North Castor River 2015

Stream Watch Report

Watershed Feature Summary	
Forest Conditions[1]	Fair
Wetland Conditions[1]	Excellent
Surface Water Quality[1]	Good
Watercourse Type	88% Natural 18% Altered 100% Permanent Flow
Invasive Species	3 different invasive species were identified during City Stream Watch: -Common Buckthorn -European Frogbit -Purple Loosestrife
Fish Community	12 fish species were observed or caught in the North Castor River in 2015.

With support from Fisheries and Oceans Canada and RBC Blue Water, South Nation Conservation undertook the 2015 City Stream Watch monitoring efforts. Many thanks goes out to the funding partners, South Nation Conservation staff, and the volunteers who took the time to participate in the monitoring program and restoration projects in 2015.

[1] Guideline and condition data from the Castor River Subwatershed Report Card—January 2014

Introduction

The City Stream Watch program for South Nation Conservation (SNC) targeted the North Castor River, a tributary of the Castor River, for the 2015 field season in addition to other areas within the North Castor River Subwatershed. The North Castor River begins northeast of Greely, ON at the confluence of Shield's Creek and Findlay Creek. It flows southeast towards Russell, ON across both agricultural and forested land before entering the main branch of the Castor River west of Russell near Victoria Street. Landowners along both banks of the North Castor River were contacted prior to beginning field surveys in order to gain permission to access the river along its entire length. In total, 66 landowners were contacted and 100% granted access to the river and permission to complete surveys along the stream banks. As a result, SNC staff and volunteers were awarded a valued chance to survey the entire North Castor River and obtain important data on a subwatershed scale.

Overall, 124 sections totaling 12.4 kilometers of the North Castor River were surveyed from the confluence of the North Castor River with the Main Castor River up to the headwaters below the confluence of Shield's Creek and Findlay Creek. The following is a summary of observations and monitoring done by staff and volunteers along the 124 sections.

The North Castor River near the confluence of the North Castor River with the Castor River, west of Russell, Ontario.

Adjacent Land Use

Land use along a stream can greatly influence that stream's physical morphology and chemical characteristics. For example, agricultural activities have the capability to introduce excess nutrients into streams whereas urban areas can introduce toxins and pollutants.

Within the North Castor River, 12 different land classification categories were evaluated to a distance of 100 metres from the stream in order to reveal information on the dominant land uses directly adjacent to the stream. Figure 1 depicts the results of the evaluation and indicates that 64% of the stream was bordered by forested land uses. After forests, active agriculture was present along 18% of the stream's length and meadows accounted for 9%.

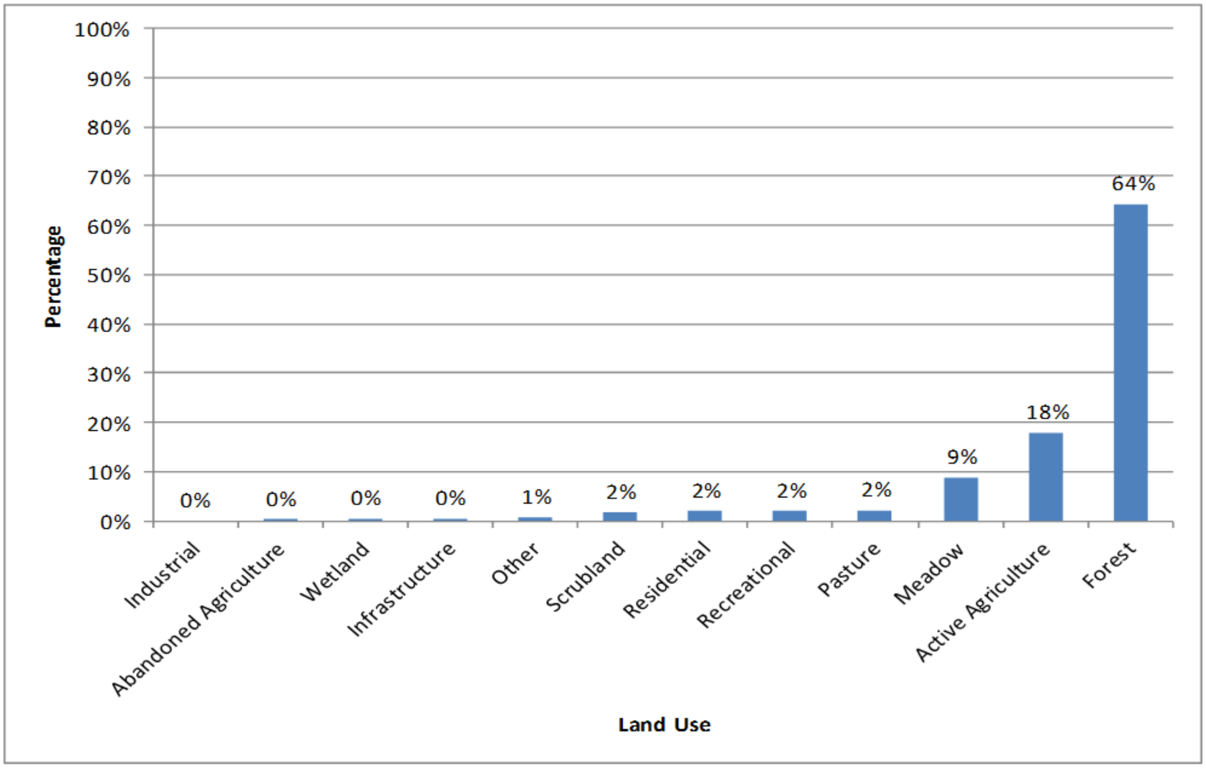

Figure 1. The percentage of sections bordered by each land use along the North Castor River.

Agricultural land use is present along the left bank of this section of the North Castor River.

A forested land use is present along this section of the North Castor River.

Overall Subwatershed Land Use

As much as the directly adjacent land use will affect a streams physical and chemical composition, the effects from overall land use within a subwatershed cannot be underestimated. When forest cover was evaluated to 100 meters from the stream, 64 % of the stream was considered bordered by forests. When one considers the entire North Castor Subwatershed, overall forest cover only accounts for 8.07 % of the subwatershed. Moreover, agricultural land uses account for 61.51 % of the subwatersheds total land area; an area of over 75 sq. km. Figure 2 below shows the overall land uses in the North Castor River Subwatershed. Table 3 below shows a summary of the major land uses within the North Castor River Subwatershed and the area and total percent each accounts for.

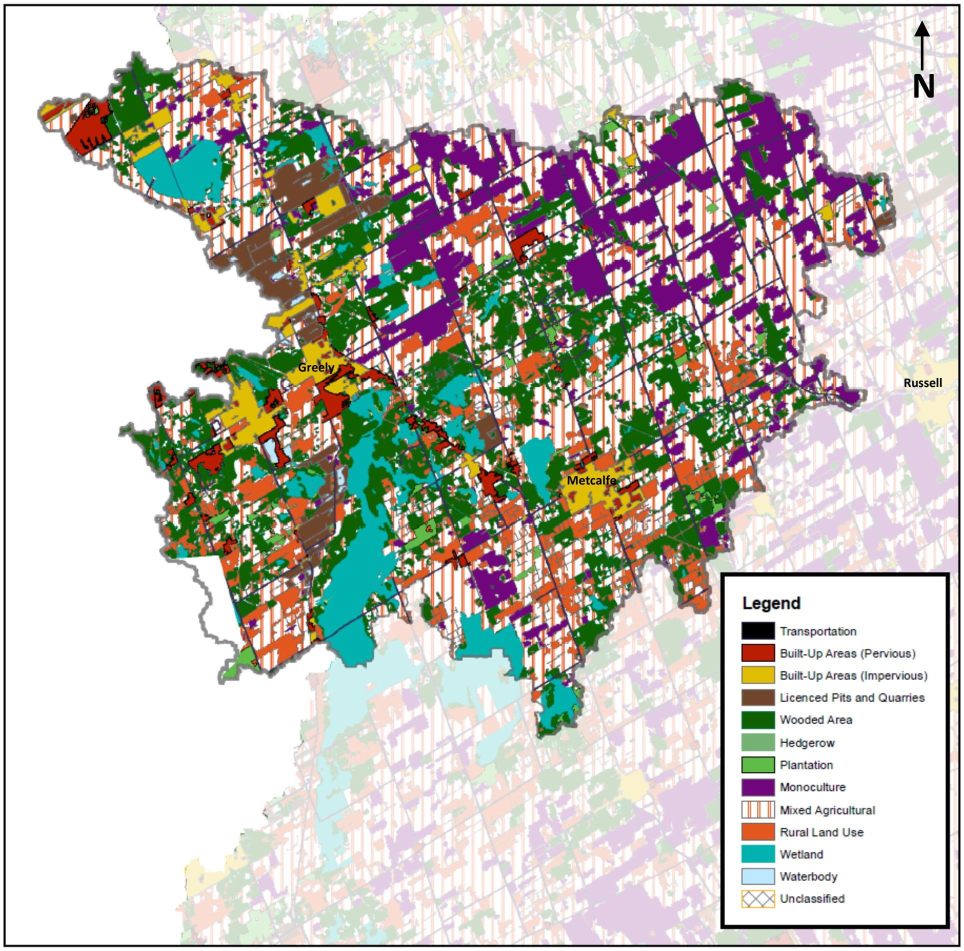

Figure 2. Major land uses within the North Castor Subwatershed as delineated by color.

Table 1. Area (Sq. km.) and percentage of watershed (%) that each land use is observed within the North Castor Subwatershed.

Land Use	Area (Sq. km.)	Percentage of Watershed (%)
Agriculture and Undifferentiated Rural Land Use	75.245	61.508
Swamp	16.324	13.344
Forested	9.949	8.067
Sand/Gravel/Mine Tailings/Extraction	2.135	1.746
Hedge Rows	0.816	0.667
Marsh	0.745	0.610
Fen	0.072	0.059

North Castor River Riparian Characteristics

Riparian Buffer Width

Riparian buffers along a stream provide important environmental benefits to water quality and quantity. Riparian buffers will reduce sediments from runoff entering the stream, filter pollutants from runoff, and will sieve runoff water of excess nutrients that can be detrimental to stream health. Moreover, riparian buffers will reduce water temperature through stream shading and provide important habitat for birds and other wildlife.

Recommended by the Canadian Wildlife Services' (2013) publication *How Much Habitat is Enough-Third Edition*, riparian buffer strips ought to be 30 metres or more in width in order to provide and protect aquatic habitat. As well, 75% of a stream's length should be naturally vegetated (Canadian Wildlife Service, 2013). As illustrated in Figure 3, the North Castor River falls below the recommended width on the left and right bank for approximately 50% and 40% of its length, respectively.

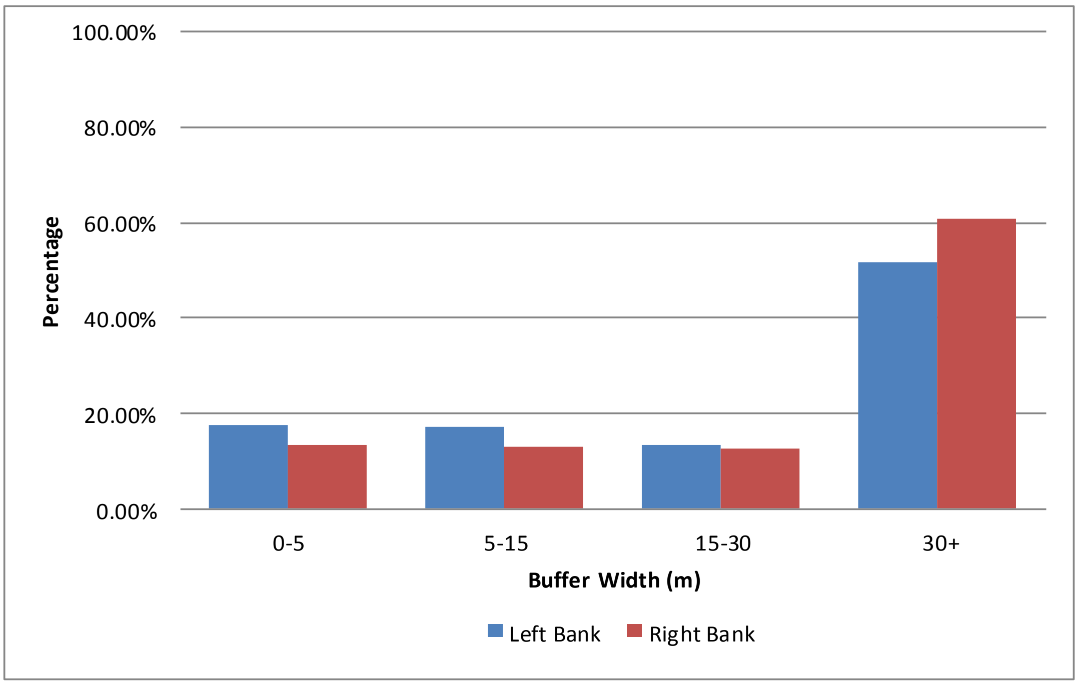

Figure 3. The percentage of the North Castor River with each buffer width for the left and right bank.

A section of the North Castor River without a suitable buffer between the stream and agricultural practices.

A section of the North Castor River with wide and dense forested buffers on either side of the stream.

North Castor River Shoreline

Erosion

Streams are dynamic and continually changing environments. One of the forces that causes stream dynamics is the erosive force of flowing water. Erosion in a stream can cause excess sedimentation and soil losses along stream banks leading to bank failures. This results in a reduction in the quality of habitat for fish and aquatic biota. Consequently, severe erosion issues along a stream represent opportunities to improve water quality through bank stabilization projects. Figure 4 depicts the percentage of each section that has been characterized as having an unstable bank. An unstable bank is one that is eroding and has little to no vegetation cover.

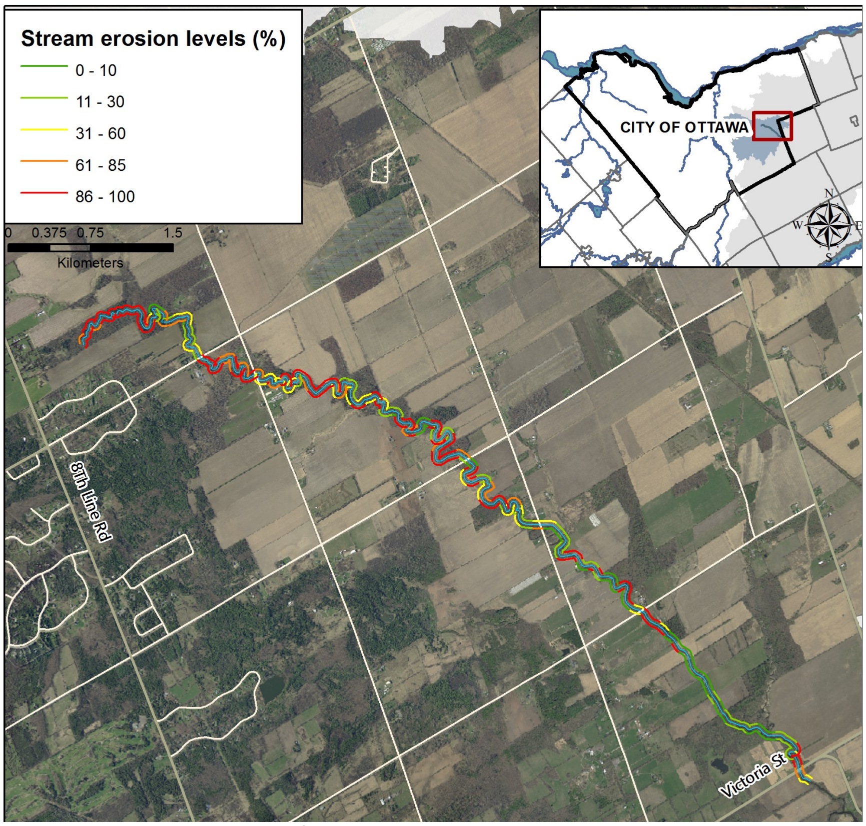

Figure 4. The percentage of each section that is characterized as having an unstable bank on the left and right banks.

Stream bank erosion along the right bank of the North Castor River may cause future bank failures.

Stream bank erosion has left bare and exposed soil on the bank of the North Castor River in some sections.

Undercut Stream Banks

Stream banks can become undercut in areas where flowing water erodes the soil beneath the vegetation root system and deposits it elsewhere in the stream. While undercutting can cause eventual bank failure, it also provides shaded habitat for fish and the biota living in the stream. In the North Castor River, bank undercutting was not very common. From Figure 5 it is clearly visible that negligible undercutting is occurring in the North Castor River until the upper reaches where some undercutting has been observed. Therefore, it is likely that the fish and biota of the North Castor River rely more heavily on instream woody debris for shaded habitat and refuge than they do undercut stream banks.

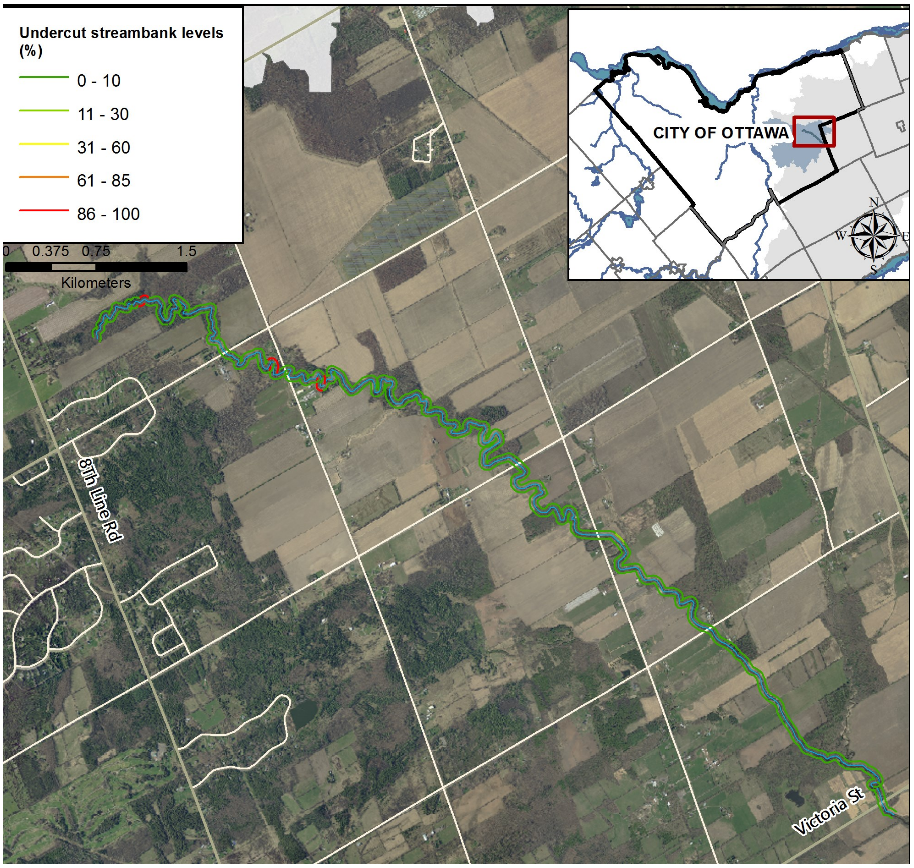

Figure 5. The percentage of each section that is characterized as having undercut banks on the left and right banks.

Bank undercutting is occurring along the North Castor River in a few areas near the upper reaches of the river.

Bank undercutting on the right bank of the North Castor River.

Stream Shading

Riparian vegetation that grows and leans over the stream will contribute to stream shading. As a result, water that is shaded from the sun will remain cooler than water that receives direct sunlight. Since cooler water has the capacity to hold more dissolved oxygen and support a greater diversity of fish and aquatic biota, adequate stream shading is of importance to a stream's overall health. Figure 6 delineates the stream shading levels that were observed along the North Castor River.

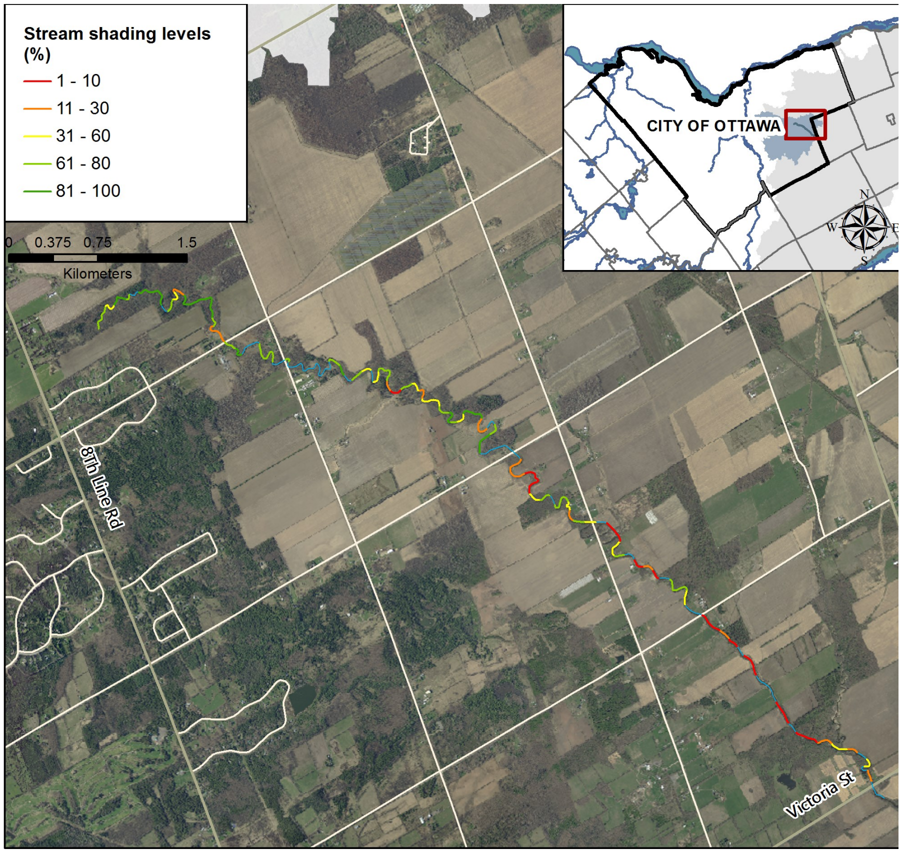

Figure 6. The percentage of each section that is considered shaded from direct sunlight.

Stream shading along the North Castor River is a function of the amount of riparian vegetation along the stream.

Inadequate forest cover along a stream will allow sunlight to increase water temperatures.

Instream Woody Debris

Instream woody debris includes large fallen trees, logs, and other woody material that ends up in the stream from riparian vegetation. While large jams of woody debris can cause obstructions to water flow, most woody debris is beneficial to a stream ecosystem by providing fish and aquatic biota habitat. Moreover, Ontario Streams (2002) recognizes that instream woody debris will contribute to stream health by capturing and depositing sediment and organic matter while redirecting flow to create riffles and pools. Figure 7 displays the occurrences of woody debris in the North Castor River.

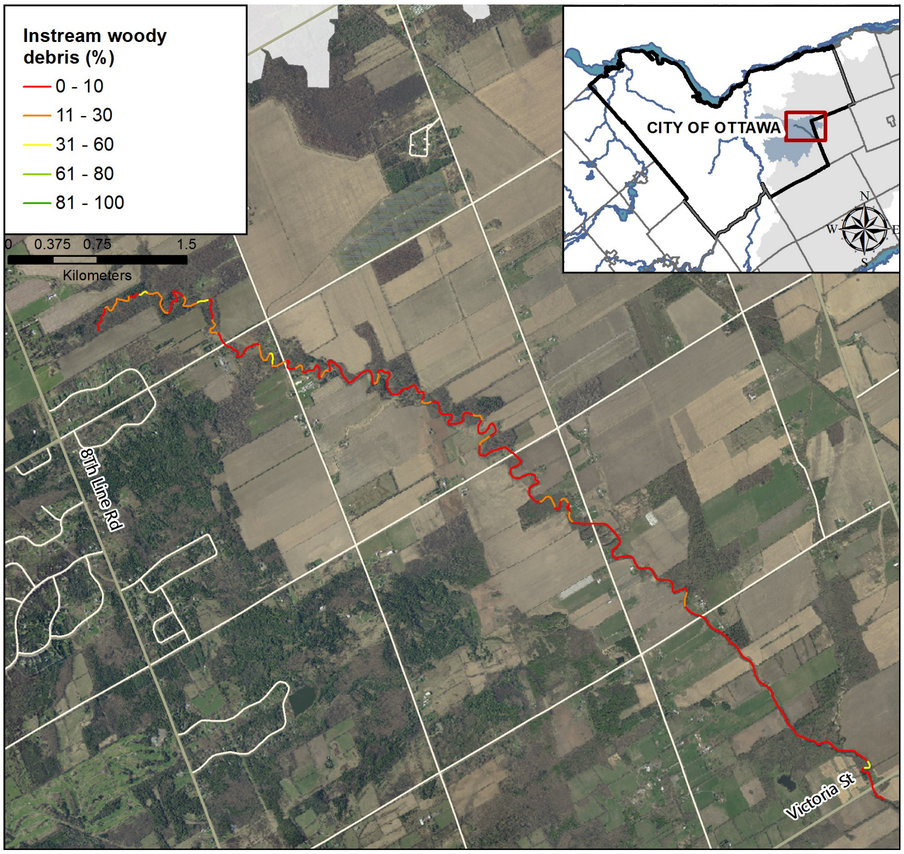

Figure 7. The percentage of each section that is characterized as containing in-stream woody debris.

Instream woody debris was more prevalent in the upper sections of the North Castor River.

Instream woody debris was very common in some sections of the North Castor River and made sampling a challenging task.

Overhanging Woody Debris

Fallen or overhanging trees that are less than 1 metre above the water surface are considered overhanging woody debris. Similar to instream woody debris, overhanging woody debris is beneficial for fish and stream biota. It provides stream shading to cool water temperatures, it provides nutrient inputs to the stream, and it provides habitat for nesting birds and other wildlife. Figure 8 displays the occurrences of overhanging woody debris along the North Castor River.

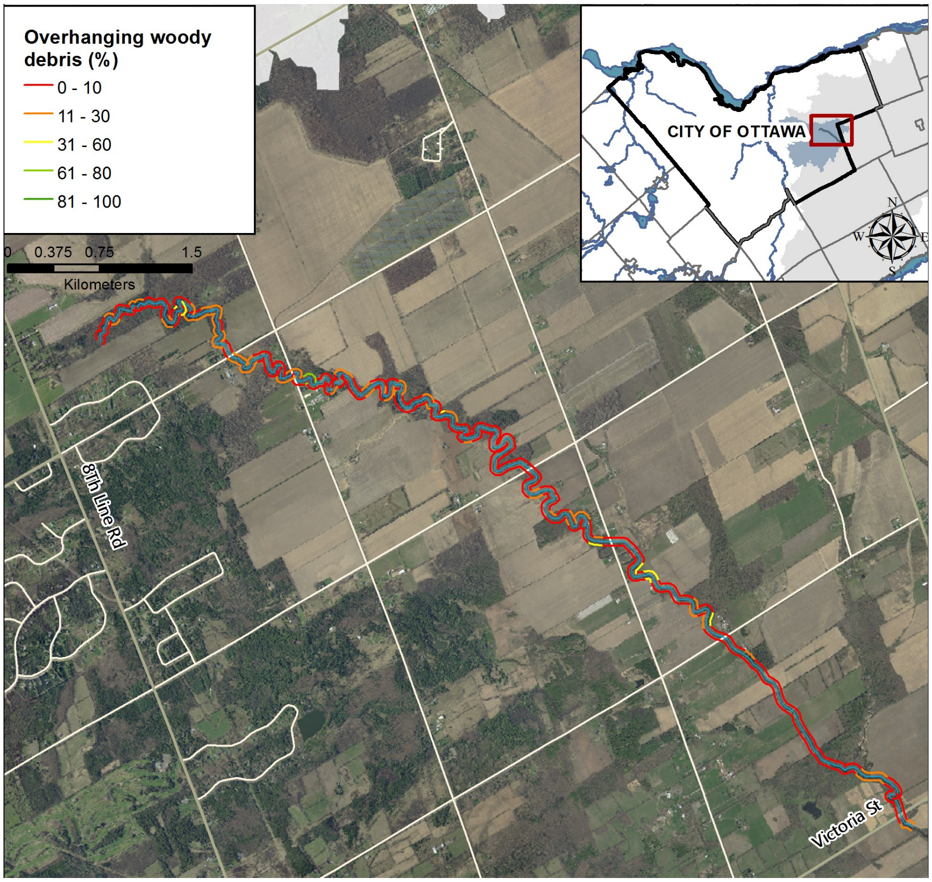

Figure 8. The percentage of each section that contains overhanging woody debris on the left and right bank.

Overhanging woody debris on the North Castor River provides food for aquatic biota and habitat for wildlife.

Overhanging woody debris on the North Castor River is more common when the adjacent land use is forests.

Anthropogenic Alterations

Areas adjacent to the North Castor River were evaluated as either natural areas or as areas that have been altered. As shown in Figure 9, 82% of the North Castor River is considered natural whereas 18% is altered. Areas that are altered are those which have been straightened or diverted for less than 50% of the section length, the riparian buffer is 5-15 meters in width, 25-50 % of the section is altered by lawn, garden beaches, rip-rap, or human made wood structures, less than 30 % of the section has armored or hardened shorelines, or one or two stormwater outlets are present in the section. Natural areas have not been straightened or channelized, have a buffer greater than 15 meters, less than 25 % of the section has been altered by lawn, garden beaches, rip-rap, or wood structures, there is no shore armoring, and there are no culvert crossings present.

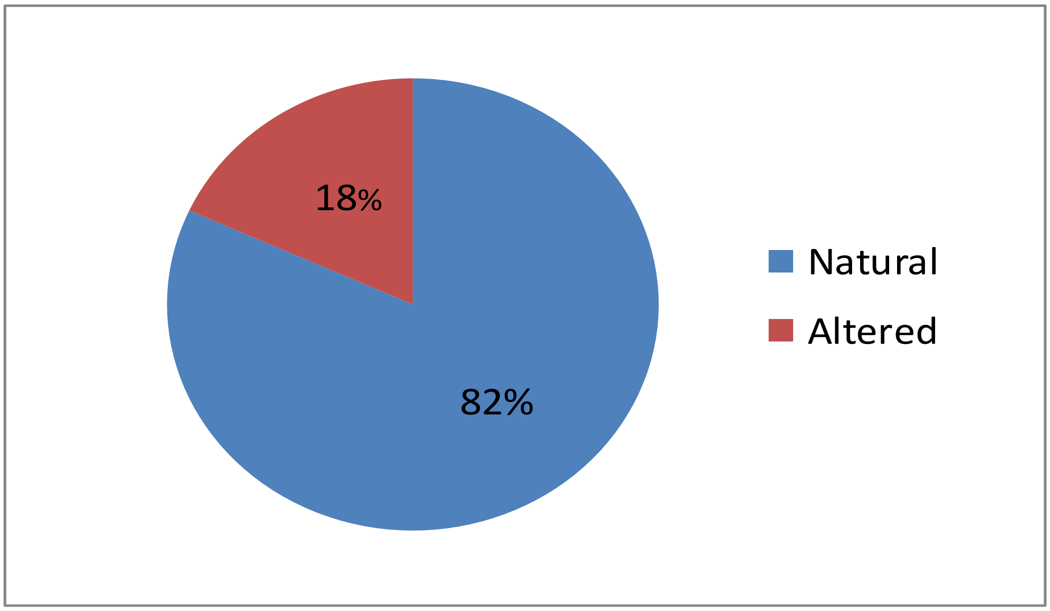

Figure 9. The percentage of areas along the North Castor River that are evaluated as natural or altered.

Bridges and other river crossings represent the majority of the altered areas along the North Castor River. A bridge such as the one shown above increases the amount of hardened shoreline and reduces habitat availability.

North Castor River Instream Aquatic Habitat

Substrate Complexity

Within a single stream, the substrate type can vary greatly along its entire length as the stream meanders through different geological parent materials across great distances. Thus, habitat provision and complexity will vary along with the changes in substrate since different species of fish and vegetation thrive with different substrate types. Altogether, the heterogeneity of a stream's substrate will influence the biodiversity of fish, aquatic biota, and vegetation that will inhabit the stream. Figure 10 portrays the distribution of heterogeneous and homogenous substrate compositions in the North Castor River.

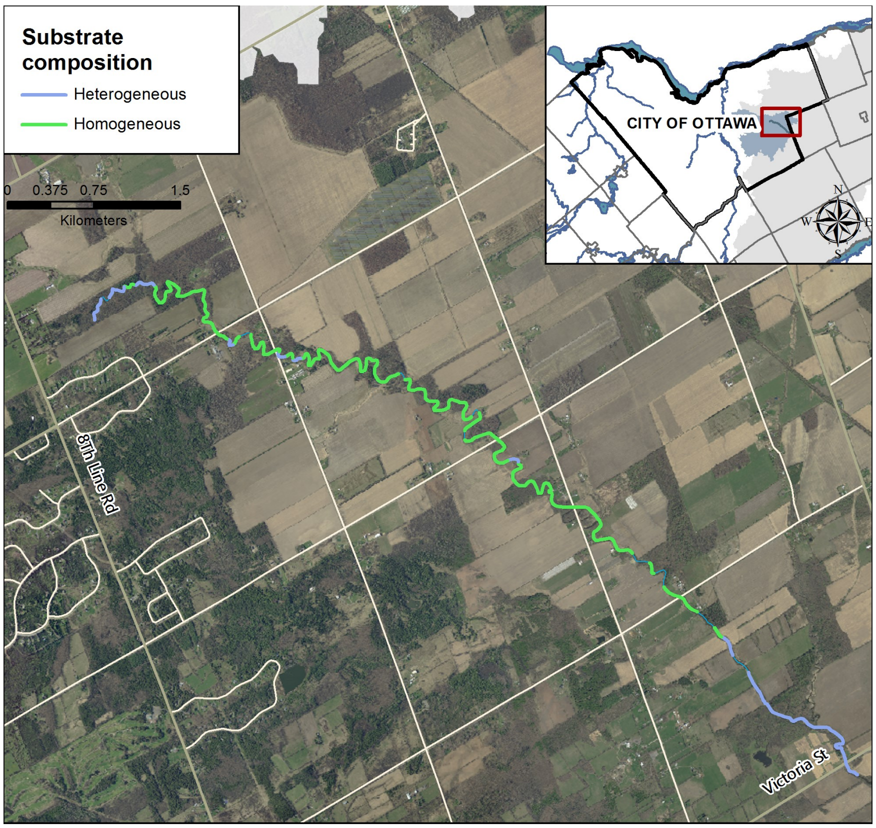

Figure 10. The substrate composition along the length of the North Castor River.

A section of the North Castor River with a heterogeneous substrate type that has influenced diverse vegetation communities.

The substrate of the North Castor River is predominately a homogenous clay.

Instream Substrate

Just as the diversity of substrate types within a stream can influence the presence of fish, aquatic biota, and vegetation, the relative amount of each type of substrate can influence the abundances of fish and aquatic biota. For example, the Northern Redbelly Dace (*Chrosomus eos*) prefers stream bottoms of silt and fine particulates whereas the Threatened Cutlip Minnow (*Exoglossum maxillingua*) will only inhabit streams with a gravel substrate free of silt and vegetation (Scott and Crossman,1973). Figure 11 interprets the percentage of each substrate observed and Figure 12 depicts the distribution of each along the North Castor River.

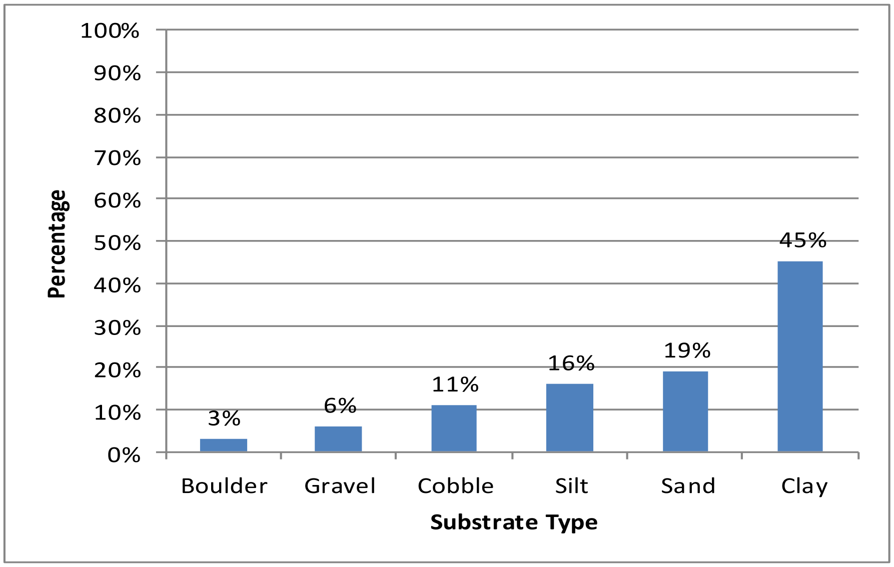

Figure 11. The percentage of sections within which each substrate was observed in the North Castor River.

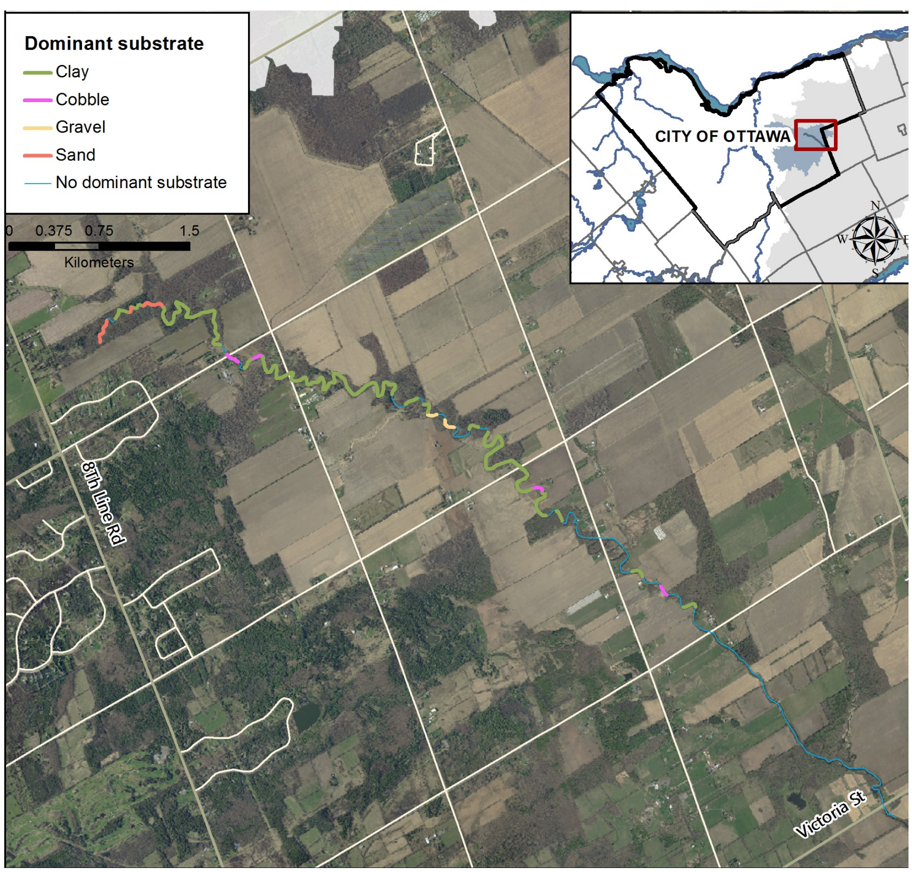

Figure 12. The spatial distribution of substrate types along the North Castor River. No dominant substrate implies an even mixture of substrate types was observed.

Cobble and Boulder Habitat

Cobble and boulders within a stream add diversity to the available habitat and provide many beneficial services to a stream. Cobble will provide spawning areas for fish, oxygenate water, and provide habitat for benthic invertebrates. Boulders within a stream provide areas for fish to seek refuge and spots for benthic invertebrates to live. Within the North Castor River, boulder and cobble presence was sporadically distributed. Figure 13 displays the spatial extent of cobble and boulder habitat along the length of the North Castor River.

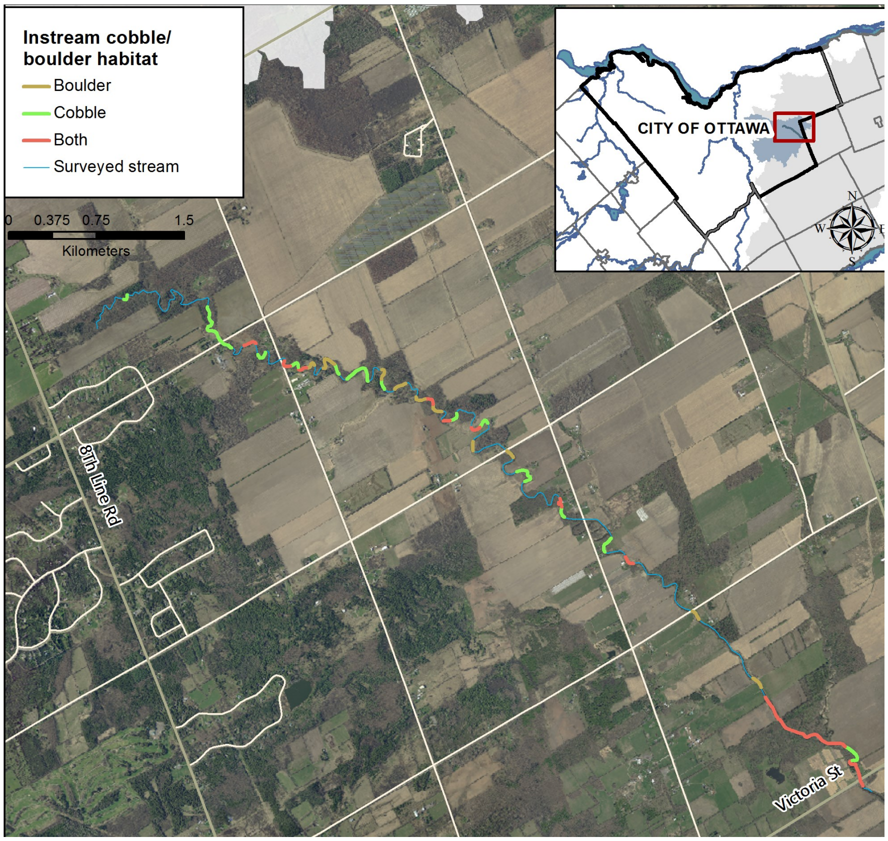

Figure 13. The spatial distribution of cobble and boulder habitat along the length of the North Castor River. Surveyed stream indicates no cobble or boulder habitat.

Cobble and boulder habitat observed within the North Castor River.

Cobble areas can create riffles that oxygenate water, provide benthic invertebrate habitat, and fish spawning areas.

Instream Morphology

Pools, riffles, and runs in a stream are areas of deep, slow-moving water, areas of shallow, agitated water, and areas where water runs smoothly, respectively. It is the mixture of these three differences in flows and depths that creates different habitat types for fish and aquatic biota. Pools are areas where larger fish can congregate to find cooler waters while riffles are areas for fish to spawn and benthic invertebrates to live. Runs provide areas for smaller fish and amphibians to inhabit outside of fast moving riffles.

The geological makeup and soil composition of the North Castor Subwatershed does not provide large amounts of cobble or boulders to form riffle sections. Thus, more pools were expected and were observed as shown in Figure 14. Figure 15 shows the spatial distribution of riffles in the North Castor River.

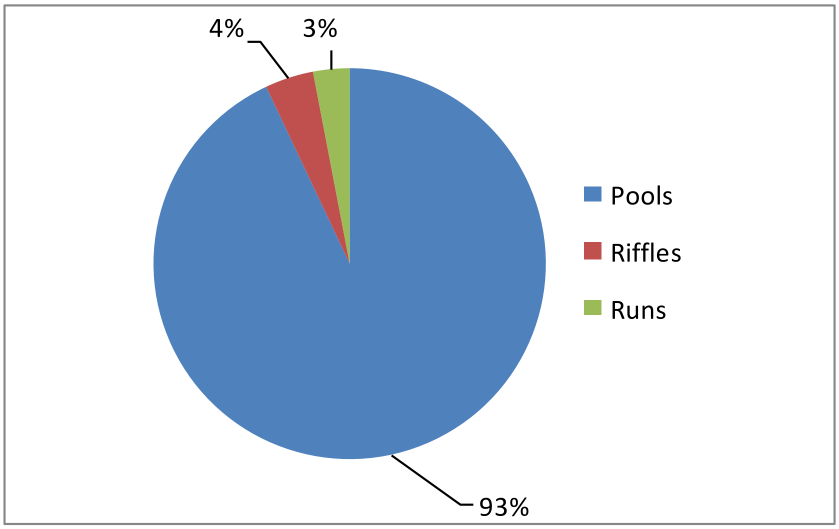

Figure 14. The percentage of pools, riffles, and runs within the North Castor River.

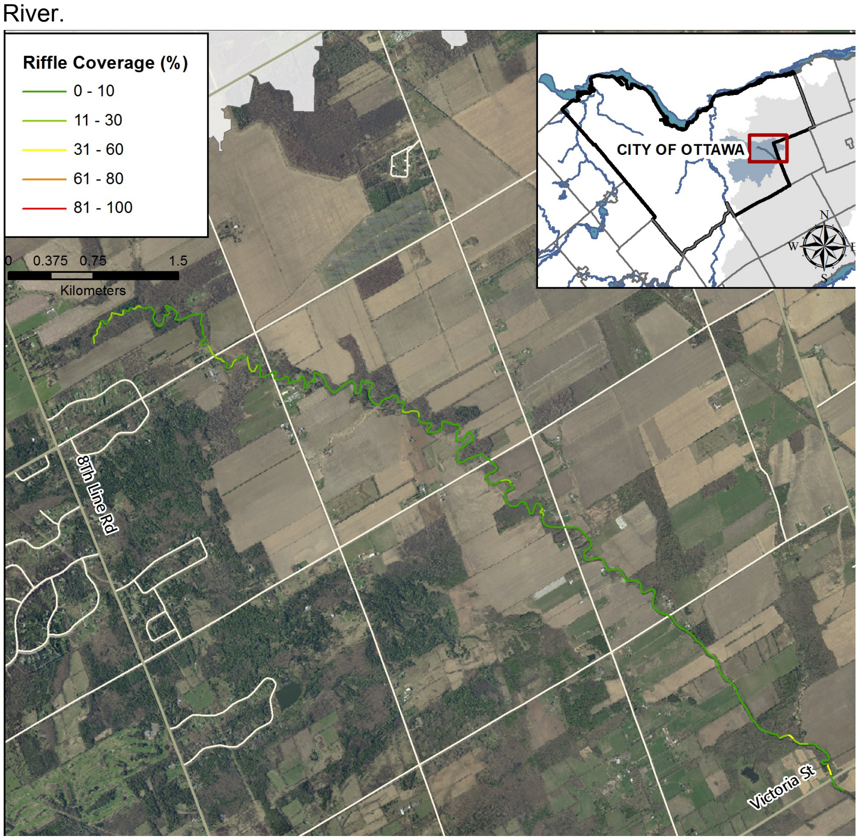

Figure 15. The percentage of each section that is characterized as being a riffle.

Vegetation Type

The aquatic vegetation in streams provides numerous benefits to overall stream health and wildlife. Vegetation can provide stream shading, food for aquatic biota and fish, oxygen in the water through photosynthesis, and habitat for fish and stream biota. Within the North Castor River, there was a large diversity of vegetation types observed. From Figure 16, the majority of vegetation observed consisted of floating plants followed by robust emergent and broad-leaved emergents. Only 4% of the sections surveyed were found to not contain any vegetation at all. The spatial distribution of the vegetation types along the stream is displayed in Figure 17.

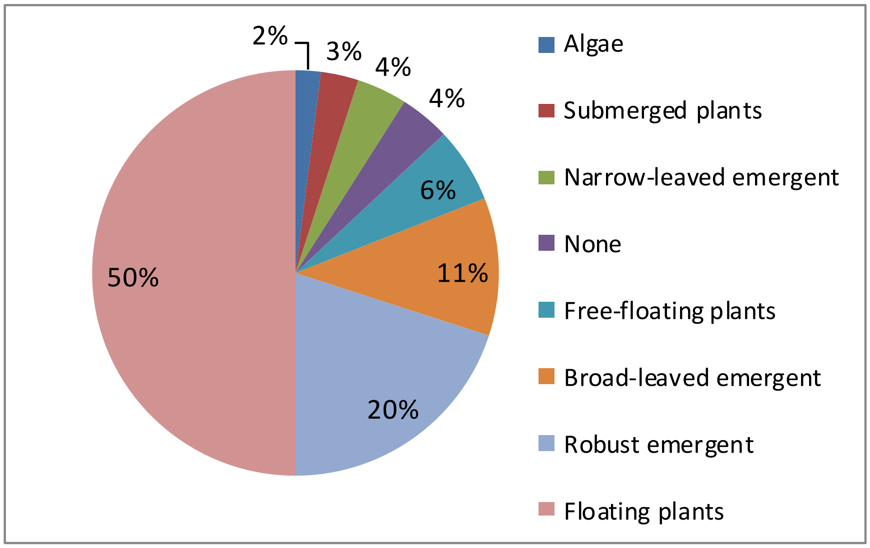

Figure 16. The percentage of sections where each vegetation type was observed within the North Castor River.

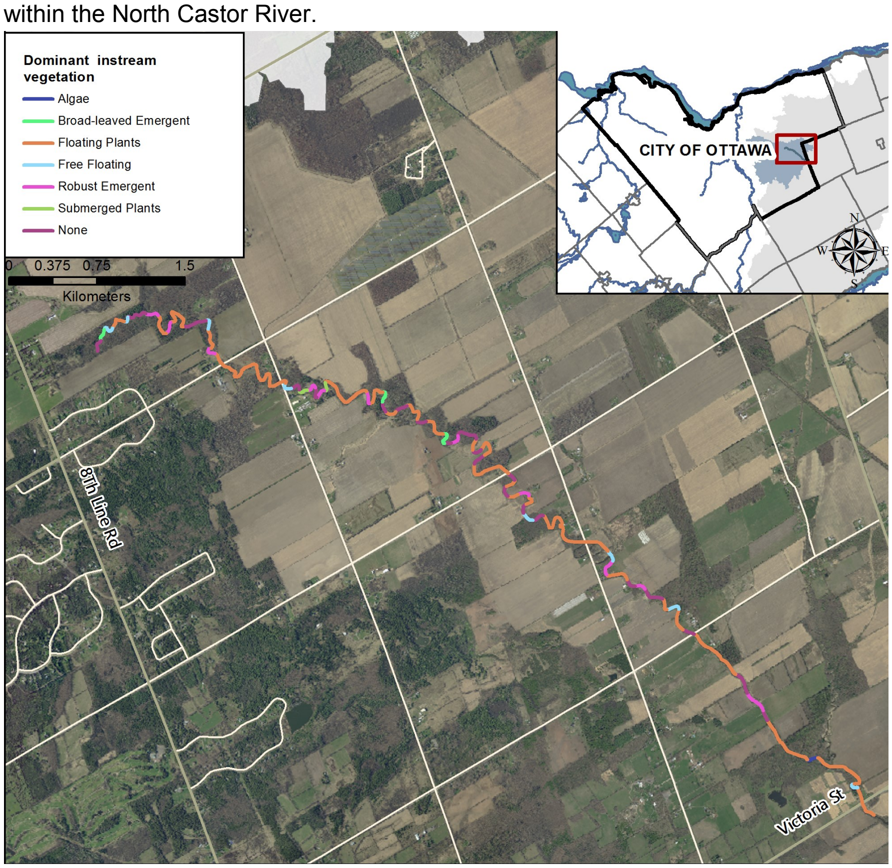

Figure 17. The spatial distribution of dominant vegetation types along the North Castor River.

Instream Vegetation Abundance

Although instream aquatic vegetation is beneficial for stream health, too much vegetative growth can have detrimental consequences. Excessive vegetative growth will stop the penetration of sunlight to the deeper areas of the stream and stream bottom plants will die. Also, when large amounts of vegetation die and decompose, the decomposition uses up a large amount of dissolved oxygen. Without enough dissolved oxygen in the water of a stream, fish and aquatic biota will become choked out and will perish. Therefore, a balance of areas of common vegetation abundance and areas where it is less common is best for stream health. As illustrated in Figure 18, the North Castor River exhibits a relatively balanced abundance of instream vegetation. Only 5% of the sections had extensive vegetative growth and the majority of sections fell within the common, normal, or low categories of vegetative abundance.

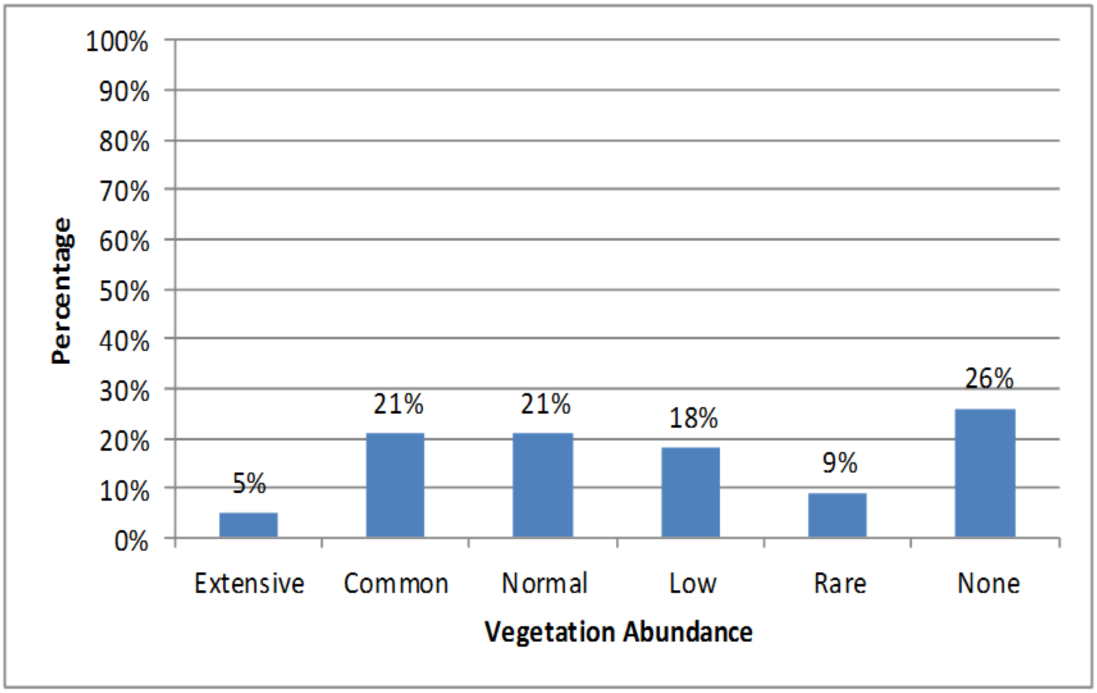

Figure 18. The within section percentage of each vegetative abundance level within the North Castor River.

A section of the North Castor River that is assessed as having an extensive vegetative abundance.

This section of the North Castor River contains emergent (on the banks) and floating (in-stream) vegetation types.

North Castor River Stream Health

Invasive Species

Invasive species within or along a stream can lead to reduced species diversity and wildlife abundance since invasive species are well suited for displacing native species. Also, wildlife, fish and other aquatic biota are unable to feed on invasive species since they are not part of natural and native food webs. Figure 19 displays the spatial distribution of invasive species in the North Castor River. Overall, there is not a large threat from invasive species in the North Castor River as only 3 species were found and all three are not very abundant. Figure 20 shows the type and prevalence of the 3 invasive species identified in the North Castor River.

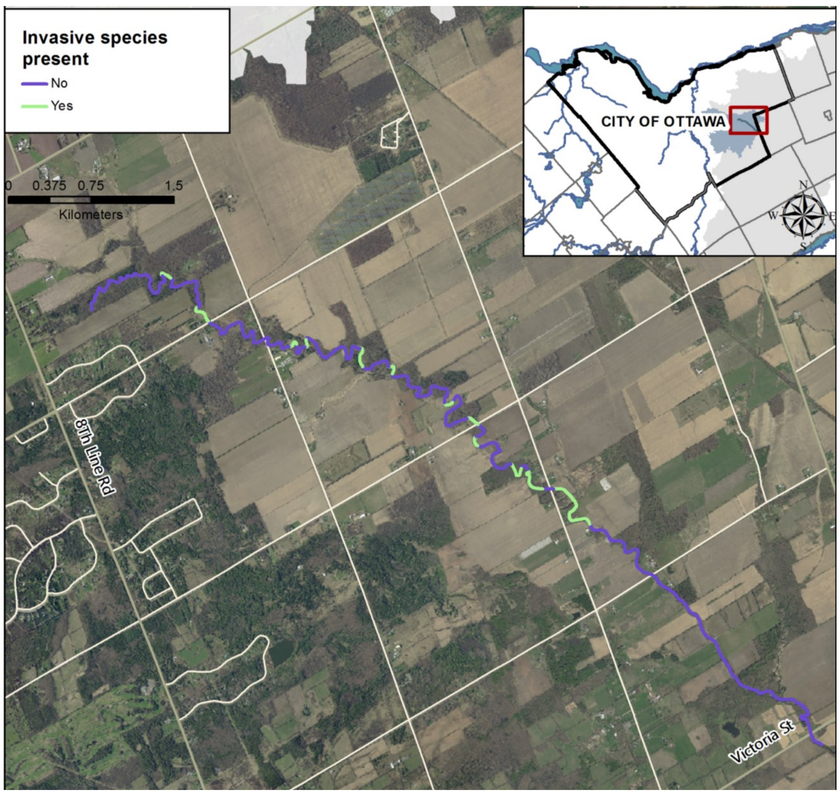

Figure 19. The spatial distribution of invasive species along the length of the North Castor River.

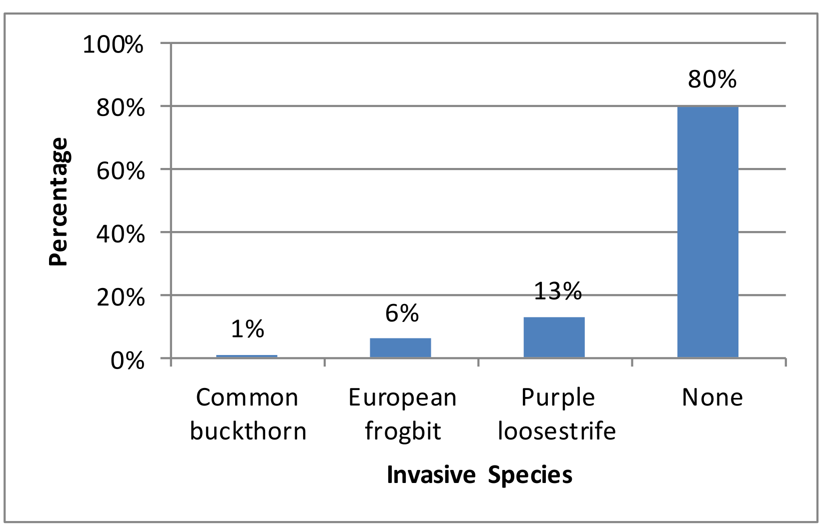

Figure 20. The percentage of sections that contained each specific invasive species that was identified.

Pollution

Within the North Castor River there were many incidences of garbage observed floating or on the stream bottom. The majority of the sections polluted by garbage were downstream of bridges and crossings that present easy access for humans to dispose of garbage and waste into the stream. Figure 21 shows the type and prevalence of pollution in the North Castor River.

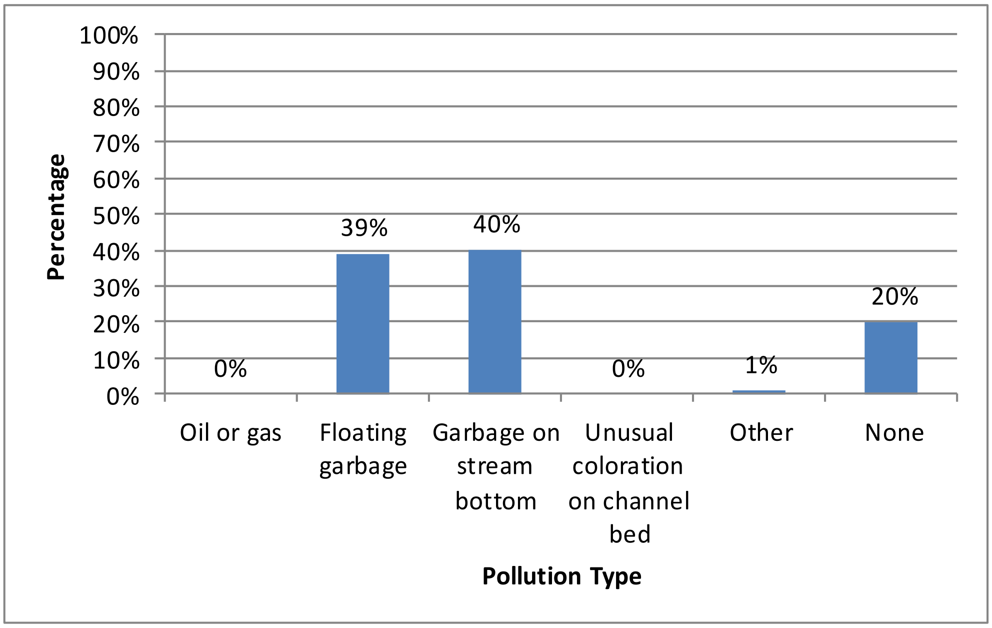

Figure 21. The percentage of sections that contained each specific type of pollution.

Wildlife and Insects

While City Stream Watch monitoring was being completed, staff and volunteers recorded any incidences of wildlife to gain an understanding of the wildlife community of the North Castor River. The results of the observations are displayed in Table 2.

Table 2. All wildlife and insects observed during City Stream Watch 2015.

Wildlife and Insects	Observed
Water birds	Kingfisher, mallard ducks, green heron, great blue heron, wood ducks
Land birds	Cedar waxwing, Baltimore oriole, northern flicker, northern cardinal, cliff swallow, American robin, barn swallow, wild turkey, blue jay, eastern wood pewee, American goldfinch, wrens, common yellowthroat, chickadee, red-tailed hawk, phoebe, American crow, common raven
Reptiles	Painted turtle
Amphibians	Green frog, American toad, leopard frog, gray tree frog
Large mammals	Deer (tracks), coyote (tracks)
Small mammals	Raccoon (tracks), muskrat, mink (tracks), beaver, chipmunk, river otter (scat, tracks)
Dragonflies and damselflies	Multiple dragonfly species, multiple damselfly species
Butterflies and moths	Multiple butterfly species, multiple moth species
Aquatic insects	Stoneflies
Flying insects	Horseflies, mosquitos, honey bees
Other	Crayfish, spiders, mussels

North Castor River Water Chemistry

Water Chemistry Measurements

While observing the physical and morphological makeup of a stream can improve knowledge on that stream greatly, a lot can be understood from the chemical characteristics of a stream. For instance, one can physically observe that there is agricultural runoff entering a stream through tile drainage, but a chemical analysis of the water downstream of the tile drain will provide insight as to what degree the agricultural inputs are affecting water quality. With this information, land managers can make informed decisions about how to protect water resources in the most efficient and cost effective way. During City Stream Watch monitoring, water chemistry data was gathered at every section using a YSI Multi Probe.

Dissolved Oxygen

Dissolved oxygen refers to the amount of oxygen that has been dissolved into the water and is typically measured as the milligrams of oxygen gas dissolved into 1 litre of water (mg/L). From guidelines on water quality published by the Canadian Council of Ministers of the Environment (CCME, 1999), the North Castor River has, on average, a lower dissolved oxygen content than is recommended for the health of warm-water biota (Figure 22). Although the average is below CCME guidelines, there are areas of the North Castor River where oxygen levels are adequate or even exceed cold-water biota guidelines. These areas may be downstream of riffles where water is being heavily oxygenated or may be in areas where aquatic vegetation is common. When aquatic vegetation is common, high photosynthesis levels will increase overall dissolved oxygen levels in the water (see sections 4 through 13 in Figure 22).

Figure 22. A graph of dissolved oxygen (mg/L) from section 1 to headwater areas of the North Castor River at section 124. Thus, as one moves right along the x-axis, one also moves further upstream. DO LOW represents the lowest recommended level of dissolved oxygen (6.0 mg/L) while DO HIGH represents the highest recommended level (9.5 mg/L) (CCME, 1999). The North Castor River average is shown as a red line and falls below the recommended threshold. Note: the measurements were observed over the course of 2 months time. Thus, other factors such as weather and rainfall will have affected overall stream dissolved oxygen.

pH

The pH of water in a stream can be influenced by a number of different factors including the geology of the area, acid rain, and the presence of vegetation within a stream. When comparing the average pH of the North Castor River over 124 sections to guidelines established by the Canadian Council of Ministers of the Environment (CCME, 1999), the North Castor River exhibits a pH that falls between the thresholds of the guidelines (Figure 23). A water pH that falls outside of these guidelines has the capability to negatively alter the normal physiological functions of aquatic organisms. Mainly, the pH of water influences the exchange of ions between organisms and the water and is directly relevant to respiration and vital physiological processes. Therefore, a relatively constant pH is beneficial for aquatic organisms.

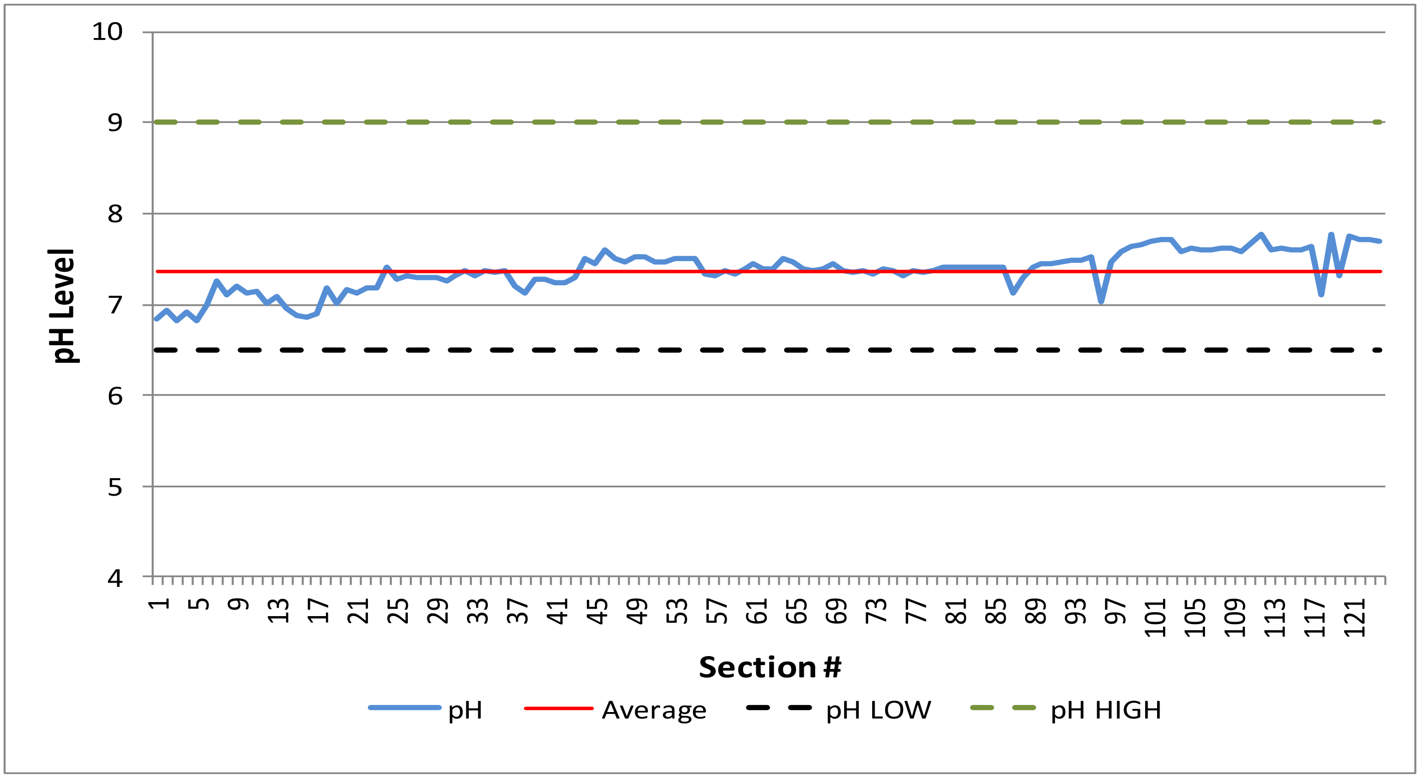

Figure 23. A graph of pH from section 1 to headwater areas of the North Castor River at section 124. Thus, as one moves right along the x-axis, one also moves further upstream. pH LOW refers to the lowest recommended pH (pH 6.5) to support a healthy aquatic ecosystem and pH HIGH refers to the highest recommended pH value (pH 9) (CCME, 1999).

The geology of the area around the North Castor River influences the pH characteristics of the stream.

Conductivity

The conductivity of a stream indicates the water's ability to conduct an electrical current and provides information into the amount of dissolved ions in the water (PWQO, 1999). Similar to pH, the conductivity of a stream is mainly influenced by the surrounding geological makeup. Additionally, surface water flow and flow from agricultural practices can influence the conductivity of a stream. Figure 24 shows the conductivity readings along the North Castor River from section 1 in the downstream area to 124 in the upper reaches. Since conductivity can be heavily influenced by storm water inputs, conductivity fluctuates daily and even hourly. The data obtained on the North Castor River indicates that the stream experiences conductivity fluctuations but the overall average conductivity was 1256 µs/cm. Currently, there are no water quality guidelines as established by the Canadian Council of Ministers of the Environment regarding conductivity in streams. However, baseline conductivity ranges can be used for comparison with regular conductivity measurements in order to detect discharges or sources of pollution in a stream in the future.

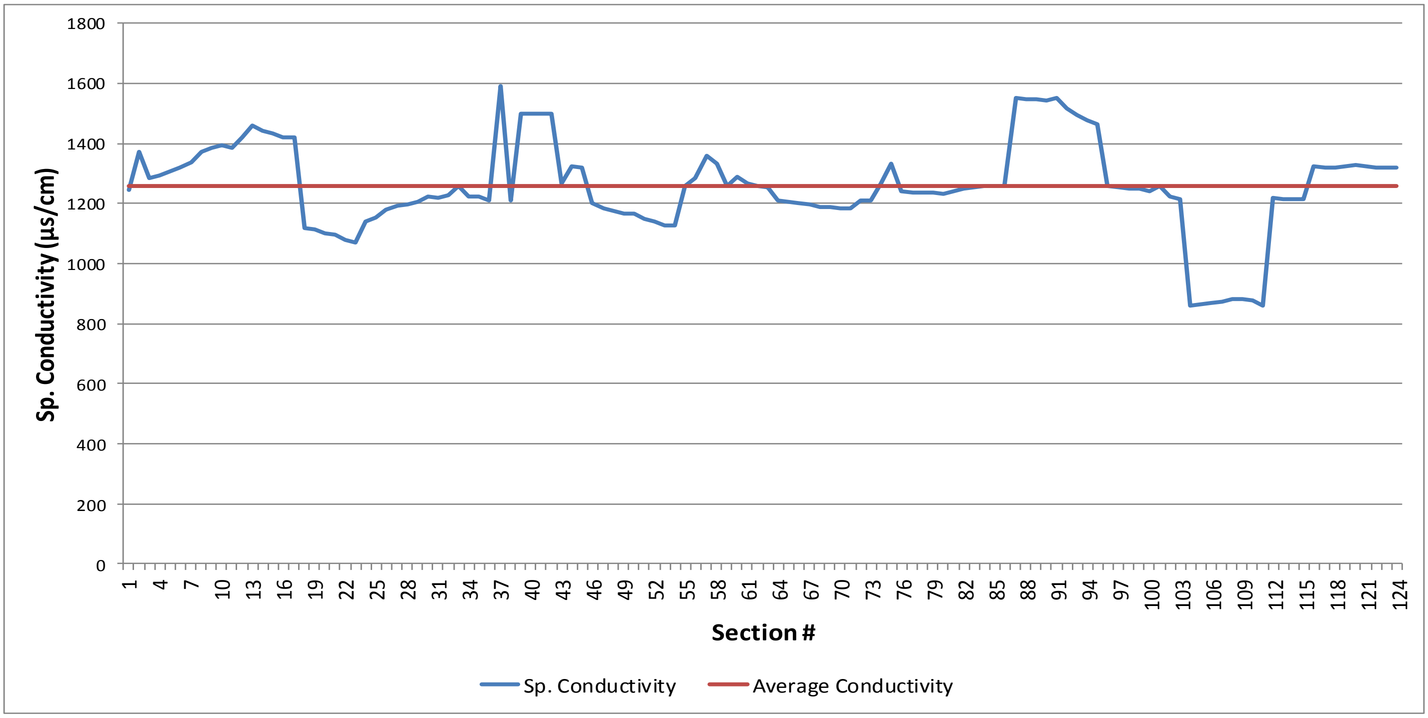

Figure 24. A graph of the specific conductivity from section 1 of the North Castor River to section 124 in the upper reaches. Thus, as one moves right along the x-axis, one also moves further upstream. The stream average conductivity (1256 µs/cm) is indicated with a red line on the graph.

The geology of the area around the North Castor River will influence the conductivity of the stream but surface water flow and agricultural runoff will cause daily and hourly fluctuations from storm events.

Water Temperature

Water temperature within a stream can be influenced by many factors including stream shading, groundwater inputs, flow rates, overland runoff, depth, and other water inputs to the stream. Since the diversity and makeup of fish and aquatic biota communities are directly related to water temperatures, it is important to gain insight into the average temperature of a stream over the summer months. Figure 25 shows water temperature as it was measured at each section along the length of the North Castor River. The average temperature over the stream length was found to be 21.82 ˚C. However, due to the nature of the monitoring techniques, the water temperatures in Figure 25 were taken over the course of 2 months of monitoring and consequently, are not indicative of the average water temperature of the entire stream length at one point in time. Nonetheless, the graph below does shed some light into the thermal dynamics of the North Castor River and where warm water inputs to the stream may be located.

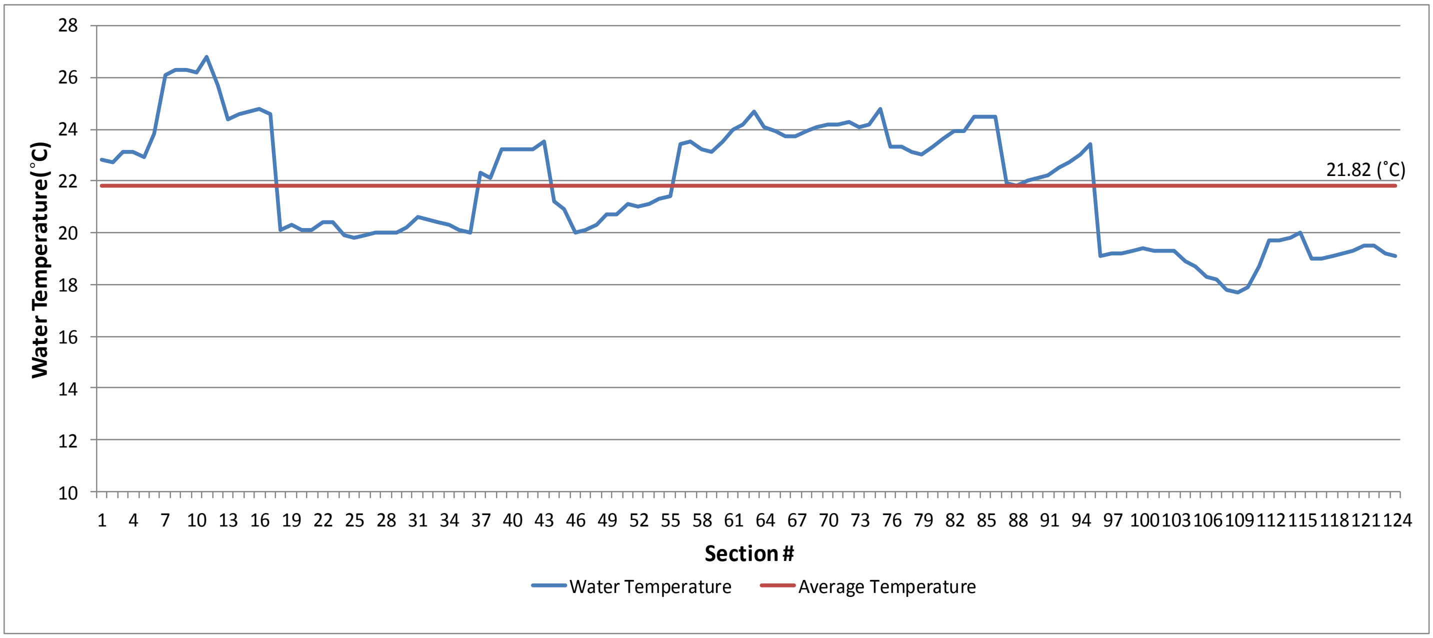

Figure 25. A graph of the water temperature recorded in each section along the North Castor River from section 1 to section 124 in the upper reaches. Thus, as one moves right along the x-axis, one also moves further upstream. The average temperature over all the sections (21.82 ˚C) is indicated as a red line.

Old stream crossings can reduce flow, create stagnant pools, and increase water temperatures.

Thermal Stability

One stationary temperature logger was placed in the North Castor River in 2015 at the Victoria Street Bridge in early July and left to gather data until December. Consequently, water temperature data was obtained on an hourly basis at one point in the North Castor River over five months. Unlike the water temperatures taken in each section during Stream Watch, the data obtained by the stationary logger can be used to better understand the thermal stability of the stream.

The thermal stability of a stream is a measure used to determine how well a stream can buffer against high or low water temperatures when air temperatures increase or decrease (Stoneman and Jones, 1996). The maintenance of relatively constant water temperatures is important as large fluctuations in temperature can harm fish and aquatic biota. As well, thermal stability data can be used to determine what type of fish community can be expected as a function of the water temperatures.

Following methodology laid out by Stoneman and Jones (1996), the maximum daily air temperature and the water temperature at 1600 hours was plotted on a thermal stability nomogram to determine the temperature profile of the North Castor River at the Victoria Street Bridge in 2015. This was done for as many dates as possible that fit the criteria set out by Stoneman and Jones (1996) over the course of the summer in order to increase accuracy. Figure 26 illustrates the results of this practice and shows that the North Castor River at the Victoria Street Bridge falls under the warmwater stream thermal stability ranking. In the future, stationary temperature readings ought to be taken at the headwaters of the North Castor River in order to determine if any differences exist between the headwaters and the mouth of the stream with reference to thermal stability. As well, loggers placed at the confluences of tributaries with the North Castor River and at other road crossings can help to identify any areas where there are major differences in thermal stability. Such an event may be indicative of a groundwater seep or inputs of unusually warm water to the stream from industrial or agricultural activities.

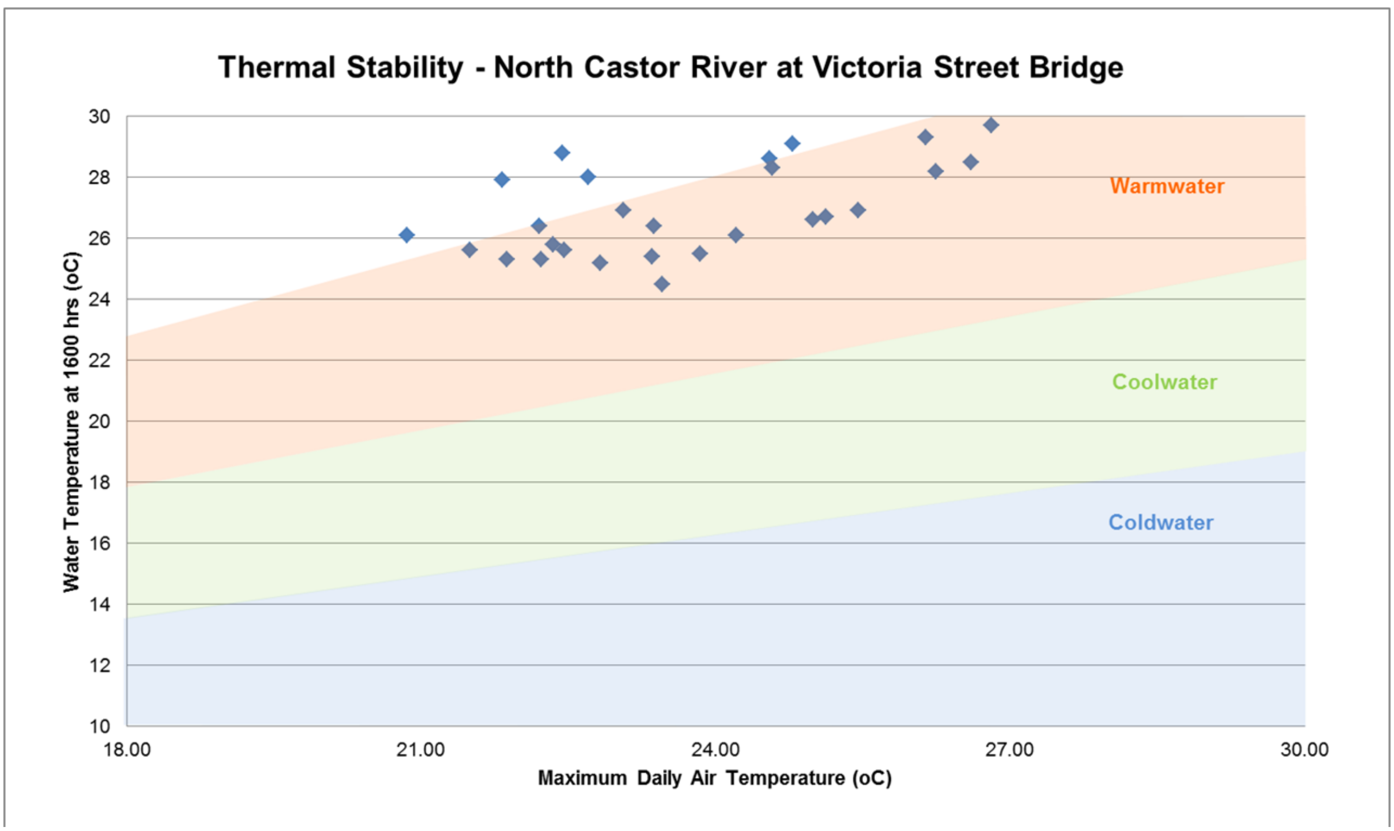

Figure 26. A modified nomogram showing the thermal stability of the North Castor River during summer 2015. The water temperature at 1600 hours and maximum daily air temperature are shown. All dates examined indicate that the North Castor River at Victoria Street Bridge is a warmwater stream.

Bioassessment—Benthic Macroinvertebrate Community

Benthic macroinvertebrate community composition was assessed to determine river conditions at two locations in the North Castor River. Benthic macroinvertebrates are small creatures (bugs) without backbones that live in the sediment on the river bottom and include insects, mollusks, crustaceans, and worms. These animals have many traits that make them useful as indicator organisms and have been widely used throughout the World as indicators of ecological health. The bug community of each test site was compared to the bug communities at 13 reference sites (minimally impacted sites) in the South Nation Watershed. These reference sites have similar habitat conditions to the test sites and it is assumed that if the bug community at a test site is much different from the set of reference sites, the condition of the river is poor. To determine if the bug community is impacted, a statistical exercise called Test Site Analysis was used.

Test site UC081013 is located on a tributary of the North Castor River and was sampled in 2010. The bug community is statistically different compared to communities present at reference sites and thus, is considered impaired. Three metrics were important in determining that the test site is different compared to reference sites; % Amphopoda, %EPT (Ephemeroptera, Plecoptera, Trichoptera), and EPT/EPT Chironomidae. Test site UC081013 has fewer sensitive taxa, such as those belonging to EPT families, and more chironomids and amphipods; taxa that are more tolerant of pollution.

Amphipods are found in almost all aquatic environments. However, when dominant, indicate that the stream is impaired and can use some sort of restoration work to improve stream health. Figure 27 below shows where Site UC081013 falls when statistically analyzed and compared to reference sites in the South Nation Watershed.

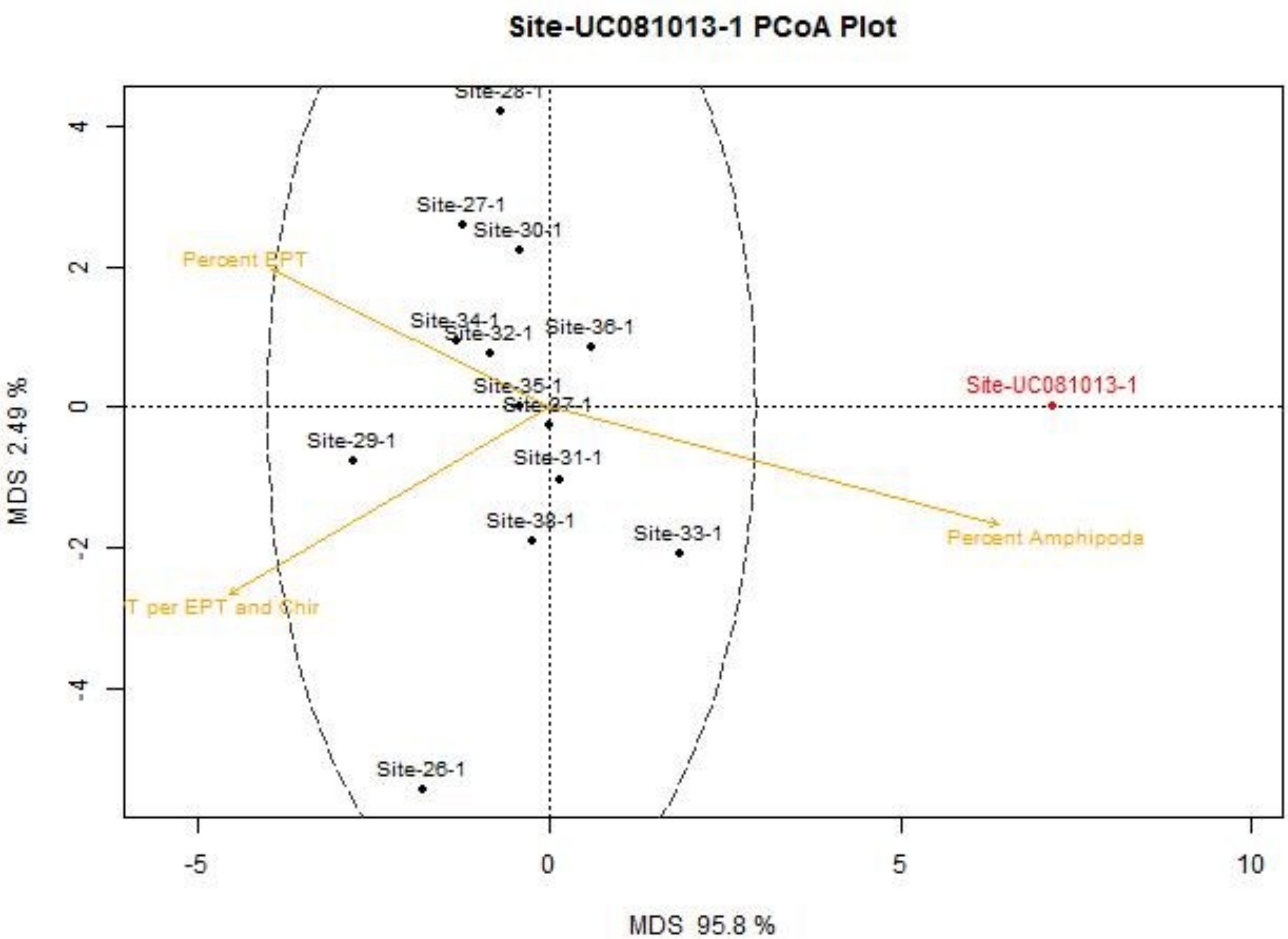

Figure 27. A figure illustrating where Site UC081013 falls when statistically compared to 13 reference sites across the South Nation Watershed. As shown, Site UC081013 is impaired and exhibits a statistically significant percent Amphipoda relative to unimpaired reference sites. Reference sites are portrayed with black text.

Bioassessment—Benthic Macroinvertebrate Community

Test site UC151038 is located on a tributary of the North Castor River and was sampled in 2015. The bug community is statistically different compared to communities present in the reference set and thus, is considered impaired. Similar to Test site UC081013 on the previous page, three metrics were important in determining that the test site is different compared to reference sites; % Amphopoda, %EPT (Ephemeroptera, Plecoptera, Trichoptera), and EPT/EPT Chironomidae. Test site UC151038 has fewer sensitive taxa, such as those belonging to EPT families, and more chironomids and amphipods; taxa that are more tolerant of pollution. Figure 28 below shows where Site UC151038 falls when statistically analyzed and compared to reference sites in the South Nation Watershed.

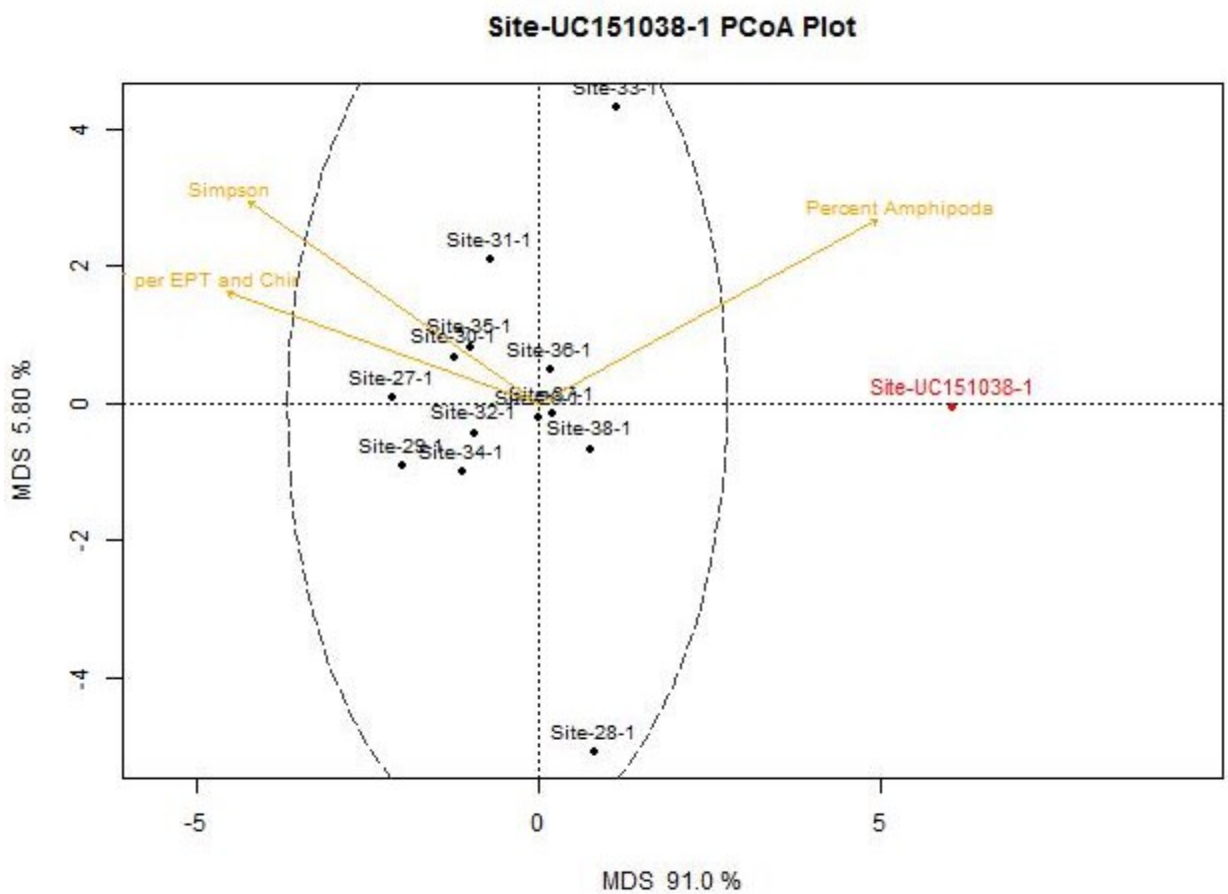

Figure 28. A figure illustrating where Site UC151038 falls when statistically compared to 13 reference sites across the South Nation Watershed. As shown, Site UC151038 is impaired and exhibits a statistically significant percent Amphipoda relative to unimpaired reference sites. Reference sites are portrayed in black text.

An image of a typical Amphipoda species (*Gammarus sp.*) found within the North Castor River Subwatershed.

North Castor River Fish Community

Fish Community

In order to gain an understanding of the fish community in the North Castor River, fisheries sampling was completed at 6 different bridge crossings along the stream. Sampling was completed using both small minnow traps and larger fyke nets in order to capture species and individual fishes of all sizes. The location of the net sets and the fish species that were captured at each site is displayed in Figure 29 below. Table 3 outlines each species caught within the North Castor River and corresponding short form from Figure 29. Overall, 10 different species of fish were captured in the North Castor River and 2 more (walleye and northern pike), were observed at different points in the stream.

The diversity of a fish community within a stream is a function of many factors including water temperature, conductivity, pH, organic inputs to the stream, sediment types, and the availability of food. Therefore, the diversity of fish within the North Castor River can reveal evidence about the overall stream health. For instance, brown bullhead, white sucker, pumpkinseed, central mudminnow, smallmouth bass, and yellow perch are all tolerant to warm waters and fluctuations in water temperature (Scott and Crossman, 1973). Since water temperatures within the North Castor River reach high temperatures at points during the summer and the stream is considered warmwater, it is no surprise that these species are found within. If water temperatures were lowered through stream shading and reduced flow interruptions, it is likely that cooler water species could colonize areas of the North Castor River and increase overall fish community diversity.

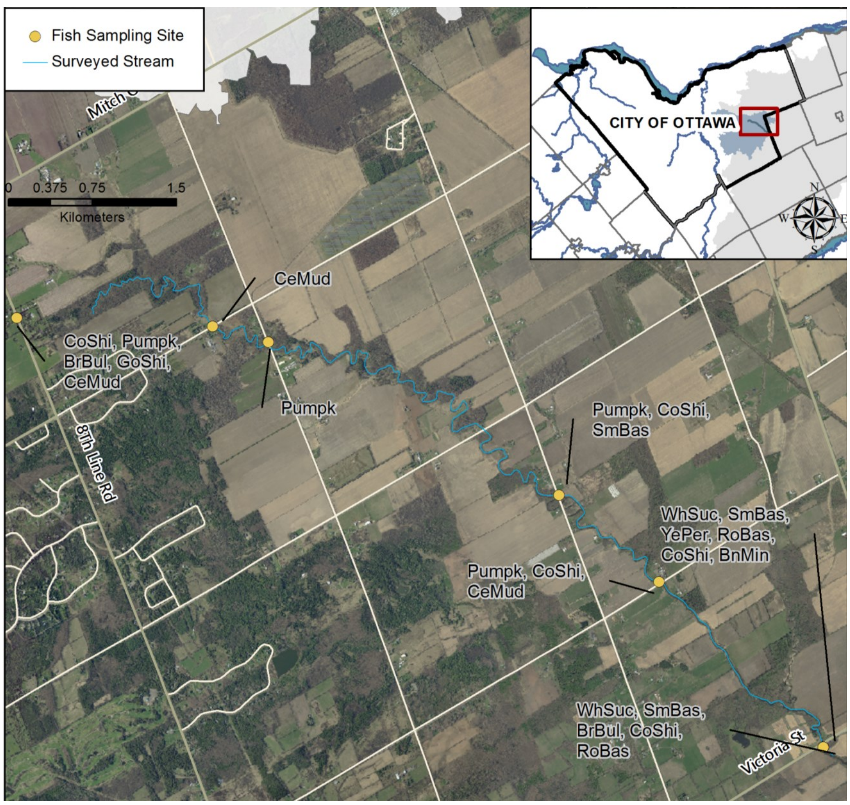

Figure 29. The location and species of fish that were caught within the North Castor River. Refer to Table 2 for common name short forms.

Table 3. The fish species captured by minnow trap or captured by fyke netting within the North Castor River and the common name short form.

Species	Short Form	Species	Short Form
Bluntnose minnow	BnMin	Pumpkinseed	Pumpk
Brown bullhead	BrBul	Rock bass	RoBas
Central mudminnow	CeMud	Smallmouth bass	SmBas
Common shiner	CoShi	White sucker	WhSuc
Golden shiner	GoShi	Yellow perch	YePer

Migratory Obstructions

Migratory obstructions within the stream will prevent fish from moving in the stream. This can have detrimental consequences for species that rely on specific spawning grounds they cannot reach. Although some of the migratory obstructions observed on the North Castor River were natural, the manmade ones pose severe obstructions to fish movement and water flow. Several low water crossings are no longer maintained and are causing severe water backup and pooling and are leading to increased water temperatures and lower dissolved oxygen in the stream. Figure 30 delineates the distribution of migratory obstructions observed.

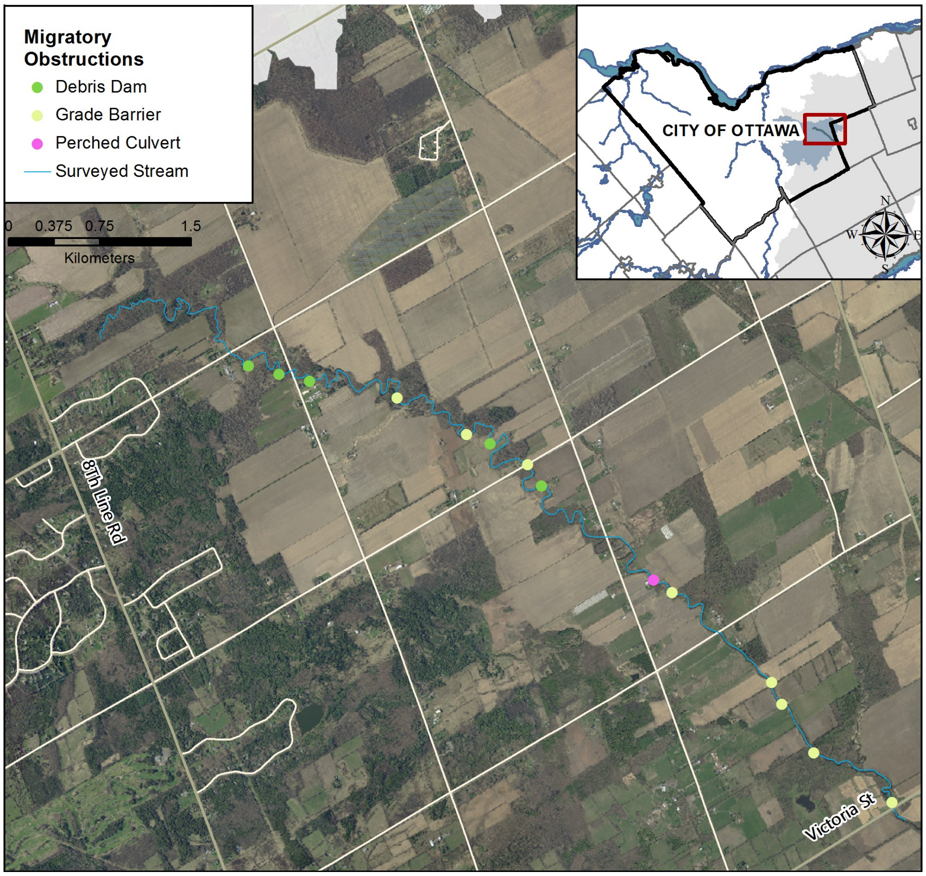

Figure 30. The spatial distribution of migratory obstructions on the North Castor River.

Abandoned stream crossings are obstructions to fish migration.

An old beaver dam can act as a barrier to fish migration.

Headwater Drainage Feature Assessment

Headwaters Sampling

A headwater drainage feature (HDF) is a depression in the land that conveys surface flow (Stanfield, 2013). As such, HDF's are areas where large amounts of water will accumulate during the spring freshet and be discharged to larger watercourses as spring turns to summer. Since HDF's are the areas where water first collects prior to entering larger streams, they can have consequential effects on water quality and quantity downstream. Therefore, it is beneficial for land managers to know the location and physical morphology of HDF's so that they can be properly managed, maintained, or protected.

HDF's were analyzed in 2015 as per the Assessing Headwater Drainage Features Module of the Ontario Stream Assessment Protocol (Section 4: Module 10). Overall, 45 HDF sites were assessed within the Castor River Subwatershed. The feature type, flow amounts, modifications to the HDF, surrounding landscape, and sediment transport levels were all measured or observed at each HDF site. Figure 31 shows the spatial distribution of HDF sites sampled in 2015 in close proximity to the North Castor River.

With the acquired knowledge on HDF's within the Castor River Subwatershed, South Nation Conservation will be better prepared to protect and manage sensitive water resources at the source. As well, if new land use practices are proposed in an area, South Nation Conservation can more accurately predict how the changes will affect water resources within the North Castor River Subwatershed.

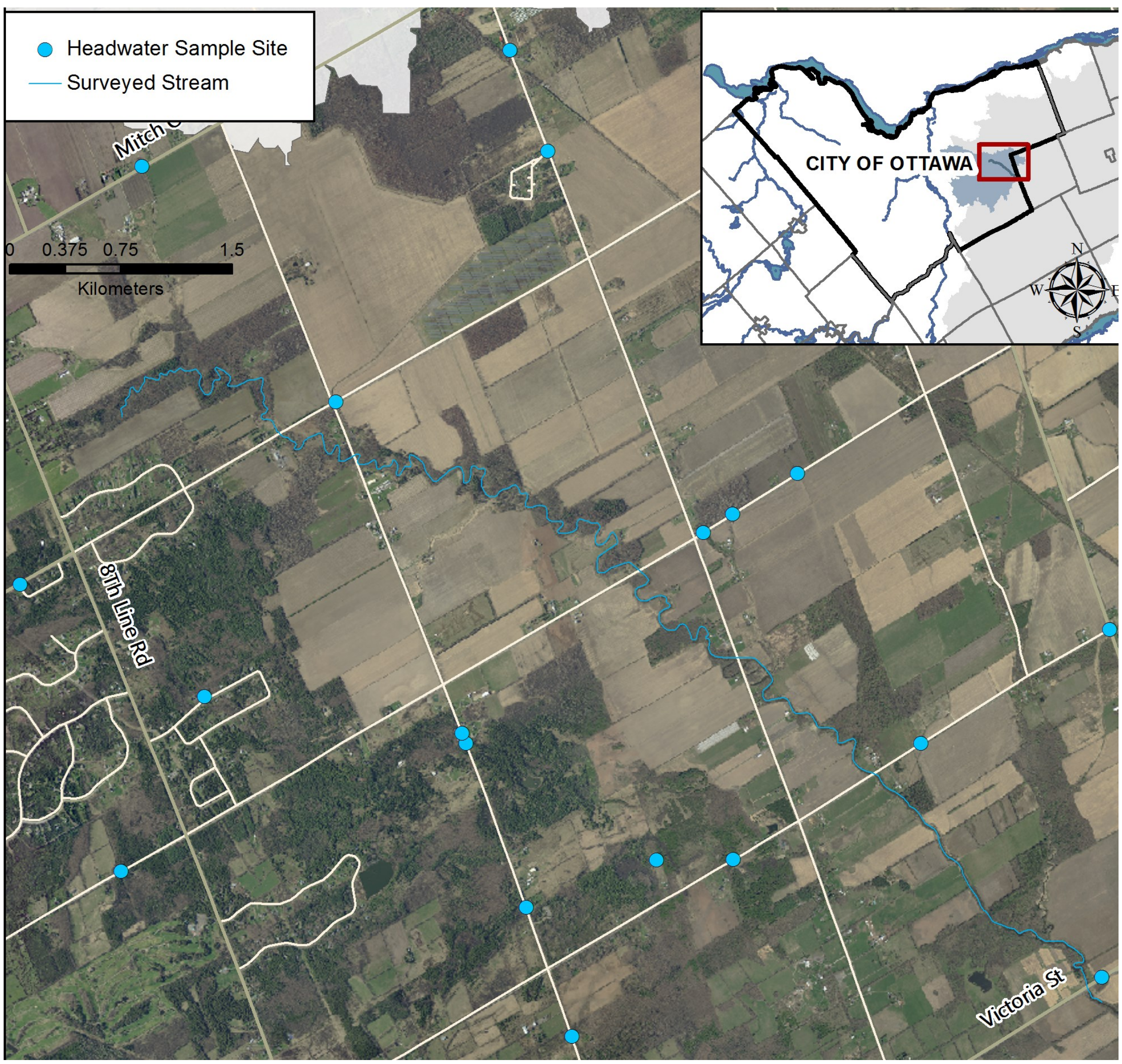

Figure 31. The spatial distribution of HDF sites in close proximity to the North Castor River.

Restoration

Potential Riparian and Stream Restoration Opportunities

While monitoring the North Castor River, staff and volunteers noted areas of the stream that could be improved by restoration projects. It was documented where riparian planting, stream garbage clean-ups, fish habitat enhancements, erosion control, channel enhancement or modifications, invasive species control, cattle access restrictions, wetland creation, and wildlife habitat enhancement projects could be undertaken. Overall, the North Castor River has many sections that could be enhanced specifically by riparian tree planting, erosion control, garbage clean up, or multiple restoration initiatives. Figure 32 illustrates where these areas were identified along the stream.

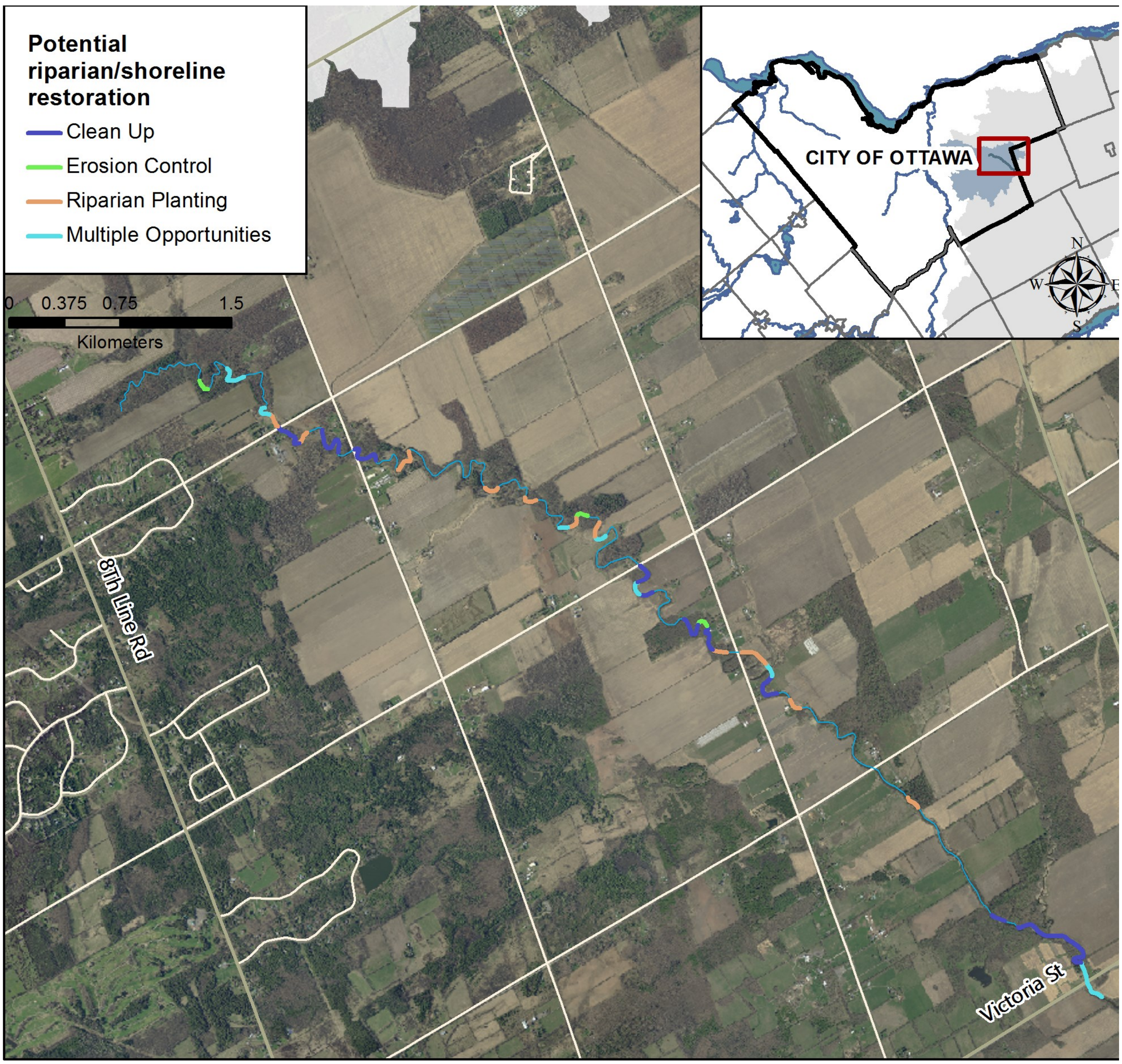

Figure 32. The spatial distribution of areas that have been identified for potential restoration initiatives.

Restoration Recommendations

Accumulatively, the many small scale stressors and interruptions to water flow along the North Castor River lead to decreased overall stream health and hindrances to fish and wildlife. Thus, it is recommended that land owners and land managers along the North Castor River work together in order to improve water quality. The best and most cost effective way would include increasing forest cover along the North Castor River. By simply planting riparian areas in trees, water temperature can be decreased which leads to increases in dissolved oxygen. Indirectly, riparian tree cover will stabilize stream banks and lead to decreased turbidity in the water. In the future, native tree species ought to be planted along areas identified through Stream Watch in partnerships between South Nation Conservation and land owners.

Along the North Castor River, several areas could benefit from the removal of low water crossings or perched culvert crossings. There are many old and abandoned low water crossings that are no longer in use since bridges and other infrastructure was built within the North Castor River Subwatershed. As well, there are some culvert crossings where there are perched or raised culverts at certain times of the year. If they were removed or repaired, water flow would be increased and fish migration routes restored to the river. In the future, the removal or repair of abandoned low water crossings and perched culverts ought to be prioritized based upon impact to water quality and quantity. Then, projects can be undertaken to restore water flow to natural form and function in the North Castor River.

A large amount of garbage was found in the North Castor River along the banks and on the stream bottom. Most of the garbage was found downstream of bridges that allow easy access to the river. Future projects ought to involve stream garbage clean-ups in areas identified through Stream Watch to remove the garbage from the stream. Volunteers and land owners in the North Castor River Subwatershed should be encouraged to participate in stream cleanups.

There are several areas along the North Castor River where riparian planting could improve stream shading and habitat.

Tires, propane tanks, farm equipment, and household garbage were commonly found within the North Castor River.

A triple-perched culvert was identified along the stream that could be improved to allow more effective fish migration in low water flow times.

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For more information on monitoring activities, restoration efforts, and volunteer events for South Nation Conservation and the City Stream Watch Program, please refer to the City Stream Watch 2015 Summary Report.

To volunteer with SNC's City Stream Watch program, please contact:

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613-984-2948
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