty Crayfish, Spiny Water Flea, Zebra Mussels

Fish- Common Carp, Goby, Rudd, Ruffe, Sea Lamprey, White Perch

Plants- Curly-leaf Pondweed, European Frog-bit, Eurasian Watermilfoil, Fanwort, Flowering Rush, Purple Loosestrife

If you are especially concerned about exotic species on your property or observe what may be an exotic species, visit the Ontario Federation of Anglers and Hunters website at www.invadingspecies.com or report a sighting at 1-800-563-7711

Landscaping - Habitat for Wildlife

Landscaping most often conjures up images of manicured lawn and garden. Landscaping, though, is really any form of working with the land and what grows upon it. In a stewardship sense, landscaping can be very much a part of the solution for a healthy environment.

A healthy forest and ground cover of vegetation absorbs and filters nutrient and sediment, retains and cools soil moisture, and cools runoff before it reaches the water, contributing to the overall health of lakes, rivers and streams. This applies to properties even distant from waterbodies, even those in cities and towns. Natural habitats attract birds and other wildlife, to the pleasure of landowners and to the benefit of the creatures themselves. Intact forests are seldom an option on many smaller properties, however, but items and elements from them can give new life to landscaping.

Perhaps the best and most pleasant research to habitat landscaping is done by talking a stroll through a forest or field that is similar to slope, soil, exposure and drainage to your own candidate land. Record what you see and like with notepad and camera, calling in expertise from friends or conservation groups if you need. In most cases, getting the landscape the way you want it will be a succession of steps, creating the conditions of shade, soil and moisture along the way.

Lawns are very ineffective in terms of preventing runoff, filtering nutrient, holding soil moisture and providing wildlife habitat. In fact, almost all species of grasses are not native plants at all. Even so, their effectiveness can be improved by letting it grow taller, and eliminating mowing altogether, creating a meadow, wherever practical for the property's pattern of use. That, coupled with less raking, will allow the slow process of succession to old field conditions to take place. Trees and shrubs already present will seed in, and become healthier because of more soil moisture present. Other trees, shrubs, wildflowers and vines can be added along the way, and before long, butterflies and songbirds will add their colour and song to the scene. The infilling process can be halted at any step along the way that suits your taste and needs.

Here are some examples of shrubs that help create habitat for wildlife:

<u>Species</u>	<u>moisture</u>	<u>light</u>	<u>height</u>	<u>importance</u>
Highbush cranberry <i>Viburnum trilobum</i>	moist, well-drained	full, partial	2.5-3 m	berries are winter food for birds
Red-osier dogwood <i>Cornus stolonifera</i>	moist, wet	full	1-2 m	birds love berries; deer and rabbit browse
Gray dogwood <i>Cornus racemosa</i>	moist, dry	full	1-2 m	deer and rabbit browse
Nannyberry <i>Viburnum lentago</i>	moist	full, partial	3-4 m	berries and browse

Elderberry <i>Sambucus canadensis</i>	well drained	partial	1-3 m	berries for birds, squirrels, chipmunks
Staghorn sumac dry, <i>Rhus typhina</i>	well drained	full	2-3 m	berries and browse
Chokecherry <i>Prunus virginiana</i>	rich, moist	full, partial	2-4 m	berries attract 70 species of songbirds
Beaked hazel <i>Corylus cornuta</i>	moist	full, partial	1-3 m	nut crop for animals

The following are notes about various trees and shrubs common to the region, and about their handling for naturalizing landscaping projects:

Evergreens:

White pine is the most common and abundant of the pines of the region. It is the tree that is the most eloquent aspect of a sunset silhouette with its 'flagged' away from the prevailing wind profile. White pine grows best in full sun, damp but not wet ground and on deep to moderate depth of soil. It is seen here as very large trees on the sides and slopes of rock ridges because it is hardier in those locations than most hardwood species. It is usually shaded out by hardwoods on deeper soils where the better conditions allow the hardwoods an edge in the competition. White pine can be transplanted in many sizes and to many locations. For success in the long term, they will need a sunny spot and the roots will need to find a constant source of moisture, as in deep crevices or deep pockets of soil. The soil itself can be loam, sandy loam and even gravelly at depth as long as there is a humous or vegetable matter layer for roots near the soil surface. White pine can be moved in spring or fall as long as it is cool and the ground is moist. Larger trees should be root pruned the fall before. The transplanted trees should not have branches pruned or trimmed for several years because of bleeding and damage. Wounds in trees of any age tend to attract pine boring beetles, which will kill the trees.

Red pine is much less common than white pine. It gets its name from the red hue from the rough bark when the trees are more mature. Red pine grows tall, slender and with a bottle-brush character, less prone to the wind pruning that gives white pine its flagged shape. Red pine grows best in sunny locations with good drainage on sandy, gravel-based and even rocky ground. It likes a little moisture all the time, but needs less than white pine. There needs to be a moisture absorbing vegetable matter layer at the surface of the soil. Red pine can be moved spring or fall, with all the same considerations as with white pine.

Pitch pine is a special tree in the Thousand Islands because of its rarity in Canada. It is at the northern limits of its range here and exists because of the ecological link to the east coast plains across the land bridge of the granite rock types that are found from here south through the Adirondack Mountains. Pitch pine grows in exposed to wind and sun locations at west-facing points of land and on higher and exposed ridge tops. It cannot exist in shade and at first glance seems to grow where there is no soil at all. A closer look shows that the roots are penetrating cracks in the bedrock or that they are in pockets of gravel soil. Pitch pine needs a little soil moisture but can tolerate drought for short periods. While the other two pines can be bought at nurseries or be found at private or government tree farms, pitch pine is

harder to come by. The source will be through local government tree farms. Pitch pine is planted best in spring, and because its roots need to seek out crevices, it should be planted small – probably the only size it will be available. Choose sites where this slower growing pine will have future prominence with its naturally knarled and weather-bent form. Use a soil mix of gravel and peat moss, keeping it damp but not wet. Like any small tree or shrub to be planted these days in the islands, it may need to be protected by a circle of hardware cloth to keep it from the deer.

Eastern hemlock is dark green and lacy with trunks that are dark red-brown. It grows in damp, shady places such as ravines, and north-facing slopes and shorelines that have sun for just part of the day and sheltered from the full force of the wind.

Hemlock prefers thin, rocky but humous-rich soil that always has moisture seeping into it from rain runoff or from spring water. There was once a large stand of hemlock in the ravine where the present driveway has been built and it could be planted along the lane again. Similar sites would work well. This is a valuable tree for plantings because it thrives where others would fail in the damp shade and it is green with a pleasant character year 'round. Hemlock can be bought in its native form from nurseries or dug out as small trees locally. Be sure to get lots of its ropy roots. Plant in spring into peaty soil and keep it damp.

White cedar grows quickest if it is planted in clusters. As well, it is most effective for landscaping and as wildlife refuge if in clusters to create thickets because such arrangements give the best visual impact and presence. It grows best in sun and in deeper soil pockets that do not completely dry out during the summer. It will grow in sand, gravel or clay.; it's not fussy.

White cedar makes a good nursery tree. That is, other trees can be planted amongst the clumps and they will be sheltered in soil that is kept moist by the cedars so that they will grow taller quicker. It is also a good backdrop against which other bushes, shrubs or flowers can be planted and displayed against the cedar's soft green foliage. White cedar can be planted best in spring. Any size of tree can be moved, as long as there is a large root ball moved with it. It is readily available through local sources very inexpensively. Plant it into peat and any other soil and water it well.

Hardwoods

There are several species of maples in the Thousand Islands. Two of these, sugar maple and striped maple, lend to your landscaping because of your situation.

Sugar maple is very abundant in this forest type. It grows in a variety of soils, as long as there is some shelter from the strongest winds and there is always some soil moisture. Seedlings need some shade to germinate and under a healthy adult tree where seeds fall, they grow quickly and in large numbers. Their strategy in nature is to outnumber and out-shade the competition. When they reach sapling size, or heights of ten to twenty feet, they begin to shade themselves out so that only the strongest survive.

Choose sites for sugar maple where an extensive root system can spread out and where there is plenty of space overhead for the future tree's big canopy. Plant several saplings, and these may be as big as can be handled by equipment, and the future will decide the survivors. Plant them in spring or mid September into basins of loam soil that are as big as the diameter of the root systems and water well, keeping the soil just damp for the first year.

Striped maple is just a distant cousin to sugar maple. It gets its name from the character of the bark, which is vertically striped in green and brown. It will be a full and bushy small tree, much less tall than its cousin.

It grows in semi-shady places on gravel or sandy ground that is usually moist from runoff or that has seepage from springs. Its roots spread out through the top layers of the soil and so it does not

like to be trampled on. It is very pleasant to look at because of its big, soft green leaves and character of the bark. Striped maple can easily be dug out in spring as saplings and moved to depressions of gravel soil mixed with peat and kept moist.

Juneberry, also called service berry, never reaches the height and diameter of other hardwoods, but it has a very graceful form and character. The tree's bark is light grey on dark grey and almost smooth, even on older trees. The small, spade-shaped leaves are dark green in summer and dark red in fall. Juneberry flowers in early May with white flowers that are like delicate apple blossoms.

Juneberry grows in a variety of soil and light conditions. It may be found along ground that is quite wet in spring but that nearly dries out in fall. It also grows on rocky slopes where there seems to be little soil, but its roots dip into crevices. It needs places that have full sun or only partial shade. The sites may be breezy but seldom exposed to full force of the wind. Juneberry can be found in many local woodlots and moved in roots balls in spring or fall. Small or medium size trees can be moved. They are best placed into prepared depressions in the ground, with sandy loam and some peat and that soil kept moist.

Ironwood is a lacy branched, fine leafed tree that grows to moderate size. Its bark is dusty grey and rough and scaly. It grows in many of the same places as juneberry because it shares most of the same requirements of soil, light and water. Like juneberry, it is an interesting tree to put into the mix because of its character and form. It too is found readily in local woodlots and it is not difficult to transplant.

There are two principal species of oak in the Thousand Islands; red and white.

White oak, with its round-lobed leaves and coarse, grey scaly bark, is found in sunnier and drier upland woods. Red oak, with its sharp-toothed leaves and bark that is waxy-smooth on younger trees and becoming deeply and heavily ridged when older, grows in lower, damper and more protected locations. Both are slow growing but can be moved in fairly large sizes. Both can be purchased from the right nurseries in native form. Many cultivated forms, which are not nearly so hardy, are at nurseries so the buyer must beware.

Oaks lend a sense of maturity and grace to landscaping because even though they might not start as the biggest trees, everyone recognises them and knows their potential. Oaks are best moved in spring and in root balls. Big trees can be handled by tractor. They should be placed into prepared depressions of loam and peat and then watered in. Their placement should take into account that someday they will take up considerable space in the canopy overhead and that they will have big trunks and limbs. White oak looks good and is proper alongside white pine. Red oak can be planted in mixed stands with sugar maple, basswood and white ash.

Basswood is a fast growing tree and is generally found in woodlands with a good depth of soil. It has big buds in spring, which, incidentally, taste like raw peanuts. These buds develop into big, soft green leaves in late spring. The bark is very dark and moderately ridged in mature trees. It often grows in clumps or with multiple stems that have sprouted up when a main old trunk has fallen and many suckers grew from the stump. Basswood enjoys moderate shade in sheltered locations on damp soil. Hence, it is best placed into valleys or pockets of deeper soil. Basswood should be moved in spring. Saplings can be moved bare-rooted for short distances, but should be root balled for longer times to keep the roots moist. It should be planted into depressions with clay or rich loam. They could be planted in clumps and then let go to choose their own leader. Basswood can be found at some nurseries in native form.

White ash is plentiful in this region, especially on soils of moderate depth where there is some moisture year round. Ashes grow straight, tall and reach heights fairly quickly. Their lofty

branches are favourite nest sites for orioles. In fall, the green gives way to hues of purple, gold and magenta.

White ash can be moved in spring or fall, with many of the same parameters as basswood. It has, however, a deep, central tap root, so that it must be dug to enough depth to get a length of that root.

Shagbark hickory is a species of the southern woodlands that is very close to its northern range limits in the Thousand Islands. It is a slow growing hardwood of the shady, rich soil forests and so tends to be found here in sheltered valleys. It has interesting physical character with its large, flaky sheets of bark that hang down and away from the trunks of mature trees. In spring, the leaf buds, before they open, stand upright from the ends of branches like pointy green light bulbs and then burst open to fans of compound leaves. In fall, a mature tree produces huge numbers of rough-shelled nuts that attract every squirrel in the neighbourhood.

Shagbark hickory can be moved even as a moderate sized tree, twelve or even twenty feet in height, as long as enough root is bound up in the soil and it is kept damp to the ground of its new location. Plant them in spring into pits of rich loam and keep damp. The growth of a healthy tree will be two to four feet; similar to other large hardwoods. This tree is available in pure native form from some nurseries.

White birch is a tree familiar to just about everyone because of its distinctive paper bark. It grows best in open areas that have plenty of sun, that are not exposed to strong winds and that are always a little damp. This may be along shorelines, along stream banks, in low places where water can collect or even on rocky hillsides if there is constant seepage from runoff or a spring.

White birch grows singly or in clumps. In plantings, a good effect is with clusters or birch. The branches can dry out easily and be lost during moves, so it is best to plant saplings that are up to eight or ten feet, keeping the soil damp at all times. Plant them into pits with loam and peat and keep the soil wet at first and then damp after a few days. Spring plantings are far more successful than those in fall. There should be no trouble in finding plenty of the locally.

American beech, even as a mature tree, has smooth, silver grey bark. It grows to considerable size in time and spreads a wide canopy of lacy limbs overhead. An interesting feature is that the youngest limbs of the tree hang onto their leaves even well through the winter. These leaves waver in the wind and become more and more pale and thin over time.

It shares the same habitat and general conditions as shagbark hickory and sugar maple. It can be transplanted in the same way and is available from the same sources.

Red mulberry is another tree of the southern forests that is at range limits here. It is a small tree, generally less than twenty-five feet, and grows well branched and bushy. In late May, it blooms and in mid to late June, the tree can produce great quantities of purple-red fruit. The tasty berries are like candy and attract wildlife at all hours of the day and night. Grosbeaks, orioles, cardinals, raccoons, squirrels and plenty of others show up for the feast.

Red mulberry can be found in nurseries but be aware that there are many horticultural forms; ask for the real thing. Plant them into pits with good loam in semi-shaded and wind protected areas.

Bushes and shrubs

There are numerous bushes and shrubs that can be used to fill in areas, provide accent and focus, and as ground covers.

Blueberries and huckleberries form dense mats of low, bushy green on thin seemingly dry ground in open and even windswept areas. They like acid soils as associated with pines and red cedar.

They have delicate white flowers in mid May and produce the prized berries by early summer. They can be found abundantly locally and moved to sites prepared with peaty sandy loam soil. Throw a few handfuls of leaves over them and keep damp from time to time so that they don't dry out until the roots take hold.

Red cedar is actually a juniper. It, and the ground-hugging form, are common on arid ground and exposed places on thin soil that is well drained. They can be planted even bare-rooted into pits of loam if they are soon watered in and kept damp for a few weeks. There are plenty of these to found locally and they will be much more hardy than nursery types. They form screens and windbreaks, at least on a small scale, and are refuge for small birds that claim open areas.

Red and white elderberries, wild current and gooseberry are small bushes of these woodlands. They grow in the shade of hardwoods such as maple, beech and hickory. Their favourite soils are rich loams. All are common here and are easily planted in early spring. Their berries are treats for birds and mice.

There are various herbaceous plants that can be planted in semi-shaded places to "build up" the amount of greenery. Grape vine and Virginia creeper vine will grow up onto walls, cliff faces and trees. Purple flowering raspberry forms dense stands on damp ground in sunny sheltered places; its big soft leaves and large purple flowers are very pretty in early summer.

Attracting Wildlife

Interestingly, landscaping can also include wildlife. If the right conditions are there, there's a very good chance they will come.

<u>Species</u>	<u>Needs</u>
Hawks and owls	large trees, especially those that are mature and with cavities and hollows for nesting, isolated from general disturbance
Songbirds	variety of tree and shrub cover, especially with dense branches and nest cavities, and with berries and fruit that ripen at various times of the seasons
Larger birds	ruffed grouse prefer forest edges and thickets with varieties of berries; woodcock enjoy old fields and long grass, damp meadows; wood ducks nest in cavities of trees in swamps and can be attracted to specialty nest boxes; mallards and teal enjoy grassy swales near ponds
Amphibians	salamanders, frogs and toads are attracted to ponds, wetlands, moist woods, streams and shady gardens; and can be helped by protecting ponds and wetland pools, especially from pesticides
Mammals	deer, becoming very abundant throughout southern Ontario, will likely be seen; red squirrels prefer coniferous woods while grey squirrels and their black-phase relatives prefer deciduous forests; flying squirrels enjoy nut trees and can be attracted with suet

attached to tree trunks; foxes, fisher and coyotes will drop by looking for small animals and large insects for dinner

Butterflies and moths

especially attracted to nectar-producing flowers, as those found in wildflower seed mixes which can replace lawns as wildflower meadows

A wildflower meadow recipe:

- Till a section of lawn; leave fallow over the summer.
- Leave the soil surface rough; in fall, apply wildflower mixture blended with fine sand or sawdust, so it can be easily seen. Roll in lightly.
- The next spring, add clover mix to help trap moisture.
- Mow once, in fall, never shorter than 10 cm.
- Enjoy.

Wildflowers and Their Habitat

		height cm	blooms	light needs	soil	notes
Wet meadow	Cardinal flower <i>Lobelia cardinalis</i>	90-125	July-Aug	full sun	wet	attracts hummingbirds
	Swamp milkweed <i>Asclepias incarnata</i>	80-150	July	full sun	wet	attracts butterflies
	Great lobelia <i>Lobelia siphilitica</i>	30-90	Aug-Sept	partial to full sun	wet	attracts hummingbirds
	Jewelweed <i>Impatiens biflora</i>	80-100	July-Aug	partial shade	wet	butterflies; anti-poison ivy
	Blue vervain <i>Verbena hastata</i>	60-200	July-Aug	full sun	wet	attracts butterflies
Forest plants	Wild geranium <i>Germanium maculatum</i>	30-60	May	shade	damp	colour at forest edges
	Bunchberry <i>Cornus canadensis</i>	10	July	shade	damp	pretty white flower
	Violets <i>Viola sp</i>	5-8	May-June	shade	damp	variety of colours
	Bloodroot <i>Sanguinaria canadensis</i>	10-15	May	shade	damp	blood-red sap
	Dutchman's breeches <i>Dicentra cucullaria</i>	10-20	Apr-May	partial shade	damp	dormant after blooming
	White trillium <i>Trillium grandiflorum</i>	25-30	May	partial shade	damp	provincial flower
Open meadow	Goldenrod <i>Solidago sp</i>	50-150	Aug-Sept	full sun	dry	showy
	Thimbleweed <i>Anenome cylindrica</i>	50-80	July	full sun	damp/dry	drought tolerant
	Butterfly milkweed <i>Asclepias tuberosa</i>	40-80	July-Aug	full sun	damp/dry	attracts butterflies
	Lance-leaved coreopsis <i>Coreopsis lanceolata</i>	40-80	July-Aug	full sun	damp/dry	attracts butterflies
	Asters <i>Aster sp</i>	40-200	Aug-Sept	full sun	damp/dry	tolerant of many conditions
	Beebalm <i>Monarda didyma</i>	50-150	June-July	partial sun	damp	attracts butterflies

Light Trespass and Light Pollution

Our eyes always adapt to the brightest light, making the surroundings appear darker. By reducing your ability to see, glare reduces safety and security. Remove the lampshades in your living room and you will experience glare. In towns and cities at night, with street lights, yard lights, lighted signs, lighted houses and buildings and lights of many passing cars, it seems like the night sky is just black, and ends somewhere above the tree tops. Light pollution is such an issue now that there are by-laws regulating lighting in cities such as Richmond Hill and Calgary, and there is a popular Dark Sky Reserve at the Torrance Barrens, near Bala, Ontario.

Light trespass is light that shines where it is not needed or wanted. Also referred to as "light spill", light trespass is light from somebody else's property lighting up your property, shining in your windows, or otherwise interfering with your enjoyment of your property. Light trespass occurs whenever light shines beyond the intended target and onto adjacent property. Light over water isn't absorbed, but bounces off the water. It can severely limit the night vision of boaters, and intensifies the trespass effect to neighbours across the water. It can be reduced or eliminated by using a shielded light fixture and by aiming lights down where the light can be used.

Light pollution, on the other hand, occurs with excessive amounts of light and undirected light. Over-lighting results when light levels exceed those needed for the task. Too much light often arises when decks, docks, paths and outbuildings have spotlights trained on them from a distance. More is not always better. Over-lighting results in indirect glare, where illuminated objects are too bright compared to their surroundings, and the spill-over overwhelms visibility in the area.

Uplight is, quite simply, wasted light, wasted energy and wasted money—not unlike other forms of pollution. Uplight is a main culprit in reducing the visibility of the night sky, where a special pleasure of being in the country is seeing the sea of stars, constellations, and perhaps shooting stars. It occurs where improperly aimed or unshielded lights emit light above the horizontal. Light that simply goes up into the night sky serves no useful purpose. Uplight is what causes the dome of sky glow over towns and cities, reflecting and dispersing from moisture in the air, and clouds. Typically, lights that cause uplight also cause significant glare and light trespass. Unshielded yard or porch lights, most "security" lighting, most streetlights, and billboards with bottom-mounted lights are typical sources of uplight, light trespass and glare. Again, using shielded lights that are aimed down so that no light is emitted above horizontal will stop uplight and reduce light trespass and glare.

If the light source itself is more apparent than what it is illuminating, then you have bad lighting. The rule of thumb is that you should only be able to see the light source if you are standing under the light.

Five Easy Steps to Responsible Lighting

1. Ask yourself, "What do I need to illuminate and how much light do I really need?" Outdoor light at night should have a purpose. Just as we do indoors, think "task lighting." Determine if you wish light for safety, as a marker (like low-voltage garden path lights) or for aesthetic reasons. Remember your neighbours may not share your taste in lighting aesthetics, any more than you may share their tastes in art or music.
2. Use the right amount of light. More is not usually better. Too much light reduces visibility by creating glare, forming dark shadows and is wasteful of energy. By ensuring smooth transitions from light to dark areas, so that one's eyes can adjust easily, you can avoid deep shadows. This is important for those traveling on the water at night.
3. Avoid letting the light shine sideways or upwards. Use full cut-off, shielded fixtures and aim light downwards where you need it. This avoids glare, which always harms visibility, light trespass, which is nuisance light on adjacent property, and minimizes uplight. Never use fixtures that spray light everywhere.
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. Less light is needed after 10 pm. when few people are out.
5. Use efficient lamps: Remember, shielded fixtures with good reflectors waste little light, so you can use lower wattage bulbs.

Residential Lights. An article in the October 2002 issue of Cottage Life magazine discussed lighting matters in some detail. A finding was that the worst offenders in terms of types of lights are coach lights and flood lights. Coach lights spread illumination over 360 degrees where the intent is generally to light up something more specific, like a deck or dock surface, walkway or entranceway. The excessive and blinding glare from these lights often makes approaches to or past these places difficult, and most of the light goes where it was not needed—or wanted. Two solutions are to reduce the wattage from the usual 60 or 100 watt lamps to 25 watt chandelier type; and/or to insert a perf-roll—a perforated cylinder of metal, which directs most light down with some allowed to cast a glow around the area.

Another culprit is the post or wall mounted flood light. There are two issues here: the wattage and the lack of direction. While most are rated for 150 watts, that maximum is usually overkill. Finding your way into the area that needed some illumination means squinting your way through a zone that is dramatically darker in comparison. As well, the "flood" light does just that—it broadcasts light over a greater area than needed. A solution with these offenders is to replace the bulbs with lower wattage reflective spots lights, such as 35 watt parabolic-reflector halogen bulbs. In addition, there may be a more effective location for these lights, where the aim is as intended; or a shield can be placed to prevent light from escaping the intended area.

Decorative, motion-sensor fixtures are readily available and turn lights on when needed. To minimize glare, use reflector or director light bulbs (aimed downwards) and half-mirrored or silvered light bulbs (base up). These directional lamps, as well as soffit lighting, provide good, even, illumination without harmful glare. And since all of the light is directed downwards, you can use a 25-, 40- or 60-Watt lamp, which minimizes

energy consumption. Resist the temptation to buy the brightest bulb available—it just creates an island of brightness, and the adjacent unlit areas seem extra dark in contrast.

All in all, you don't have to suffer from a lack of light where it is needed, but on the other hand, your neighbours don't have to suffer from light that is excess or uncontrolled. Lighting can provide both a safe and aesthetic nighttime environment.

Lyme Disease

Lyme disease was named in 1977 when a special form of arthritis was observed in children in the community of Lyme, Connecticut, in the United States. It was found that this infectious disease was caused by a bacterium, *Borrelia burgdorferi*, which is transmitted to humans through the bite of infected deer ticks.

While the disease has been labeled just in recent years, various aspects of it have been known for over a century. It was first described in Europe, as a red, slowly expanding rash. It was linked even then with tick bites. Over the years, the multiple steps and associations of the disease with ticks became better understood.

The ticks which are carriers of the bacteria, and therefore the disease, have been widespread in eastern and western North America. However, the population of ticks themselves are being affected with this disease over increasingly larger parts of their range, and it has been found in this area. The species of tick in eastern areas is *Ixodes scapularis*. In their larval and nymphal stages—early in the life cycle—they are merely pinhead sized. They settle on their hosts by being brushed onto them, usually in thickets where contact is easy, and begin to feed by inserting their mouth parts and sucking blood. Usually, it takes two to three days for the bacteria can enter the new host. The tick, engorged, drops off if not discovered, and completes its life cycle.

If the tick is discovered early and taken off, the disease may not develop. Most people can be treated successfully with antibiotics. The best prevention is being well-covered in the walks through the woods, and being inspected, especially around collars, hair and ankles, after a walk.

New Home Environments

In all municipalities, urban and rural, there are Official Plans which are the framework for the Zoning Bylaws, which are the actual controls for developments. Town and city developments are done on lots created by plans of subdivision, where all of the parameters are clear before a shovel hits the ground. In the country, and especially on waterfronts, there are many places where lots have been created individually, at some point in the near or distant past. It becomes very important to find how bylaws and restrictions apply to your particular lot.

In recent years, revisions to rural area Official Plans have been made with the realization that with septic disposal being disposed of on the same lot as the water source comes from, water quality can be at risk. Small lots, especially where there are numbers of them together, threaten ground water supplies. It is estimated in our area that most of the groundwater is under such threat. The problem compounds on waterfront properties, as the waterbody too is at risk. To that end, new lots are to be larger than those of the past, and setbacks from waterfronts are greater.

In developing and redeveloping the property, it becomes important for landowners to understand why the ground rules, so to speak, have changed for new lots. The regulations are intended to protect not only the new landowner, but the neighbours as well. In that spirit, it would be prudent for landowners and builders on older “grandfathered” small lots and in redevelopments to understand the potential impact that some of their development choices may make.

Here are some environmental considerations for new building or reconstruction:

Feature	best procedure	advantage
Sun exposure	Maximum exposure to winter sun	Increase passive solar heat and lighting
Natural habitats	Locate where tree loss is minimal Reduce tree loss in access for construction Locate as far back from waterfront as possible; groundwater studies recommend 30 metres or more Avoid damage to wetland habitats Minimize lawns, use natural landscaping	Improves visual aesthetics, for you and neighbours Less habitat loss and forest fragmentation Reduces stormwater runoff Less impact on shoreline and aquatic habitats Protects biodiversity Reduces some insect pests Reduces maintenance costs
Wind exposure	Avoid open siting Mature trees help block storm winds Some summer breeze exposure	Best siting reduces heat loss in winter and allows cooling, insect-chasing breeze in summer
Drainage	Locate away from poor and natural drainage areas	Reduces both potential for building damage and impact on natural habitats
Cluster communities	Grouped developments Avoid strip developments	Minimize habitat fragmenting and impact Better aesthetic appeal
Lot alteration	Choose a lot type and shape that meets your needs as is	Reduces impacts on habitat and surface and groundwater flow Less obtrusive to neighbours

Landscape and aesthetics	Integrate, don't dominate Match site, building shape, colours to the surroundings	Maintains scenic appeal to neighbours and regional visitors
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Noise on the Water

While new regulations were introduced in the spring of 2003, intended to curb this annoyance, the measures appear to go only part way. There are still subtle wrinkles in the fabric of the law dealing with the efficiency and actual noise level. The following is what has been enacted at this time. The notes were assembled by the Lake Of Bays Cottagers Association.

The Federal Government through the Canadian Coast Guard and CMAC, the Canadian Marine Advisory Council (an advisory Board of stake holders sponsored by the Coast Guard to assist in identifying problems related to marine activities) has replaced 1999 regulations with new regulations under the Canadian Shipping Act. These are cloned from the Highway Traffic Act that is familiar to Police, and are more enforceable than the regulations they replace.

In layman's terms, the new law is this:

- a) No one may operate a pleasure boat unless it has a muffler in good working order and is in operation at all times to prevent excessive noise, or unless the exhaust gases are directed underwater through the propeller hub or below the cavitation plate.
- b) If the boat is equipped with a muffler bypass, it must be disengaged in such a manner that it cannot be engaged accidentally.
- c) This does not apply to older boats built prior to 1960 i.e. wooden inboard boats, or race boats in a sanctioned competition.
- d) This does not apply if the boat is operated more than five miles from shore, e.g., Lake Simcoe or Great Lakes.

A muffler means: an expansion chamber within the exhaust pipe from the engine specifically designed to reduce engine exhaust noise. It does not include a muffler cut-out system, straight out exhaust pipes, or a fibre glass packed muffler or by-pass. A problem of enforcement seems to be with the lack of rating of efficiency of the expansion chamber.

In most of Ontario, the OPP are responsible for enforcing the regulations. If you are bothered by a noisy boat, contact your local OPP office or dispatch centre, and an officer will investigate the complaint. To assist the OPP, ensure that you have recorded the following information about the event:

The date and time of the occurrence.

- Where it took place, including distance from shore, estimated speed and direction
- A description of the boat including the registration number
- A description of the operator, and the operator's name if known
- The cottage or home of the operator, if known

- The name and phone number of additional witnesses
- A photograph or a video, while not essential, adds to the evidence.

Old Growth Forests

Old growth forests are virtually gone from southern Ontario today. Such woodlands would host trees that are greater than 200 years of age. When we see paintings and sketches made by early explorers, and see rare old photographs of forest stands, the size of the ancient trees seems somehow way out of proportion in relation to people or other objects we recognize in the illustrations. Ironically, many of the trees that have reached old-timer status are found in old city parks. These, while of immense girth, were grown in the open, and have shortened trunks and spreading branches. The forest trees of old towered far overhead, creating hushed, still cathedral-like forest canopies.

Centuries from now, our ancestors will see old growth forests again. In the protected spaces of parks and conservation lands, and on private lands where landowners choose to be stewards over several generations, stately oaks, pines, hemlocks, hickories and beeches will grow tall, straight and solid, and so big around several will have to link hands to encircle the trunks. The trees will likely not be those we see now, but may be among the seedlings that will grow up and through the maturing forests that we preserve.

An old forest is very much alive from the tip of the roots to the very tops of the trees. Habitat is vertical as well as horizontal. There are insects, birds, mammals, fungi, lichens and mosses at every altitude of the forest stand. The forest is a complexity of microclimates and ecosystems, from top to bottom. A healthy forest, like a healthy person, is well from tip to toe.

The life of a forest does not end with the death of a tree. The term “over mature” is simply a forester’s wording for trees that are past the point of maximum cash yield. Fallen trunks and limbs are of immense value as they will be broken down to their nutrient level by insects and fungi. The nutrient is quickly recycled by plants, strengthening the forest. Birds, amphibians, reptiles and mammals use the logs for cover and vital nesting sites, and will forage food from the insects and worms that burrow through the decaying wood. The moist and decaying wood often becomes a nursery for new seedlings. A healthy woodlot, even in the forester’s eyes, has at least 50 fallen trees per hectare that are greater than 10 cm in diameter, and at least 3 per hectare greater than 60 cm in diameter at any given time.

In a healthy forest, there is no such thing as a useless tree. Every species and every tree in any condition has a role to play somewhere in the integrity of the system and in the food chain. Soil is built from all the leaves and twigs that fall, as well as every tree that topples in storm or in old age. Wildlife habitats are found not only at every level of the forest, but at every stage of forest life.

Forests are great reservoirs of water. Every plant and every animal of every size is a container. The forest canopy shields and cools the earth, retaining moisture and holding water that would have run off open land. Forests, like wetlands, regulate the flow of water from the land, hold back seasonal precipitation to a more steady flow, and recharge

the groundwater supply. In the process, they filter and cleanse the water, and absorb nutrient that would otherwise prematurely age the waterbodies into which runoff flows.

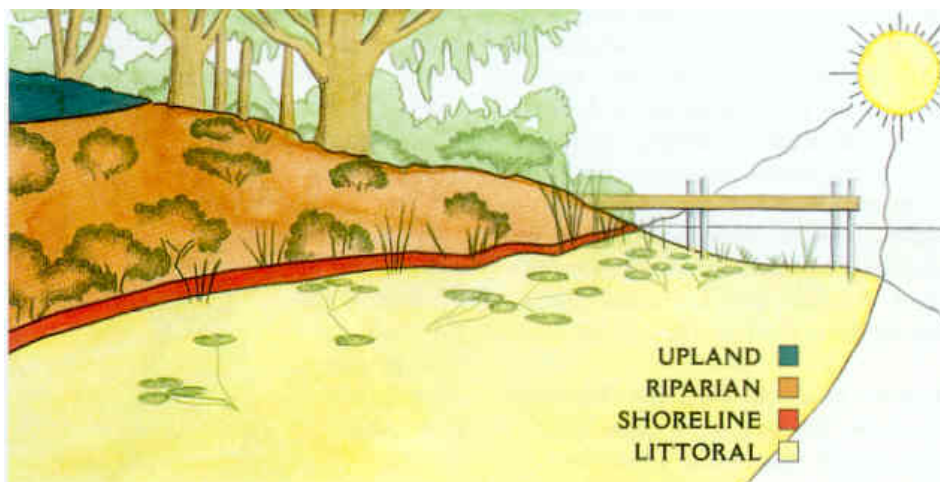
Forests are partners, in a sense, in our healthy communities.

Shorelines – a brief primer

Shorelines are among the richest environments in any region, but at the same time they are among the most vulnerable environments. They are vital zones for wildlife, and are critical to the health of the waterbody and the upland as well. In human terms, a healthy shoreline is prerequisite to enjoyment of lakes and rivers—without good water quality, swimming becomes a health risk, clean drinking water is an issue, fishing declines while eating the fish becomes a health concern, and property values are reduced. Ecologically, shores support most of the life of the waterbody, and filter and cleanse the water. Shorelines are actually a broader band than just the line where land and water meet. They can be broken down into specific sections, each with their own distinctive functions:

- The upland zone is back from the water's edge by perhaps ten to 15 metres; depending on the steepness of the slope to the water. In the upland, the plants and animals are less directly dependent for part of their lives on interaction with the water. Uplands are a shorter distance back from the water if the slope is quite steep, and may be further removed from the water's edge if the slope is very gentle. It's generally in the upland where houses and sheds are built.
- The riparian zone is the shallow water, wet edge and the first ten to 15 metres of shore land around lakes, rivers, and streams. It is of great importance to the overall quality of the aquatic system. Ninety percent of all life in the water-body is raised, born, or fed in this region. The rich and complex habitat of the shoreline supports plants, insects, microorganisms, amphibians, birds, mammals, and fish. Aquatic system health hinges on the health of the delicate shore-land area.
- The littoral zone extends from the shoreline out into the water until the sunlight no longer reaches the bottom. This is where aquatic plants can grow, via photosynthesis. The width and depth of this zone varies with clarity of the water, and the clarity itself depends upon the amount of sediment and nutrient in water.

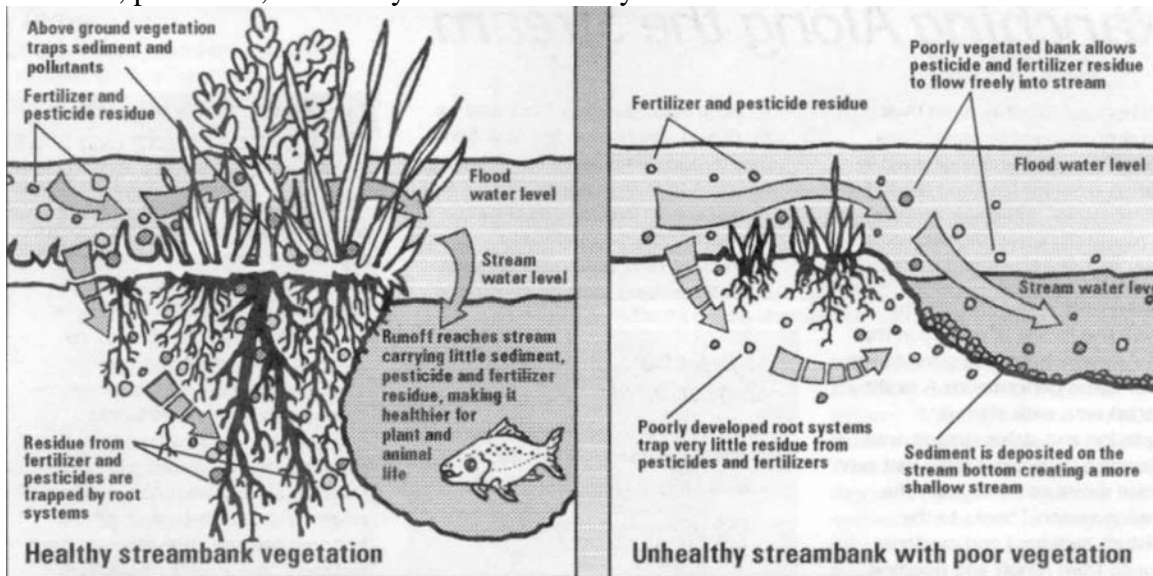
Shorelines can be classified as hard, soft, and sensitive. Hard shorelines are those generally comprised of bedrock, rock, rubble, and boulders. Soft shorelines are comprised of sand, silt, fine gravel, clay, muck, and organic matter. Sensitive habitats that are found along both hard and soft shorelines are vital and often scarce. These include fish spawning, nursery, and feeding areas, areas of important aquatic vegetation or other cover for fish, fish migration routes, and nesting areas for sensitive birds. Sensitive habitats require protection; they are fragile and essential for fish and wildlife.



Shoreline Zones

Shoreline Buffer Plantings

A natural buffer of trees, shrubs, and grasses extending 30 - 50 metres from the waterline provides the most amount water quality protection, but any buffer is better than no buffer. It prevents erosion by holding soil via roots, provides a wildlife corridor and habitat, and shades and cools the water for aquatic life during the summer months. In addition to stabilizing the shoreline, a well-maintained vegetative zone will filter out sediments, nutrients, pesticides, and heavy metals carried by rain and snowmelt runoff.



Sediment trapping and filtration

Shoreline vegetation has a stabilizing effect on the soil, minimizing the detrimental effects of erosion on the shoreline. It improves the natural beauty of the landscape by enclosing the waterbody with greenery. These buffers can produce or re-establish edge habitats between aquatic and land ecosystems, creating a continuous travel corridor for wildlife. This corridor allows them to move safely from the shelter of wooded areas to the water to drink.

Plant Selection

Weeds are simply plants out of place, like a rose bush in a cornfield or a dandelion in a lawn, or lawn grasses in a woodland. Many species that we think of as weeds are not native to North America, and so are exotic to native forests and fields. Native plants are those that have existed in a region prior to European settlement. They are already adapted to site and climate conditions, are generally weed and pest resistant, require no chemical applications, and cater to local wildlife species. For buffer plantings, those that are native to the region are recommended above exotic, hybrid, and ornamental species. Some wildflowers, shrubs and grasses can also be exotic and invasive, but are sometimes confusing because they have become so commonplace in this environment. Very often these imports, and hybrid landscape varieties as well, are not part of the ecology of native wildlife and insects. When used in buffer zones, they can attract the wrong species, encouraging other animals to the exclusion of natives.

Shorelines can be re-naturalized through either a passive or supportive approach. A passive approach allows the shoreline to restore itself naturally, by simply not mowing the grass or pulling “weeds”. A no cutting zone of even four or five metres will provide habitat and help preserve the natural aspects of the shore. A more hands-on approach would be to plan and physically plant the buffer zone. In that case, to get the best results and minimize the chance of failure – and to even have a sneak preview of the outcome – note the physical attributes of your property, and find another nearby that appears most similar. The plant species and the conditions they require are there in plain view. Nature has already done the selection, and there is no copyright on that success.

There are, in this region, over a thousand species of plants in forests, fields, wetlands and waterbodies. Some of these are exceedingly rare, while others are quite common. Each species has particular needs for moisture, soil type, sun exposure and so forth. Again, knowing what will work in your case may involve a visit to similar sites nearby. Unfortunately, few local garden centres stock native species, but ask your usual source what they may have. Fortunately, there are local sources of expertise to help you put names on plants you’ve noted may do well at your location. For instance, the Leeds County Stewardship Council, Cataraqui Region Conservation Authority, Centre for Sustainable Watersheds at Portland, the Biosphere Network, Charleston Lake Provincial Park and St. Lawrence Islands National Park have capable staff.

In this region, some of the species most commonly found along shorelines are:

Trees

white pine
red pine
pitch pine
red oak
white oak
white ash
ironwood

sugar maple
red maple
paper birch
black willow
cottonwood
trembling aspen
large-tooth aspen
hemlock

Shrubs

red osier dogwood
staghorn sumac
elderberry
common juniper
red cedar
white cedar

sweet gale
blueberry
grape vine
Virginia creeper
Meadowsweet
speckled alder
viburnum

note that each of these species has a preference for amounts of moisture, sunlight and soil conditions, and these are spelled out clearly in books like *Native Trees of Canada* by R.C. Hosie, published by Environment Canada; and *Shrubs of Ontario* by James Soper, published by the Royal Ontario Museum.

A broad information source on native plant species is
Native American Native Plant Society
Box 336, Station F

Toronto, Ontario, M4Y 2L7
416 924-6807
www.naps.org/publications/source/act.pdf

locally, here are some sources, which may be an incomplete listing:

Eco Source
RR# 7 Pembroke, Ontario K8A 6W8
613 735-3002

Howard Ferguson Forest Station
275 County Rd. #44
Kempville, Ontario K0G 1J0
888 791-1103

Next Generation Tree Farm
RR# 1, 305 Lake Elaida Rd., Frankville, Ont. K0E 1H0
613 275 2929

Rideau Nursery
6986 McCormick Rd., RR# 2 North Gower K0A 2T0
877 881-3485

The Seed Source
RR# 2 Oxford Mills, Ontario K0G 1S0
613 258-2570

Shoreline Buffer Zones

Buffers, in the shoreline sense, soften the effects of impact of one environment on the other. At the shoreline, buffers are for the most part in the riparian zone – from the shallow water just beyond the water's edge to a distance of ten to 30 metres inland, where the upland begins. Shoreline buffers can be a natural continuation of the upland forest to the water's edge, or could as well be a restored strip of vegetation in the riparian zone.

As a buffer, riparian vegetation is an important part of stream, river, and lake ecology. Such vegetation improves water quality by cooling runoff and soil moisture, which in turn helps keep water temperatures in lakes and rivers from rising abnormally. Abnormally warm water accelerates algae growth, leading to lower oxygen levels, and stresses other aquatic organisms. The buffer vegetation helps retain soil moisture, which in dry summers and winters could make the vital difference in the health of the buffer itself, and the stress-sensitive mature trees. The networks of stems and roots trap fine soil particles that would otherwise be swept away by runoff; and filtering out fertilizers, pesticides, and other chemicals before they reach the water. All in all, this natural system cleanses and purifies the water that flows in any form of runoff into river, lakes and streams. In a sense, the buffer zone is the waterbody what your kidneys are to your body.

Beyond the water-related functions, the buffer zone is very important as wildlife habitat, providing critical shelter, food, protection and nesting and breeding sites. With a healthy buffer, landowners are rewarded with extraordinary viewing opportunities. As well, the buffer provides valuable services such as privacy screening, and shelter from wind and sun. The aesthetic value is often beyond price, as nature's landscaping is usually the reason landowners were attracted to the waterfront living.

If the buffer zone is intact on the property, all of the invaluable functions and values are there, and should be maintained. Although preservation of a natural or naturalized shoreline may take more planning in the beginning, it is generally the lowest cost, lowest maintenance shoreline treatment either through erosion or development, a "naturalized" shoreline can usually be developed. In the many cases where the zone is compromised, or has even been entirely removed, restoration is usually possible.

A naturalized shoreline is one that is designed to work with and not against the forces of nature and should include natural features, such as vegetation, rocks, logs, etc., based on existing site conditions. If the site was developed before you owned the property, check out locations with shoreline features most similar to your own. You can design a naturalized shoreline to accommodate boat docking, scenic views, access, fishing, and other activities. A naturalized shoreline can easily accommodate both proper usage and site conservation.

While a buffer of trees, shrubs, and grasses extending 30 - 50 metres from the waterline provides the most amount water quality protection, any buffer is better than no buffer. Consider the restoration as a special landscaping venture, planning with both the use and physical character of the land in mind. Here are a few things to consider:

- Where are the sightlines for important views.
- Which places between cottage and water are most prone to erosion.
- Where are the sensitive habitats, such as wetlands, and species of interest.
- Where are best places to provide shelter from the wind.
- Where are best places to provide shade.
- Where is screening for privacy best achieved.
- Where could be good opportunities for wildlife viewing.
- Where are the natural wildlife corridors; where animals would pass to the water from or back to the upland.
- Where are the places that harmful runoff can be intercepted, to prevent sediment, nutrient or harmful chemicals and fertilizers from reaching the water.
- Where could vegetation be planted or maintained in order to reduce the labour of groundskeeping and landscape work, so there is more leisure time.
- Where are the locations that are most suited, in terms of minimal development impact but most functional for their use, for necessary structures.
- Are there special features, such as particular trees and shrubs, rock outcrops and so forth that would lend character to your property.

With all that in mind, access routes and structures can be placed with minimal impact on habitats and with less chance for erosion, and to create a property setting that is in best harmony with the land.

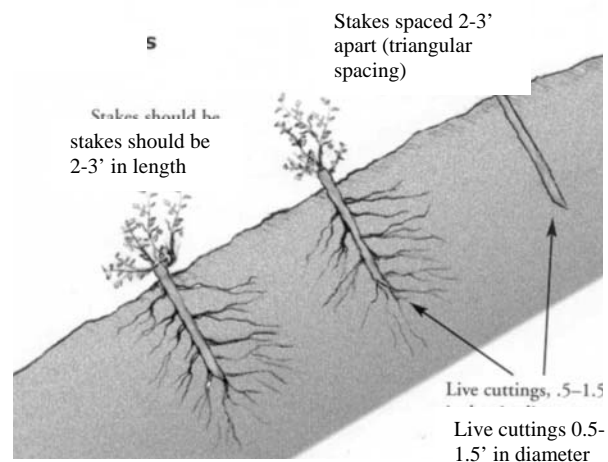
Shoreline Erosion Control

1. Bioengineering Approaches

Sometimes, nature needs a hand getting back on her feet. In decades past, before the vital functions of natural shorelines were understood, a common practice was to civilize the waterfront, removing vegetation and reshaping the land, with lawns and retaining walls to the water's edge. To recover from that old-school approach, allowing a natural buffer zone to develop on its own is not entirely feasible. To restore the many vital systems and functions (see A5 – Buffer Zones) and to control erosion, bioengineering techniques are needed.

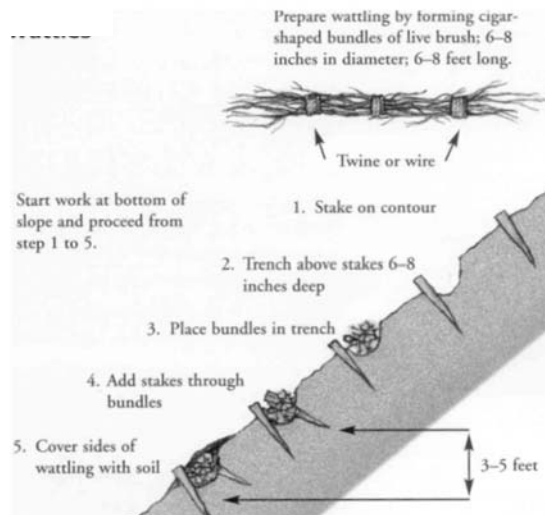
Bioengineering is an erosion control method that uses dead or alive organic material to create living erosion control systems. Soil bioengineering refers to the installation of living plant material as a main structural component in controlling problems of land instability where erosion and sedimentation occur. Soil bioengineering uses native plants collected/purchased within the immediate area of a project site. This ensures that the plant material will be well adapted to site conditions and 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 bioengineering are willow species, dogwood species, and other plants with extensive root systems.

- **Live Staking-** Live stakes are approximately metre-long live, rooting shrub cuttings, cut diagonally on the bottom and flat on the top. The stakes are placed in a hole made in the ground and then tamped into place. If the ground is initially kept moist, they will eventually take root and grow. An arrangement of stakes produces a living root mat that stabilizes the soil by reinforcing and binding soil particles together and by extracting the excess soil moisture which can lead to the slope tending to slump. Most willow species are ideal for live staking they

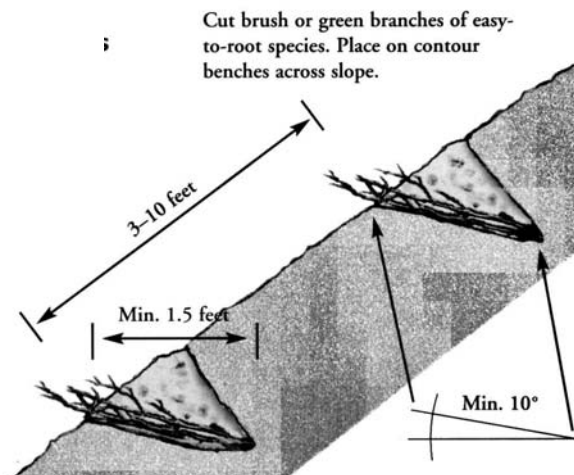


root quickly and soon begin to dry out a slope. This type of bioengineering is often used on smaller areas and wetter areas with collapsed soil.

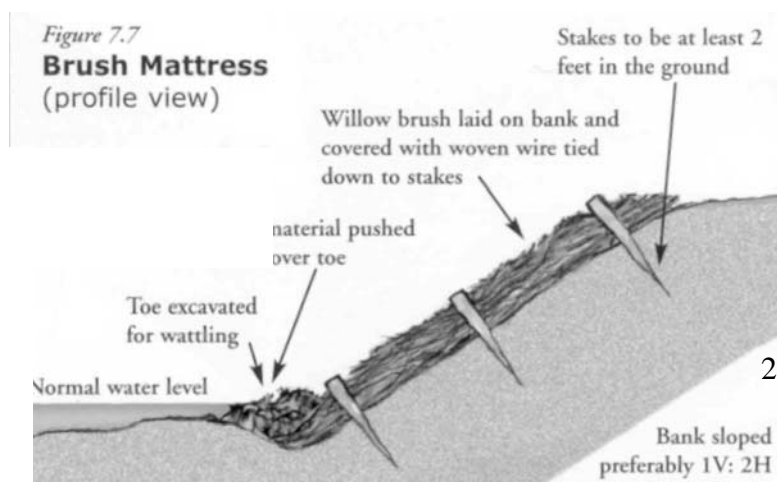
- Wattles-** Wattles (live fascines) are 6-8 foot long bundles of branch cuttings twine bound together into cigar-like structures. The wattles will root and sprout new shoots and immediately start protecting the bank. A 15 to 20 cm. trench should be dug for each wattle, and then staked with wooden stakes or live stakes to hold in place. Cover the wattle with soil, leaving a small amount of vegetation protruding. The wattles will reduce water velocity and trap sediments flowing downhill.



- Brush layering-** Brush layering is primarily digging trenches (minimum 20 cm. deep) and placing layers of freshly cut branches in the trench. Brush is cut into metre lengths and is 2 to 5 cm. in diameter and left untied. The trench is then backfilled with soil, leaving some tips uncovered. The trenches can be spaced as closely as required, with 1 to 3 metres being the norm. The protruding portions of the brush intercept runoff and reduce surface erosion. The underground portion will take root and act as a soil stabilizer. Brush layering is comparable to wattle systems because both involve the cutting and placement of live branch cuttings on slopes. Brush layers are generally used on upland slopes where deeper soil reinforcement is required.



- Brush Mattressing-** Brush mattressing is



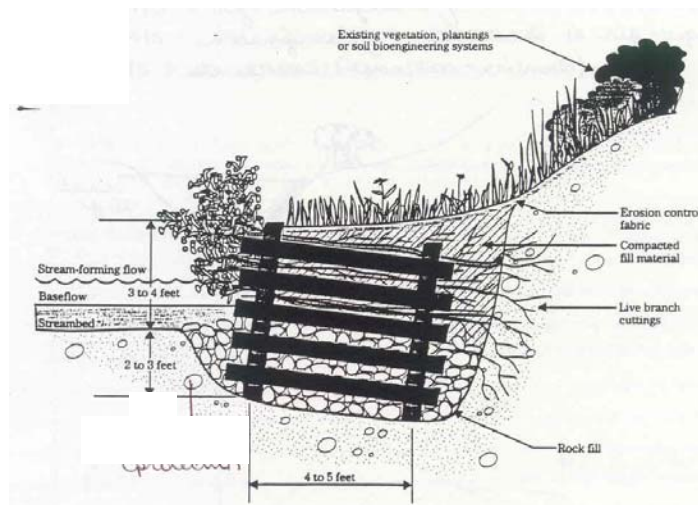
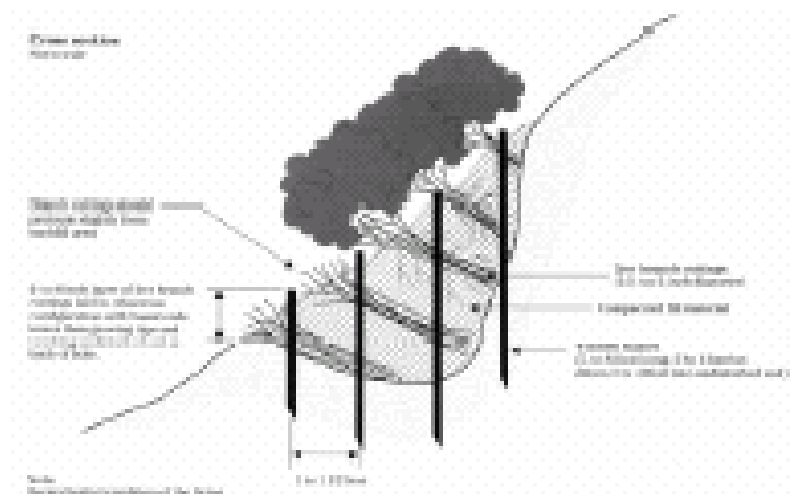
basically laying freshly cut brush on a slope creating a mattress. Brush that is 1 to 3 metres long and about 1 cm. in diameter is layered in a criss-cross pattern along the slope with the bottom ends alternating to get even coverage. At the bottom of the slope, a small trench should be created to enforce “toe” protection. The brush is then covered about 80% with soil and water to promote growth and fill any voids. To keep the brush from blowing away or disturbed by wildlife, wooden stakes are placed at metre intervals and wire is then attached, again in a criss-cross pattern, to secure the mattress. Brush mattresses are useful for covering large, open areas.

- **Branchpacking-**

Branchpacking is much like brush layering but on a larger scale. It can be used to fill washouts. Start by tamping in 2 to 3 metre long stakes into the ground vertically about a metre apart. Place a 10 to 15 cm. layer of compressed

cuttings between the stakes and cover with soil and gravel (about 20 to 30 cm. deep). Make sure the soil mixture is compacted. Continue to pack the area with the cuttings and soil until the washout is filled. Make sure to leave approximately 30 cm. sticking out of the soil. The underground cuttings will take root and trap sediments and runoff. They also create an underground root mass stabilizing the soil, preventing a wash out from occurring again.

- **Live Cribwall-** Live cribwalls are wooden rectangular boxes placed at the base of a slope with vegetation growing in and through them. Because they are constructed in the water, you will require a permit from the Conservation



- Begin installing the cribwall by digging out a base for it below the existing streambed. Place the first log or piece of wood parallel to the bank and then continue with the next series of logs at right angles to the first log, overlapping each piece. Fill the openings with compacted soil and place the second parallel log on the right angle logs. Install live cuttings on the parallel logs at right angles to the streambank. Add another layer of fill and continue to alternate between logs and cuttings. The lower end should be protected with a layer of rip rap. This system is useful anywhere but especially where there are strong currents or where space is limited.

- **Slope Terracing-**

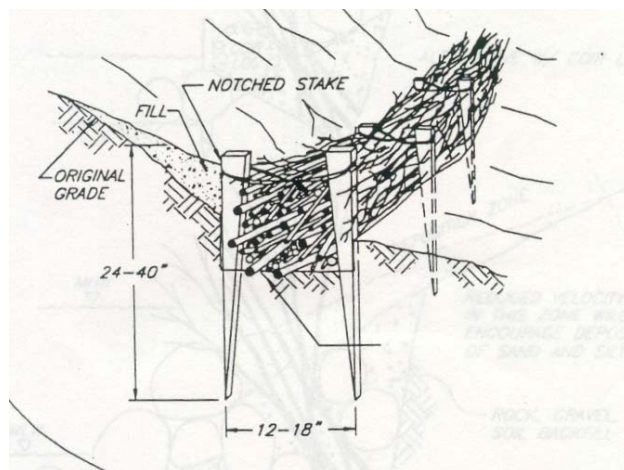
Slope terracing is the creation of a series of steps along the slope that have vegetation between each one. Runoff is retained within the steps and the vegetation adds a natural feel as well as

binds the soil. Each step is made with wood cut

to the size and width necessary. Railway ties were usually used, but because of harmful chemicals, they are no longer used. Only native grass and flower species should be used as they are conditioned to the site and have a better success rate.



- **Living Dams-** Living dams, also called brush boxes, are walls made of live cutting (length and width depends on size of project area) placed at the bottom of the slope. The cuttings are held in a “box” made with wooden stakes. The area is then covered in soil so that rooting may take place. The soil must be worked into the living dam so that contact with all rootable parts is made.



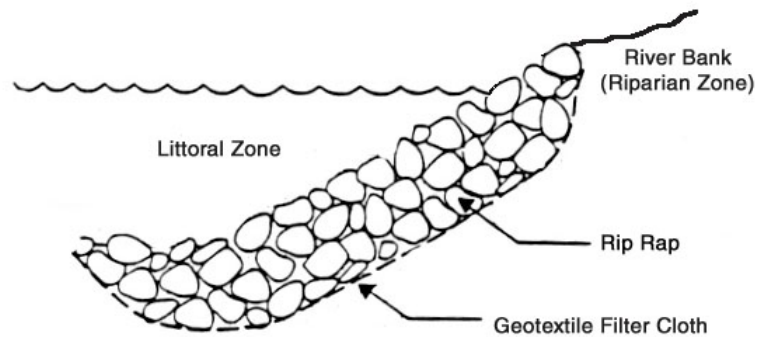
The concept of the brush box is that it will catch the eroding material before it enters the water body, causing pollution.

2. Artificial Erosion Control Approaches

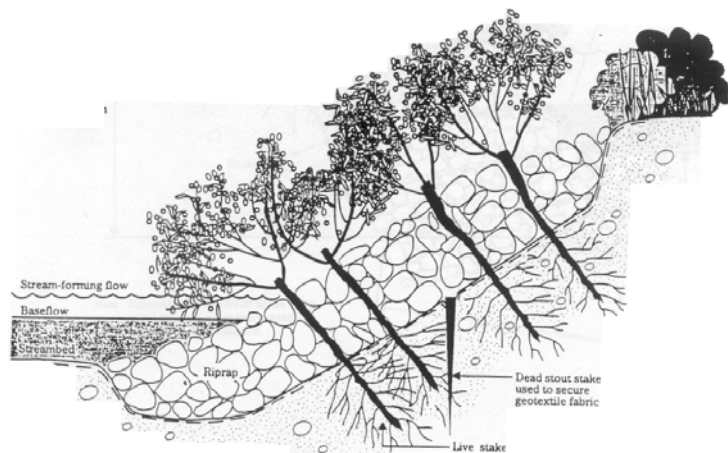
Sometimes, bioengineering approaches alone are not feasible and hard structures are needed. While these are more costly and usually detrimental to the shoreline ecosystem, they are solutions where the circumstances of wake and wave, and extent of recovery needed demand a more engineered approach. These types of erosion control methods are often seen in larger areas at marinas and city owned waterfront.

- **Rip-Rap-** Rip rap is an aggregate rock material that is placed on a maximum of a 2:1 slope along the shore. This is one of the more desirable types of hard structures as

small spaces in between the rocks can serve as hiding places for small organisms and minnows. Rip rap rock is generally 5-20 cm. in diameter, and has a rough, angular shape to it. To prevent sediment from entering the watercourse while construction is taking place, a geotextile filter cloth is laid along the shoreline before the rip rap is positioned on it.

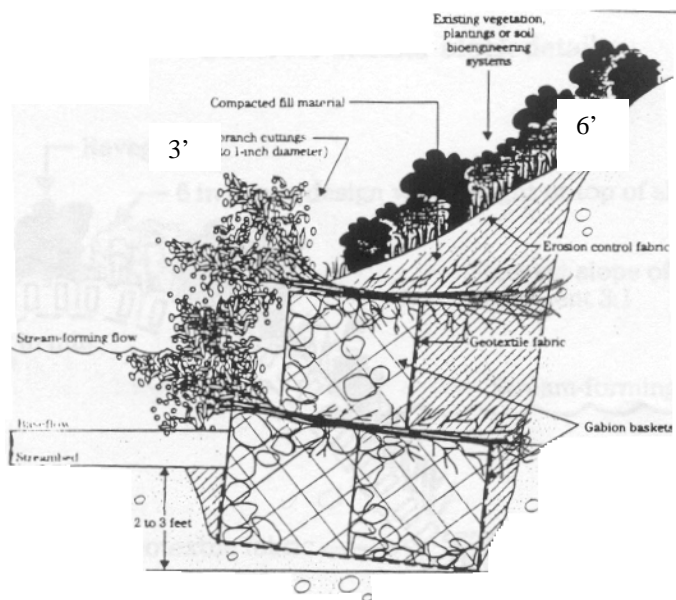


Vegetated Rip Rap- Rip rap can be improved environmentally by adding vegetation. This will create more habitat space as well as make the area less constructed looking. The vegetation will further stabilize the bank via root systems. Again, the rip rap is placed on a 2:1 slope with wattles or live stakes placed in between the rocks.



- **Gabion Baskets-** Gabion baskets are similar to rip rap in that they are made with rock 5 to 20 cm. in diameter. The difference is that the rocks are placed in wire or mesh baskets stacked along the shoreline. These types of applications are often used in small channels that are often occupied with boats. This type of erosion control causes loss of habitat and reflected energy, causing erosion on adjacent properties as well as undercutting of the gabion basket bank. This in turn can lead to the slumping and collapse of the wall.

- **Vegetated Gabion Baskets-** Like rip rap, gabion can be visually and environmentally enhanced with vegetation. Simply place live branches on each successive layer between baskets. The branches will then take root inside the baskets as well as in the soil behind the baskets. Eventually, the roots will bind the soil and contribute to the stability of the slope. Vegetation is recommended wherever it can be used.



- **Retaining Walls-** Retaining walls are made with stone, sheet piling, concrete, or railway ties that are constructed into a wall against the shore, creating a vertical barrier. Like gabion baskets these are detrimental to the environment and offer no habitat to aquatic life. On a normal sloping shore, or where there are jumbles of broken rock and bedrock, wave and wake energy is absorbed or dissipated. Hard, flat walls reflect waves and wake back with as much force as they came to the wall, and that energy carries not only sediment, but surprisingly large stones and rocks away from the shore. Most often, walls actually accelerate the erosion that they were intended to prevent. Very few plants or animals can live in this hostile environment. As well, walls are barriers to the water to land movements of most shoreline animals.

This type of erosion control is also prone to failure from undercut banks, ice and water erosion to the base of walls, and structural failure as expansion in frozen ground pushes the wall away from the bank. This is a costly and temporary treatment, and is not aesthetically pleasing compared to the intricate beauty of natural shores.

Although hard structures seemingly offer benefits, they can also offer more problems. Most harden structures increase water velocity on adjacent properties and are detrimental to the environment. They are also prone to failure as the weather and time take their toll. Overall, using one or more bioengineering methods will be more cost efficient, beneficial to the environment, long lasting and strengthening over time, as well as aesthetically pleasing. If you presently have a hard structure method, consider adding vegetation wherever possible, and restoring the shoreline when there is opportunity.

Good information sources about erosion control methods and requirements are found in the series of fact sheets of Fisheries and Oceans Canada, titled *Working Around Water*. They are available in this area from the Fisheries and Oceans office in Prescott, at 401 King Street West, or online at the DFO website www.dfo-mpo.gc.ca. As well, there is excellent information in the series *Extension Notes* from the Ministry of Natural Resources, available by mail or pickup at MAPLE (Mutual Association for the Protection of Lake Environments, PO Box 271, Perth, Ontario K7H 3E4). These, and several other information sheets are generally available at the WaterShed office of the Biosphere Network, at the corner of the Reynold's Road and Thousand Islands Parkway; and at the Centre for Sustainable Watersheds in Portland.

Shoreline Erosion

An Overview

On many shorelines, it is obvious that a major concern of many landowners is shoreline erosion. Erosion is a natural process on any landscape, but throughout the largest part of this region, the natural and normal rate is very slow. It generally only becomes an issue when something in the normal systems of control and stabilization become upset, such as clearing of land or attempts at altering the area in landscaping. In those cases, issues can quickly become concerns.

Erosion of materials from a shoreline, stream or riverbank results in the sedimentation of these water bodies. Sedimentation, especially if it occurs on a large scale or in a very short time period, can physically affect aquatic organisms. For example, benthic or bottom-dwelling organisms, such as clams and caddisfly larvae, can be buried deeply as the spaces between sand and pebbles are filled in with silt. In the worst cases, deposited material may cause the area to become unsuitable for habitat. Many fish species, such as walleye, trout, and bass, require coarse sands and gravel for spawning purposes. Spawning sites are destroyed by sedimentation. The delicate gills by which fish and many other organisms breathe, are less effective and even abraded by sediment.

Biological impacts on fish and other aquatic life are more subtle than physical ones. Less sunlight penetrates turbid (suspended material) waters, reducing the growth rate of aquatic plants and algae—the basis of the food source for all aquatic organisms including fish. Northern pike, walleye and trout—which rely on their vision in order to feed—are less able to find food in turbid waters and less able to find protective areas. Thus, erosion of shores, channels, banks, yards and fields, directly and indirectly, affects the amount of food and habitat available to all aquatic organisms.



Erosion types

Erosion by the Oxford Dictionary of Ecology is defined as “the part of the overall process of denudation which includes the physical breaking down, chemical solution, and transportation of material”. There are two types of erosion that occur on mainland—wind and water. Fortunately, wind erosion has limited impacts in this region. Erosion in this area is predominantly caused by hydraulic pressure.

Wind Erosion (mainland)

Wind erosion damage is dependant on a number of factors including the condition of soil surface (texture, structure, roughness), vegetation cover, and wind velocity. Wind erosion generally occurs when soils with little or no vegetation are exposed to high-velocity winds. When the velocity exceeds the gravitational and cohesive (binding) forces of the soil particles, wind will move the soil. The movement of soil particles 0.1-0.5 mm in size

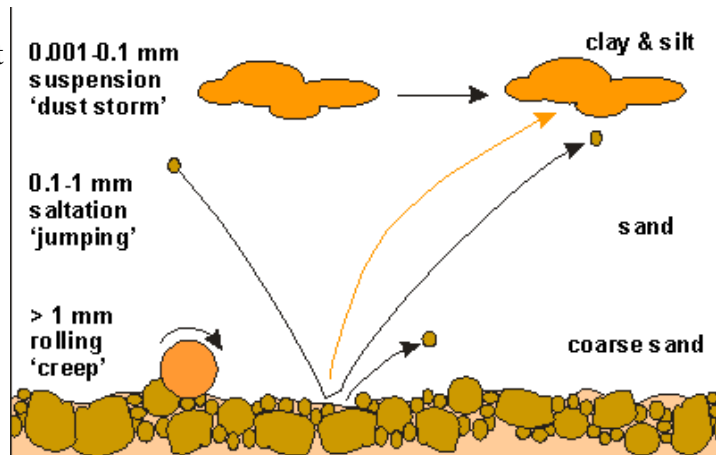
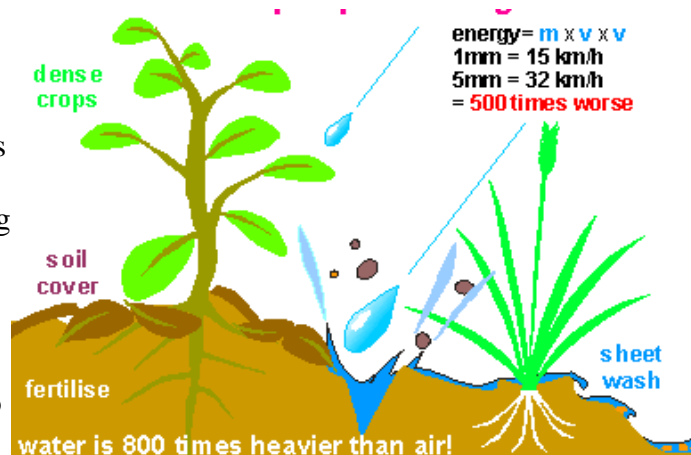


Figure 11: Wind

Erosion occurs in a hopping or bouncing fashion (saltation). Those greater than 0.5 mm are rolled (soil creep). The finest particles (less than 0.1 mm) are suspended by the wind (dust storms).

Water erosion (mainland) caused by precipitation

An average-size raindrop (5 mm diameter) falling through still air contacts the soil at around 32 km/hour. Wind gusts and larger drops result in higher velocities. Drops operate like small bombs when falling on exposed or bare soil, dislodging soil particles and damaging soil structure. With constant rainfall, displaced particles fill in larger soil pores and limit water penetration into the soil profile. Additional rainfall creates pooling and the water will ultimately start to move downhill as runoff, creating rills and gullies.



Initially, this run-off will be 'muddy' or 'turbid' from the soil particles that were displaced by rainfall. The longer the runoff continues, and the further it travels, the more destructive it will be.

Sheet erosion involves the removal of a uniform thin layer of soil by raindrop splash or water runoff. This thin layer of topsoil often disappears progressively, making it challenging to monitor because the damage is not instantly noticeable. This type of

erosion occurs when the amount of rainfall exceeds the amount of infiltration happening, a thin mixture of soil and water is created and particles are washed away.

Surface erosion, takes place on banks with little or no vegetation where the soil is extra susceptible to movements of runoff. The runoff from rainfall and spring melts, develop channels that eventually increase into rills or in more severe cases gulleys. Rill erosion is the most common type of surface erosion and regularly occurs with sheet erosion and is frequently seen following high-intensity rainfall. It is easily recognized as small streamlets (rills) that are up to 30 cm deep.

Shoreline Erosion

Shoreline erosion is caused by two factors: wave action that disintegrates shore material and transforms it into mobile sediment; and associated littoral currents that move the sediment away.

Wave Erosion

Waves have potential energy dependant on their height and have kinetic energy based on their movement. As waves and wake move towards a shore, the increasingly shallow water forces the lower section of the waves to slow down, while the upper section continues at its initial speed. The waves then spill over into breakers, radiating their energy ahead as pressure on the shore. Large blocks of material can become removed or damaged throughout time. The stirring water further fragments soils, rocks, plants and any other materials, and draws the loosened material away from the shore.

Erosion types will vary depending on the characteristics of the property (exposed or sheltered, high bank or low bank, soil, gravel, bedrock, boulder). The advance of shoreline erosion may be because of natural causes such as wave action or from an intense amount of precipitation and ground thaw during the spring. Boat wake or the clearing of shoreline plants also contribute to erosion.

Water quality worsens when the shoreline is eroded. Algal blooms and overcrowded aquatic plants will grow with the addition of phosphorous and nitrogen coming from the soil and plant material that enters the water. Siltation has two ways of harming aquatic life. The increased turbidity from the silt makes it difficult for fish to find plants and crevices to protect themselves from predators. Also, as silt settles, it accumulates among rocks and pebbles decreasing the spawning success of fish and making it more difficult for fish to find aquatic insects on which they feed.



When waves enter the shallow waters, they drag along the lake bottom and unsettle plants, animals and eggs in the area. Waves also erode riverbanks and destroy loon nests. The strength and size of the waves will determine the amount of impact they have on the shoreline. The larger the wake, the more damage it can cause. Hydrologists estimate that a wake 15 cm. high creates limited damage to the shoreline. A 20 cm. wake is 5 times more destructive, and a 60 cm. wake is nearly 30 times more destructive than a 15 cm. wake. On plane, runabouts and larger fishing boats can easily produce a 20 cm. or more wake; whereas watercraft with displacement hulls (houseboats or cruisers) can produce wakes of 60 cm. or higher. Ontario and federal boating regulations state that power boaters must slow down to 10 km per hour (jogging speed) within 30 meters of a shoreline. Look back to see what size of wake you've created, and avoid wake as much as possible, any distance out from sensitive shores and marshes.

Aquatic species such as fish, frogs, and invertebrates (caddisflies, dragonflies) deposit their eggs (usually in a protective membrane) into the water and on aquatic plants. Wave action from boats can break and damage the eggs or cause sediments to be stirred up that will stick to the eggs reducing the amount of oxygen, possibly killing the eggs.

Waves have impact on the environment by:

- Eroding the shoreline
- Disturbing shoreline plants and wetland habitats
- Disturbing aquatic ecosystems
- Swamping nests of loons and other waterfowl



Shoreline Erosion

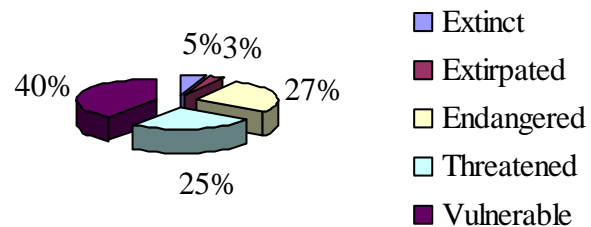
Species at Risk

Along with concerns for water quality, the need to more about Species at Risk and their habitat was a motivation for this study to have been made. As explained in the introduction to the Biosphere Reserve, this region is one of the highest ranking in terms of species richness and diversity in Canada. Among the many species are some that are noted in various categories of interest, as outlined below.

The Canadian Biodiversity Strategy defines biodiversity as "...the variety of species and ecosystems on Earth and the ecological processes of which they are a part". Biodiversity includes genetic diversity, species diversity, and ecosystem diversity. A key reason for such diversity here is the merging of the many Forest Regions of eastern North America, and the very broad range of habitat types because of the varied topography, soil conditions and microclimates.

If your property is in good natural health, with the habitats normally found there being intact, you are contributing to this now globally recognized ecology. If this is not the case, it is possible to contribute, and ease the precarious situation of some species, by restoring the diversity of habitats on your property. You can increase the variety of birds, animals, and aquatic life in your area. For example, a mixture of coniferous and deciduous trees and shrubs throughout your property will attract many types of wildlife including many bird species. Native plants are especially appreciated by wildlife, and very often have very specific requirements, including native species.

Ontario Species At Risk



Ontario Species at Risk

There are 75 species of plants, animals, mammals, reptiles, insects, fish, and birds in Ontario that are either extinct (no longer exist), extirpated (no longer in Ontario), endangered (close to disappearing), threatened (risk of endangerment), or vulnerable or of special concern (monitoring population levels). A list of those species follows, but the space here is too limited to show and outline them all. Instead, there is an excellent web site from Environment Canada where you can click on each name, and see illustrations, descriptions and maps. Note, though, that even though this region is known to have many of these species, there are still large gaps in the knowledge, because there are still many parts of the Biosphere Reserve that are under-explored.

Go to www.speciesatrisk.gc.ca/search/species

That address will open a page with the following. Click on search after setting the categories as below:

Search by Species

Taxonomic group: all
Risk Category: all
Range: Ontario

Here is the Ontario list that will appear, should you wish to explore the species via field guides. Not all of the species listed here have been found here. While there are some that most likely won't turn up, there are some that have as yet not been seen because of the under-exploration of the region as a whole, and some locations in particular.

Of course, plants and animals cannot exist without their required habitat. As it happens, a great number of critical habitats are those found in the shoreline area of lakes, rivers and streams. That is why habitat protection matters so very much here.

Endangered

* Acadian Flycatcher (<i>Birds</i>)	* Kirtland's Warbler (<i>Birds</i>)
* American Badger jacksoni (<i>Mammals</i>)	* Lake Erie Watersnake (<i>Reptile</i>)
* American Ginseng (<i>Plants</i>)	* Large Whorled Pogonia (<i>Plants</i>)
* Aurora Trout (<i>Fishes</i>)	* Mudpuppy Mussel (<i>Molluscs</i>)
* Barn Owl (Eastern population) (<i>Birds</i>)	* Nodding Pogonia (<i>Plants</i>)
* Bashful Bulrush (<i>Plants</i>)	* Northern Bobwhite (<i>Birds</i>)
* Bird's-foot Violet (<i>Plants</i>)	* Northern Cricket Frog (<i>Amphibians</i>)
* Blue Racer (<i>Reptile</i>)	* Northern Madtom (<i>Fishes</i>)
* Bluehearts (<i>Plants</i>)	* Northern Riffleshell (<i>Molluscs</i>)
* Blunt-lobed Woodsia (<i>Plants</i>)	* Pink Milkwort (<i>Plants</i>)
* Cucumber Tree (<i>Plants</i>)	* Piping Plover circumcinctus (<i>Birds</i>)
* Drooping Trillium (<i>Plants</i>)	* Pitcher's Thistle (<i>Plants</i>)
* Eastern Loggerhead Shrike (<i>Birds</i>)	* Prothonotary Warbler (<i>Birds</i>)
* Eastern Prairie Fringed Orchid (<i>Plants</i>)	* Pugnose Shiner (<i>Fishes</i>)
* Eastern Prickly Pear Cactus (<i>Plants</i>)	* Purple Twayblade (<i>Plants</i>)
* Engelmann's Quillwort (<i>Plants</i>)	* Rayed Bean (<i>Molluscs</i>)
* Eskimo Curlew (<i>Birds</i>)	* Red Mulberry (<i>Plants</i>)
* False Hop Sedge (<i>Plants</i>)	* Round Hickorynut (<i>Molluscs</i>)
* Forked Three-awned Grass (<i>Plants</i>)	* Scarlet Ammannia (<i>Plants</i>)
* Gattinger's Agalinis (<i>Plants</i>)	* Showy Goldenrod (<i>Plants</i>)
* Heart-leaved Plantain (<i>Plants</i>)	* Skinner's Agalinis (<i>Plants</i>)
* Henslow's Sparrow (<i>Birds</i>)	* Slender Bush-clover (<i>Plants</i>)
* Hoary Mountain-mint (<i>Plants</i>)	* Small White Lady's-slipper (<i>Plants</i>)
* Horsetail Spike-rush (<i>Plants</i>)	* Small Whorled Pogonia (<i>Plants</i>)
* Juniper Sedge (<i>Plants</i>)	* Small-flowered Lipocarpa (<i>Plants</i>)
* Kidneyshell (<i>Molluscs</i>)	* Snuffbox (<i>Molluscs</i>)
* King Rail (<i>Birds</i>)	* Spoon-leaved Moss (<i>Mosses</i>)

- * [Spotted Wintergreen](#) (Plants)
- * [Toothcup](#) (Plants)
- * [Virginia Goat's-rue](#) (Plants)

- * [Wavy-rayed Lampmussel](#) (Molluscs)
- * [White Prairie Gentian](#) (Plants)
- * [Wood-poppy](#) (Plants)

Threatened

- * [American Chestnut](#) (Plants)
- * [American Water-willow](#) (Plants)
- * [Black Redhorse](#) (Fishes)
- * [Blackfin Cisco](#) (Fishes)
- * [Butler's Gartersnake](#) (Reptile)
- * [Channel Darter](#) (Fishes)
- * [Colicroot](#) (Plants)
- * [Common Hoptree](#) (Plants)
- * [Crooked-stem Aster](#) (Plants)
- * [Deepwater Sculpin](#) (Great Lakes populations) (Fishes)
- * [Deerberry](#) (Plants)
- * [Dense Blazing Star](#) (Plants)
- * [Eastern Foxsnake](#) (Reptile)
- * [Eastern Hog-nosed Snake](#) (Reptile)
- * [Eastern Ratsnake](#) (Reptile)
- * [Eastern Sand Darter](#) (Fishes)
- * [Fowler's Toad](#) (Amphibians)
- * [Goldenseal](#) (Plants)
- * [Grey Fox](#) (Mammals)
- * [Hooded Warbler](#) (Birds)
- * [Jefferson Salamander](#) (Amphibians)

- * [Kentucky Coffee-tree](#) (Plants)
- * [Lake Chubsucker](#) (Fishes)
- * [Lake Whitefish](#) (Lake Simcoe population) (Fishes)
- * [Lakeside Daisy](#) (Plants)
- * [Least Bittern](#) (Birds)
- * [Massasauga](#) (Reptile)
- * [Peregrine Falcon anatum](#) (Birds)
- * [Queen Snake](#) (Reptile)
- * [Round-leaved Greenbrier](#) (Great Lakes Plains population) (Plants)
- * [Shortjaw Cisco](#) (Fishes)
- * [Shortnose Cisco](#) (Fishes)
- * [Spiny Softshell](#) (Reptile)
- * [Spotted Gar](#) (Fishes)
- * [Stinkpot](#) (Reptile)
- * [Western Silvery Aster](#) (Plants)
- * [White Wood Aster](#) (Plants)
- * [Wild Hyacinth](#) (Plants)
- * [Willowleaf Aster](#) (Plants)
- * [Woodland Caribou](#) (Boreal population) (Mammals)

Special Concern

- * [American Columbo](#) (Plants)
- * [American Hart's-tongue Fern](#) (Plants)
- * [Bigmouth Buffalo](#) (Fishes)
- * [Black Buffalo](#) (Fishes)
- * [Blackstripe Topminnow](#) (Fishes)
- * [Blue Ash](#) (Plants)
- * [Branched Bartonnia](#) (Plants)
- * [Bridle Shiner](#) (Fishes)
- * [Broad Beech Fern](#) (Plants)
- * [Cerulean Warbler](#) (Birds)
- * [Climbing Prairie Rose](#) (Plants)
- * [Dwarf Hackberry](#) (Plants)
- * [Eastern Mole](#) (Mammals)
- * [Eastern Ribbonsnake](#) (Great Lakes population) (Reptile)
- * [Eastern Wolf](#) (Mammals)
- * [Eastern Yellow-breasted Chat](#) (Birds)
- * [False Rue-anemone](#) (Plants)
- * [Five-lined Skink](#) (Reptile)
- * [Green Dragon](#) (Plants)

- * [Greenside Darter](#) (Fishes)
- * [Hill's Pondweed](#) (Plants)
- * [Kiyi](#) (Fishes)
- * [Louisiana Waterthrush](#) (Birds)
- * [Milksnake](#) (Reptile)
- * [Monarch](#) (Lepidopterans)
- * [Northern Brook Lamprey](#) (Fishes)
- * [Northern Map Turtle](#) (Reptile)
- * [Orangespotted Sunfish](#) (Fishes)
- * [Polar Bear](#) (Mammals)
- * [Pugnose Minnow](#) (Fishes)
- * [Red-headed Woodpecker](#) (Birds)
- * [Red-shouldered Hawk](#) (Birds)
- * [Redside Dace](#) (Fishes)
- * [Riddell's Goldenrod](#) (Plants)
- * [River Redhorse](#) (Fishes)
- * [Short-eared Owl](#) (Birds)
- * [Shumard Oak](#) (Plants)
- * [Silver Chub](#) (Fishes)
- * [Silver Shiner](#) (Fishes)

- | | | | |
|---|--|---|---|
| * | <u>Small-mouthed Salamander</u>
(<i>Amphibians</i>) | * | <u>Tuberous Indian-plantain</u> (<i>Plants</i>) |
| * | <u>Southern Flying Squirrel</u> (<i>Mammals</i>) | * | <u>Warmouth</u> (<i>Fishes</i>) |
| * | <u>Spotted Sucker</u> (<i>Fishes</i>) | * | <u>Wolverine</u> (Western population)
(<i>Mammals</i>) |
| * | <u>Spotted Turtle</u> (<i>Reptile</i>) | * | <u>Wood Turtle</u> (<i>Reptile</i>) |
| * | <u>Spring Salamander</u> (<i>Amphibians</i>) | * | <u>Woodland Vole</u> (<i>Mammals</i>) |
| * | <u>Swamp Rose-mallow</u> (<i>Plants</i>) | * | <u>Yellow Rail</u> (<i>Birds</i>) |

Swimming Pools and Hot tubs

Chlorine and disinfectants kill aquatic organisms. That's precisely the reason they are added to pools and hot tubs, but the concern in these is the health of the user. However, the chemicals released in to the environment are lethal to plants and animals, and were not intended to target them. In that regard, disposing of pool and tub water at the end of the season is a serious concern. In fact, in many towns and cities, there are very strict by-laws defining and controlling just how the disposal is to be made. In the countryside, and particularly around lakes and rivers, the landowner must take on the serious responsibility of their own accord.

The flow from draining pools and hot tubs toward the water body is a vital concern for the aquatic health. Strictly speaking, improper handling contravenes the Fisheries Act, which prohibits any action that is harmful to fish (a very broad definition is used here), and their habitat, and carries substantial fines. Here are some suggestions, assembled from various urban ordinances:

- The chemicals will degrade considerably if the water is let to stand for a several days—a period of at least one, but preferably two weeks is recommended.
- The pool and tub water should never be run directly to the lake or river.
- Drain the fixtures onto a porous surface, such as lawns or meadows, as far from the waterbody as possible. It can be used for irrigation in this way, after the two week standing period is up.
- If possible, drain or pump the water over a back slope; one which runs away from the waterbody.

Water Levels

Great Lakes water levels have been monitored since the mid-1800s, revealing more than a century of consistent, natural variability. This data is supported by the historic record contained in sediments that depicts more than 5,000 years of natural change. In contrast, human influence has impacted Great Lakes water levels for a relatively short time. Lakes Ontario and Superior have been regulated at their outflows since the mid-1900s to permit consistent shipping and hydroelectric power production by reducing lake level variability.

Both natural and human-induced fluctuations impact a broad range of wetland characteristics, ranging from water chemistry to plant community composition. Most often, vegetation is the first wetland component to be affected. This alteration then changes the fish and wildlife community.

Water level fluctuations impact not only wetland biology, but also the many other components that make wetlands dynamic and productive systems. Currents, wave action, turbidity, acidity, temperature, and nutrient content are all affected by changing water levels. For example, low water levels result in faster warming of wetland water and may result in unsuitable habitat for certain fish species. Conversely, high water levels may dilute nutrient and contaminant concentrations to decrease local toxicity to plants, fish and other wildlife.

Water level cause and impact on shoreline wetlands

Over the short-term, storms, and wind and atmospheric pressure-driven "tides" known as seiches of usually less than 0.5 metres can cause rise or fall of water levels. These are usually less than one day in duration, and can cause damage to vegetation due to high winds and waves.

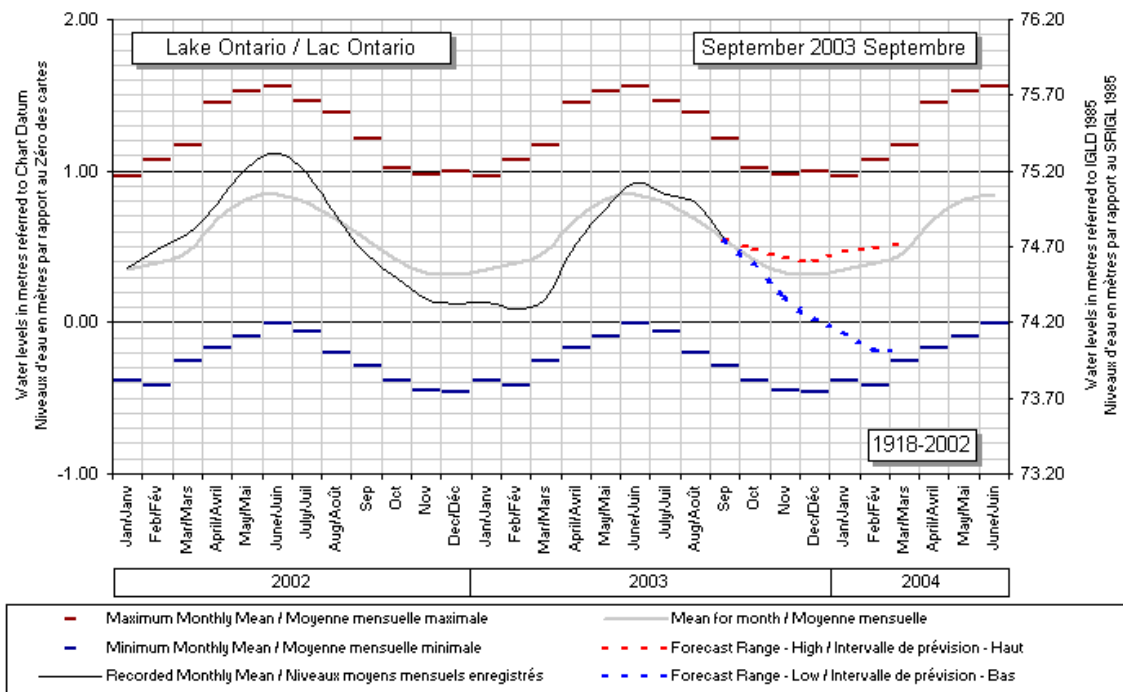
Seasonal variations are a reflection of the yearly hydrologic (water) cycle in the Great Lakes basin, and the inland lakes and rivers from which they are fed. Lowest levels often occur in late summer, after evaporation has peaked, and can easily be 30 to 50 centimetres or more, lasting for several months. Unpredictable and variable water levels result in diversity as many plants and animals are adapted to and depend on a highly changeable wetland environment. Low water levels in the autumn expose wetland bottom sediments, which allow the seeds contained there (in the seed bank) to germinate.

Multi-year fluctuations in water levels can be basin-wide, continental or global. Climate changes that result in different patterns of precipitation and evaporation over a number of years are generally the cause, although they are also caused by human-induced water level regulation to facilitate shipping. Variations of up to 2 metres have been recorded during the 20th century. If high water levels last for more than one year, they can eliminate large areas of wetland by flooding. On the other hand, low water levels that expose mud flats with an extensive seed bank will allow wetlands to expand toward the new lakeshore.

Lake Ontario Water Level Regulation

Lake Ontario's water level has been regulated since 1960 to facilitate increasing demand for shipping and hydroelectric power. Unfortunately, what is good for shipping is not so good for coastal wetlands. Natural water level variability has been diminished, thereby reducing the biological diversity of coastal wetlands that depend on variability to maintain their vegetation communities.

Determining the criteria to control regulation of water level and flow in Lake Ontario and the St. Lawrence River, is a challenge being addressed through a binational study launched in 2001 by the International Joint Commission (IJC). The five-year IJC study provides a major opportunity to improve the understanding of past water regulation impacts on coastal wetlands. The new knowledge will be used to develop and recommend water level regulation criteria for the benefit of all interests, including the specific objective of maintaining coastal wetland diversity and health.



Lake Ontario Monthly Mean Water Levels in metres

Mean for Month (preliminary data)	75.75
Mean for month last year	74.65
Mean for month, last 10 years	74.75
Statistics for period of record	1918-2002
Maximum monthly mean / year	1986 75.41
Mean for month	74.74
Minimum monthly mean / year	1934 73.91

Charleston Lake Water Level Regulation

The water levels at Charleston, and many other inland lakes and rivers that are part of the Gananoque River watershed, have been manipulated for over a century. The Gananoque Water Power Company was granted the right to build a dam at the Outlet in 1896, at what was about four feet, or something more than a metre, above its normal level. Similar dams were built on other lakes outlets, and along the Gananoque River to hold back water from spring thaws, and even out the flow through the remainder of the year to create a more constant supply for power generation. The new and relatively stable water level was seen as a mixed blessing. The more static water levels were beneficial at docks and boathouses, but the dams prevented fish from traveling up and downstream seasonally. By 1890, the Charleston lake Association was asking the power company to build fishways at the outlet and at other dams.

On Charleston, the plant communities above and below the relatively new ranges of high and low water are still coming to equilibrium. The shores with shallow slopes and high plant growth productivity will settle to those new levels most quickly, and show a smooth transition. Steep and rocky slopes take far longer to adjust, and for roots of shoreline plants to stabilize the appearance of the water's edge. As well, everywhere that water levels are controlled within narrower limits than would naturally and seasonally occur, variability of shoreline plant and animal communities decreases, resulting in a more abrupt transition. Any erosion is focused at a narrower range of shore elevation, and undercutting is more pronounced.

There is also less seasonal flushing of the lakes and rivers, and more accumulation of sediment and organic matter. This results in some places having a more constantly aging plant and animal community. While it seems from year to year that water levels are swinging from extreme to extreme, the amount of change is likely much less than would have been the case in the pre-power company era. In human terms, the change is sometimes inconvenient and expensive. In terms of ecological functions and water quality, change is generally healthy.

Adaptable Plants

There are plant "specialists" which live along the shoreline edge, and are adapted to thrive at various naturally fluctuating water levels.

- **Floating plants** are those that may be rooted underwater, but whose leaves float on the surface. These include Yellow Pond Lily (*Nuphar variegatum*) and duckweeds.
- **Submergent plants** are rooted under the water and grow entirely underwater, for example Wild Celery (*Vallisneria americana*) and Coontail (*Ceratophyllum demersum*).
- **Emergent plants** are those species whose roots might be underwater, but which grow and flower above the water's surface. The most common examples include Cattail (*Typha* sp.) and Bulrush (*Scirpus* sp.).

- **Wet meadow/shrub plants** are those that grow above the water line where conditions allow. This area is still influenced by periodic flooded conditions. Plant types include shrubs, sedges, grasses and other herbs, such as the Spotted Touch-me-not (*Impatiens capensis*), Leatherleaf (*Chamaedaphne calyculata*) and Meadowsweet (*Spiraea* sp).

Climate, bedrock, land use, and the lake influence vary markedly around the lake and river shoreline. As a result, every coastal wetland evolves as a unique community of plant species determined by local physical conditions.

Water Quality

Concerns over the quality of the water in Charleston Lake, in the Thousand Islands and other waterways and waterbodies of the region are one of the basic reasons this study came into being. A shoreline review? It makes perfect sense. A healthy shoreline ecology, from the upland to depths, is the source of life and the natural filter system. The data from the study will be used to relate the known condition of water quality to the types and amounts of habitats present, along with the types, state and quantity of shoreline development. All of the types of information gathered will help find the directions and plans that may see water quality improve.

The Ministry of the Environment, through the Lake Partner program, has monitored Charleston Lake's water quality for a number of years. By recording Secchi Disk depth and phosphorus values, data has been collected that can provide a general idea of the health of the local watershed.

Secchi Disk / Water Clarity / Turbidity

Secchi disks are most commonly used to estimate the amount of algae or suspended solids in the water. Particles affect the penetration depth of light into the water and therefore, the Secchi depth. In essence, the light entering the water will be either absorbed or scattered by particles, dissolved colored matter, and the water itself. As the amount of light decreases from dissolved algal matter and/or particles, the Secchi depth increases. This inverse relationship produces the typical hyperbolic curve when Secchi depth is plotted against known standard values for substances and indicators such as algal chlorophyll, color, turbidity, or suspended solids. A low Secchi disc reading, where the disk disappears at shallow depths, would indicate a high amount of suspended solids and little water clarity. On the other hand, a high reading would indicate very clear water and a small amount of suspended matter.



Secchi disk

There are three different types of lake classifications. Oligotrophic indicates that there are little nutrients in the water and little productivity by means of aquatic life. A secchi disk reading greater than 5 metres indicates an oligotrophic ecosystem. A reading of 2 to 5 metres means that the lake is mesotrophic. This suggests that there is plant and animal activity within the waters. This is a midway classification between no nutrients and too much nutrients which is considered a eutrophic lake. If the secchi disk reading is less than 2 metres, then the water has an overabundance of nutrients.

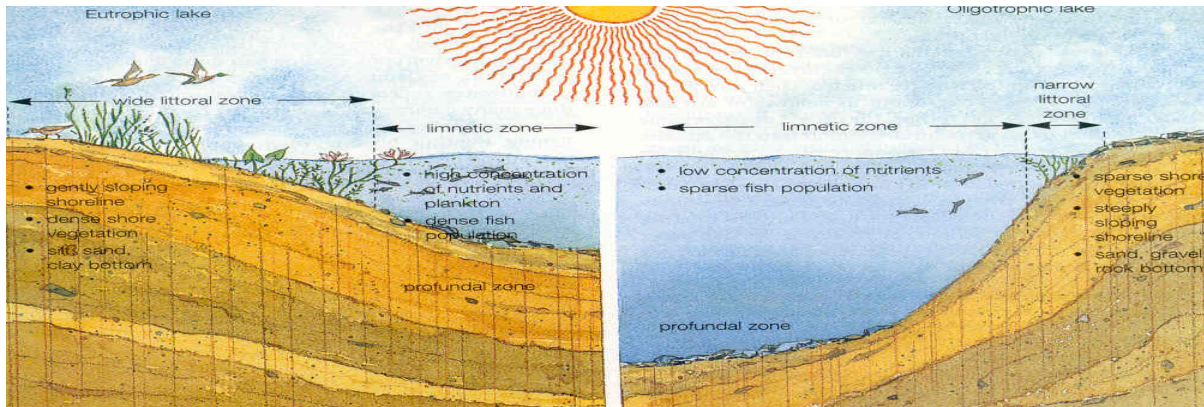


Figure 3: Eutrophic vs. Oligotrophic Ecosystems

At Charleston Lake, the secchi disk average depth for the summer of 2000, as recorded for the Ministry of the Environment Lake Partner Program Biomonitoring Section, was 4.131 m (42 readings). A range of values were recorded throughout the lake with a high of 6m and a low of 2.5m (over 42 samples). While a similar study has not been conducted in the Thousand Islands section of the St. Lawrence River, it is apparent that the values would run higher, with a very high clarity, the result of filtering effects of the invasive zebra mussel. The zebra mussel has only recently and locally been noted in Charleston Lake, and as its populations explode, the water clarity will increase. This indicates that the amount of life in the water declines. This does not mean that water quality has improved, necessarily, but that the filter feeder has removed plant and animal plankton, vital food for native clams, invertebrates and young fish and tiny minnows, so that light penetrates to greater depths.

Phosphorus and Nutrient Loading

Phosphorus is a naturally occurring nutrient in the aquatic environment that effects the water quality. It is usually present in river and lake systems as phosphates. These phosphates occur in minute, healthy amounts except if there has been enrichment of the water through fertilizer leaks on the lawn and garden, or household soaps being carried by groundwater. Total phosphorus includes both organic and inorganic phosphates. Organic phosphate is a part of living plants and animals and is released into the water column when they die. Inorganic phosphates contain the ions bonded to soil particles, and phosphates present in laundry and dishwashing detergents are polyphosphates, used to make water seem less “hard”, to speed the effect of soaps.



Algal Bloom

Phosphorus is regarded as a limiting part of aquatic systems, meaning that it is not normally freely available in quantities for easy utilization by aquatic organisms. The amount of phosphates that water can hold without polluting varies. In a river draining into a natural lake, the phosphate level should not exceed .05 mg/L. Natural lake level phosphates should not exceed .025 mg/L. However, when the quantity of phosphorus surpasses these levels, aquatic productivity can radically intensify. This development, known as eutrophication, or rapid aging from excessive growth and lower oxygen levels, can have negative impacts on the aquatic environment.

pH and Acidity

The pH values that were recorded for Charleston Lake averaged 8.24 (Ministry of the Environment Lake Partner Program Biomonitoring Section), which represents a basic solution. This presents a natural buffer to acid rain and acid shock caused throughout spring snowmelt and high levels of precipitation.

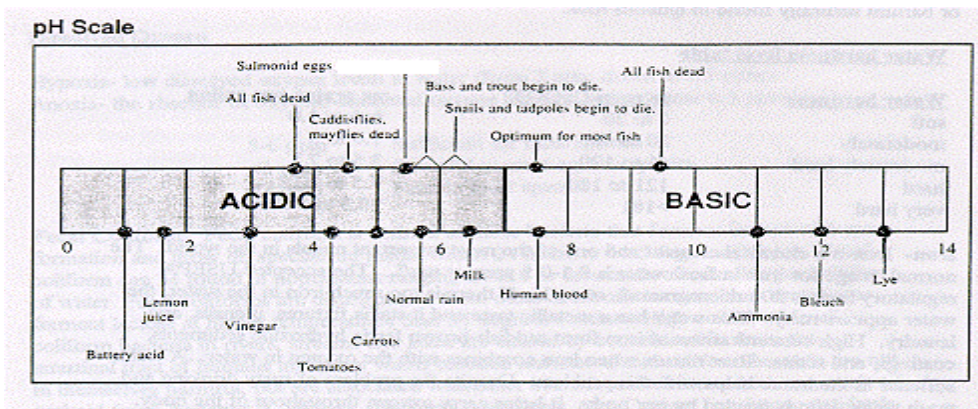


Figure 5: pH Scale

Bacteria levels and E.Coli

Levels of bacteria in our drinking water, lakes and rivers became a front-of-mind issue after the tragedies of Walkerton, Ontario. While we've always assumed our water resources to be safe beyond possible degradation, we now know otherwise and are more conscious of threats water could host. Perhaps sadly, this era may be remembered for the reliance on bottled water. We are now aware too that one can become ill after swimming in, drinking from, or using untreated water if the water contains high levels of bacteria. E.Coli and fecal streptococci are the better known types of bacteria present. As one swims, bacteria can invade the body and cause gastroenteritis (Stomach flu), dysentery, Beaver Fever (diarrhea, nausea, stomach cramps), diarrhea, or infections of the skin, eye, ear, nose, and throat.

E.Coli is measured by counting the number of bacteria present in a 100-milliliter sample (recorded as #/100mL). In Ontario, the Ministry of the Environment and the Ministry of Health have issued a minimum quality guideline. "Safe" recreational water must contain less than 100 E.Coli in 100 mL of water. In comparison, 3 E.coli in a 100mL sample is unsafe for human consumption.

E.Coli and streptococci are found in the stool of almost all warm-blooded animals including humans. When the stool washes into the water body, it raises the water's bacterial level, contaminating it.

Pet and wildlife droppings may wash into the water, and large numbers of water birds (ie. Canadian Geese) may pollute the beach. It can also come from farms; via surface runoff of fields fertilized with manure or from cows standing directly in a stream and depositing fecal matter.

Typically, the bacteria comes from people, and gets into the water from sewer outflows, badly constructed sanitary sewers, illegally connected basement bathrooms, inadequately treated sewage, faulty septic tank systems, grey water from boats or from storm water runoff. Hot summer weather encourages the growth of bacteria magnifying the problem on most public beaches and swimming areas.



E. Coli bacteria, magnified

An ounce of prevention is worth a pound of cure. We would like to believe that the lakes and rivers we use for recreation are, if not ideally pure, not going to hurt us. Keeping, or restoring if necessary, the natural buffer functions for a healthy shoreline can deliver us all peace of mind, but it takes commitment, and a will to work together.

Wildlife Matters

Perhaps one of the greatest pleasures of country and waterside living is seeing more wildlife. Healthy natural environments have an abundance of animals, large and small, and because we've moved into their neighbourhood, we share the domain. Sharing is both give and take, and sometimes, there's the rub. Here are some situations you may be familiar with.

Sharing your home. Raccoons, squirrels and bats may want to take advantage of your accommodations too. Heavy-duty screening, such as wire lathe or hardware cloth, can be placed over openings under eaves, on chimney caps or openings into crawl spaces where it's apparent—or sometimes not so apparent—that there are unauthorized entrances. Bats can use openings that are remarkably small, and though they are given more credit for carrying nasty diseases than is actually the case, their noise and smell is a nuisance. They can be lured away by placing bat houses on the shady side of nearby trees. Bat houses are like rough, bottomless bird houses. The entrance is the bottom, and separating slat dividers are surfaces to hang upon. Problematic raccoons and squirrels are sometimes dealt with by live-trapping, and the Ministry of Natural Resources may be of assistance in suggesting where you can find traps.

Deer are becoming a huge nuisance in gardens, as they are becoming overly abundant without major predators as the natural control. Despite the many garden magazine suggestions of scents and plants that are deterrents, deer eat almost everything green. There are exceptions, but most are gray and fuzzy exotic plants and grasses. There are fine, black open screens, designed originally to keep birds from berry bushes, which are nearly invisible when placed over ground cover and shrubs, and discourage deer from feeding.

Mosquitoes (see also West Nile Virus) and blackflies are well established residents here. While sometimes it's hard to believe, they have important roles as food for summer songbirds, and for the roles of the males in pollination, as where blackflies are important pollinators of blueberries. During peak times, in late spring and early summer, protective clothing lets you co-inhabit to a degree. Avoid dark colours, and be sure that they cover your wrists, ankles and collar. Mosquitoes in particular are most active at dawn and dusk, and indoors may be the place to be. There are now dozens of devices to trap or kill these insects, but most are better entertainment than they are effective. Purple martins, tree swallows, fly-catchers and bats work for free, and are encouraged in your neighbourhood with an investment in specialty housing.

Dogs and cats are natural born hunters whose instincts to catch and kill run deep. Turned loose in the cottage countryside, they can cause havoc with bird and animal populations, anytime of the year. Keep pets indoors or on leashes at all times unless they are under controlled fun times for workouts and recreation.

Birds don't always see the glass in the windows. Windows reflect the surroundings, and look like flight or escape routes. Birds fly into these and break their necks, or drop

unconscious, perhaps then prey to predators or freezing temperatures before they recover. Avoid placing feeders near windows. If a window seems particularly susceptible to being hit, place a predator bird silhouette there, or hang curtains.

Seasonal disturbances are problems avoided by knowing where there are causes and effects. Many woodland and meadow birds nest in lower parts of trees and in thick bushes, and prolonged disturbances such as woodcutting or groundskeeping can keep them away from nests for critical amounts of time. Fish spawning times too are critical, and disturbance of sediment from prop wash or work in the water can be deadly to populations. There are restricted times for in-water work, and the Conservation Authority must be contacted.

Insect infestations can occur naturally, from insects which often have periodic cycles of populations; and from introduced species. It is always important to understand which species of insect is making an appearance. While some may be a part of the usual ecology, some are more of a concern. A source of information is the Kempville office of the Ministry of Natural Resources, Charleston Lake Provincial Park, and St. Lawrence Islands National Park. Sometimes, insect infestations are symptoms of something gone wrong or under stress at your property. Many trees and shrubs are heavily stressed in dry summers and winters, and are more at risk from hungry caterpillars and wood-borers. In cases like this, the insects are contributors, and not the sole cause of death. Woodpeckers are often blamed for making holes in trunks and killing trees, but they too are just taking advantage of weakened trees that were doomed by cleared and sun-dried ground. Healthy ground covers and layers of natural leaf litter are simple and effective preventions. Any insecticide kills far broader than the intended target. Easier solutions are using native species for plantings, which generally have a natural series of checks and balances; and using dousings of mild soap solutions.

Fallen trees and limbs are part of the forest process. Dead, dying and fallen trees are vital parts of the life cycle. They provide nesting cavities for birds and animals; platforms for the growth of new species such as fungi and moss; and in crumbling on the ground from digestion by fungi and microbes, return energy and nutrient to nourish the next generation. This applies as well to leaf and twig litter. When these are removed from the system, all that energy and nutrient is lost and the system as a whole is weakened. Logs that are cut and piled, and piles of “tidied” brush, are not in contact with the damp ground, and take far more time to be recycled. Left on its own accord, the subtle process of death and decay opens new wildlife viewing possibilities.

Zebra Mussels

Zebra mussels (*Dreissena polymorpha*) are small, fingernail-sized mussels native to the Caspian Sea region of Asia. They are believed to have been transported to the Great Lakes via ballast water from a transoceanic vessel. The ballast water, taken on in a freshwater European port was subsequently discharged into Lake St. Clair, near Detroit, where the mussel was discovered in 1988. Since that time, they have spread rapidly to all of the Great Lakes and connected waterways, including the St. Lawrence through the Thousand Islands, the Rideau Canal, and into many smaller lakes as well. They have now been found in Charleston Lake.

Zebra mussels filter almost everything from their habitat. Organic pollutants get stored in the zebra mussels' tissue. Before zebra mussels infested the Lakes, most material of that kind would either be absorbed by zooplankton or settle into sediments. The mussels have made a dramatic change in the ecosystem because they filter plankton from the water and reduce the amount of energy available for fish. Lakes and rivers where the zebra mussel has been established in numbers for a time have become very clear. While this is a boon for sport diving, the ecological consequences are severe. Native species of clams are not only in competition for plankton to feed upon, but their shells are colonized by the mussels, weighing them and preventing them from moving freely. Many species are threatened. Walleye, sensitive to light, are forced to move to deeper water, and so have their habitat limited. Aquatic plants can grow to deeper depths because more sunlight penetrates deeper than before, and so habitats are being altered and limited. Large colonies of zebra mussels have equally large die-offs, and when they do, harmful bacteria and toxins they've accumulated are released. The deaths of scores of loons on the Great Lakes has been linked to this, the botulism causes the birds to lose the ability to hold their heads up, and they drown.

Diving ducks and freshwater drum eat zebra mussels, but will not significantly control them. However, the round goby, first detected in the St. Clair River in 1990, does eat the mussels. That isn't a good reason to lay out the welcome mat: the goby is a small, pugnacious species that feeds on the fry and eggs of native Great Lakes fish. It aggressively defends its spawning sites in rocky habitats, denying access to native species to prime areas for reproduction. And it forces native sculpins and darters, important species in the food chain, from their habitat.

The zebra mussel and the round goby have evolved together in other areas of the world. Both originated in the Black and Caspian Seas area and both were brought to this continent in the ballast of foreign freighters.

Zebra mussels reproduce rapidly and cause their greatest damage to industry by clogging water intake pipes. Over the past 10 years, estimated zebra mussel costs have totaled \$5 billion, with ongoing annual costs to industry of \$20,000 to \$350,000 per facility. The figures do not include the cost to cottagers: clogged water pipes, and ruined motor boats and beaches.

Likely means of spread: Microscopic larvae may be carried in livewells or bilgewater. Adults can attach to boats or boating equipment that is in the water. Zebra mussels lay hundreds of thousands of eggs.

Round Gobies

Gobies, normally three-to-six inches long, can grow up to 10 inches. They resemble the Great Lakes native sculpin fish but have a distinctive fused pelvic (bottom) fin. The sculpin has two separate pelvic fins and, commonly, a dark spot on the dorsal fin.

Gobies have a well-developed sensory system that enhances their ability to detect water movement, allowing them to feed in complete darkness. This creates a major competitive advantage over native fish in the same habitat.

Gobies prefer a rocky or gravel habitat, generally inhabit the nearshore area but will migrate to deeper water in winter. They can also survive under degraded water quality conditions. This characteristic, coupled with an ability to swim into holes and other crevices, likely allowed gobies to enter and survive in the ballast water of North America-bound ships.

The goby spawns over the summer months, taking advantage of temperature and food conditions. A single female produces 300 to 5,000 eggs, deposited in nests on tops or undersides of rocks, logs or cans, which are then guarded by males.