

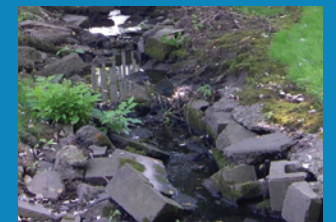


ONE MILE CREEK

LANDOWNER STEWARDSHIP GUIDE



250 Thorold Road West,
3rd Floor Welland, ON L3C 3W2
Phone: 905.788.3135 Fax: 905.788.1121
www.npca.ca





This guide would not be a reality
without the hard work and dedication
of the Friends of One Mile Creek.



250 Thorold Road West,
3rd Floor Welland, ON L3C 3W2
Phone: 905.788.3135 Fax: 905.788.1121
www.npca.ca

© 2009 First Edition — Niagara Peninsula Conservation Authority

The Niagara Peninsula Conservation Authority has made every attempt to ensure the accuracy of the information contained within this publication and is not responsible for any errors or omissions. The Niagara Peninsula Conservation Authority warns consumers that it is not advisable to eat any of the fruits or plants described in this publication.



Designed By
CATERS HARDY
DESIGN STUDIO

Table of Contents

Introduction.....2

How to Improve Water Quality.....9

Introduction

1. Stormwater Runoff.....10

2. Downspouts15

3. Storm Drains/Catch Basins19

4. Water Supply25

5. Erosion28

How to Improve Habitat Quality36

Introduction

1. Riparian Buffers37

2. Creek Alterations.....43

3. Aquatic Habitat.....46

4. Invasive Species.....52

5. Wildlife Habitat58

Conclusion63

References.....64

Appendices

1. Friends of One Mile Creek.....65

2. Rain Garden Plant List66

3. Butterfly Garden Plant List.....67

4. Contact Information68

Introduction

Living near water is something that many people want. It can be very satisfying to hear water trickle through the creek, to watch wildlife in your backyard, and to have a natural feature to add aesthetic value to your property. Anyone who has ever lived next to water knows that along with the joys come many challenges. During storm events, the water in the creek can overflow onto your property causing damage as a result of flooding and erosion to the creek bank. Residents are often not fully aware of how their actions as landowners may be impacting the environment around them, particularly in and around water. Many problems with our local creeks and streams are caused when landowners do seemingly simple things on their property, such as watering their lawn or cutting their grass.

This Landowner Stewardship Guide was developed especially for residents living within the One Mile Creek watershed in Niagara-on-the-Lake (NOTL). The purpose of this guide is to provide you with information about the watershed you live in, how your actions can impact the environment, and provide you with options for better environmental decision making. How you manage activities on your property has a role in determining local water and habitat quality. Although no one person can solve all the issues within the One Mile Creek watershed, as a community we can make a big impact.



Creek alteration
Kerry Royer, photographer

This guide includes the following:

- Examples of simple steps that can be taken to improve the water quality and habitat of One Mile Creek, including how to begin restoring the stream on your property to a more natural state.
- Options for reducing water quality impacts from chemicals and other domestic activities.
- Recommended naturalization and riparian plantings, focusing on native plants.

The Landowner Stewardship Guide for One Mile Creek is divided into two sections:

1. How to Improve Water Quality
2. How to Improve Habitat Quality



One Mile Creek tour
Photo provided by FOMC

Each section outlines specific actions you can take to help improve the overall quality of One Mile Creek. You will see that some actions can be taken individually, while others may require the help of professionals. In addition, this guide will provide relevant information about why it is important to take these actions and what the benefits are for you and for your community.

Although we have done our best to provide as much information as possible, please remember that each property is unique and may require an individual assessment. We strongly recommend that before undertaking any construction activity in or near the creek, that you contact the Niagara Peninsula Conservation Authority. Any work related to erosion control, bank stability, in-stream habitat, construction plans, tree removal, etc. may require permits and permissions.

Niagara Peninsula Conservation Authority

Established in 1959, the Niagara Peninsula Conservation Authority (NPCA) serves approximately 500,000 people and covers an area of 2,424 square kilometres, encompassing the entire Niagara Region, 21% of the City of Hamilton and 25% of Haldimand County. The driving force behind the Conservation Authority movement



Niagara Peninsula Watershed Map

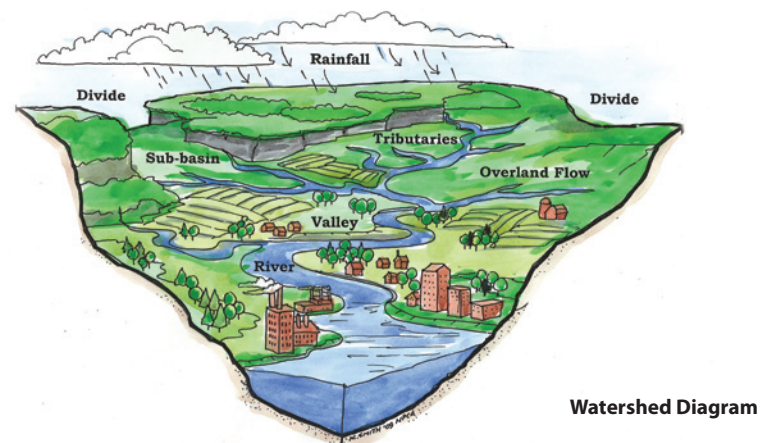
was its grassroots land stewardship focus and its involvement with water programs. Today, this vital commitment continues, as we strive to address the impact on the watershed from current human activities. Our programs focus on environmental protection and preservation. Watershed management activities include planning, regulations, water quality monitoring and improvement through stewardship and restoration, community outreach, and conservation through land acquisition and public ownership.

With its unique resources, the Niagara Peninsula is one of the most complex watersheds in the Province. It includes lands drained by the Niagara River, Twenty Mile Creek, the Welland River, and the Welland Canal. Nestled between Lake Erie and Lake Ontario and transversed by the Niagara Escarpment, the Niagara Peninsula has truly unique climatic and biotic zones that are unlike anywhere else in North America. Arguably the best example of this uniqueness can be seen within the NOTL watershed.

The Conservation Authority has long recognized the importance of partnerships to assist in addressing environmental challenges, realizing that our strength lies in the continued involvement and cooperation of many community groups, all levels of government, and area residents. As a watershed resident, you can help ensure that our water and land is as healthy as possible. Please read on to find out how you can make a difference in creating a healthy and sustainable environment.

What is a watershed?

No matter where you live, you live in a watershed. A watershed is an area of land over which precipitation such as rain and snow drain, defined by topography (high and low areas) and eventually forming some type of watercourse such as a creek. As water trickles over the surface of the land, moving from high areas to low areas, it combines to form swales, creeks, streams, rivers and eventually outlets into lakes and oceans. Water always flows from high to low areas, from upstream to downstream. A watercourse is recharged or "refilled" by precipitation. The way that plants and vegetation breathe (evapotranspiration) and the permeability (ability of water to seep through spaces) of soil and bedrock all contribute to the formation of a watershed and the water cycle.



Watershed Diagram

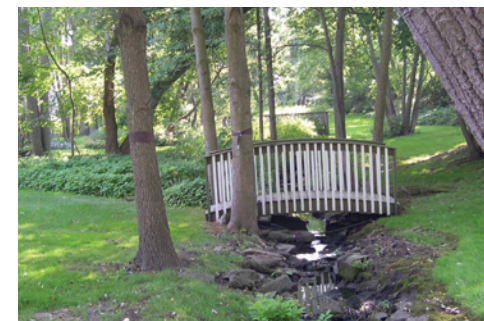
One Mile Creek Watershed

One Mile Creek Watershed drains mainly through the 'Old Town' of NOTL, outletting to Lake Ontario west of the mouth of the Niagara River. The watershed is small and highly urbanized, with a population of approximately 1950 people and a drainage area of approximately 5.2km², flowing in a north-westerly direction. The area drained by One Mile Creek has a rich cultural and archaeological history. A portion of the creek flows along the boundary of the Parks Canada historic site that includes Fort George and the Commons, which have a significant military history dating back to the War of 1812. Landsdowne Pond, a small wetland area at the mouth of One Mile Creek, is separated from Lake Ontario by a barrier beach that forms and re-forms in response to wave action and creek flows.



Upper headwater area

In the upper headwater areas, the creek channel winds through residential areas and is mainly ditch-like, with some stagnant sections. The Epp Drain was constructed in 1973 to divert regional storm/flood water away from the lower watershed, as a result, 30% of the One Mile Creek watershed is now outletting to the Niagara River. During major storm events the diverted headwater will spill over into the One Mile Creek system, resulting in the potential of flood damage.



One Mile Creek

The mid-section of the creek, below King Street, becomes better defined as it flows through several woodlots, becoming ditch-like again as it passes through more residential areas. The lower section of the creek, below Nassau Street, is forested with a more natural channel structure. Landsdowne Pond, located just upstream of the outlet to Lake Ontario has filled in with sediment over time, becoming more characteristic of a shallow marsh.

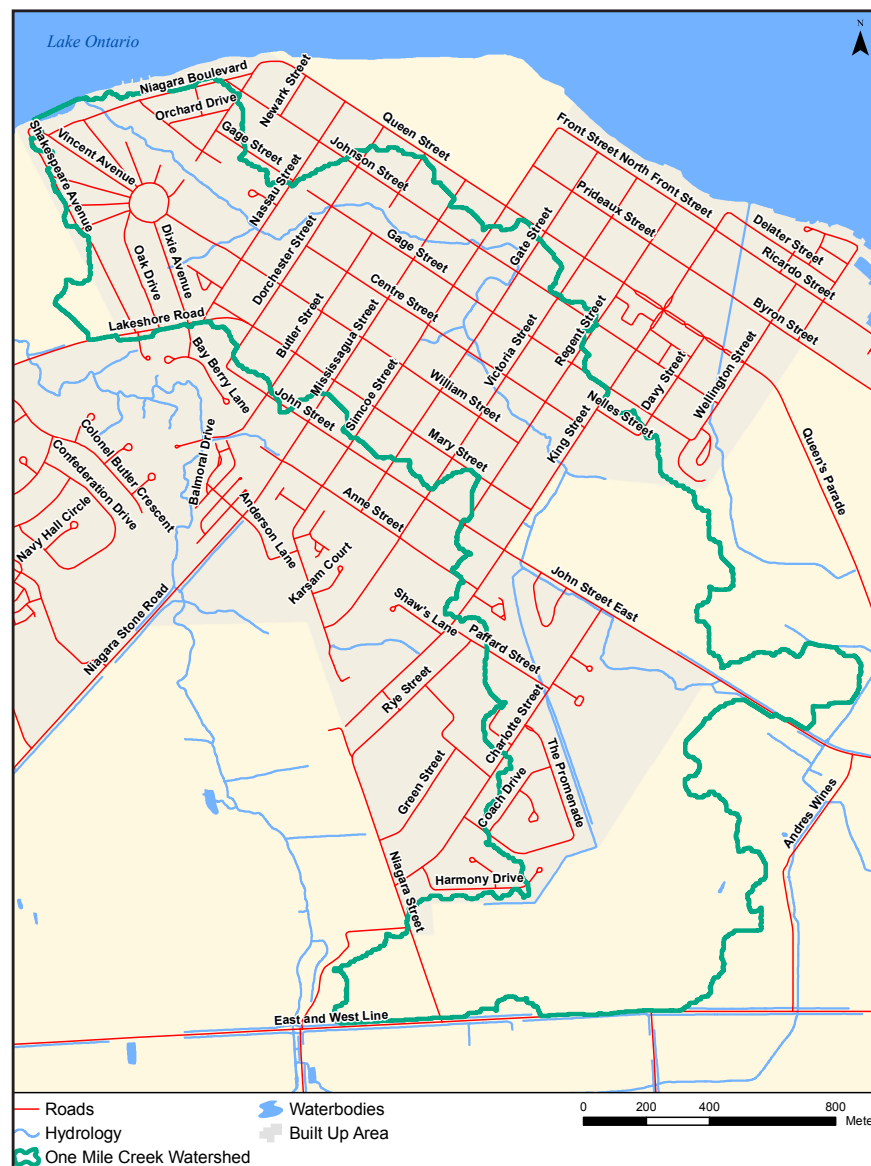


Landsdowne Pond

Land uses within the watershed are not expected to change drastically in the future. The entire watershed is serviced municipally for sewage and drinking water, therefore there are no wells being used for potable water, or septic systems. The William Street Pumping Station conveys sewer flows to the Regional Water Pollution Control Plant. There is one emergency

sewer overflow in this system and it outlets to the creek, downstream of Nassau Street. In addition there are also 16 storm sewer outlets discharging to the creek, as there are no stormwater management facilities within the watershed.

The physical characteristics of One Mile Creek have been significantly influenced by the surrounding human environment. Much of this influence is due to the fact that the surrounding lands are largely paved and urbanized. Also, many portions of the One Mile Creek bed are privately owned and each person may treat the adjacent riparian lands differently. Although One Mile Creek runs through many private properties, it is important to remember that no one person owns the creek.



Watershed tour
Photo provided by FOMC

Conservation Authorities across Ontario regulate watercourses. Locally, the NPCA regulates One Mile Creek. Any proposed floodplain or in-stream work or construction must be approved in advance by the NPCA. With that said, if your property borders One Mile Creek you also have certain rights as a property owner. These rights are called "riparian rights". Riparian rights are common law rights available to any property owner whose land borders on a watercourse, such

as a creek, river or lake. Riparian law entitles such landowners to the right to access and use water, the right of natural water flow, the right of drainage, and undiminished water quality. Under the common law, people have strong property rights. They have the right to both use and enjoy their property. With this right, landowners also have a responsibility not to interfere with their neighbours' rights to use and enjoy their property. This principle has been passed down in common law in the following form; "No one may do in his own estate anything whereby damage or nuisance may happen to his /her neighbour". This principle governs court decisions to this day but has been shortened to "Use your own property so as not to harm another's". Therefore any activity that alters the water, or that reasonably threatens to do so, entitles the landowner to the intervention of the court. (Brubaker, 1995)

What are the issues?

One Mile Creek watershed residents have raised concerns regarding the condition of the creek and Landsdowne Pond. In response to those concerns, in 2003 the Friends of One Mile Creek Community Group (FOMC) was established (refer to appendix #1 for more information about the organization). The FOMC advocated the need for a One Mile Creek Watershed Plan to address the variety of environmental issues and develop a long term strategy for dealing with identified concerns.

The One Mile Creek Watershed Strategy was developed by the NPCA in consultation with our watershed partners, in order to improve and protect the ecological integrity of One Mile Creek. Local and regional governments, researchers, and local community groups such as FOMC provided the necessary input into this strategy. In recognizing these interests, the Strategy was initiated to achieve a sustainable ecosystem.

The following list of issues were identified through the technical studies and based on input received from a public open house.

- Lack of baseflow (groundwater linkages)
- Diversion of flows (Epp Drain)
- Sanitary Sewer Pumping Station overflow
- Erosion

- Private property flooding
- High flows and pollutants from urban storm sewers
- Lack of riparian vegetation
- Alterations of stream
- Landsdowne Pond (odour and water quality)
- Siltation within the creek
- Debris
- Lack of access
- Health issues with deposits in the creek (including West Nile risks)
- Loss of natural stream functions
- Impact on agricultural lands
- Wildlife impacts
- Agency/landowner responsibilities (who does what?)
- Impacts on Lake Ontario (beaches)



Typical storm flooding

Based on these watershed concerns and issues, the NPCA believes that a cooperative approach between the Authority, the Region, Municipalities, community partners and private landowners is essential to achieve Strategy goals. The variety and complexity of these issues demonstrates the need to establish true ecosystem goals and objectives, in order to ensure that all issues are considered. By thinking about the One Mile Creek ecosystem as a whole, we can focus on addressing the source of the problems and not just on correcting the effects of the problems.



Common snakes doing uncommon things
Tom Staton, photographer

How to Improve Water Quality

Improving the water quality of One Mile Creek is important not only for local residents, but for the health of the larger watershed. All the water on the Earth is connected, whether it is a small creek in NOTL, the Pacific Ocean, or an iceberg in Alaska. Water is important to all life on Earth, for the simple reason that it is one of our basic needs, from the smallest organisms to the largest. For this reason, it is essential for us to remember that water is a resource that we all share.

We value clean, abundant and healthy sources of water. Identifying areas of pollution inputs is critical to the long-term health of Niagara's human and non-human residents.



Painted Turtle
Barry Porter, photographer

Whatever we do to the land is reflected in the quality of our water. If we are cutting down trees, filling in wetlands, paving over natural environments, not maintaining septic systems, pouring chemicals down drains, using fertilizers and pesticides, etc., poor water quality will result. Problems such as turbidity, low dissolved oxygen, high levels of bacteria, phosphorus and other nutrients in our local water sources indicate that we are not being good stewards of the land.

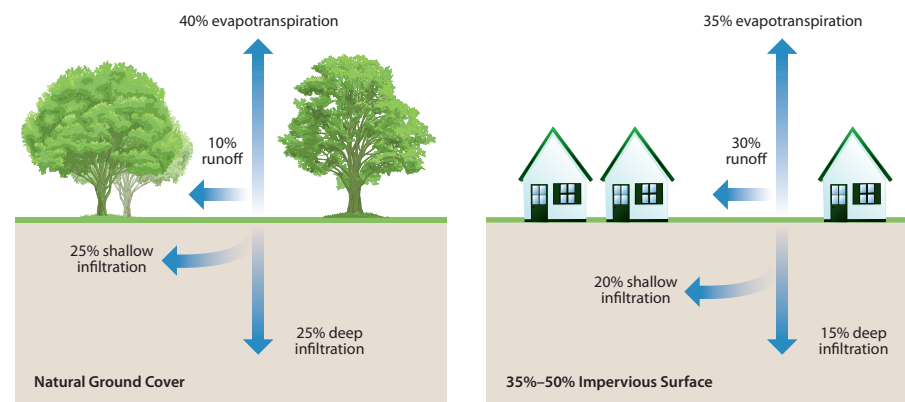
When water falls on the surface of the Earth, it has to go somewhere. When it reaches the ground, it immediately starts to move, either into the soil or over the land. Water always moves from a higher to a lower area. Eventually those little droplets of rain will combine to form or join a small creek or drain, eventually making their way to a river or lake. In NOTL, One Mile Creek drains to Lake Ontario. Before this water gets to Lake Ontario it will run over our lawns, driveways, and streets. This can have a serious impact on the quality of the local water that we use everyday. For this reason, every landowner should consider what role their actions have on local water quality. If we can identify sources of pollution on our own property, then we can take steps to correct or reduce them.

This section of the guide will help you to identify areas where changes can be made to help improve local water quality.

1. Stormwater Runoff

What is the problem?

Stormwater runoff is the water from rain, snow or hail that moves over the land, instead of soaking into the ground. It is easiest to see stormwater runoff on hard surfaces, such as driveways, roads, roofs, sidewalks, and parking lots. In urban areas, much of the water runoff ends up in storm drains, also called catchment basins. These storm drains empty directly into the nearest creek, river or lake. In a natural environment, there is much less runoff as there are few hard surfaces and therefore much of the water can be absorbed into the ground. When runoff occurs in the natural environment it is usually because the ground is saturated and is not able to absorb any more water.



Runoff. Hard versus a natural surface

In urban areas such as NOTL, the number of hard or impervious (does not allow water to soak in) surfaces are very high. The impervious surfaces around homes (roads, sidewalks, driveways, patios, roofs, etc.) prevent rainwater from being absorbed into the ground. Therefore when it rains in the historic district of NOTL, all of this water runs off into the nearest ditch or storm drain and is taken directly to One Mile Creek.

As water moves over the land it can pick up harmful pollutants, including sediment, bacteria, pathogens, oil, chemicals, pet waste and debris. In a natural environment, water would soak into the soil, where it would go through an underground network of soil, rocks, and plant roots, which would help to eliminate many of the pollutants found in the runoff water. The One Mile Creek watershed does not contain many natural areas and therefore many of the pollutants mentioned above are often transported directly to the creek and then into Lake Ontario. In addition, the lack of natural areas increases the degree of flashy flows and nuisance flooding in the watershed. The rain simply has nowhere else to go but into the creek. Some of the



Lack of baseflow
Kerry Royer, photographer

rainwater will soak into our lawns and gardens, but this is nothing compared to the amount of water that would soak into the ground and get absorbed by trees and other vegetation in a natural environment. During rain events, natural areas, such as wetlands, act like large sponges, absorbing high volumes of water. When water is allowed to sit in a low spot, like a wetland, it will slowly seep into the ground, recharging groundwater. This water will eventually make its way back into the creek, but it will be at a much slower rate when compared with the water rushing directly into the creek during a storm.

Slowing down the rate in which water travels over the landscape improves water quality, water quantity (water supply) and helps to control/lessen flooding. Water can be slowed down by capturing and controlling it. Read on to find out how you can do your part.

Why should I care?

The lack of natural areas and the increasing number of hard surfaces in the watershed, is the main reason there is either too much or too little water in One Mile Creek.



One Mile Creek flooding
Photo provided by FOMC.

Having water in the creek is arguably the most important factor regarding the fate of aquatic organisms, including fish and their food source. Many creatures rely on a sustainable flow of water in One Mile Creek in order to survive. Without the flow of water, fish are unable to move up or downstream and may become "trapped" in small pools of water along the creek. Having a sustainable flow of water in One Mile Creek also makes it more aesthetically pleasing for residents living adjacent to the creek.

The three main reasons for capturing and controlling rainwater/runoff are:

- improved water quality
- improved water quantity, maintaining baseflow during dryer periods
- improved drainage/prevent excessive flooding during storm events

Some benefits resulting from the capture and control of rainwater/runoff include:

- reduced surface runoff during storm events
- less pollutants entering watercourses (e.g. pesticides, oil, fertilizers)
- reduced nuisance flooding
- groundwater recharge
- aesthetic value
- water conservation
- reduced pressure on waste water treatment plant
- reduced emergency sewer overflow events
- protection of public and local wildlife from health risks associated with sewer overflows
- reduced erosion/sedimentation
- provides habitat for wildlife such as birds, fish, pollinators and other beneficial insects

Baseflow

Baseflow is the water in the creek that comes from groundwater. Groundwater enters the creek when the water table rises above the creek bed. Under normal conditions, the water in One Mile Creek comes from both groundwater and surface runoff water. However, when there is no precipitation, the creek falls to baseflow conditions. Baseflow conditions are when there is no surface runoff contributing to the water in the creek. Baseflow can be variable within the system and is influenced both by the geology of the land (soil and bedrock conditions) and by the groundwater table. The amount of baseflow a stream receives is closely linked to the permeability of rock or soil in the watershed.

Unfortunately, because there are fewer and fewer permeable surfaces in the One Mile Creek watershed, there is less water seeping into the ground contributing to groundwater and baseflow.

What can I do?

There are many ways to capture and control rainwater/runoff. Increasing natural areas is the easiest way. Reducing/eliminating hard surfaces may be more difficult, but it can be done. For example, gravel driveways are better than asphalt. Stone paths are better than concrete. Naturalized lawns are better than manicured ones.

In urban stream systems, the following four techniques are effective solutions for helping to capture and control rainwater/runoff.

Riparian Buffers

A **riparian buffer** is a strip of land along the edge of a watercourse that is left in a natural state. In urban areas such as One Mile Creek, riparian areas are often cleared of vegetation and maintained in turf grass. Turf grass offers limited aid in the control of runoff or protection against erosion.



Excellent riparian buffer

Inadequate riparian buffers permit increased volumes of water to enter the creek during storm events and cause water to move quickly through the system, increasing flooding. Healthy riparian buffers include native trees, shrubs, grasses and wildflowers. The benefits of riparian buffers are discussed in greater detail later in this guide.

Rain Gardens

Having a rain garden is a simple and cost-effective way of reducing the amount of water that rushes off your property into the creek during storm events. This type of low-maintenance garden can be easily created by re-directing the rainwater from your rooftop, via eavestroughs and downspouts.

Rain gardens are designed to collect the few centimetres of water during a rain event and allow that water to slowly seep back into the ground. Your rain garden will rarely need to be watered, because most of the water it needs will come during regular



Rain garden
Allison Graszat, photographer

rain events. A rain garden can be planted with any type of vegetation to help facilitate absorption and transpiration. Native wildflowers, grasses and shrubs are recommended, because they are adapted to local climate and environmental conditions. They respond well with very little maintenance, and are resistant to most diseases and insects. They are the plants that wildlife such as birds and butterflies prefer. They also add colour and aesthetic value to your property.

Rain gardens are capable of capturing 30% more rainwater when compared with regular turf grass. The plants intercept and capture the rainwater, allowing the water to slowly seep into the ground, travelling through an underground filtering network of plant roots, organic matter, silt, sand, clay, gravel, and rocks. This network helps to absorb and eliminate many of the pollutants found in rainwater runoff. In addition, this process of water filtration allows groundwater to recharge and improves baseflow.

(Refer to appendix #2 for Rain Garden Plant List)

Will my rain garden become a breeding ground for mosquitoes?

A rain garden is designed to allow rainwater to soak into the ground fairly quickly after a rainfall and therefore should not pond. Without prolonged ponding, the rain garden is unlikely to provide a breeding area for mosquitoes. The water will dry up before the eggs can hatch. Keep in mind that different soil types will allow the water to seep in at different rates.

Rain barrels

Using a rain barrel is one of the simplest ways to capture and control rainwater. Collecting rainwater from a rooftop via eavestroughs and downspouts with a rain barrel is a great way of reducing runoff and saving money. Rainwater is healthier for plants than municipally-treated water because many plants are sensitive to chlorine and other additives.

When we hear about the accumulation after a rain event it doesn't sound like much, usually a few centimetres. However, when we calculate the amount of rain that falls onto an average size roof during a rain event, we can see that it quickly adds up.

How much water comes off my roof?

Average roof size: 112m²
Average rainfall event: 2cm
Volume of water: 112m² x 0.02m (2cm) = 2.24m³ or 2240 litres of water



Rain barrel

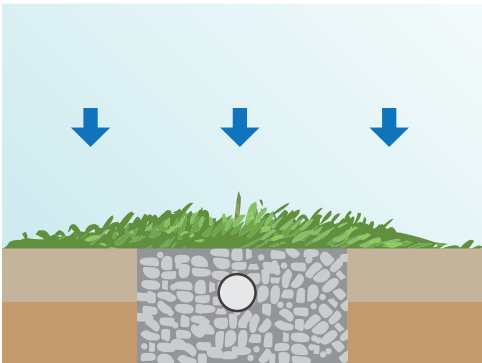
The average person's roof has the ability to intercept over 2000L of water per rain event. The average bathtub holds approximately 150L of water. Capturing 2000L of roof water is the equivalent of filling your bathtub up 15 times. As you can see, a significant amount of water can be diverted, controlled or captured from roof tops in rain events. The average rain barrel holds between 180L and 300L of water. There may be more water coming off your roof in a single rain event than a rain barrel can handle, therefore; many people choose to have a rain barrel at each downspout. Some rain barrels come with an overflow system that will help direct the water away from your home should it start to overflow.

You can purchase a rain barrel at most local hardware stores, and many municipalities offer subsidies. Rain barrels generally cost between \$80-150, depending on the size and model.

Once you obtain a rain barrel, the next step is to redirect your downspout into the barrel, use the water for your garden and save money on your next water bill. Your plants will thank you and so will your downstream neighbours.

Soakaway pits

Soakaway pits function similar to rain gardens in that they control and capture rainwater/runoff by diverting water from your downspout away from ditches and storm drains. Soakaway pits are different from rain gardens because they do not have an aesthetically pleasing above-ground portion — they are underground. For this reason, they are ideal for landowners that do not have the space to devote to a rain garden. The deep underground pit is lined with gravel, sand and other coarse materials. The gravel and sand help to filter the water as it moves through the pit spaces. During this filtration process, groundwater is recharged and baseflow improves.



Soakaway pit

Unlike rain barrels and rain gardens, soakaway pits typically require professional design and installation. If you would like more information about soakaway pits contact the NPCA.

2. Downspouts

What is the problem?

A downspout is a downward leading pipe that carries rain water away from a roof and foundation of a building in order to prevent leaking and basement flooding. In the One Mile Creek watershed, many downspouts are connected to, or discharge towards the sanitary sewer system or the storm sewer systems. These connections contribute more water to the sewer systems and can cause stress on the system during rain/storm events. These stresses can cause basement flooding and result in sanitary sewer overflows to One Mile Creek.



Downspout connected to storm system
Kerry Royer, photographer



Disconnected downspout
Kerry Royer, photographer

Disconnecting downspouts reduces the amount of water entering the system and will reduce the frequency of sanitary sewer emergency overflows. One disconnected downspout can redirect thousands of litres of stormwater every year.

NOTL Sewer System Overview

Sanitary Sewer System

A sanitary sewer system is used to transport waste water from toilets, showers, sinks, etc. in our homes, businesses and industries, to the waste water treatment plant. A waste water treatment plant cleans and filters the waste water and then releases it back to the environment (via the nearest creek, lake or river system) once the harmful pollutants have been removed.

Storm Sewer System

A storm sewer system collects rain water through catch basins usually located on the sides of roads. These catch basins are designed to capture runoff from roads, driveways, lawns and roofs. In a natural

system, wetlands, creeks and rivers are the “storm drains” which collect runoff. In urban areas these natural areas generally do not exist. Impermeable surfaces do not allow rainwater to infiltrate into the ground, therefore there is a need for these manufactured systems.

Combined Sewer System

A combined sewer is one that consists of two partially separated pipes for storm water and sewage water. These were built in the early 1900's as a way to decrease the cost of building the system. During dry periods, the waste water goes to the waste water treatment plant (WWTP), gets treated and is discharged back into the environment. However, when it rains, the rain water is collected in the same pipe and is also sent to the WWTP. This increases the volume of water that needs to be treated and also increases the cost to the tax payer. During large rain events, the combined sewer system does not have the capacity to treat and hold all of the excess water. The result is the discharge of wastewater (both sewage and stormwater) to the nearest outflow pipe. The combined sewer system overflow (CSO) is designed to protect against the backup of water and sewage into basements and prevent over-loading pumping and treatment facilities. Because the domestic waste is released untreated into local water supplies, CSOs often trigger increased bacteria levels and associated problems, such as unsafe swimming conditions in lakes.

There are no combined sewer systems in NOTL. The last system was separated in 1997. The sanitary sewer system in NOTL still has illegal connections and is subject to extraneous flows (refers to page, leaks, etc). These additional water inputs cause stress on the system during rain/storm events and can overload the current system. The William Street pumping station has an underground storage tank which can hold a significant amount of stormwater to help alleviate some of the stress on the system. An emergency outflow is located at the pumping station and may discharge sanitary sewer water to One Mile Creek under large event conditions.

Why should I care?

When downspouts, sump pumps or weeping tiles are connected to the sanitary sewer system, they can cause a number of problems, including an excess volume of water in the sewer system. This excess volume puts extra stress on the infrastructure and increases treatment costs, which are generally absorbed by the taxpayer. Another problem is increased property flooding. Many homes could experience basement flooding, which can cause property damage and become costly for the homeowner.

According to NOTL By-law 767-77, **it is illegal to have your downspout, sump pump or weeping tiles connected to the sanitary sewer system.** Removal of illegal connections is critically important to help prevent excess volumes of water from discharging to the sanitary sewer system during rain events. When rainwater enters the sanitary sewer system through connected downspouts, sump pumps or weeping tiles, it gets carried to the treatment plant and is treated along with the wastewater. During smaller rain events this does not cause any significant problems, except for the fact that rainwater is being treated unnecessarily. However, during larger storm events, the excess water in the sewer systems can cause basement flooding and overflows at the William Street pumping station.

Do illegal connections really contribute large amounts of water to the sewer system?

Yes! An 8" sanitary sewer can handle domestic water flow from up to 465 homes. However, it takes only twelve sump pumps operating at full capacity during a rain event to overload the same sewer pipe.

(Town of Niagara-on-the-Lake, Extraneous Flow Remedial Action Plan)

It is NOT illegal in NOTL to have your downspout connected to the storm sewer system. However, a downspout connected to the storm sewer system will increase nuisance flooding in One Mile Creek because this causes water to enter the creek quickly. In general, it is best to disconnect your downspout and let the water run over a natural area before entering the creek.

What can I do?

Disconnect your downspout, sump pump or weeping tiles from storm and sanitary sewer systems. Roof flows and runoff can be redirected over your lawn or garden, allowing water to infiltrate the ground. This infiltration will help to reduce the risk of flooding and to recharge the groundwater supply. If possible, the redirection should be towards natural areas to allow a greater volume of water to be absorbed. Water running over turf grass will not infiltrate as well as natural areas. Water running over driveways, roofs and other hard surfaces will not infiltrate at all. Native grasses, wildflowers, trees and shrubs have very deep root systems that help to increase infiltration. In contrast, turf grass has a very shallow root system and therefore it will not absorb as much water. That being said, it is still better to have rainwater running over grass than over pavement, but water running over a natural area or gardens is best.

Downspouts or eavestroughs should be cleared out and cleaned regularly. In order to avoid basement flooding, downspout spillways should be extended to 1.8 metres (6 feet) away from your basement walls. This will avoid adding extra flow to the house drains (weepers).

The benefits of disconnecting will depend on the specific situation, and whether you were originally connected to the sanitary, or storm sewer.



Disconnected downspout
Jocelyn Baker, photographer

Disconnection from the sanitary sewer system will result in:

- reduced overflows of the sanitary sewers
- reduced basement flooding
- reduced treatment costs at the sewage treatment plant
- reduced energy consumption and greenhouse gases
- reduced overflows at the William Street pumping station

Disconnection from the storm sewer system will result in:

- reduced nuisance flooding that can cause erosion and other property damage
- reduced chance of flooding caused by sewer backup
- improved groundwater recharge
- increased baseflow
- reduced pollution (e.g. sediment, nutrients, heavy metals, oil, grease, bacteria, etc.)
- improved aesthetics
- improved water quality for aquatic organisms

Refer to the reference section for more information about NOTL Extraneous Flow Remedial Action Plan and Downspout Disconnection Program.

3. Storm Drains/Catch Basins

What is the problem?

A storm drain is typically a grate that is found on the street by a curb or in a parking lot. Storm drains collect runoff, such as rain water, and redirects it through a network of underground tunnels (storm sewer system). This untreated water is discharged to the natural environment. There are 16 storm sewer discharge points in the One Mile Creek watershed. Runoff that is collected by storm drains may contain pollutants, including nutrients, chemicals and bacteria. Anything that runs off lawns, driveways,



Typical storm drain

sidewalks and roads can end up in One Mile Creek. In an urban area like NOTL, litter, salt, soaps, fertilizers, pesticides, bacteria and nutrients can be found in runoff. All of these things can have a negative impact on the environment (ecosystem) in and around One Mile Creek, not only because they will harm fish and wildlife, but also because they have a negative impact on surface water quality and drinking water quality for humans.

The following substances that can have a negative impact on water quality in One Mile Creek include:

- Soap from washing vehicles in the driveway. Many brands contain phosphates, which cause algae blooms and reduce dissolved oxygen levels.
- Nutrients from fertilizing lawns or gardens. Another source of nutrients can be pet feces. Although we don't often think of nutrients as a bad thing, too many nutrients entering a watercourse can cause significant problems, including algae blooms and a general overgrowth of plant material.
- Bacteria and pathogens from pet feces. The increasing amount of pet waste found in urban areas is causing a significant negative affect on water quality. Bacteria can be harmful to aquatic life and human health.
- Oil, grease and gas from leaking vehicles and equipment containing small engines, such as lawn mowers and hedge trimmers.
- Litter, including discarded packaging, coffee cups, newspapers, grass and garden clippings, pet litter, food waste, cigarettes and improperly secured recycle and garbage receptacles.
- Pesticides and herbicides that are handled improperly or applied inappropriately, can be harmful to aquatic and human life.
- Salt, sand and silt from snow removal practices. When salt enters our freshwater creeks and streams, it can have negative impacts on aquatic life and may even be fatal to some species. Salt can also have a significant impact on trees, shrubs and other types of vegetation. It can infiltrate the ground and accumulate in aquifers that provide most of our drinking water. Removing salt from freshwater is very costly and time consuming. In order to reduce impacts on watercourses, sand is often used as an alternative to salt, however, it can clog storm sewer systems and cause sediment accumulation in the creek.

Why should I care?

If you own property in the One Mile Creek watershed, your actions are having an impact on the quality of water in the system. You have the ability to minimize or eliminate the pollutants running off your property. According to Environment Canada, as much as 50% of the chemicals that are applied to lawns and gardens to ward off insects and plant pests or to increase plant growth, end up in ground or surface water. Reducing chemical use around our homes can improve local water quality and create a safer environment for our children, pets and ourselves. In addition, we can reduce the costs of treating our drinking water.



Pesticide free lawn

What can I do?

The best way to improve the quality of the water running off your property is to carefully think about what goes down the storm drain. When we take a minute to consider the things that end up in One Mile Creek via the storm drain system, we can take the steps necessary to eliminate some of these things.

We can make improvements to One Mile Creek by simply making the following adjustments to the way we handle and use products.

Soap

Wash your car at a car wash. The drainage from car washes is connected to the sanitary sewer system and therefore it will get treated before it is discharged back into the environment. If you want to wash your vehicle at home, it is best to do so in a relatively flat area on your lawn where the water can seep into the ground and the soap can get filtered before entering the stream.

Nutrients and bacteria

Purchase earth friendly gardening products. Reducing the amount of chemical fertilizers used in your garden or flower bed will help to control the amount of nutrients entering the creek. Using slow-release fertilizers allows the nutrients to slowly infiltrate into the ground, as opposed to quick-release formulas, which tend to overload the soil with more nutrients than can be absorbed by plants.

Organic fertilizers are great slow-release fertilizers. Because these nutrients will slowly be released into the environment, they are less likely to damage your plants and are less likely to wash away. They are also gentler on soil organisms that your plants will need to transform the nutrients into a usable form.

Compost! It is an excellent soil amendment that adds trace and macronutrients to your soil as well as organic matter.

Clean up after your pets. Feces can be composted or flushed down a toilet. This is better than placing in a plastic bag and having it end up in a landfill.

If you must fertilize your lawn, do it in the Fall. Applying fertilizer in the Spring encourages top growth for grass and weed species. Summer is a natural dormant time for grass and therefore little nutrients are required for it to be healthy.



Garden compost
Kerry Royer, photographer

Oil, grease and gas

Properly maintain your vehicles. Fluid leaking from your car will likely be washed untreated into the creek. Automotive fluids are harmful to the watercourse and the creatures in it. Fixing leaks will also save you money. When pouring oil or gas into your lawn mower or other equipment, do so over a protective cover/receptacle to contain spills. Ensure excess oil, grease and gas are properly stored and disposed of. Used oil, grease and other hazardous materials should be brought to a household hazardous waste (HHW) collection facility.



Creek clean-up
Photo provided by FOMC

Litter

Don't litter, it's just plain rude. Yard and garden clippings, as well as food waste, should go into the organics collection or a compost bin. Cigarette butts should always go into the garbage. Properly secure your garbage and recycling on collection day. Use plastic recycling bags instead of bins on windy days. A significant portion of road side litter is a result of poorly secured recycling bins.

If you are interested in helping to reduce the amount of litter along One Mile Creek, contact the Friends of One Mile Creek, who organize routine creek clean-ups.

Pesticides

Reducing or eliminating the amount of pesticides and herbicides that are used around homes is very important to the health of One Mile Creek. Natural lawn care techniques are available and offer solutions to many common problems. The following are just a few tips for reducing your pesticide and herbicide use:

- Use native plants. They are resistant to local pests and diseases, and are adapted to local climate conditions.
- Pull unwanted weeds or pour boiling water on them instead of using chemicals.
- Attract beneficial insects to help control common pests (e.g. ladybird beetle /lady bugs will help control aphid populations).
- Encourage deep rooting grass, by watering no more than 2.5cm (1in) per week. Early morning is the best time to water.
- Let grass grow longer (between 8-10cm or 3.5-4in.)
- Keep mower blades sharp (shredded grass blades are more susceptible to diseases).
- Leave grass clippings on the lawn, they will provide nutrients.
- Use a saucer of beer or brewer's yeast in gardens to catch nuisance slugs or snails.



Beneficial insect

Salt, sand, silt

The Town of NOTL has been pro-active in reducing the amount of salt that is used in their municipal road programs, by participating in Environment Canada's Salt Management Program. The Town uses a sand/salt mix at a ration of 5:1 with salt comprising only 20% of the mix. In the Old Town and urban areas, the sand/salt mix is applied at intersections and corners, not the entire road. Operators are also able to monitor their application use, which helps to prevent over application and decreases the amount of sand and salt that ends up in One Mile Creek.

When using sand and salt around your property, use it in moderation and be conscious of why you are using it. Make sure that you shovel off as much snow and ice as possible before application. This will reduce the amount that is necessary. Always use sand and salt sparingly and only when absolutely necessary for safety reasons. Remember that the salt and sand on your driveway will easily wash away into the storm drain as snow and ice melts.

Refer to the reference section for more information about the Niagara's Region Smart Gardening Guide, other fertilizer and herbicide alternatives.

Yellow Fish Road™ Program

The Yellow Fish Road™ program is a hands-on environmental project for youth, to help decrease water pollution in their community. The program is implemented nationally by Trout Unlimited Canada. To date, over 220 communities across Canada have approved and implemented this educational initiative.



Yellow Fish Road™ volunteers paint "yellow fish" symbols next to storm drains and

distribute fish-shaped brochures to nearby households, reminding people that anything that enters the storm drain system goes directly into the local water body.

The NPCA is the regional coordinator for Yellow Fish Road™ in Niagara. Refer to the reference section for more information about the NPCA's Yellow Fish Program.

4. Water Supply

What is the problem?

The demand for fresh, clean water is steadily increasing. In Niagara, it may seem like we have an endless supply of fresh water, but we don't. The demand for water is increasing, because there are more people and practices that require it. Increasing water pollution, declining water tables and prolonged drought conditions (climate change) are shrinking our supply of useable water.

Only 7% of the available water on the planet is fresh water and of that, only 1% is available for drinking. North American residents use more water than anyone else in the world. The average Canadian uses 350L of water in a single day. Of those 350L, only 5% (17.5L) is used for drinking and cooking. The majority of water is used in the bathroom.

On the environmental side, high consumption places stress on rivers, lakes and groundwater aquifers. Many rivers are dammed to hold back water, causing flooding and serious ecological impacts. As well, the discharge of used water or treatment water can damage aquatic ecosystems.

On the economic side, high water consumption requires ever-increasing and expensive investments in water system infrastructure, needed to gather, deliver and dispose of water (dams, reservoirs, water treatment facilities, distribution networks and sewage treatment). This in turn increases our energy consumption and magnifies the problem.



Consuming energy causes a wide range of health and environmental impacts, from the habitat loss associated with exploration for fossil fuels and the construction of hydroelectric facilities to the pollution resulting from the burning of fossil fuels. Fossil fuel combustion is the main source of three major air pollution problems – climate change, acid deposition and urban smog. According to Environment Canada, energy

use produces 90% of Canada's carbon dioxide emissions, 55% of sulphur dioxide emissions, 90% of nitrogen oxide emissions and 55% of volatile organic compound emissions.



Lawn sprinkler
Kerry Royer, photographer

Niagara-on-the-Lake residents get their water from the DeCew Falls Water Treatment Plant in St. Catharines. It is the largest water treatment plant in Niagara and can supply 227.3 million litres of water per day. The supply of water comes primarily from Lake Moodie in Thorold. **Wastewater** is the water that leaves our homes when we run a tap, drain a tub, take a shower, flush the toilet, do a load of laundry or run a dishwasher. The wastewater goes into the sanitary sewer system and is transported to a wastewater treatment plant. Here it is cleaned and filtered before being returned to the lake.

The summer is the biggest yearly peak period for water use, when about half to three-quarters of all municipally treated water is sprayed onto lawns. Watering less often and using water from your rain barrel can help reduce the amount of potable water which is used for lawn watering.

Why should I care?

Collectively, all our actions are having an impact on the quantity of available fresh water. You have the ability to reduce and conserve water.

The benefits of conserving water include:

- reduced stress on water treatment plants and wastewater treatment plants
- reduced infrastructure maintenance costs
- less environmental impact by decreasing the need to supply water from additional sources
- reduced energy and materials being used to treat and supply water and wastewater
- less stress on the water source and the organisms that live there
- less chemicals being produced to treat water
- reduced frequency of sewer overflow events
- healthier drinking water supply
- healthier environment

What can I do?

Water conservation is the conscious act of using less water around our homes and in our everyday lives. Although it is important to conserve water both indoors and outdoors, this section will focus primarily on reducing water use outdoors.

Limiting water use can help prevent untreated water from entering natural water courses and reduce stress on our fresh water resources. The following water conservation tips will help reduce the stress on both the water treatment plants that supply our drinking water and on the wastewater plants that treat our water after we use it.

Lawn

- Avoid watering your lawn in the spring. This will assist your grass in developing a deeper root system to tap into the natural water table, encouraging it to become drought resistant
- Water in early morning (watering in morning lowers the chance of fungal disease)
- Listen to the weather report and water accordingly
- Lawns do not require more than 2-3cm (1in) of water per week
- If you use a sprinkler, a low sprinkler that lays the water down in a flat pattern is much better than an oscillating sprinkler, which can lose as much as 50% of what they disperse through evaporation
- Avoid watering your driveway or sidewalk, make sure your sprinkler is aimed properly and is not leaking
- Avoid cutting your grass too short. Leaving it longer (between 5 and 8cm) allows the blades to provide shade for the roots and requires less watering

Garden

- Use rain water collected in your rain barrel to water plants
- Apply water directly to the base of plants, not the leaves, to lessen water loss through evaporation. Trickle irrigation systems work best for both water conservation and for giving your plants the best drink
- Rethink your yard. Evaluate the areas on your property that you are currently mowing and consider retiring or naturalizing areas that you are not actively using
- Apply mulch. Mulching around plants helps to retain moisture in the soil and protect the roots from drying out on hot summer days

Other

- Use a broom to sweep your driveway/walkway as opposed to hosing it off. You can save 200 litres of water each time, plus you can sneak in a little exercise.
- Wash your car at public car wash. They are equipped to deal with the wastewater. If you must wash your car at home, use a bucket and rag instead of leaving the hose running. Once the car is clean, use the hose to quickly rinse it off. This can save about 300 litres of water each time.

Refer to the reference section for more information about Smart Growth and Watersmart Niagara.

5. Erosion

What is the problem?

Erosion is the gradual wearing away of land surface materials including rocks, sediments, and soils, by water, wind or glaciers. Although erosion is a natural process, humans have accelerated erosion in many areas, including One Mile Creek. Watercourses such as One Mile Creek are dynamic systems; they are constantly moving and changing. Think of a downhill skier. They move side to side in “s” shaped patterns in order to slow and control their movements. Watercourses behave in a similar way. They meander back and forth in an effort to slow and control the energy of moving water.



Flooding of storm drain
Kelly Jamieson, photographer

In an effort to move water off our properties as quickly as possible, watercourses are often deepened and straightened. This is actually counter productive. Flooding occurs from downstream to upstream; speeding up water will actually make flooding worse. In addition, it increases the erosive force of the creek. To add to the problem, the increasing amount of hard or impervious surfaces in the watershed causes rainwater to run off very quickly into the creek. This excess volume of water also increases the erosive force of the water. This is very different from a natural landscape, where much of the rainwater would slowly seep into the soil.

In One Mile Creek the following two main types of erosion are occurring.

- bank erosion
- the transport of eroded materials, such as silt and sediment, from the upstream area of the creek to the downstream area of the creek.

The clearing of vegetation (riparian edges/buffers) from the edges of One Mile Creek is one of the most common problems contributing to erosion in the system.

There are a number of factors that can contribute to the erosion potential of your property. The following are some of these factors:



Soil type

Different soil types have different erosion rates. Generally, soils that have greater infiltration capabilities (larger spaces to allow water to easily seep in, such as sand and loam textured soils) are less likely to erode. Soils that do not allow as much infiltration such as clay and silt are more likely to erode.

Bank erosion

Other factors that contribute to soil erodibility include, the amount of organic matter in the soil structure and compaction. Increased levels of organic matter and/or better soil structure usually result in better infiltration and less erosion. In contrast, heavily compacted soils do not allow much infiltration and are much more susceptible to erosion.

Slope

In general, the steeper the slope, the more likely it is to erode. In addition, the longer the slope is, the more susceptible it will be to soil erosion.

Vegetation

If natural vegetation has been cleared from the creek edge, the ground will be more likely to erode. The roots of mature trees, shrubs and grasses will help to stabilize



Cleared bank

the slope and prevent erosion. However, trees that create dense shade, including Norway Maple and Manitoba Maple, can sometimes prevent the growth of understorey vegetation, such as shrubs, grasses and wildflowers. This results in a lack of root structure to hold the soil in place. Generally it is best to have a good mixture of wildflowers, grasses, shrubs and trees with more open canopies.

Hardened creek edges

Hardened creek edges such as retaining walls, concrete, gabion baskets, rip rap, etc will likely cause increased erosion downstream. Hard surfaces will speed up the rate at which water moves through the channel, increasing its erosive force.



Kerry Royer, photographer

Rainfall and runoff

Runoff is the water from rain, snow or hail that moves over the land, instead of soaking into the ground. In a natural environment, there is much less surface runoff because much of the water is absorbed into the ground. During a rain storm, the intensity of the rain drops hitting the ground can cause soil erosion. Rain tends to move lighter soil types, such as very fine sand, silt, clay and organic matter. Generally, a short, high intensity storm will cause the most severe erosion. If the rain is falling quicker than it is being absorbed, the result will be water running to the creek or nearest storm drain. As the water rushes over the landscape, it will pick up soil particles and carry them to the creek.



Debris in flooded creek
Kerry Royer, photographer



Creek flooding

Why should I care?

Erosion problems are common for people living near water. As mentioned, some erosion is naturally occurring. Most problematic erosion problems are caused by well intentioned landowners who are trying to solve a perceived problem. Even small creeks like One Mile can become very powerful after a heavy rain. Erosion of the creek bank can cause the loss of land over time, decreasing property values and land productivity. The most susceptible part of the creek for erosion concerns is where the water meets the land (riparian zone). This is the area that causes most concern for landowners and is the area most often fiddled with.

Erosion compromises water quality because it causes sedimentation in the creek. When sediment enters the creek it can cause a number of problems, including clogging of fish gills, suffocation of fish eggs, destruction of the habitat of bottom dwelling organisms such as crayfish and insects. The silt and sediment that enters the creek from runoff or erosion can increase the cost of water treatment, decrease the aesthetic quality of the creek (cause unpleasant odours) and change the structure of the creek bed (can fill it in and make the creek shallower).

The main benefits of controlling erosion include:

- improved habitat
- improved water quality
- reduced silt/sediment in the creek
- increased floodplain holding capacity
- reduced threats to aquatic life

What can I do?

Prevention of erosion causing problems is the first step. The easiest and simplest way to prevent erosion is to maintain a riparian buffer of natural vegetation such as trees, shrubs, wildflowers and grasses. The trees, shrubs, flowers and grasses that naturally



Excellent riparian buffer
Jocelyn Baker, photographer

grow along the bank of One Mile Creek are vital to the stability of the bank and the health of the watercourse. Turf grass (lawn) is not naturally occurring and offers very little erosion protection. If every person living along the creek maintained a riparian buffer, this would go a long way to improving the sedimentation and water quality of the creek.

Property owners have the right to protect their land from erosion. In many cases

landowners magnify their erosion problems by undertaking activities that are not properly understood or designed. Avoid building or adding weight close to the edge of the creek, as the extra weight can cause the bank to slump and erode more quickly. This includes heavy machinery or any type of large equipment (lawn mowers for example).

Ask for help, the Conservation Authority has programs to assist landowners with erosion concerns.

Locally, the NPCA regulates One Mile Creek. Any proposed floodplain or in-stream work or construction must be approved in advance by the NPCA, the municipality and possible additional agencies. We recommend you consult the NPCA anytime you are planning to work in or around One Mile Creek.

If your erosion problems are mild and you have a gentle slope leading to the creek, it may be adequate to plant some fast-growing trees and shrubs along the edge to establish a riparian buffer to prevent further erosion.

The following tips can assist in preventing and controlling erosion along One Mile Creek:

Plant/maintain a riparian buffer

As mentioned, planting along the creek edge is the simplest and most cost-effective way of preventing and correcting erosion problems. Plant material can range from seeds to potted stock. For more information about planting along the edge of the creek, see “Riparian Buffers” on page 37 of this guide.



Before riparian buffer project



After riparian buffer project



Cardinal Flower
Kerry Royer, photographer

Choose native

Always try to use plants that are native to the Niagara Peninsula. Native plants are the species that have evolved through thousands of years of changing geological and ecological conditions. More specifically, native plants are those that were growing naturally in the area before humans introduced plants from distant places.

In pre-settlement Niagara, native plants typically grew in communities with species adapted to similar soil, moisture and weather conditions. Some of the widespread vegetative communities would have included deciduous swamps, deciduous forests, fingers of prairie/meadow complexes, and freshwater marshes. Additional communities occupied specialized niches, including savannahs, fens, bogs and alvar areas. The vegetative communities that currently exist are representative of what would have existed historically on a much broader scale. For example, the clay plains south of the Niagara Escarpment would have been dominated by slough forests (wet forests). These communities still exist today; there are just less of them. The



Great Horned Owl

natural evolution of native plants makes them ideal for use in local climate and environmental conditions. Adapted to deal with local insects and diseases, they get all the nutrients they need from the soil. They can be easily incorporated into your landscaping to reduce mowing and improve water quality. They also provide food and breeding areas for many species of birds, butterflies and desirable insects. Native plants normally do not require extra watering and thrive without the application of pesticides and fertilizers.

Native floodplain trees, shrubs, wildflowers and grasses are great for stabilizing stream banks because they have extensive root systems which can secure soil and bank material in place. Willows and dogwoods are among the most useful for quick establishment along riparian zones because of their high growth rate and low maintenance requirements.

Bioengineering

Bioengineering is the technique of using live plant materials in the place of hard engineering structures to control erosion problems and unstable slopes. The great part about bioengineering is that not only are you helping to stabilize the slope and reduce erosion, you are also creating a riparian buffer at the same time. One of the basic tools of bioengineering is the live stake. A live stake is basically a pointed cutting from a live native tree or shrub (willows, poplars and dogwoods are common donors of live stakes). The stakes are inserted into the ground, with the cut side down. Once the stake is in the ground, if there is sufficient water, it will start to root and grow above ground as well. The roots of the stake will form a network that will hold the soil in place. Another function of the root system is to remove moisture from the bank. This will help to stabilize it and make it less likely to erode. Live stakes are generally used in situations where there is mild erosion.



Bank bioengineering

Live stakes should be collected from more than one plant to get a wider genetic variety of plants. Cutting the bottom part of the stakes on an angle will make it easier to pound or drive the stakes into the ground. If you are cutting the bottoms on an angle, cut the top straight across so that you can differentiate the tops from the bottoms later on. Cuttings should be stored in a bucket of water (bottoms in water) for up to ten days before planting them.

Sources of plant material

Sometimes plant material can be “rescued” from a site that is being developed, but be sure to get the permission of the landowner before doing so.

Seeds can be collected from natural areas, but plants should never be taken out of natural areas. Wherever possible, plants should be collected close to the site that you will be planting them and from a site that is similar to yours.

Collection of live stakes should be done when the plants are fully dormant, from a site that is similar in conditions and soil type to yours. It is best to collect them as close to your own site (geographically) as possible. You should never collect plants from someone else’s property without their permission.

Seed your slope

Seeding is an appropriate technique to use if you have only mild erosion problems. It can be used in combination with other techniques outlined below. Seeding is useful for stabilizing a slope until shrubs or trees can become established. All you have to do is choose native grasses and wildflowers that are suitable for a floodplain and ideally you would choose fast-growing species. It is possible that you may have to lay down a straw mulch or biodegradable fabric to hold the seeds to the slope for the first while until they become established and to protect them from being eaten by birds and wildlife. It will also be necessary to water the seeds for the first several months until the plants become self-sufficient.

Seeding can be done either by scattering the seeds by hand uniformly or by digging small holes and placing several seeds in the same hole. It is best to seed during a dryer time of the year otherwise your seeds may wash away into the creek when it rains.

Refer to the reference section for information about the NPCA’s A Guide to Celebrate Niagara Peninsula’s Native Plants and the NPCA’s Restoration Program.



Before bioengineering
Rob Diermair, photographer



After bioengineering
Rob Diermair, photographer

How To Improve Habitat Quality

Creating wildlife habitat is a great thing to do, especially in the One Mile Creek watershed, where there are few habitat areas left. As natural areas disappear, it becomes increasingly necessary to look at our own landscapes as a refuge for biodiversity. Native organisms including plants, mammals, birds, amphibians and insects create an intricate web of life. This is a wonderful natural orchestration with each species' life cycle highly dependent on the others.



Swamp Milkweed

For example, spring wildflowers are pollinated by and provide nectar to tiny flies. These flies become food for early spring birds. The timing is orchestrated perfectly. It is not a coincidence that the local native plants have seeds and berries ready just when the birds need them. Bird droppings are the best way for plants to get their seed dispersed. Plants and animals that have evolved together depend upon each other for survival.

Unfortunately, native plants, a vital part of the natural web of life, are being lost at an alarming rate. Removing a certain native plant from the landscape will likely remove the insects that feed on that plant, which in turn may eradicate the bird that feeds on that insect. And this is just a simplified example. The loss of a species can quickly escalate to affect an entire ecosystem.

There are real and practical pay-offs to encouraging a more biologically diverse landscape. Healthy, balanced ecosystems clean our water and our air. Pollinators are vital to food production, especially fruit grown in Niagara.



Beneficial insect

There are also other profound reasons for using native plants in our yards. Aesthetically and spiritually, native plants enhance our sense of place. Native plants are one of the most visible elements in the local landscape. They are part of what makes a region unique. Learning about and growing native plants promotes a deeper understanding and respect for the land.

Species diversity is key in Niagara, where well over 2,200 species of plants and animals live. Unfortunately, nearly 10% of these species are considered to be rare or at risk due to habitat loss, urban sprawl, invasive species competition, pollution and climate change. Every year, over 150 species of plants and animals become extinct globally.

The Niagara Peninsula falls within the Carolinian Vegetation Zone of Canada, which encompasses most of Southern Ontario. The line delineating the Carolinian Vegetation



Native plant workshop

Zone from the Great Lakes – St. Lawrence in Ontario, starts at York County, runs west across the north shore of Lake Ontario to Cambridge and then crosses to Grand Bend. This area is unique because of the climate, soils and vegetation found here. The Carolinian vegetation zone in Canada also contains over 30% of Canada's rare, threatened and endangered species and over 60% of Ontario's rare species. This small region accounts for approximately 1% of Canada's land area, but is home to 25% of the Canadian population.



Paw Paw Tree
Robert Ritchie, photographer

Another reason to provide habitat for wildlife in the Niagara Region is the increasing number of Species at Risk. Species at Risk are designated federally by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and provincially by the Ontario Ministry of Natural Resources (OMNR). The Canada Species at Risk Act was passed in 2003, followed by the Ontario Species at Risk Act in 2007, to help protect and restore our native species at risk from extirpation or extinction.

If you want to play a role in helping to improve or create habitat for species at risk or for any of the other native plants and wildlife in Niagara, all you have to do is start by following the simple tips outlined below.

1. Riparian Buffers

What is the problem?

The word riparian comes from the Latin word "ripa", which means bank. The riparian area is the area of land adjacent to a waterway, including streams, creeks, rivers or lakes. A **riparian buffer** is a strip of land along the edge of a watercourse that is left in a natural state. Too often riparian areas are cleared of vegetation, and usually maintained in turf grass. Turf grass provides no habitat value, does little to protect against erosion and delivers chemicals and sediment directly to the water by acting as a "green concrete". Healthy riparian buffers include native trees, shrubs, grasses and wildflowers.

In Niagara, most riparian buffer habitat has been eliminated through urbanization and agriculture. If every landowner protected or improved one small piece of riparian buffer on their property, these small changes would make a big difference in improving local water quality in One Mile Creek.



Before bank stabilization project



After bank stabilization project

Why should I care?

Buffers are complex ecosystems that provide water quality and habitat protection. Buffers can help control flooding, prevent erosion, improve water clarity and provide shade and cooler water temperatures for fish and other creatures, such as turtles and frogs.

“Riparian buffers are the single most effective protection for our water resources”

Buffers prevent erosion

The roots of turf grass are typically only a few centimetres deep and therefore they provide little protection for the soil. Buffers prevent erosion because the deep root systems of the vegetation help to hold soil. In addition, riparian vegetation such as trees and shrubs can help protect the bank of the stream from the force of falling rain, sleet and hail. Riparian areas also slow the velocity of water running into and through the creek during a storm event; this will reduce the erosive force of creek flows.

Buffers act as natural filters

A natural riparian buffer of trees, grasses, shrubs and wildflowers, removes sediment and pollution before they reach One



Naturalized bank protection

Mile Creek. A good buffer can improve water quality by over 30%. They can help to transform phosphorus and nitrogen from fertilizers and animal waste into less harmful forms, reducing algae blooms and odour problems.

Buffers alleviate flooding and regulate stream flow

Buffers can improve flooding, because they slow the velocity of surface runoff. When runoff is slowed, more water is allowed to infiltrate the soil and recharge the groundwater supply. The water will then travel slowly through an intricate underground network of soil, rocks and roots before eventually reaching the stream. Buffers can therefore help to maintain baseflow in One Mile Creek, even during the driest periods of the year.

Forested buffers provide shade, cooler water temperatures and much more

Forested or treed buffers help improve water quality because they provide shade, which helps keep the water cooler and improves dissolved oxygen levels. This is important for fish and other aquatic organisms. In addition, the leaves and woody debris that fall into the stream from the trees will help to provide food and shelter for many aquatic creatures that sustain the food web in One Mile Creek.



Before buffer naturalization
Kelly Jamieson, photographer



After buffer naturalization
Kelly Jamieson, photographer

Buffers provide habitat for native wildlife

Creating a riparian buffer is a great way to improve wildlife habitat. There are a number of plant and animal species that rely on the unique habitat features of the riparian area. If connected, riparian areas can provide travel corridors for wildlife.

Even dead trees are important. When trees fall into the creek they can help prevent erosion of the bank. Standing dead trees also provide nesting areas for birds and other



Monarch Caterpillar on Butterfly Milkweed
Alison Thomson, photographer

wildlife. Native trees, shrubs, grasses and wildflowers are the plants that wildlife, including songbirds and butterflies, prefer. Many butterfly species such as the Monarch, have a specific plant that they lay their eggs on. For the Monarch, it is milkweed plants. Having known butterfly host plants present in your buffer is a great way to attract specific species to your property.



Niagara Parkway Buffer Project
Deanna Lindblad, photographer

Buffers can reduce the amount of mosquitoes and Canada Geese

Buffers help reduce the amount of mosquitoes because they create a habitat for mosquito predators such as bats and dragonflies. Buffers can also prevent Canada Geese from accessing your property, because the Geese do not like to walk through tall vegetation.

Naturalizing can save you time and money

A buffer does not require mowing and generally requires little to no maintenance. Natural areas require no watering or chemicals to keep them healthy and free of pests. The native flora of Niagara is well adapted to our local climate, soils, pests and diseases.

What can I do?

Creating a buffer along One Mile Creek can be as easy as retiring some of the areas that you would normally maintain. Manicured lawns and gardens provide few water quality and habitat improvement opportunities. If you have an existing riparian buffer, you should protect it. If you don't have one, it can be easily created and will offer many benefits. Once you create a natural buffer, you will be amazed at the increase in wildlife using your property, including songbirds, butterflies and other attractive animals.

The following is a list of recommended guidelines that can help establish or improve your riparian buffers.



Enjoy a low maintenance yard

Stop mowing

A simple way to ease into creating your buffer along One Mile Creek is to avoid maintaining a turf grass lawn next to the creek's edge. Stop mowing and let the grass grow. In the first season, the unmowed area may look a little "messy", but over the next several seasons you will begin to see different species of wildflowers, grasses, shrubs and trees sprouting up along the creek. Be aware of what species are native to the area and which ones are potentially invasive and should be removed.

Prune trees and shrubs to open views instead of cutting them down

Many people cut down trees and shrubs to open their view of the creek. Proper pruning or "windowing" may provide a good view of the creek without compromising the water quality or the stability of the bank from tree removal. Creating "windows" to the creek can be as simple as removing specific branches that obstruct your most

desired viewing locations. Pruning should be limited to early spring and late fall. Remember that a professional tree service should be consulted if you are unsure of the proper techniques. Improper pruning techniques can be fatal to your tree.

Plant it up!

Planting a variety of native trees, shrubs, wildflowers, and grasses is the best way to increase the ability of your buffer to do great things! The more species you plant, the better the buffering capacity of your riparian area. Always try to use plants that are native to the Niagara Peninsula. Native plants do not require extra watering and thrive without the application of pesticides and fertilizers. Adapted to deal with local insects and diseases, they get all their nutrients from the existing soil. Native plants will also provide an abundant food supply for local wildlife, including birds, small mammals and insects. These species have evolved together and therefore native plants are their preferred food.

Planting in Niagara can start from early May until mid to late October. Spring planting is best when the soil is moist, but not saturated. Fall planting can be very successful when using hardy plant stock and when plants have a few weeks to establish before the first frost. However, it is not recommended that you plant in a floodplain in the fall.



Nut Hatch
Paul Philip, photographer

Although native plants are well adapted to local climate conditions, they will require watering for the first 3-4 weeks after planting. Deep, infrequent watering is best. Allow the soil to dry out between watering as this will encourage deep root growth. Unless the plants have been planted in the wrong soil type, they will not require fertilizing. Many environmentally friendly alternatives do exist if fertilizing is needed. Some weeding may also be required until the plants become established.

A list of suitable plants for different soil types, sun exposure and moisture levels can be found in the NPCA's "Guide to Celebrate Niagara Peninsula's Native Plants".



Riparian buffer project
Photo provided by Linda Buschman

Protect young trees and shrubs

Whether your young trees and shrubs are newly planted or naturally sprouting, deer, rodents and rabbits can be a challenge. Young trees and shrubs should be protected for at least three years after planting. Trees and shrubs can be protected with a wrap around plastic spiral, wire mesh or plastic tree shelter. Young trees and shrubs can be staked or flagged to make them more visible and therefore easier to find when you are watering and maintaining them.



Excellent riparian buffer
Jocelyn Baker, photographer

How wide does my buffer have to be?

When it comes to buffers, there is no one answer to this question. Generally, the more species of trees, shrubs, grasses and wildflowers it contains, and the bigger it is, the better the buffering ability will be. A minimum width of 5 metres is generally suggested, however in an urban area, any size buffer will be beneficial for the creek.

Where To Get Native Plants

Plant material that originates in and is native to your geographic region is the best to use. In general, the more closely you match the environmental conditions of the source of your plant material to that of the planting site, the better it will grow. An all-important concern today is the preservation not only of diversity of species, but also of the genetic diversity within each species. A native species varies genetically in its adaptation to the particular localities and environmental conditions under which it grows. This results in a number of ecotypes of the same species (i.e. Brown-eyed Susan). You can help preserve the local ecotypes in your area by using them in your landscaping.

Where to Buy:

Plants should be bought from reputable nurseries. A list of nurseries carrying native plants can be obtained from the NPCA.

General Considerations:

- Order plants by scientific name to ensure native species.
- Ask the nursery about the source of their plant material. Does it originate within your ecoregion?
- Ask for seedling stock, not clonal stock, cultivars or horticulturally enhanced plants. Clonal stock, cultivars and horticulturally enhanced varieties lack genetic variation. They are usually selected for bigger, showier flowers or more sturdy stems and this goal of aesthetic uniformity is at the expense of genetic diversity.
- Beware of plant material dug from the wild or plants which are “nursery grown” in pots after being dug from the wild. Plants should instead be “nursery propagated” from seed or cuttings, not collected from the wild.

- Ensure plants are not endangered, threatened or subject to a recovery plan.
- Always try to use plants native to the Niagara Peninsula, or native to where they are to be planted. For trees, seed zones have been developed. For Niagara ask for seed from EcoDistrict 37 (7E-3 and 7E5). For other plants (shrubs, herbaceous and aquatic plants) as a general rule plant material should be sourced (seeds should have been collected) within 100 km of where it will be planted.
- Advance ordering (fall and winter) will ensure you get the appropriate stock and volumes you require.

Seed collection:

When collecting seeds, collect from many individual plants from within the same ecotype of each species (rather than taking seeds only from the biggest plant, for example) and do not take all the seeds from any plant. This will help preserve and increase the genetic variation of the population. Also, be sure to get permission for seed collecting; it is not allowed in some natural areas (for example, Conservation Areas).

Seed zones — What are they?

Planting the right tree seed in the right seed zone is critical to tree species growth success and survival. The appropriate seed varies from area to area and is dependent on many things, such as geographic location, soil conditions and temperature. You can determine what tree species are best suited for your seed zone by visiting the Forest Gene Conservation Association website (refer to the reference section for website information).

2. Creek Alterations

What is the problem?

Generally, creek alterations can be characterized by the addition or removal of something from the creek. It is a common belief that we are doing something good for the creek by removing a fallen log. This can actually be doing harm by removing the shelter of fish or other aquatic life. When we add bridges, retaining walls or other hard structures along the creek, we can be contributing to downstream flooding, decreasing habitat and destroying the natural balance of the One Mile Creek ecosystem.

Alterations to creek banks or the stream bed can cause serious complications. Some common alterations include:

- hardening of creek edges with retaining walls, riprap (rock armour, rubble) or other structures
- dredging of the creek bed
- cutting down existing vegetation on the creek edge

Flooding is a natural part of any watershed and is to be expected by anyone who lives near water. There are certain times of the year, usually in the early spring and early fall, when there is much more water in the watercourses. This is typically when we get the normal flooding events. In the spring much of the flooding is due to the melting snow. When snow melts slowly, the water seeps into the ground causing the soil to be saturated. Eventually the soil can't hold anymore water and it runs into nearby streams and creeks.



Hardened creek edges

In urban areas such as the One Mile Creek watershed, alterations to the creek, including building of culverts, straightening of the creek, removal of riparian vegetation, increased impervious surfaces around the creek, soil compaction and dredging are common. As a result of these alterations, flooding events happen more often. This is typically referred to as “nuisance flooding” in urban areas. Alterations lead to an increased volume of water in the creek during storm events and causes water to move quickly (flash flooding) through the system, reducing infiltration.

Why should I care?

There are many benefits associated with avoiding creek alterations and reducing hard structures in and around One Mile Creek.



Happy frog

Improved in-stream habitat for aquatic organisms

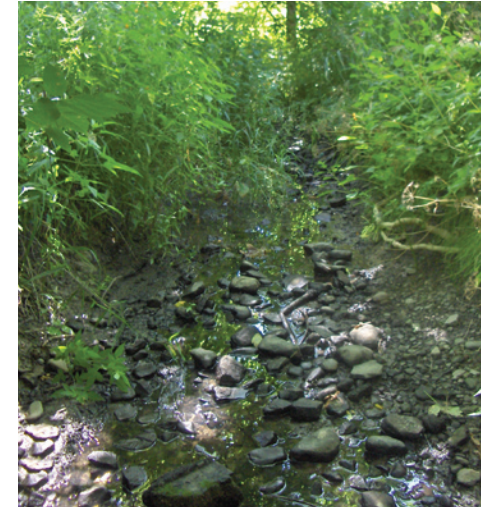
Creek alterations disrupt the creek bed and will affect the aquatic organisms that rely on the unique structure of the creek bed. Aquatic habitat such as riffles, pools, bars and runs will be improved or allowed to develop when there is little or no disturbance to the natural channel features of the stream.

Improved baseflow

Baseflow can be improved when water is not carried away as quickly as it would be if the creek was dredged. Water flow is slowed by the complexities in the creek bed. Water slowly moves over the debris and riffles in the creek instead of rushing through a smooth surface. Improved baseflow results in less flooding and ponding because there is natural creek flow and velocity, even during a large storm event.



Healthy stream



In-stream habitat
Kelly Jamieson, photographer



Natural meander
Kelly Jamieson, photographer

More infiltration

When the creek has a natural creek bed, there is improved infiltration. Water is allowed to move slowly through the creek and is able to soak into the ground. Infiltration helps to provide baseflow.

Reduced flooding

When the water in the creek is slowed down with the natural meander (pool-riffle sequence) and in-stream debris (rocks, wood), the stream will be able to act naturally by removing excess sediment and directing flood waters towards the lake, without causing increased erosion and sedimentation.

What can I do?

The first step to ensuring that the creek stays healthy and can provide habitat for all the living and non-living things that depend on it, is to leave it alone.



Excellent riparian habitat

If it's natural, leave it

Human caused barriers or channel obstructions can cause upstream ponding of water (during low and/or high flow conditions). Preventing and eliminating these obstructions enables flows to ‘work,’ with respect to moving sediment and maintaining natural channel features, such as riffles and pools. Human imposed obstructions in the creek are different than natural barriers. Natural barriers might include branches, rocks or fallen trees and

provide important habitat sources for aquatic organisms, which in turn provide food sources for fish and larger organisms. In most situations, flow will redirect itself around natural features and they should not be removed. If you are unsure or concerned about a barrier please contact the NPCA.

3. Aquatic Habitat

What is the problem?

One Mile Creek is home to numerous aquatic species, including several fish species. White sucker, several minnow species including fathead minnow and creek chub, and many types of benthic macro invertebrates (bottom dwelling insects such as mayflies) live here. Fish and other aquatic life need healthy places to live, feed and reproduce. The places that provide food and shelter for fish during all their different life stages are called “fish habitat”. Habitat and food requirements can change as a fish progresses through its life cycle, from egg to adult. If there is a threat to just one aspect of its requirements for one life stage, populations could become at risk. Creek alterations



Ruby Spot Damselfly
Alison Thomson, photographer

such as hardened banks and dredging are common occurrences in One Mile Creek. Creek alterations affect the area where they occur and will have downstream impacts, such as the disturbance of aquatic habitat and their associated species. For example, dragonflies have several life cycle stages (similar to butterflies). The first stage is aquatic. Dragonflies live as juveniles in the wetted banks of creeks and streams. If bank alterations occur, their populations will decline. Dragonflies are a very desirable species as they are stunning to look at and

they eat large quantities of mosquitoes during their aquatic and terrestrial life stages. Along with damselflies they are also a popular food choice for many fish and birds, making them a key component of a healthy aquatic and terrestrial ecosystem.

Fish and fish habitat are federally protected by the Department of Fisheries and Oceans Canada (DFO) under the Fisheries Act. Under this Act, no one is allowed to carry out any work that may result in the Harmful Alteration, Disruption or Destruction (HADD) of fish habitat, unless authorized by the Minister of Fisheries and Oceans Canada. The Conservation Authority acts as an agent on behalf on DFO and can be contacted for additional information.

Existing conditions

Water quality in One Mile Creek is a moderately degraded, warm water system supporting marginal fish habitat. The creek is generally intermittent in nature (can dry up in summer) and provides supporting habitat to fish communities downstream. This type of fish habitat is generally too small to support “fishable” populations, but may



Landsdowne Pond
Kelly Jamieson, photographer



Barrier beach blocked
Rob Diermair, photographer



Barrier beach open
Rob Diermair, photographer

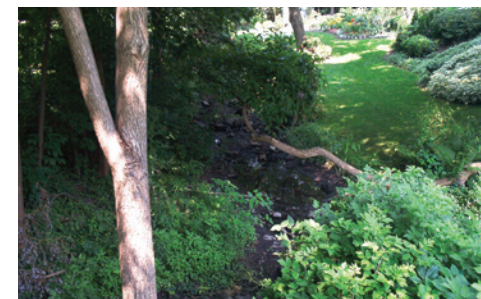
provide permanent or seasonal habitat for a variety of small minnows. Landsdowne Pond is considered to be an important link to Lake Ontario fish populations, since it offers potential nursery habitat for Lake Ontario resident species, such as white suckers. Landsdowne Pond is often partially obstructed from Lake Ontario by its dynamic barrier beach; therefore the relationship between the Pond and Lake Ontario has not been fully understood.

The following provides a brief description of the different fish habitat zones in One Mile Creek:



Zone 1 - Upstream One Mile Creek

Zone 1: Upstream of King Street. There are no known fish in this zone due to the lack of baseflow. However, this zone supplies a source of water to support fish habitats downstream, including frogs and turtles. In this area, the watercourse has been extensively modified, straightened and/or enlarged. Flows are generally insufficient to maintain a defined channel.



Zone 2 - Mid-section One Mile Creek

Zone 2: Downstream of King Street. This zone provides some habitat that may support a moderately tolerant warm water fish community, typically including species such as white sucker, fathead minnow and creek chub. A defined channel exists, however it has been extensively modified through urban landscaping. Numerous

small in-stream obstructions occur within the channel, including road culverts, which can create backwater effects. In some locations where the stream appears in a more natural state, it lacks in-stream habitat diversity, in particular refuge pools and riffle features.

Zone 3: Below Nassau Street including Landsdowne Pond. This zone is characterized by natural morphology with coarser substrates than Zone 2, and a meandering pattern and some pool/riffle development. The channel is unstable and eroding in some areas. There are some partial barriers to fish movement, channel instability and combined with lack of baseflow, may restrict fish to isolated reaches of the stream.



Zone 3 Downstream One Mile Creek

Landsdowne Pond offers potential habitat to a wider variety of warm water fish, including species such as pumpkinseed, sunfish and bass. However, both nursery and adult habitats are limited because of inadequate, open-water. It provides important aquatic habitat for other species such as frogs, turtles and salamanders. The pond has filled in with sediment over time, becoming more characteristic of an emergent wetland.

Why should I care?

Without fish habitat there will be no fish! Fish are important to the One Mile Creek ecosystem. They contribute to biodiversity, are an important part of the food web and are highly valued by humans for both cultural and recreational reasons. All living things in One Mile Creek are valuable parts of the ecosystem. We will never truly understand how closely linked different elements of a food web or an ecosystem really are.



Healthy riparian

Some would argue that although not all organisms have an “economic value”, they all have intrinsic value – that it has value in itself or for its own sake. Just because an organism isn’t valuable to humans, doesn’t mean that it is not valuable to the ecosystem or to other things that we do value. For example, the small insects that live in the stream may not be noticed by the average person, but they are the main food source for many of the fish that are important to us.



Improving in-stream habitat can also help to reduce stagnant conditions, by improving oxygen levels in the water, and slow the speed and direction of flow. Fish habitat includes a healthy riparian area to help shade the stream and filter pollutants. This habitat will help to reduce erosion, improve habitat outside of the creek and will slow runoff entering the creek, allowing for infiltration and removal of harmful pollutants. When the creek is healthy, so are the things that live in and around it.

What can I do?

We all play a role in improving fish habitat in One Mile Creek. Planting native aquatic vegetation in and along the creek can help to slow the erosive forces of water flows. In-stream vegetation also provides shelter for aquatic life and will help to shade the stream during hot summer months, improving oxygen levels in the water.



In-stream barrier
Rob Diermair, photographer

The following is a list of recommended guidelines that can help improve fish habitat.

Let the water flow

Do not attempt to slow the flow of water by damming the creek. Obstructions can hinder fish passage and migration. Working in the stream and interfering with water flow requires permits and authorizations from the NPCA.

Leave natural vegetation alone

A buffer is one of the easiest and most beneficial ways to improve the water quality of One Mile Creek. In addition, vegetation provides shade which keeps the water temperature cool during hot summer days. Riparian vegetation can also help to reduce erosion and thus cause less sediment in the creek.

The following are some examples of the native aquatic plants that are appropriate for riparian buffers and will do well in One Mile Creek. Refer to the NPCA's Guide to Celebrate Niagara Peninsula's Native Plants for a comprehensive list:



Natural vegetation

- Sweet Flag (*Acorus americanus*)
- Water Arum (*Calla palustris*)
- Blue Flag Iris (*Iris versicolor*)
- Yellow Pond Lily (*Nuphar advena*)
- White Water Lily (*Nymphaea odorata*)
- Pickerelweed (*Pontedaria cordata*)
- Arrowhead or Wapato (*Sagittaria latifolia*)
- Large-fruited Burreed (*Sparganium eurycarpum*)
- Fox Sedge (*Carex vulpinoidea*)
- Hop Sedge (*Carex lupulina*)
- Porcupine Sedge (*Carex hystericina*)
- Hard-stem Bulrush (*Scirpus acutus*)

Be careful when working near water

Operating small or heavy equipment near the edge of the creek can cause damage to the bank, as well as to fish habitat. Remember that you must obtain a permit for in-stream work from the NPCA.

Keep All-Terrain-Vehicles (ATVs) out of the creek

Do not cross the creek with ATVs or other motorized vehicles. Crossing a stream with an ATV can cause serious damage to the bed morphology and to fish habitat. Tire ruts can cause erosion problems and blockages to fish migration.



Tire ruts and bank erosion

Do not allow chemicals, garbage and other pollutants to enter the creek

Household chemicals, including herbicides, fertilizers, detergents, waste oil and gasoline are extremely harmful to fish and other aquatic life. Litter can also be detrimental to water quality and fish habitat. Remove any garbage or litter in and around the creek. Secure recycling and garbage receptacles on collection day.



Habitat restoration projects

Habitat creation or enhancement projects can involve the creation of riffles, pools and other in-stream habitat features. Consultation with a professional is recommended for this type of work. If you are interested in undertaking a habitat project on your property, contact the NPCA.

4. Invasive Species

What is the problem?

Invasive species (exotic or alien invaders) are species which have been introduced to an area where they would not naturally occur. This introduction is most often by people linked to activities such as landscaping, shipping, trade and commerce. Once a species is introduced, they typically grow out of control. This is mainly because they rarely have natural predators, therefore, there is no natural control of the species.

This becomes a problem for the natural, native species because they are often unable to compete with the invasive species for food and habitat. Invasive species are able to displace native populations (such as shrubs, trees, herbaceous plants, fish and other wildlife).

Introduced species through activities such as gardening, can become an invasive species by escaping from the environment they where introduced to. Norway Maple and Periwinkle are excellent examples. Both species were introduced from Europe. Norway Maple is a popular boulevard tree used in landscaping. It develops leaves a few weeks earlier than most native trees in the spring, providing early foliage which is very desirable (for people). Periwinkle provides a quick and easily established groundcover, used as borders in gardens.



Periwinkle invading creek bottom
Kerry Royer, photographer



Periwinkle invading creek bottom

Both species have escaped from there original uses into the natural environments. Norway Maple can now be found in many forested areas in Niagara. Norway Maples leaf out faster than other Niagara native trees, shrubs and understory herbaceous plants and they can shade out the more desirable woodland species such as Trilliums and Jack-in-the-pulpit. Periwinkle is creating dense monocultures and can be seen dominating entire areas. When a diverse plant community is replaced by a single species, it represents a significant loss of habitat for local wildlife. Many types of insects and birds rely on a variety of plants to help fulfill their life cycles. When certain species start being out competed and disappear, many associated types of plants and animals will also disappear. We are all connected.

The following section provides a list of common invasive plants found in Niagara.

Trees		
Norway Maple (Acer platanoides)	Black Alder (Alnus glutinosa)	Scots/Scotch Pine (Pinus sylvestris)
Manitoba Maple (Acer negundo)	European Alder (Alnus glutinosa)	Glossy Buckthorn (Rhamnus frangula)
Manitoba Maple (Acer nigundo)	European Birch (Betula pendula)	Black Locust (Robinia pseudoacacia)
Horse Chestnut (Aesculus hippocstanum)	White Mulberry (Morus alba)	European Mountain Ash (Sorbus aucuparia)
Shrubs, ground covers and vines		
Goutweed (Aegopodium podagraria)	European Privet (Ligustrum sinense)	Japanese Knotwood (Polygonum cuspidatum)
Japanese Barberry (Berberis thunbergii)	Japanese Honeysuckle (Lonicera japonica)	Common Buckthorn (Rhamnus cathartica)
Oriental Bittersweet (Celastrus orbiculatus)	Amur Honeysuckle (Lonicera maackii)	Multi-flowered Rose (Rosa multiflora)
Crown Vetch (Coronilla varia)	Morrow's Honeysuckle (Lonicera morrowi)	European Highbush Cranberry (Viburnum opulus)
Autumn Olive (Elaeagnus umbellate)	Tartarian Honeysuckle (Lonicera tatarica)	Periwinkle (Vinca minor)
English Ivy (Hedera helix)	European Fly Honeysuckle (Lonicera xylosteum)	
Aquatic Plants		
Flowering Rush (Butomus umbellatus)	Yellow Flag Iris (Iris pseudoacorus)	Floating Heart (Nymphoides peltatum)
Fanwort (Cambomba caroliniana)	Purple Loosestrife (Lythrum salicaria)	Reed Canary Grass (Phalaris arundinacea)
Rough Mana Grass (Glyceria maxima)	Eurasian Water Milfoil (Myriophyllum spicatum)	Common Reed (Phragmites communis)
European Frog-bit (Hydrocharis morsus-ranae)		Curly Pondweed (Potamogeton crispus)

Refer to reference section for more information about Ontario's Invasive Species.



Giant Hogweed, One Mile Creek prominent invader
Kelly Jamieson, photographer

Why should I care?

Invasive species are a threat to all living things on Earth. In Canada, the occurrences of accidental invasive species introductions are increasing, because of global trade and travel. One of the main problems with invasive species is that they can reduce biodiversity in an area. Biodiversity, or the variety of living things, is important because each species performs a function that contributes to the overall health of the ecosystem, which does not preclude humans.

The benefits of controlling invasives include:

- improved aesthetic and habitat value for your property
- increased space for native vegetation to grow
- improved aesthetic quality of One Mile Creek
- increased native food sources available for wildlife
- increasing and protecting biodiversity in the Niagara Peninsula

Understanding the enemy

What is the difference between a weed and an invasive plant species?

Weeds are simply plants that are unwanted in their current location. The term 'weed' is very subjective as it does not necessarily refer to any specific plants and does not indicate whether a plant actually belongs where it is growing. This is why it is encouraged to refer to plants as either non-invasive or invasive and/or native or introduced/exotic/alien instead of simply just weeds.



Goutweed invading landscape

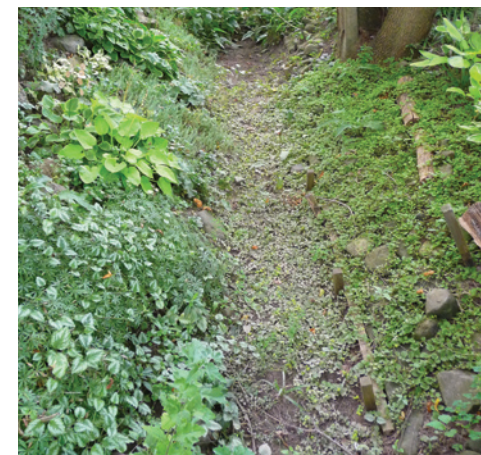
Noxious weeds on the other hand, are designated and controlled under the Ontario Weed Control Act, (Government of Ontario, 2007). Noxious weeds are not defined based on their type, character or effects, but rather by the fact that they are listed in the regulations list administered by Ontario Ministry of Agriculture and Rural Affairs (OMAFRA). It is evident though, that noxious weeds in Ontario are generally those which cause problems for the agricultural community and are mostly

poisonous to livestock, although any plant could be added. The Weed Control Act of Ontario does not distinguish between native or introduced species.

Under the Act, local or municipal governments are given the power to list additional species as noxious, conditional on the approval of the Minister of OMAFRA. The Minister of OMAFRA can also add species to the noxious weeds list for the province or a portion of it, which is then approved by the Lieutenant-Governor in Council. The Act applies to any lands or habitat which harbour listed noxious weeds with the potential to spread to farmland or land used for horticultural purposes.

In Ontario, noxious weeds that are far enough away from any land used for agricultural or horticultural purposes and do not interfere with these land uses are exempt from the Act (Government of Ontario, 2007).

However, this exemption is at the discretion of the weed inspectors. Landowners are responsible for the destruction of noxious weeds on their property. If noxious weeds are not controlled, a weed inspector can order the destruction of the weeds and if not carried out in a timely manner, will destroy them at the landowner's expense. Even so, an order to destroy weeds can be appealed by the landowner.



Invasive plants encroaching into creek
Kerry Royer, photographer

What can I do?

The first step to controlling and preventing the spread of invasives is to learn to recognize and identify them. Disturbance is something that often leads to the invasion of exotic species. These species are just waiting for an open patch of soil to invade and take over. Native ground covers should be planted quickly after any disturbance of the soil or construction to ensure that no weeds or invasives move in first. Keeping an eye out for new sprouts of invasives is an effective method of control, because you can pull them out before they become established.

Before you buy plants from a nursery, ask someone whether it can become invasive and where it is native to. Never buy varieties of invasive species. Some of the most common invaders in Niagara are available for purchase at your local garden centre. Examples of these are Periwinkle or Vinca, English Ivy and Norway Maple varieties (e.g. Crimson King). If the plant is identified as providing fast spreading groundcover, it is likely highly competitive and possibly invasive.

Be cautious when trying to control invasives because it is easy to do more harm than good. By controlling one species, you may inadvertently be making the area susceptible to the invasion of another. Research the best control method for the specific species you are trying to eradicate from your property.

The following techniques are the most commonly used for controlling and eradicating invasive plant species.

Pulling

Some species can be controlled by simply pulling them out of the ground. It is best to pull plants in the early spring before they have a chance to produce seeds. It may be necessary to pull the same plant species in an area for several consecutive years in order to completely eradicate it. Be patient! The reason it keeps coming back is because there is a seed source laying dormant in the ground. Pulling is easiest after a rainfall when the soil is moist. It is important to remove as much of the roots as possible.

Boiling water

Boiling water is an effective way of killing some invasives. Cut off the plant above the ground and pour the boiling water at ground level to kill the roots. This process may have to be repeated if the plant grows back, but again, be patient. You are gradually weakening the plant.

Solarization

Solarizing involves smothering plants with black plastic, placed over the desired area. The plastic heats the soil and burns the plants and their roots. Solarizing needs to be done in the hottest part of the summer and where flooding doesn't occur. In order for this technique to work properly, you need to have minimal airflow under the plastic to ensure that it will not cool down the temperature underneath. The plastic can be held in place with heavy pieces of wood, bricks or anything that has some weight. The perimeter of the solarizing plastic should be firmly secured so that the heat is trapped inside, allowing the plants to "bake".



Solarization plots
Kerry Royer, photographer



Solarization plots
Kerry Royer, photographer



Solarization plots before



Solarization plots after
Kerry Royer, photographer

Chemicals

On Earth day 2009 Ontario's cosmetic pesticides ban came into effect, enforced by the Ontario Ministry of the Environment (MOE). The ban was passed by the province of Ontario in order to set out clear guidelines for communities across the province, so that unnecessary exposure to toxic chemicals would be eliminated and public health would be increased.

Although you can no longer use pesticides to keep your lawn and garden weed and pest free, there are many ways to accomplish this without pesticides. One of the ways that you can maintain a healthy lush and weed free lawn is by developing a good root structure for your lawn. Try to water less often (1–2/week) and when you do water

make sure it is to a depth of about 1 inch so that the roots become trained to go deep for moisture and will therefore be able to survive much better during hot and dry spells. Fertilize or leave light grass clippings to naturally release nitrogen back into the ground and aid in the development of the lawn. Overseeding and mowing your lawn higher (7–10cm) will also promote a thicker lawn with deeper roots, which will help discourage weeds from growing and pests from invading.



Chemical spraying along One Mile Creek

Alternatively, you may want to consider converting a portion of your lawn into a wildflower or rain garden. Planting native trees and shrubs on your property, which are better adapted to our local weather conditions, need less maintenance. By planting native species around your property you will also be attracting local birds and beneficial insects, which will help to keep your property free of nuisance insects.

Don't compost invasives!

Never compost invasive plants! You may be helping them spread into another part of your property or someone else's. Carefully place all plant parts in a large garbage bag and put them out on your regular garbage day.

Refer to reference section for more information about Ontario's Pesticide Ban.

5. Wildlife Habitat

What is the problem?

Species diversity is key in Niagara, where well over 2,200 species of plants and animals live. Unfortunately, nearly 10% of these species are considered to be rare or at risk due to habitat loss, urban sprawl, invasive species competition, pollution and climate change. Every year, over 150 species of plants and animals become extinct globally.



Barry Porter, photographer

Too often, urban areas consist of mostly turf grass and non-native boulevard trees. Insects, birds and other wildlife may have to travel for miles before they can find food and shelter. If wildlife can not find appropriate food and shelter they will be forced to leave the area. Eventually these species will become less abundant as their habitat requirements disappear. In many cases, wildlife will become displaced, causing them to become nuisances. In Niagara, the coyote is a good example. As the preferred habitat (woodlots and vegetative corridors) disappears because of urban sprawl and agriculture, this species has been forced to coexist with humans in areas they certainly do not prefer. They have now become targeted as nuisances and threats.



Tom Staton, photographer

Why should I care?

Over 93% of the land in Niagara is privately owned. Governments alone cannot adequately protect and preserve wildlife and their habitats. This is everyone's responsibility. By incorporating natural areas on your property, pollutants are filtered from the surface, erosion is reduced, flooding is slowed and water can keep flowing in our creeks and streams throughout the year. Your efforts to improve and protect local water quality will help protect wildlife populations and species diversity for future generations.

Creating space for wildlife involves setting aside a piece of your property that you wish to contribute towards wildlife habitat. This can include birds, insects, reptiles, amphibians or mammals. This will help to improve the natural spaces in Niagara, where wildlife can take refuge.

The benefits of creating spaces for wildlife in your backyard are numerous, for both you and the wildlife. Once you have created the space, you can sit back and enjoy watching all the creatures that will visit your property on a daily basis. Although we may not think of our little backyard garden as a space for wildlife, we must remember that ecosystems come in many different sizes. Even a small garden, if filled with appropriate species, can be a great contribution to native wildlife.

Imagine a butterfly flying northwards over the peninsula during a long migratory journey. It looks for nourishment, but finds nothing more than acres and acres of manicured lawn or asphalt. Sadly, this scenario is a reality for an increasing number of wildlife species in Niagara. Now imagine that the butterfly can spot a refuge – your naturalized garden. It is able to rest and recharge and continue on its important journey. If every landowner in Niagara created or protected a small natural area on their property, these small changes would add up to make a big difference in protecting the environment.

If you build it, they will come



Bushmann buffer

In the summer of 2007, the NPCA helped Linda and Gunther Bushmann enhance the existing buffer at the edge of their property along the Welland River. The Bushmanns live in an urban area, where most homeowners have cut down the trees to allow for a view of the River. The Bushmanns recognized the value of the existing buffer and wanted to enhance it to provide additional wildlife habitat. The year following the habitat enhancement project, Linda Bushmann wrote the following to the NPCA:

"Since we did the back buffer, we have lots more birds in our backyard, especially in the winter and the spring. Some species we see include: Cardinal, Chickadee, Red-winged Blackbirds, Baltimore Orioles, American Goldfinches, several varieties of sparrows, House Finches, Rose-breasted Grosbeak, Downy Woodpecker, Mourning Doves and a Marsh Hawk. We have seen a family of rabbits — it is incredible to see the rabbits with birds around them. We have also seen a variety of butterflies and have been visited by ducks, including a mother and her babies. We thoroughly enjoy looking out at the buffer — it is everything that we hoped for."



Grey Tree Frog
Tom Staton, photographer



tree falls in the creek, you should talk to the Conservation Authority before removing it. Normally, trees won't cause flooding because they will allow the water to flow underneath them. In some cases, they may redirect water flow and change erosion patterns. If property loss is an issue, then removal or modification may be required, the Conservation Authority can assist with removal.

Connect the dots

Many of the natural areas in Niagara are fragmented (disconnected) as a result of urbanization and land clearing for agriculture. In the One Mile Creek watershed, there



Connecting buffers between neighbours

What can I do?

Creating wildlife habitat on your property can be as simple as not mowing the lawn, building your very own Blue Bird box from scratch or reforesting 5 acres of your land. It's all up to you! Here are a few simple tips for enhancing or creating wildlife habitat on your property.

Variety

A diversity of age, type and size is a great way of attracting many different species. Coniferous trees provide winter shelter for many bird species, while deciduous trees provide shade and habitat during the summer months. Even dead or fallen trees are important habitat for wildlife. If you are concerned that a dead or diseased tree on your property might be a safety hazard, consult a professional arborist for advice. The arborist may be able to prune the tree, leaving some branches for perching rather than cutting the whole tree down. If a



Connected buffers between neighbours
Kelly Jamieson, photographer

are numerous homes, manicured lawns, roads and parking lots, however very few natural areas exist. The natural areas that do exist are often not connected together. One Mile Creek provides a natural linkage opportunity for these areas. If the entire length of the system was vegetated with an appropriate buffer, not only would it provide excellent filtering for water quality, it would also provide a connected habitat corridor for wildlife movement. Keeping the creek well vegetated ensures that there is good cover for wildlife travelling along the edge of the watercourse. Planting between natural areas to connect the dots is a great way of providing a safe travel corridor for wildlife. This may require cooperation between you and your neighbours. Talk to them about connecting some of the natural areas between your properties.

Build a home for wildlife

You do not have to naturalize large portions of your property to provide shelter for wildlife. Many Niagara species, including birds, small mammals and reptiles would use



Backyard wildlife buffer

a simple brush pile for breeding, as well as shelter from the cold and escape from predators. Instead of burning or putting branches out to be collected, consider piling them up in one area of your yard. You can also include logs and rocks in your pile to diversify the habitat. Clay pots turned on their side are great shelter for toads, so consider placing some of them in the middle of your pile. Rocks provide excellent basking spots for amphibians and reptiles.

It is best to build the habitat during the winter or later in the fall, otherwise other creatures may be nesting and using the pile.

Bird, bat and butterfly houses are another great way of providing shelter. Bird houses or nesting boxes can be customized to attract specific bird species. Bat houses will attract bats to your property, which can help control your mosquito population. Bats are nocturnal (come out at night), so you normally won't see them during the day. They eat between 500 and 1000 mosquitoes each in a single hour! Many species of birds including swallows also consume a significant amount of mosquitoes.



Butterfly garden
Allison Graszat, photographer

Create a butterfly garden

Butterfly gardens are becoming increasingly popular. Many people want to attract these beautiful and graceful creatures to their garden, so that they can enjoy watching them float around from flower to flower.



Butterfly Milkweed
Alison Thomson, photographer



Sneezeweed

When trying to attract butterflies, it is important to remember that butterflies have four life stages in their life cycle. Butterflies start out, like many other insects, as small eggs. From the egg, a caterpillar, or larva, emerges. The caterpillar spends most of its time consuming plant material and quickly grows to maturity after shedding its skin several times throughout the growth period. At maturity, the caterpillar will start to form a pupa, or chrysalis. Many people refer to this pupa as a cocoon. In the cocoon, the final stage begins. The caterpillar transforms into a beautiful butterfly, emerges from the cocoon, dries its newly formed wings and takes flight for the first time. Due to the various life stages of butterflies, they require different plants at different parts of their lives. Most caterpillars are very picky eaters, often relying on a single plant species to survive. One example of this is monarch caterpillars, which exclusively consume plants of the milkweed family and usually it is common milkweed. Without the milkweed, the monarch caterpillar would not be able to move into the next stage of its life cycle and it would die. Unfortunately for the Monarchs, Milkweeds are on Ontario's Noxious Weed List and therefore people are removing them from their properties.

If you want to attract butterflies to your yard, you should include both host plants for the caterpillars and nectar plants for the adult butterflies. Also, some butterfly species

spend the winter months either as larvae, eggs, pupae or adults. Over-wintering butterflies will require shelter from the cold. This usually consists of wood piles or tree cavities. Many garden centres carry plants that are supposed to attract butterflies. While these may attract some species, using plants that are native to this area will be best for attracting our native butterflies, since they have evolved together for thousands of years. Native plants are also beneficial, as they require less care and grow quickly.



Brown-eyed Susans
Alison Thomson, photographer

(Refer to appendix #3 for Butterfly Garden Plant List)

Get Involved!

Living near water can be a very rewarding experience, but it also carries with it a great deal of responsibility. With 93% of the land in the One Mile Creek watershed privately owned, landowner assistance is vital to helping governments and agencies adequately protect and preserve the water and habitat quality of this watershed. We have done our best to provide you with as much information as possible in this guide; however each property is unique and will require an individualized approach.

Keep in mind that everyone living in the One Mile Creek watershed can play a part, no matter how small, in helping to build and maintain a sustainable environmental legacy within the One Mile Creek watershed.



Brianne Wilson, photographer

Your own property is where caring for the environment can start. Manicured lawns and gardens provide few water quality and habitat improvement opportunities.

An inexpensive and easy way to improve water quality and species diversity on your property is to establish naturalized areas.

You can make a difference in protecting the environment and we would like to help you get started.

For more information on how to get started please contact:



250 Thorold Road West, 3rd Floor Welland, ON L3C 3W2
Phone: 905.788.3135 | Fax: 905.788.1121 | www.npca.ca

References

- Brubaker, Elizabeth. 1995. *Property Rights in the Defense of Nature*. Toronto, ON: Earthscan Publications. <http://www.earthscan.com>
- Forest Gene Conservation Association. *FGCA: Conservation of Genetic Diversity*. <http://http://www.fgca.net/conservation/native/default.aspx>.
- Invading Species. *O.F.A.H. Invading Species Awareness Program*. <http://www.invadingspecies.com/>
- Ministry of Agriculture, Food & Rural Affairs. *Ontario Weeds Act - Frequently Asked Questions*. http://www.omafra.gov.on.ca/english/crops/facts/faq_weeds_act.htm.
- Ministry of the Environment. *Background: Ontario's Cosmetic Pesticides Ban*. <http://www.ene.gov.on.ca/en/news/2009/030401mb.php>. Viewed on July 29, 2009.
- Niagara Peninsula Conservation Authority (2009, Fourth Edition). *A Guide to Celebrate Niagara Peninsula's Native Plants*. <http://www.npca.ca/water-management/documents/NPCAPlantGuide.pdf>
- Niagara Peninsula Conservation Authority. *ECO School Program*. <http://www.npca.ca/eco-school.htm>.
- Niagara Peninsula Conservation Authority. *Native Plant Supplier List 2009*. <http://www.npca.ca/simply-tree-mendous/documents/NativePlantSupplierList2009-rev.pdf>
- Niagara Peninsula Conservation Authority. *One Mile Creek Watershed Plan*. <http://www.npca.ca/water-management/water-planning/one-mile-creek-watershed-plan.htm>.
- Niagara Peninsula Conservation Authority. *Watershed Regulation*. <http://www.npca.ca/water-management/watershed-regulation/default.htm>.
- Niagara Peninsula Conservation Authority. *Watershed Restoration*. <http://www.npca.ca/water-management/watershed-restoration/default.htm>.
- Niagara Peninsula Conservation Authority. *Yellow Fish Road*. <http://www.npca.ca/yellow-fish-road-eco-school.htm>.
- Town of Niagara-on-the-Lake, Public Works Department. *Public Works FAQ's*. <http://www.notl.org/siteengine/activepage.asp?PageID=128>. For information about the Downspout Disconnection Program contact: (905) 468-3278 ext.289.
- Town of Niagara-on-the-Lake. *Niagara-on-the-Lake Old Town Extraneous Flow Reduction Program*. <http://www.notl.org/files/%7BC86BC03B-B5A3-48E3-B377-A1DDF39BAA1C%7DRAIN%20barrels.pdf>.
- Niagara Region. *Smart Gardening Guide*. <http://www.regional.niagara.on.ca/government/initiatives/smartgardening/default.aspx>. Viewed on February 15, 2008.
- Niagara Region. *Smart Growth*. <http://www.regional.niagara.on.ca/living/smartgrowth/>. Viewed on February 23, 2008.
- Niagara Region. *WaterSmart Niagara*. <http://www.watersmartniagara.ca/>.
- Toronto and Region Conservation (2004). *West Nile Virus*. <http://trca.on.ca/dotAsset/25459.pdf>.

Appendix #1: Friends of One Mile Creek



For a number of years, landowners abutting One Mile Creek in Niagara-on-the-Lake (NOTL) as well as other interested individuals have raised concern regarding the condition of the creek and associated Lansdowne Pond. They formed the Friends of One Mile Creek (FOMC) in 2003 and have worked with the Niagara Peninsula Conservation Authority (NPCA) to implement a number of stewardship projects.

The goal of Friends of One Mile Creek is to: “Collaborate with the community and relevant agencies to work efficiently toward restoring and revitalizing the water, wildlife and natural environment of the One Mile Creek watershed.”

With support from the NPCA, FOMC has held regular meetings and has been active in developing projects within the watershed that educate and inform the community about how to help improve the health of One Mile Creek. A website was created for the general public to stay up-to-date with FOMC's activities: www.friendsofthemilecreek.org

Creek clean-up

The FOMC arrange two creek clean-ups a year; one on Earth Day and one in the Fall. Numerous bags of garbage, buckets full of broken glass, metal and various plastics are collected by volunteers each year.

Speaker series

In an effort to educate and inform the FOMC members and the general public as well as generate more interest in our initiatives, FOMC hosts a speaker series at least once a year.

Speaker Series #1: Constructed Wetlands (2006)

Dr. Edgar Lemon, a retired professor of environmental physics at Cornell University spoke to FOMC members and the public about the benefits of constructed wetlands.

Speaker Series #2: Riparian Planting (2007)

Alison Thompson from the NPCA spoke to FOMC members and the public about riparian planting and other restoration projects.

Speaker Series #3: Wild About Your Garden (2008)

Albert Garofalo from the NPCA spoke to FOMC members and the public to discuss some simple ways to create a natural and native garden and talked about the benefits of native plants.

Speaker Series #4: Source Water Protection (2008)

Jayne Campbell from the NPCA spoke to FOMC members and the public about source water protection and how this new legislation relates to NOTL and One Mile Creek specifically.

Speaker Series #5: Think Global, Act Local (2009)

Debbie Whitehouse from Niagara Parks Commission spoke to FOMC members and the public about why thinking globally and acting locally by engaging in volunteer work and grassroots organizations is important to the community.

Appendix #2: Rain Garden Plant List

There are two possibilities for a rain garden:

- (1) near the house to collect only roof runoff
- (2) in the yard to collect water from the roof and the lawn

Here are a few tips about rain garden placement:

- place the garden at least 3 metres (9ft) from your home to prevent foundation infiltration
- do not place the rain garden directly over a septic system
- Many people are tempted to put a rain garden in a low spot that exists in the yard where water tends to pond. DON'T! This is an area of slow infiltration and the rain garden is supposed to increase infiltration
- A rain garden will do best in full or partial sun
- The rain garden will work best if it is placed on a flatter part of your yard

What are the dimensions of a rain garden?

Rain gardens come in many different shapes and sizes. Usually, time and cost are the most important factors determining the size. You will have to decide on how much area you are willing to use. A good sized rain garden is approximately 10m².

Most rain gardens are between 10 and 20cm (4-8in) deep. If the garden is too deep, the water may not be able to infiltrate fast enough, and may pond. This is especially true on clay soils. If the garden is too shallow, it may not be able to collect enough rainwater to make it useful during larger rain events.

The depth of your rain garden can be determined by the slope of your land:

- If the slope is less than 4%, it is best to build a rain garden that is 8-13cm deep
- If the slope is between 5-7%, it is best to build a rain garden that is 15-18cm deep
- If the slope is between 8-12%, it is best to build a rain garden that is about 20cm deep

What are some good native plants for a rain garden?

Although it is not absolutely necessary to use native plants for a rain garden, we strongly recommend that you do. Using native plants instead of horticultural varieties will increase the number of beneficial insects that will visit your rain garden and the value of the habitat.

Sunny Conditions

Swamp Milkweed (*Asclepias incarnata*)
 White Turtlehead (*Chelone glabra*)
 Spotted Joe-Pye-Weed (*Eupatorium maculatum*)
 Sneezeweed (*Helenium autumnale*)
 Blue-eyed Grass (*Sisyrinchium montanum*)
 Ohio Goldenrod (*Solidago ohioensis*)
 Blue Vervain (*Verbena hastata*)
 Tall Ironweed (*Vernonia altissima*)
 Canada Bluejoint (*Calamagrostis canadensis*)
 Bebb's Sedge (*Carex bebbii*)
 Porcupine Sedge (*Carex hystericina*)
 Fox Sedge (*Carex vulpinoidea*)
 Riverbank Wild Rye (*Elymus riparius*)
 Prairie Cordgrass (*Spartina pectinata*)
 Sweet Flag (*Acorus calamus*)
 Blue Flag Iris (*Iris versicolour*)

Part-shade

Boneset (*Eupatorium perfoliatum*)
 Spotted St. Johnswort (*Hypericum punctatum*)
 Michigan Lily (*Lilium michiganense*)
 Cardinal Flower (*Lobelia cardinalis*)
 Great Lobelia (*Lobelia siphilitica*)
 Bee Balm (*Monarda didyma*)
 Green-headed Coneflower (*Rudbeckia laciniata*)
 Rough-leaved Goldenrod (*Solidago patula*)
 Tall Meadow Rue (*Thalictrum pubescens*)
 Hop Sedge (*Carex lupulina*)
 Sweet Flag (*Acorus calamus*)

For more information on native plant species — refer to the NPCA's, A Guide to Celebrate Niagara Peninsula's Native Plants.

Appendix #3: Butterfly Garden Plant List

List of appropriate species for butterfly gardening in Niagara
 (includes host plants for caterpillars and nectar sources for butterflies)

Plants for Dry, Sunny Conditions

Black-eyed Susan (*Rudbeckia hirta*)
 Butterfly Milkweed (*Asclepias tuberosa*)
 Evening Primrose (*Oenothera biennis*)
 Heath Aster (*Aster ericoides*)
 Longleaf Bluets (*Hedyotis longifolia*)
 Pale Purple Coneflower (*Echinacea pallida*)
 Pearly Everlasting (*Anaphalis margaritacea*)
 Sky Blue Aster (*Aster oolentangiensis*)
 Smooth Aster (*Aster laevis*)
 Wild Bergamont (*Monarda fistulosa*)

Plants for Moist to Wet, Sunny Conditions

Blue Vervain (*Verbena hastata*)
 Ohio Goldenrod (*Solidago ohioensis*)
 or other Goldenrod sp.
 Porcupine Sedge (*Carex hystericina*)
 Sneezeweed (*Helenium autumnale*)
 Spotted Joe-Pye-Weed (*Eupatorium maculatum*)
 Swamp Milkweed (*Asclepias incarnata*)
 Tall Ironweed (*Vernonia altissima*)
 White Turtlehead (*Chelone glabra*)

Plants for Moist to Wet, Part-Shade Conditions

Bee Balm (*Monarda didyma*)
 Boneset (*Eupatorium perfoliatum*)
 Cardinal Flower (*Lobelia cardinalis*)
 Great Lobelia (*Lobelia siphilitica*)
 Green-headed Coneflower (*Rudbeckia laciniata*)
 Michigan Lily (*Lilium michiganense*)
 Pawpaw (*Asimina triloba*)
 Rough-leaved Goldenrod (*Solidago patula*)
 Tall Meadow Rue (*Thalictrum pubescens*)

Plants for Moist to Wet, Shade Conditions

Spicebush (*Lindera benzoin*)

Plants for Normal or Moist, Sunny Conditions

Common Milkweed (*Asclepias syriaca*)
 Dense Blazing Star (*Liatris spicata*)
 Foxglove Beardtongue (*Penstemon digitalis*)
 New England Aster (*Aster novae-angliae*)
 Sweet Ox-eye (*Heliopsis helianthoides*)
 White Ash (*Fraxinus americana*)

Plants for Normal or Moist, Part-Shade Conditions

Tulip Tree (*Liriodendron tulipifera*)

Plants for Normal or Moist, Shade Conditions

Heart-leaved Aster (*Aster cordifolius*)
 Large-leaved Aster (*Aster macrophyllus*)
 Poke Milkweed (*Asclepias exaltata*)
 White Baneberry (*Actaea pachypoda*)
 White Snakeroot (*Eupatorium rugosum*)

Plants for Almost All Conditions

Star-flowered Solomon's Seal
 (*Maianthemum stellatum*)
 Wild Columbine (*Aquilegia canadensis*)
 Woodland Sunflower (*Helianthus divaricatus*)

Aquatic Plants

Blue Flag Iris (*Iris versicolor*)
 White Water Lily (*Nymphaea odorata*)

For more information on native plant species — refer to the NPCA's, A Guide to Celebrate Niagara Peninsula's Native Plants.

Appendix #4: Contact information

Fisheries and Oceans Canada (DFO)

Bayfield Institute
Canada Centre for Inland Waters
867 Lakeshore Road
Burlington, ON L7R 4A6
Tel: 1.800.667.3355
www.dfo-mpo.gc.ca

Ministry of the Environment (MOE)

Niagara District Office
9th Floor, 301 St. Paul St.
St. Catharines, ON L2R 3M8
Toll Free: 1.800.263.1035
Tel: 905.704.3900
Fax: 905.704.4015

Ministry of Natural Resources (MNR)

Vineland Office
P.O. Box 5000
4890 Victoria Avenue North,
Vineland Station, ON L0R 2E0
Tel: 905.562.4147
Toll Free: 1.800.667.1940
www.mnr.gov.on.ca

Niagara Peninsula Conservation Authority (NPCA)

250 Thorold Road West, 3rd Floor
Welland, ON L3C 3W2
Tel: 905.788.3135
Fax: 905.788.1121
www.npca.ca

Niagara Region

P.O. Box 1042, 2201 St. David's Road
Thorold, ON L2V 4T7
Tel: 905.685.1571
Toll Free: 1.800.263.7215
TTY Phone: 905.984.3613
Fax: 905.687.4977
www.niagararegion.ca

Parks Canada (PC)

Parks Canada National Office
25-7-N Eddy Street
Gatineau, QC K1A 0M5
Tel: 1.888.773.8888
TTY: 1.866.787.6221
www.parkscanada.ca