Carp B Tributary Catchment Report 2019

Monitoring Activity in the City of Ottawa

The City Stream Watch program (CSW) is an in-depth survey of a watercourse where data is collected by wading through the stream and taking detailed observations every 100 meters (m). In 2013, Mississippi Valley Conservation Authority (MVCA) joined the CSW working group and adopted the program. Since implementing the CSW program, MVCA staff and volunteers have surveyed 542 sections across 12 watercourses. This information has been utilized for the planning of riparian planting sites, habitat improvements, stream garbage pick-ups in Poole Creek and the Carp River, and invasive species removal events.

The CSW Program has three main goals:

- To provide long-term documentation of the aquatic and riparian conditions in our watershed
- To enhance public awareness about the condition and value of freshwater streams through volunteer engagement and the creation of catchment reports
- To use the information collected to encourage community driven restoration projects

When possible, each CSW assessment is enhanced with the application of other monitoring programs such as benthic biomonitoring, fish community sampling, temperature monitoring and assessing headwater drainage features.

Seasonal weather conditions in 2019 resulted in an above average spring flood followed by a hot summer and a late season drought which lasted until the end of October. Given the atypical seasonal conditions in 2019, all assessments were subject to the effects of low water and may not reflect the overall health of the systems. With the efforts of the MVCA staff and the volunteers, 45 sections in three catchments were assessed in 2019.

Figure 1 shows the location of the Carp B subwatershed within MVCA's City Stream Watch program area.

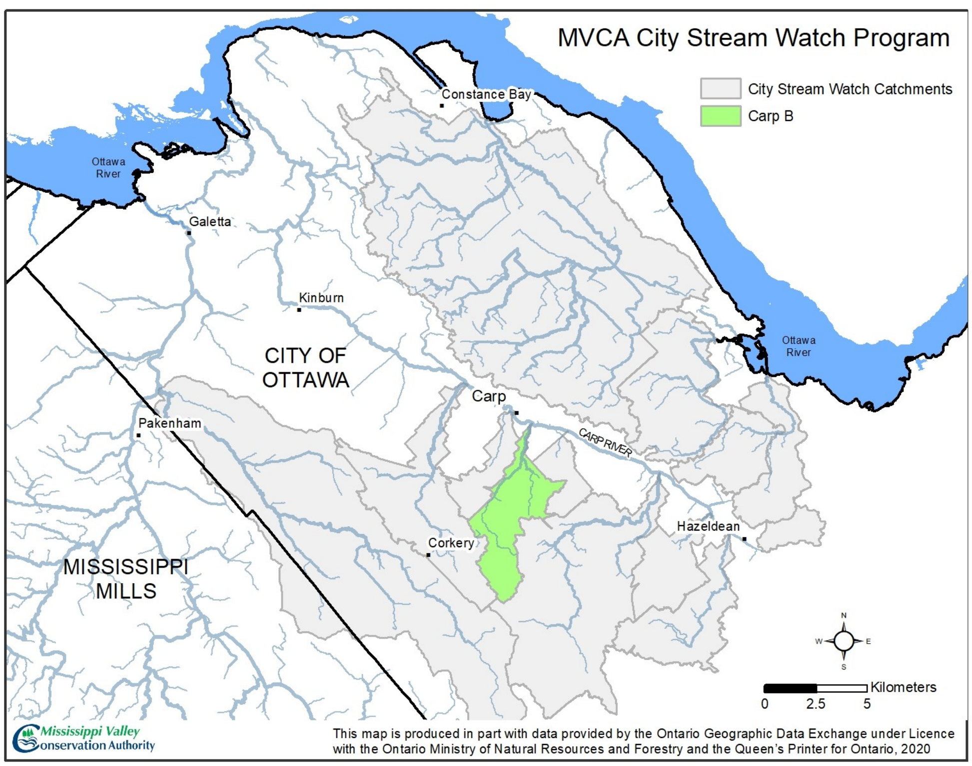


Figure 1: *MVCA's City Stream Watch area highlighting the location of the Carp B subwatershed.*

Carp B Tributary

With a length of 9.3 kilometers (km) and draining an area of 15.2 km^2, it the Carp B tributary makes up 5% of the Carp River watershed.

Carp B's headwaters originate in a large wetland south of March Road and west of Highway 417. It flows north and east through wetlands, forested lands and agricultural lands to the Carp River in the Village of Carp. Table 1 presents a summary of some key features of the Carp B Subwatershed.

Table 1: Subwatershed Features	
Area	15.2 Square Kilometers 5% of the Carp River watershed
Length	9.3 Kilometers
Type	100% Permanent Cool-warm water habitat
Land Use	18.6% Agriculture 0.5% Aggregate sites 27.8% Wooded area 3.7% Rural land-use 38.4% Wetlands 6.7% Grassland 4.2% Roads 0.1% Water
Surficial Geology	14.2% Clay 0.0% Diamicton 23.0% Organic deposits 15.4% Bedrock 42.1% Sand 5.3% Gravel

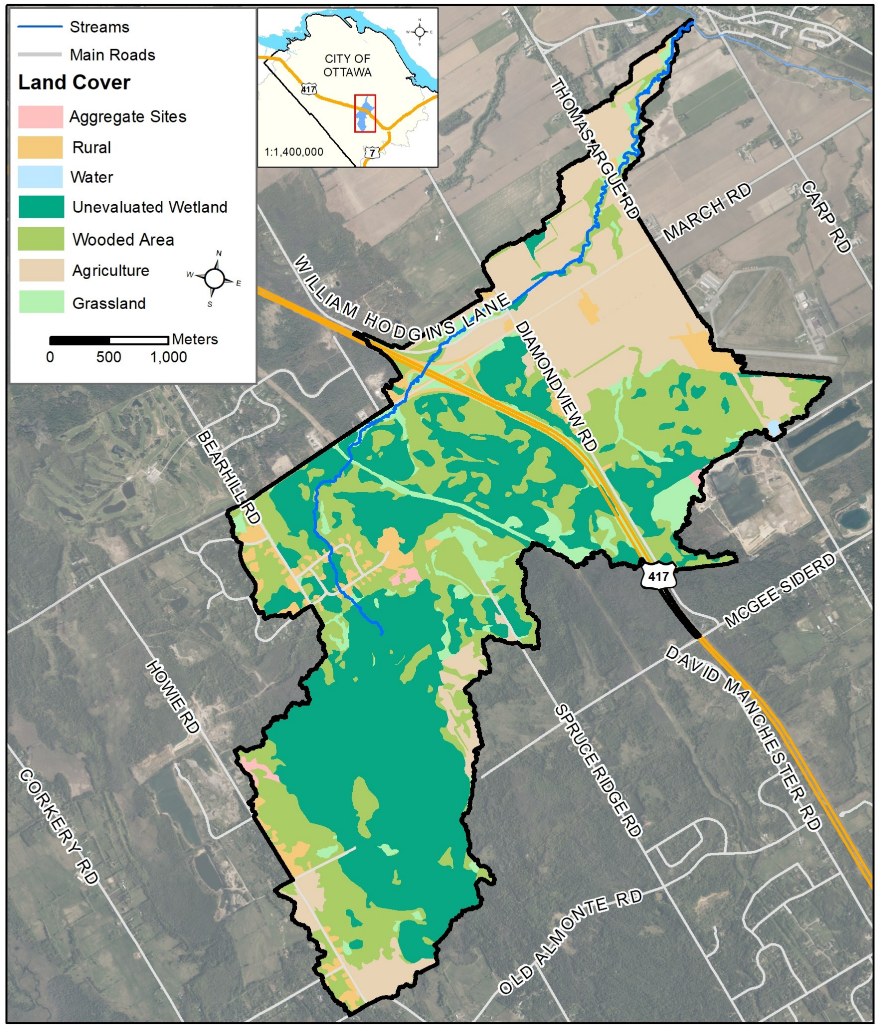
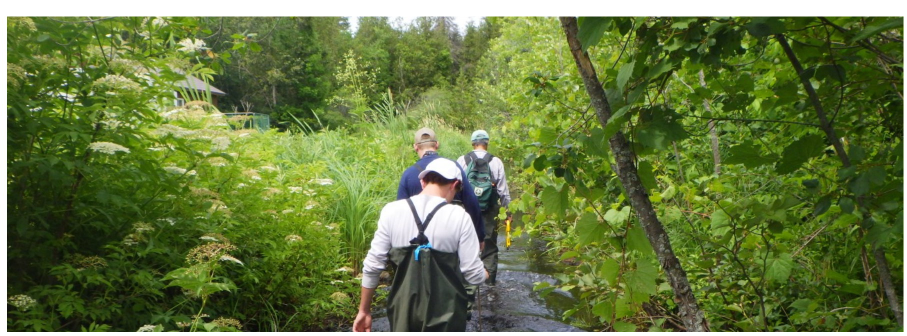


Figure 2: *Land Use in the Carp B subwatershed.*

The Carp B Subwatershed

As shown in Figure 2, the upper potion of the Carp B subwatershed is dominated by wetlands and woodlands while the lower portion is agricultural land uses such as tilled crops, hay fields and livestock pastures.

Crossing a mixture of wetland, woodland, farmland and rural residential areas, the creek and its tributaries provide a natural corridor and habitat for a range of aquatic and terrestrial species. Page 17 elaborates on the variety of species, or signs of species, that were observed during the 2019 survey.



Monitoring Carp B

In 2019, permission was obtained to survey 15 sections of Carp B, shown on Figure 3, which cover approximately 1.5 km of the main creek.

While these sections provide a good representation of the overall condition of Carp B, it should be noted that there are sections of the creek that are not represented in this assessment. These areas provide an additional diversity of habitat with valuable natural functions. The portions of the creek that were not sampled represent areas we did not have time to access, wetland areas that could not be assessed using the macro stream assessment protocol and areas where permission was not granted.

Table 2 shows some basic assessment measurements for Carp B. The surveyed sections had an average stream width of 3.38 meters (m), an average depth of 0.32 m, an average hydraulic head of 2 millimeters (mm), which is an indicator of surface water velocity.

Table 2: Carp B Assessment Facts			
	Minimum	Maximum	Average
Stream Wetted Width (m)	0.77	7.75	3.38
Stream Depth (m)	0.10	0.80	0.32
Hydraulic Head (mm)	0	22	2

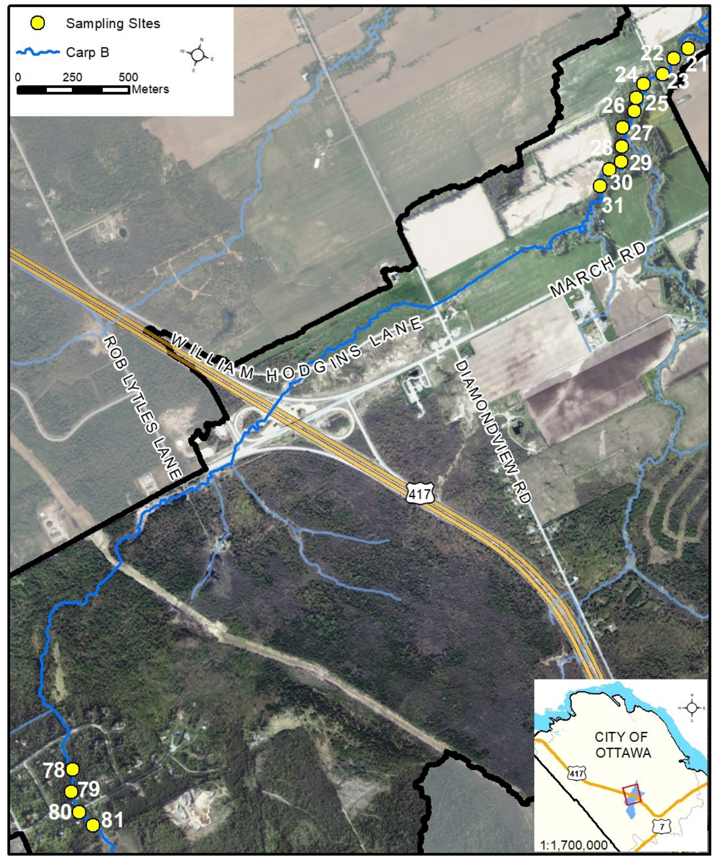


Figure 3: *Locations of the monitoring sites along Carp B.*

Methodology

The macro stream assessment is completed using a protocol that divides the entire length of the creek into 100 meter (m) sections. Starting at the downstream end, a monitoring crew wades the creek and completes a detailed assessment of every 100 m section. If a section of the creek is unwadeable, that section is bypassed and the assessment is continued once the creek becomes wadeable again. The parameters assessed include general land use, in-stream morphology, human alterations, water chemistry, plant life, and other features presented in this report.

General Land Use Adjacent to Carp B

General land use along each surveyed section of Carp B is considered from the beginning to the end of each survey section (100 m) and extending outward 100 m on each side of the creek. Land use outside of this area is not included in the surveys but is nonetheless part of the subwatershed and will influence the creek (Castelle et al, 1994).

The categories of land use include infrastructure, active agriculture, pasture, abandoned agricultural fields, residential, forests, scrubland, meadow, and wetland. Figure 4 shows the overall percent of land use that was observed adjacent to the Carp B Tributary.

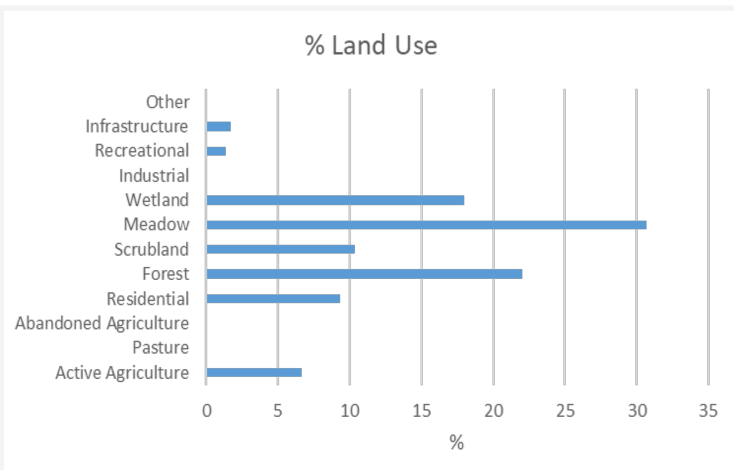


Figure 4: *Land use alongside Carp B.*

Of the eleven categories, industrial, pasture and abandoned agriculture were not found to be present along surveyed sections. At 30%, meadow represents the most prominent category of land use followed by forest at 22%, and wetland at 18%.

As described on page 2, the land use in the watershed is dominated by wetlands and woodlands. This is reflected well in the percentages seen in Figure 4. The land use observed directly adjacent to the surveyed portions of the tributary is dominated by meadow with 22% forests and 10% scrubland. The presence of these woody ecosystems is a benefit to the creek as well as the surrounding landscape as they provide shelter and food for a wide variety of animals, shade which cools the water and deep root systems which protect the banks from erosion.

Human Alterations to Carp B

In this assessment, human alterations refer to artificial changes to the actual channel of the watercourse either by straightening or relocation. Such alterations can be made in streams and rivers for many reasons including to accommodate development, such as road crossings and culverts, to make more land available for agriculture, and to minimize natural erosion caused by the meandering pattern of flowing water. As seen in Figure 5, 27% of Carp B was found to be unaltered and 73% was natural (with minor alterations). No surveyed sections were considered altered or highly altered.

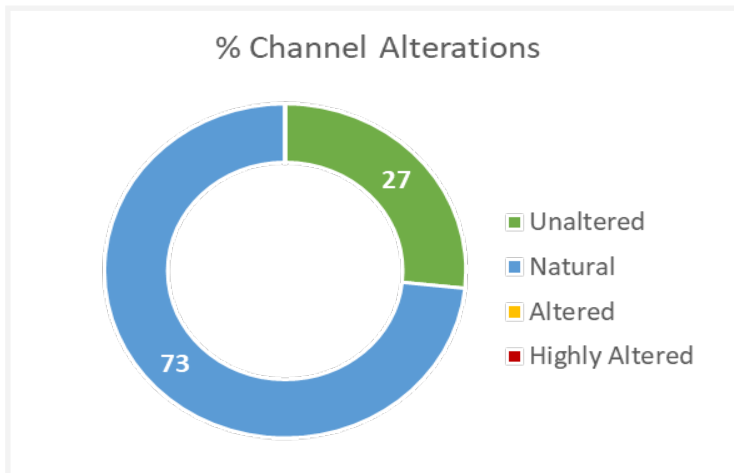


Figure 5: *Extent of human alterations to the shoreline of Carp B.*

It is beneficial to the overall health of the system that such a significant portion of the creek is in an unaltered or natural condition and has not been channelized. The sections that have been altered were in areas not surveyed and are mostly associated with the road crossings.

Riparian Buffer along Carp B

The riparian buffer refers to the amount of vegetated area along the edges of the stream banks. It can consist of a variety of vegetation types including trees, shrubs, grasses and other plants. Vegetated buffers are important for protecting water quality and creating healthy aquatic habitats. They intercept sediments and contaminants as well as protect the stream banks against erosion. Buffers also improve habitat for aquatic species by shading and cooling the water and providing protection for birds and other wildlife that need to be near water for feeding or rearing young. Riparian buffers along the creek corridor also provide a natural area for wildlife movement. While it is not the only factor affecting stream health, studies assessing adjacent land use largely show a positive relationship between buffer size and stream health (Stanfield and Kilgour, 2012).

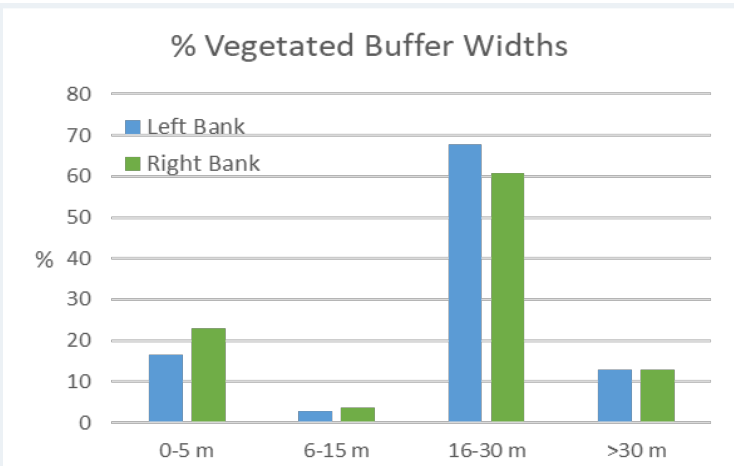


Figure 6: *Riparian buffer widths along Carp B.*

Environment Canada's Guideline: *How Much Habitat is Enough?* recommends a minimum 30 m wide vegetated buffer along at least 75% of the length of both sides of a watercourse. Therefore, for this assessment, we record the width of the riparian buffer within 30 m of either side of the watercourse. As summarized in Figure 6, most (68% Left Bank and 61% Right Bank) of the surveyed sections of Carp B have a moderately wide riparian buffer between 16 and 30 m. 19% of the left bank and 26% of the right bank had a buffer of 15 m or less.

Figure 7 shows the differences in riparian buffer widths along the surveyed reaches of the Carp B Tributary.

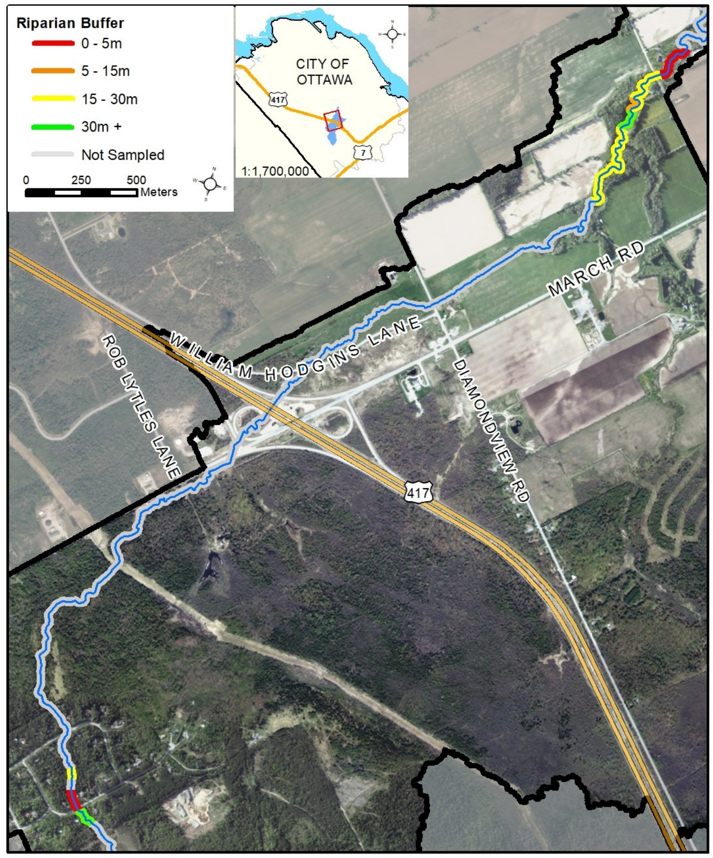


Figure 7: *Vegetated buffer widths along Carp B.*

Shoreline Classification

Two distinct areas were surveyed along the Carp B corridor. The first was a rural residential area in the headwaters and the second was a natural corridor through agricultural lands.

The shorelines through these areas consisted of 53% natural habitats, 38% regenerating habitats and 9% ornamental features. Degraded shorelines were not identified in the surveyed portions of Carp B.

Overhanging Trees and Branches

Overhanging branches and trees are a byproduct of a good riparian buffer, provide crucial nutrients, in the form of coarse particulate organic matter (leaves, insects, seeds etc.), to small streams (Vannote et al. 1980). This organic matter is broken down and eaten by aquatic insects, phytoplankton and zooplankton, which are an important food source for fish and other wildlife. Overhanging branches also provide stream shading, and fallen logs create excellent habitat for fish.

Overall, the surveyed sections of Carp B have a low percent coverage of overhanging trees and branches, as seen in Figure 8 with 100% of the reaches having less than 41% overhanging cover. This reflects the surrounding natural vegetative community, where the creek passes through sections of wetland and meadow habitat, areas dominated by tall grasses or shrubs, and in some areas it reflects clearing of the vegetation close to the creek.

Figure 8 shows the percentage of creek sections classified according to the various amounts of overhanging trees and branches. 53% of the 15 surveyed stream sections were classified as having 1-20% overhanging trees and branches along both banks, which is considered low.

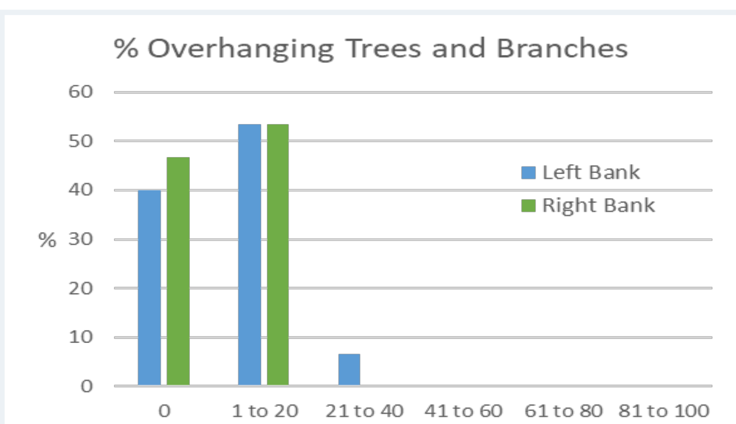


Figure 8: *Percentage of each surveyed section of Carp B with over-hanging trees and branches.*

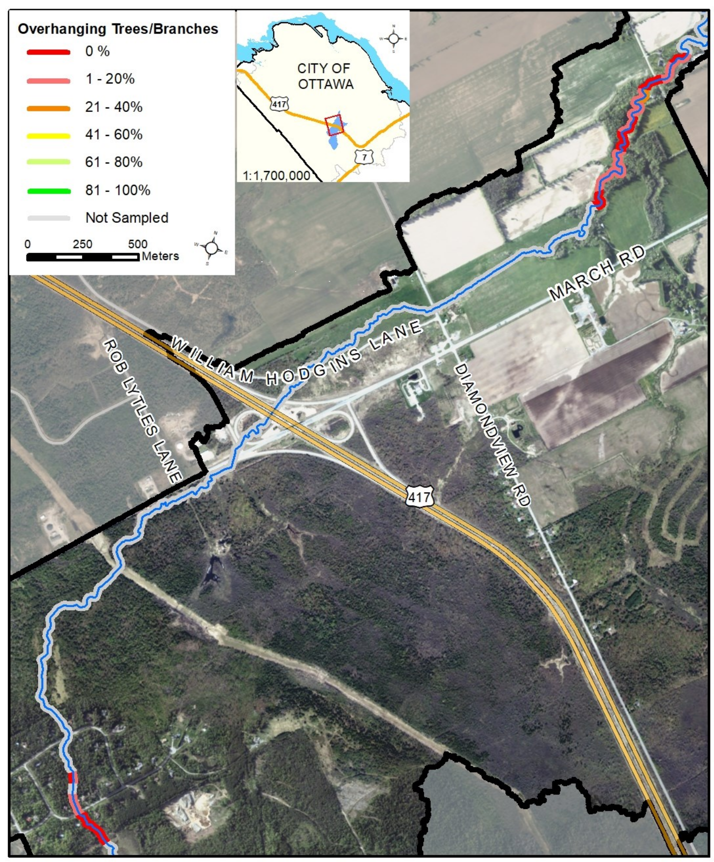


Figure 9: *Overhanging trees and branches along Carp B.*

Stream Shading

Shade is important in moderating stream temperature, contributing to food supply and helping nutrient reduction within a stream. Grasses, shrubs and trees can all provide shading to a stream, with trees providing more full coverage and grasses providing much needed shade directly along the edges of the channel where shading from trees may not be available.

Figure 10 shows the variability in the amount of stream shading along different sections of Carp B. The amount of stream shading in the surveyed sections is quite low. This is mostly due to the diversity of riparian vegetation along the creek, with large sections of open meadow, wetland or scrub land interspersed with areas of dense forest.

Figure 11 shows the data quantified as the percent of creek sections classified according to the various levels of shading. For example, 71% of the 15 stream sections surveyed were classified as having less than 20% shading. Only a small portion of the reaches (7%) were found to have greater than 60% shade.

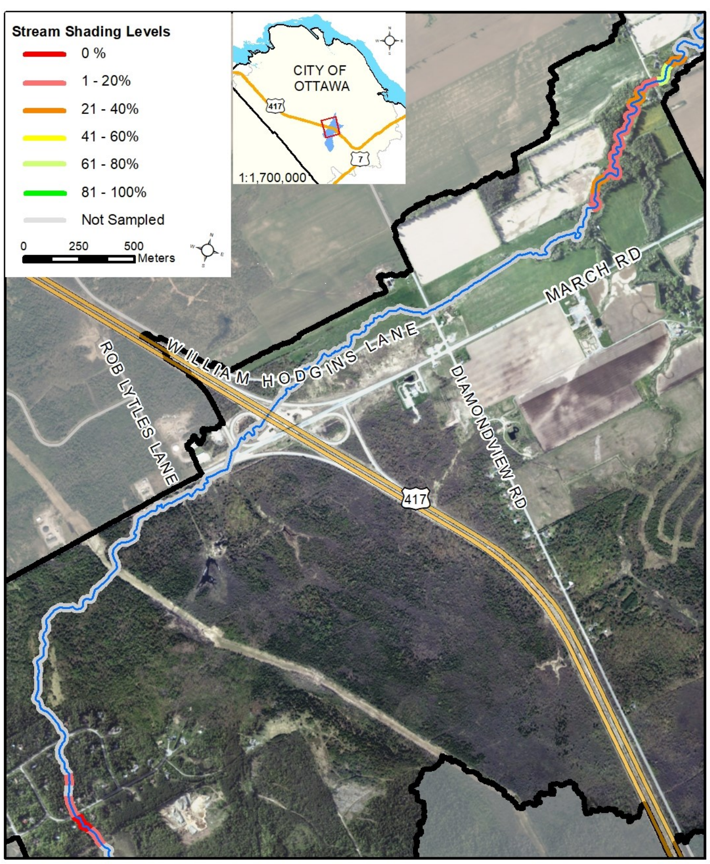


Figure 10: Stream Shading along Carp B

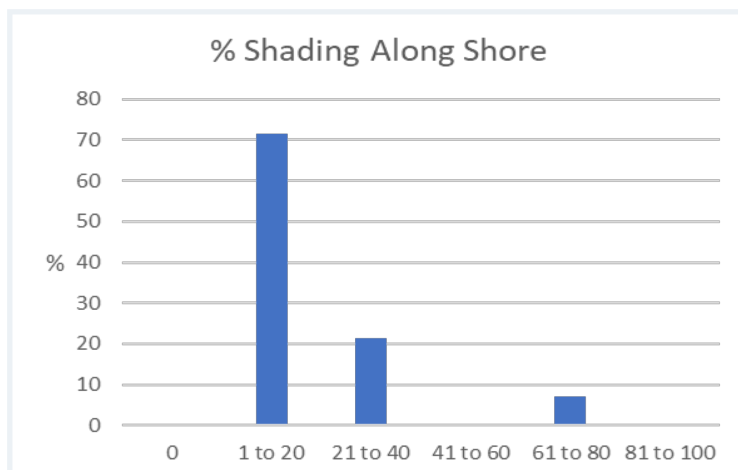


Figure 11: *Shading along Carp B.*

Erosion and Streambank Undercutting

Rivers and streams are dynamic hydrologic systems, which are constantly changing in response to changes in the watershed. Streambank erosion is a natural process that can produce beneficial outcomes by helping to regulate flow and shape a variety of habitat features. When the natural rate of erosion is accelerated or changed through human activities, such as stream straightening and over-clearing of catchment and stream bank vegetation, the system is thrown off balance. The acceleration of the natural erosion process can lead to stream channel instability, land loss, sedimentation, habitat loss and other adverse effects that negatively impact water quality and important fish and wildlife habitat.

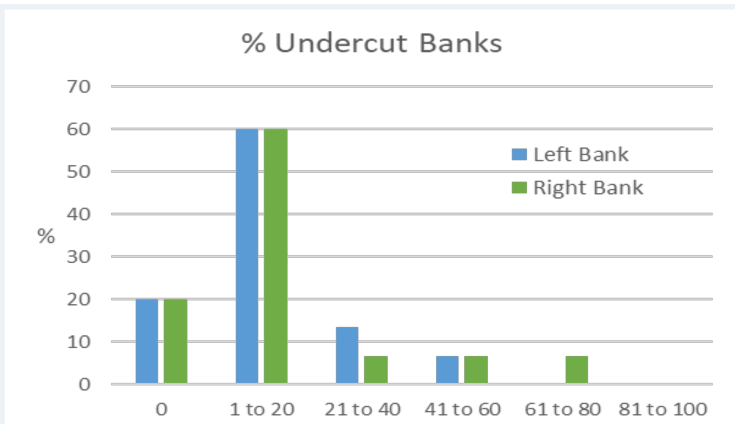


Figure 12: *Percent undercut stream banks along Carp B.*

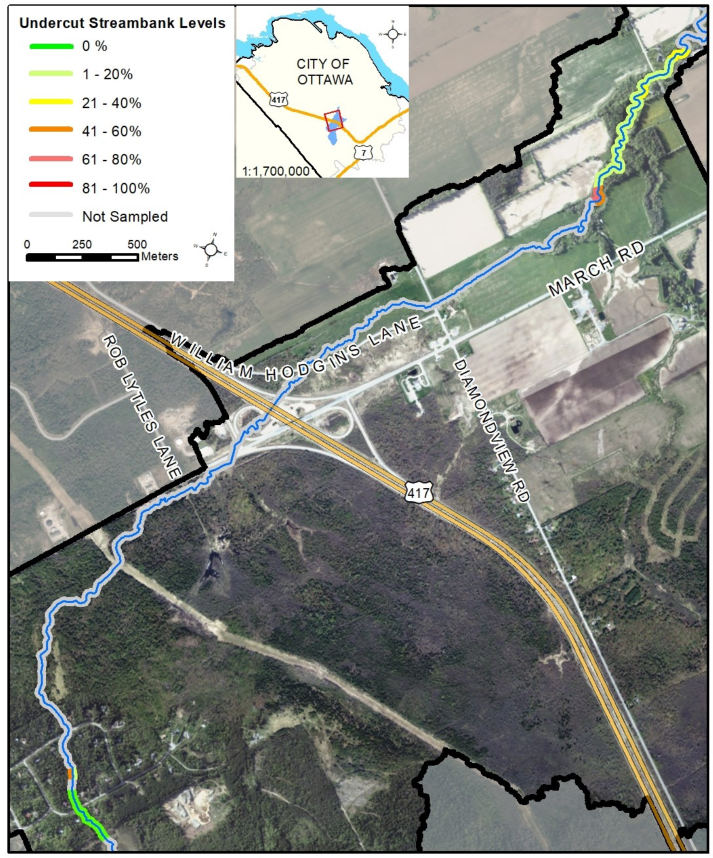


Figure 13: *Map of undercut banks in Carp B.*

One of the features created by erosion is undercutting of the banks, where the creek is then able to flow underneath of the banks. While some undercutting of stream banks can provide excellent refuge for fish, too much undercutting can become harmful if it results in bank instability, erosion and sedimentation.

Figure 12 shows the percentage of undercut stream banks along each surveyed section of Carp B. Overall, the sections of the Carp B tributary that were surveyed were found to have very little undercutting. However, 7% of the left bank and 14% of the right have a greater than 40% undercutting.

In-stream Substrate

In-stream substrate describes the composition of the bed of the watercourse. A diversity of substrates is important for fish and benthic invertebrates because some species have specific habitat requirements and will only reproduce on certain types of substrate. A healthy stream will generally have a large variety of substrate types which will support a greater diversity of organisms.

Figure 14 summarizes the different types of substrate which make up the bed of Carp B.

Carp B is composed of high percentages of clay, with smaller percentages of bedrock, gravel and sand. Clay, which makes up 67% of the dominant and 43% of the sub-dominant in-stream substrate, is prone to disturbance and erosion. Cobble and gravel which make up 7% of Carp B's dominant and 29% sub-dominant in-stream substrate, provides spawning habitat for fish and invertebrates. It also provides habitat for benthic invertebrates (organisms that live on the bottom of a water body or in the sediment) which are a key food source for many fish and wildlife species. Boulders create cover and back eddies for larger fish to hide and to rest out of the current, however none were identified within the surveyed reaches.

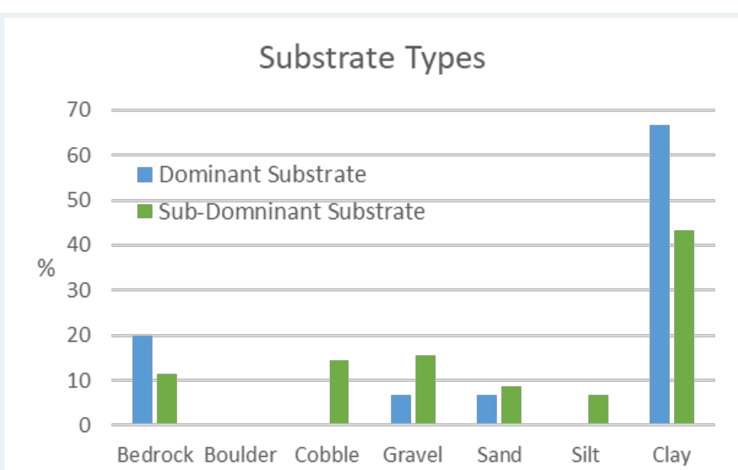


Figure 14: *Percentages of in-stream substrate types in Carp B.*

Cobble and Boulder Habitat

As discussed, cobble and boulders both provide important fish habitat. Figure 15 shows the sections of Carp B where cobble and boulders were found to either be present or not present on the stream bed and shows that only cobble substrate was found within the surveyed sections of Carp B.

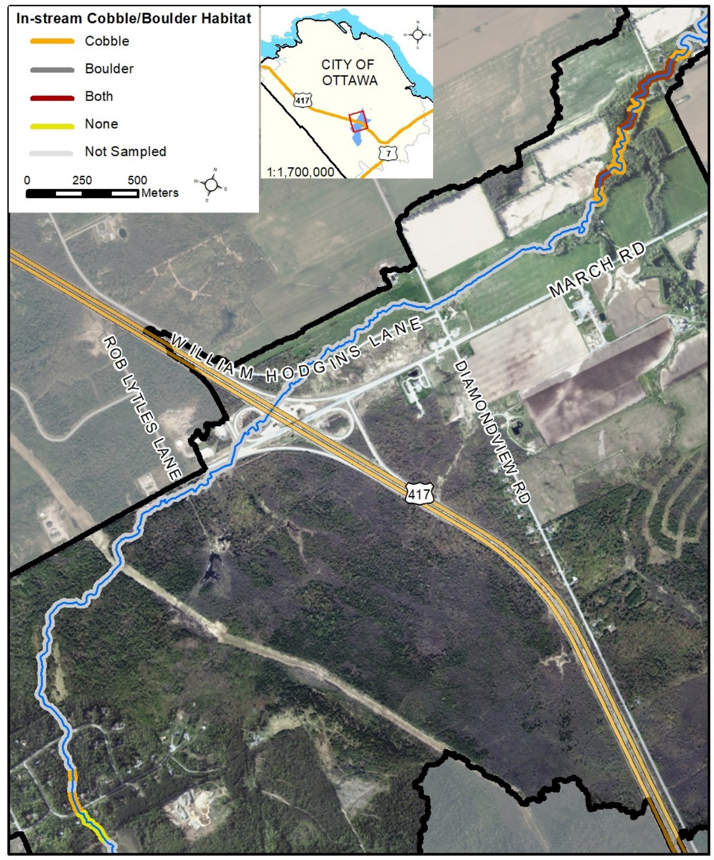


Figure 15: *Cobble and boulder habitat along Carp B.*

In-stream Morphology

In-stream morphology is categorized as pools, riffles, and runs. Pools and riffles are both particularly important for fish habitat. Pools, which are deeper and usually slower flowing sections in the stream, provide shelter for fish, especially when water levels drop or when water temperatures increase. Riffles are sections of agitated and fast moving water that add dissolved oxygen to the stream and provide spawning habitat for some species of fish. Runs are areas along a creek that are typically shallow and have un-agitated water surfaces.

It is beneficial for the health of the ecosystem if there is a variety of these in-stream features, to allow oxygen to flow through the creek, to provide habitat, and to have a well-connected watercourse. As seen in Figure 16, Carp B was found to consist of 84% runs, 8% riffles and 8% pools. Habitat enhancement efforts could be focused at creating more in-stream pool/riffle sequences to diversify and oxygenate fish habitat.

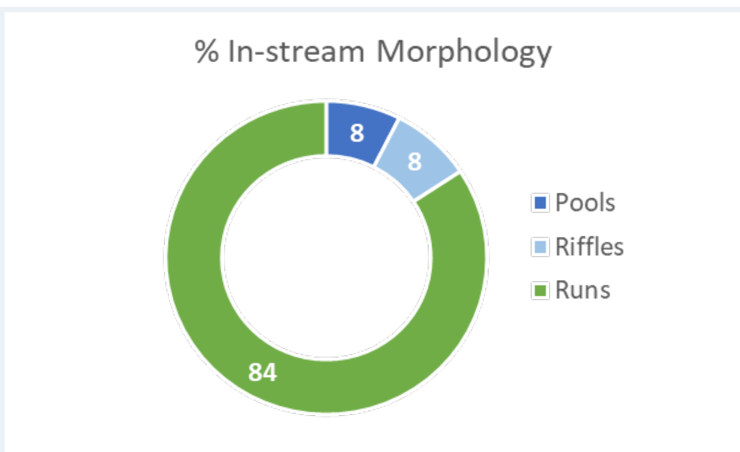


Figure 16: *In-stream morphology along Carp B.*

Habitat Complexity

Habitat complexity is a measure of the overall diversity of habitat types and features within a stream. Streams with high habitat diversity support a greater variety of species niches, and therefore contribute to a greater potential for species diversity. Factors such as substrate, flow conditions, and cover material all provide crucial habitat functions for aquatic life.

The habitat complexity score, seen in Figure 17, is based on the presence of gravel, cobble, or boulder substrates as well as the presence of woody or vegetative material in each surveyed reach of Carp B. The presence of one of the variables carries a score of 1. A reach with all five features receives a score of 5 for high habitat complexity.

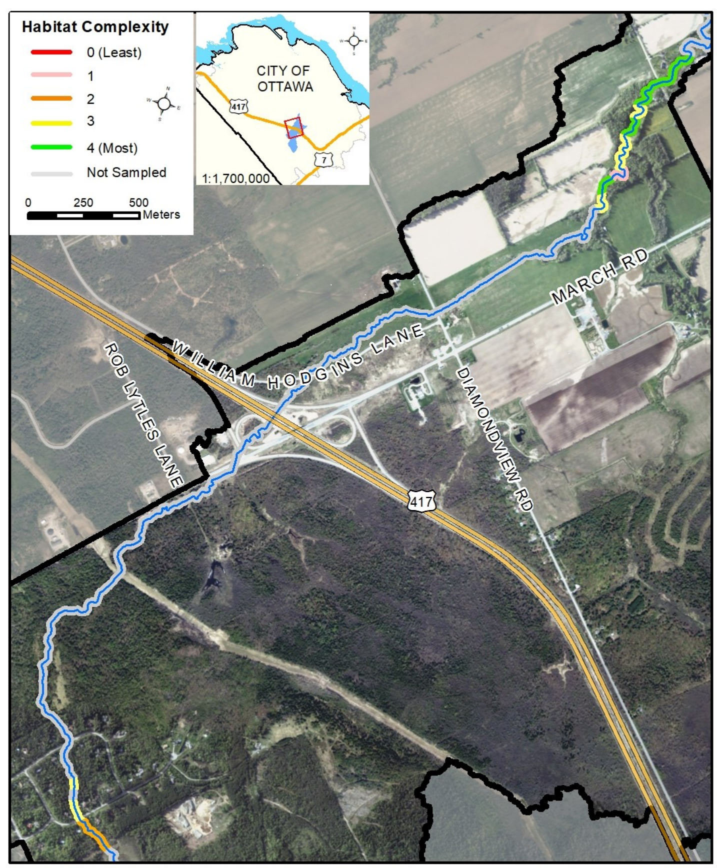


Figure 17: *Habitat Complexity Scores for Carp B.*

In-Stream Vegetation

A well-balanced amount and a suitable variety of in-stream vegetation is important for a healthy stream ecosystem. Aquatic plants provide habitat for fish and wildlife, contribute oxygen to the stream, and help to remove contaminants from the water. However, too much in-stream vegetation can be detrimental and can signify an unhealthy stream. Certain types of vegetation, such as algae, can also be indicative of poor stream health, as it is often seen in streams with high nitrogen and phosphorus inputs (from runoff or wastewater).

Types of In-stream Vegetation

There are many factors that can influence the presence of aquatic plants, some of which include the substrate type, increases in air and water temperature, and the time of year the assessment was completed. As seen in Figure 18, the in-stream vegetation that was observed in each surveyed section was divided into eight categories; narrow-leaved emergent, broad-leaved emergent, robust emergent, free floating plants, floating plants, submerged plants, algae and no plants. Algae (41%) was the most prominent in-stream vegetation in Carp B.

Amount of In-stream Vegetation

For this assessment, the amount of in-stream vegetation is measured according to five categories, ranging from "extensive", where the stream is choked with vegetation, to "rare", where there are very few plants.

Figure 19 shows the amounts of in-stream vegetation in Carp B. The surveyed portions of the creek were found to have a diversity of vegetation abundance with each category being represented. Overall the creek had more sections with low density vegetation, with 65% having less than 25% in-stream vegetation coverage.

Low in-stream vegetation levels in Carp B are likely due to substrate type. For example, many areas had a clay bottom which is not preferred by aquatic plants. A lack of aquatic vegetation may also be the result of water currents creating conditions that limit plant growth.

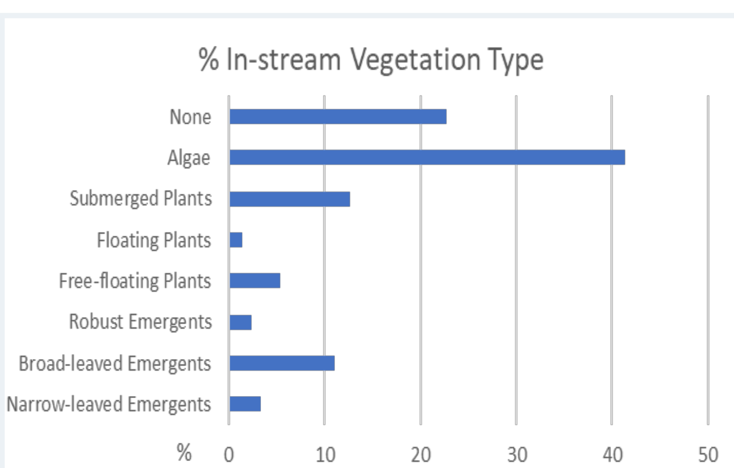


Figure 18: *Types of in-stream vegetation in Carp B.*

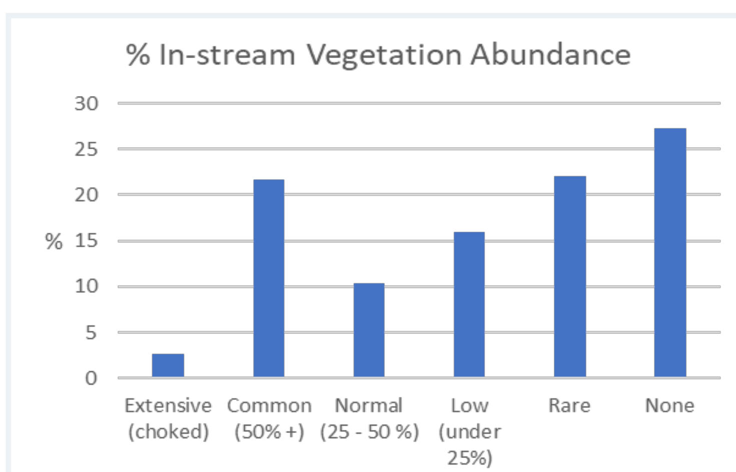


Figure 19: *Abundances of in-stream vegetation in Carp B.*

Water Chemistry and Quality

A YSI probe was used to collect water quality data including pH, dissolved oxygen, and conductivity, at each site assessed. The maximum, minimum and average readings for each of those parameters are presented in Table 3 and are discussed further on page 14.

Conductivity is defined as the ability of water to pass an electrical current, and is an indirect measure of the saltiness of the water caused by dissolved ions. Fish cannot tolerate large increases in ion concentrations in the water. Factors that can change the conductivity of freshwater include climate change and human activity. Warmer climate conditions increase the evaporation of water, leaving existing water with higher concentrations of dissolved ions (higher conductivity). Use of road salts and fertilizers around the stream can also elevate ion levels, along with industrial and human wastewater. Because of all these factors, conductivity of a stream can fluctuate greatly with readings between 0 and 10,000 microSiemens/centimeter (µS/cm). Environment Canada (2011) sets a target of 500 µS/cm as part their Environmental Performance Water Quality Index. The average specific conductivity of Carp B is 592 µS/cm, putting it just above the target level.

Since background conductivity can vary between systems, the 2019 results have been compared to the surveyed average for Carp B as seen in Figure 20.

pH tells us the relative acidity or alkalinity of the creek. The scale ranges from 1 (most acidic) to 14 (most basic) and has 7 as the middle and most neutral point. A range of 6.5 to 8.5 should be maintained for the protection of aquatic life. As can be seen in Table 3, the pH values found in Carp B stay within this ideal range. The average pH in the Carp B tributary is 7.73, a nearly neutral condition, which is ideal for many species of fish to thrive.

Table 3: Carp B Water Quality Data

	Minimum	Maximum	Average
Water Temperature (˚C)	18.4	25.6	21.5
Specific Conductivity (µS/cm)	400.75	994.00	592.39
pH	6.43	8.17	7.73
Dissolved Oxygen Concentration (mg/L)	1.06	10.53	7.60

Dissolved oxygen concentration measures the amount of oxygen available within the water that is useable by wildlife. According to the Canadian Water Quality Guidelines for the Protection of Aquatic Life, the guideline value for dissolved oxygen in freshwater for early life stages is 6.0 milligrams/liter (mg/L) for warm water ecosystems and 9.5 mg/L for cold water ecosystems.

The average amount of dissolved oxygen in Carp B measured at 7.60 mg/L, indicating that large reaches of the creek have adequate dissolved oxygen levels for most warm water fish to thrive. There are three reaches at the top end of our survey that had low dissolved oxygen concentrations which indicates a potentially stressed environment for fish in these locations. This will be discussed further on the following pages.

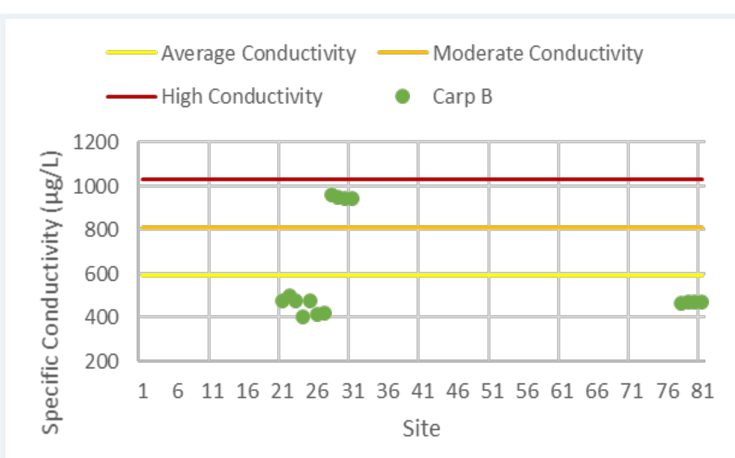


Figure 20: *Specific conductivity results from Carp B.*

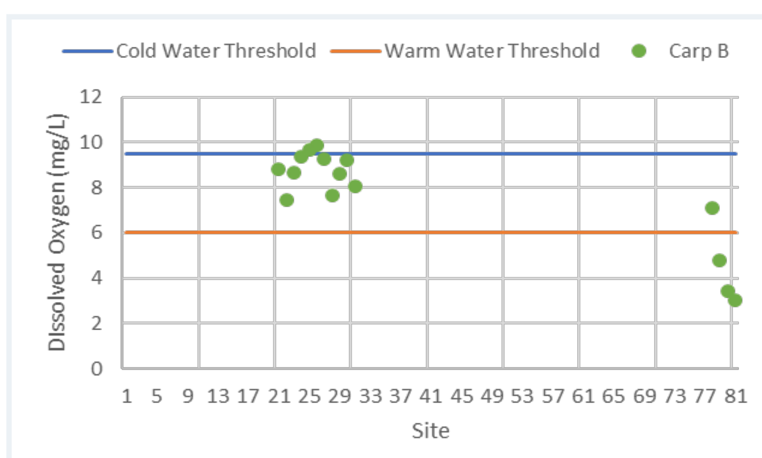


Figure 21: *Dissolved oxygen concentration results from Carp B.*

Dissolved Oxygen Saturation is measured as the ratio of dissolved oxygen relative to the maximum amount of oxygen that will dissolve depending on the temperature and atmospheric pressure. Well oxygenated water will stabilize at or above 100% saturation, however the presence of decaying matter and pollutants, which consume oxygen, can drastically reduce these levels. Oxygen input through photosynthesis has the potential to increase saturation above 100% to a maximum of 500%, depending on the productivity level of the environment.

Combining the dissolved oxygen concentrations with the saturation values provides us with 6 categories to classify the suitability of the stream for supporting various aquatic organisms. Results are shown in Figure 22.

1) <100% Saturation / <6.0 mg/L Concentration
   Oxygen concentration and saturation are not sufficient to support aquatic life and may represent impairment.
2) >100% Saturation / <6.0 mg/L Concentration
   Oxygen concentration is not sufficient to support aquatic life, however saturation levels indicate that the water has stabilized at its estimated maximum. This is indicative of higher water temperatures and stagnant flows.
3) <100% Saturation / 6.0-9.5 mg/L Concentration
   Oxygen concentration is sufficient to support warm water biota, however depletion factors are likely present.
4) >100% Saturation / 6.0-9.5 mg/L Concentration
   Oxygen concentration and saturation levels are optimal for warm water biota.
5) <100% Saturation / >9.5 mg/L Concentration
   Oxygen concentration is sufficient to support cold water biota, however depletion factors are likely present.
6) >100% Saturation / >9.5 mg/L Concentration
   Oxygen concentration and saturation levels are optimal for warm and cold water biota.

The three reaches with the lowest dissolved oxygen amounts and saturations were just downstream of a large wetland. It is possible that the dissolved oxygen levels were influenced by the low flows and high decomposition rates in the area. (organic decomposition consumes oxygen).

9 areas in total had poor oxygen concentration scores, mostly associated with low saturation levels.

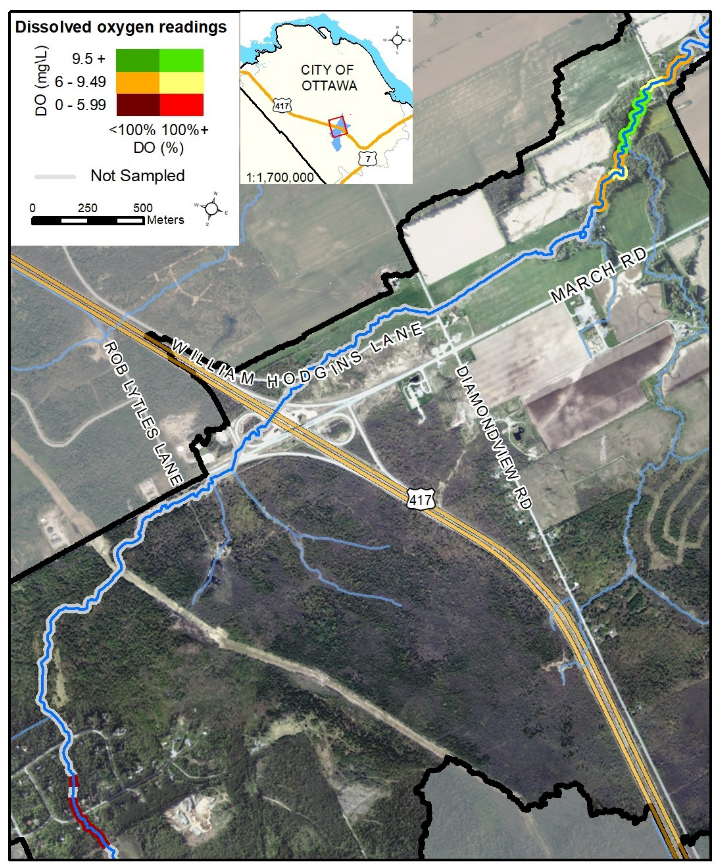


__Figure 22:__ Dissolved oxygen concentration and saturation results for Carp B.

Areas of Water Quality Concern (AOC)

This is a summary of areas that are potentially under stress due to one or several water chemistry factors. Three water quality factors; oxygen saturation score, pH, and conductivity are used to classify the areas of water quality concern.

As shown in Table 3, one pH value was below the ideal range. Combined with a good conductivity score and a moderate dissolved oxygen score this reach has a moderate AOC score.

Conductivity values were fairly low throughout the creek with higher values occurring in four consecutive reaches that also had reduced dissolved oxygen saturation readings.

While oxygen concentration levels were fairly good for most of the creek, the saturation levels were often below 100% (as shown in Figure 22). This indicates that some reaches have less than ideal conditions for aquatic organisms.

The seven poor scores shown in Figure 23 reflect areas where oxygen concentration and saturation scores were very low or where low oxygen scores combine with higher than average conductivity readings.

The four sections receiving a good score reflect the areas that had low oxygen concentration and saturation results combined with average conductivity scores.

The four sections with an excellent score had low conductivity readings and high dissolved oxygen and concentration results.

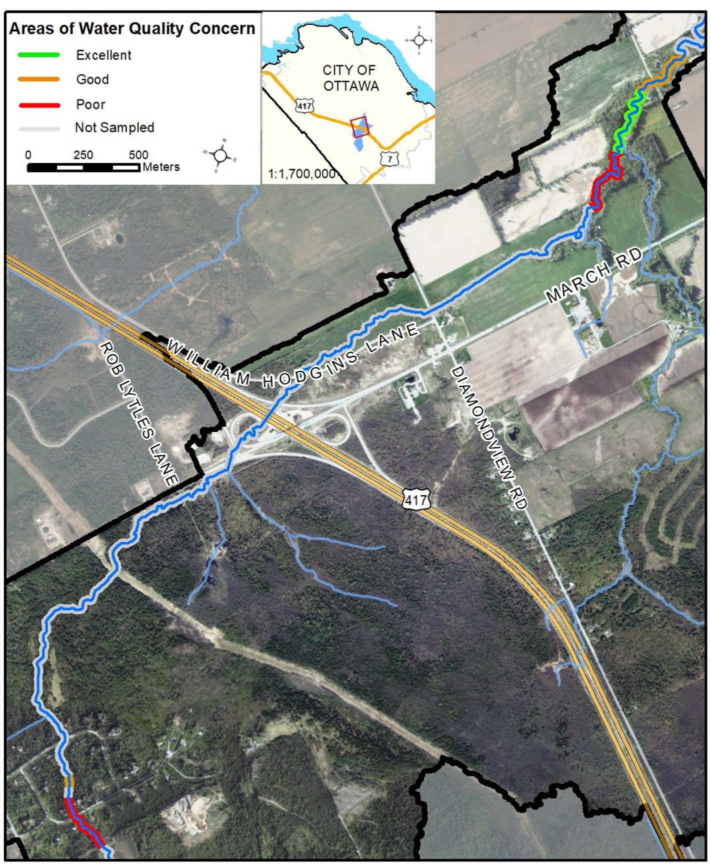


Figure 23: *Areas of Water Quality Concern in Carp B.*

Thermal Classification

Temperature is an important parameter in streams as it influences many aspects of physical, chemical and biological health. Figure 24 shows where the two temperature dataloggers were deployed in Carp B from May to October 2019. This data provides a representative sample of how water temperature fluctuates throughout the summer season.

Many factors can influence fluctuations in stream temperature, including springs, tributaries, precipitation runoff, discharge pipes and stream shading from riparian vegetation. Water temperature is used along with the maximum air temperature (using the revised Stoneman and Jones method by Cindy Chu *et al*), to classify a watercourse as either warm, cool-warm, cool, cold-cool, or cold water. Figure 25 shows the thermal classifications of Carp B for 2019.

Analysis of the data collected indicates that both sites in Carp B should be classified as a cool-warm water stream.

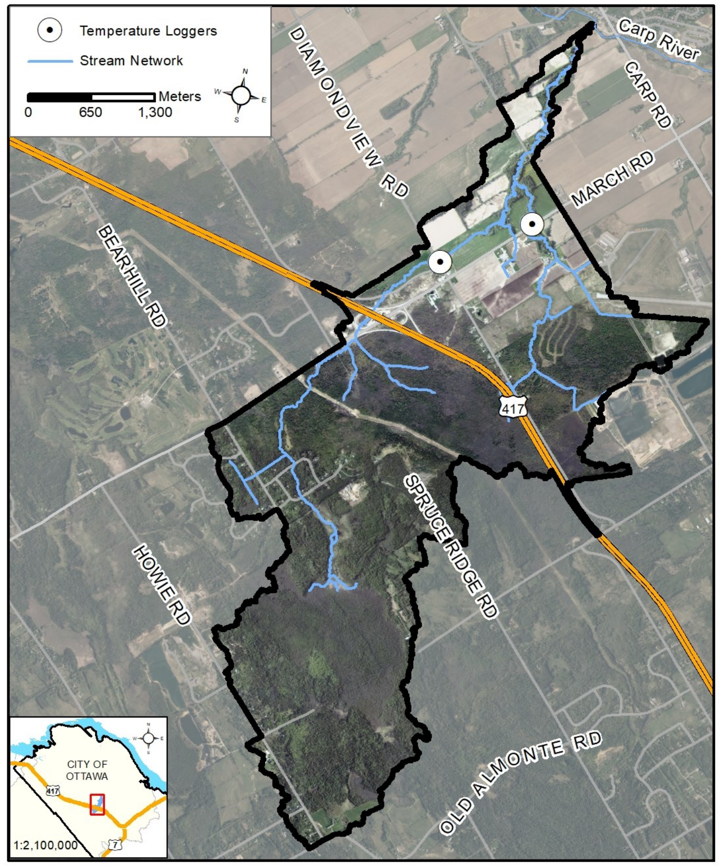


Figure 24: *Location of the temperature loggers placed in Carp B.*

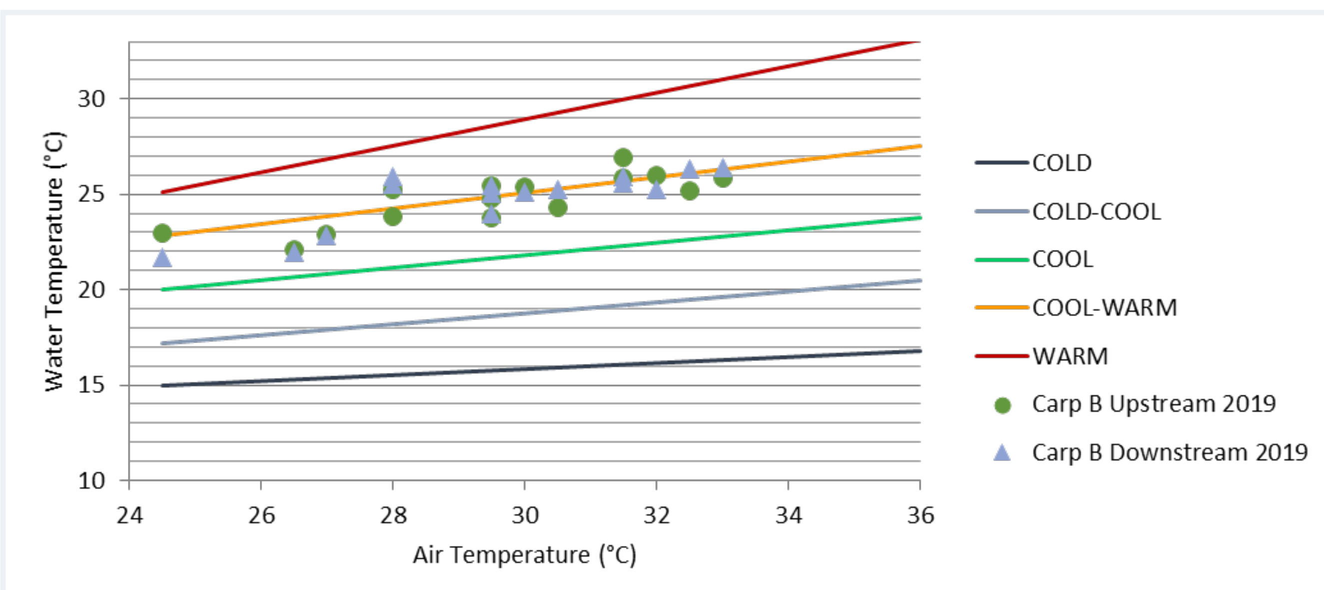


Figure 25: *Thermal classification of Carp B.*

Each point on the graph represents a water temperature that was taken under all the following conditions:

- Sampling dates between July 1 and August 31;
- Sampling date has a maximum air temperature ≥ 24.5 °C and was preceded by two consecutive days with a maximum air temperature ≥ 24.5 °C during which time no precipitation occurred; and
- Water temperature at 4:00 pm.

Fish Sampling

Unfortunately MVCA was unable to perform a fish survey in Carp B in 2019. However, MVCA has records of past fish sampling efforts along Carp B and has been able to compile a fish species list shown in Table 4. (Thermal classes from Coker, 2001)

Table 4: Fish Species Found In Carp B	
Species Common Name	**Thermal Class**
Brook Stickleback	Cool
Common Shiner	Cool
Creek Chub	Cool
Eastern Blacknose Dace	Cool
Finescale Dace	Cool
Johnny/Tessellated Darter	Cool
Longnose Dace	Cool
Northern Redbelly Dace	Cool
Pearl Dace	Cool
White Sucker	Cool

Beaver Activity

Signs of beaver activity were noted predominately in and near the headwater wetland area with observations of cropped trees, a lodge and stockpiles of woody material.

There were fewer indicators of beaver activity in the surveyed sections near Thomas Argue Road, however the crew did observe a deceased beaver on the banks indicating their presence in the area.

Although signs of beaver activity were found in both surveyed portions of the tributary, no intact dams were presently creating blockages to flow or fish migration.

Migratory Obstructions

Migratory obstructions are features in a water way that prevent fish from freely swimming up and downstream. This can negatively affect migration to breeding or foraging habitats, as well as restrict a fish's ability to access deeper, cooler water refuges when summer droughts come. These obstructions can be anthropogenic, such as perched culverts or debris dams at road crossings, or they can be natural features such as waterfalls and beaver dams.

As shown in Figure 26, the surveyed portions of Carp B revealed that there is a perched culvert acting as a migratory obstruction.

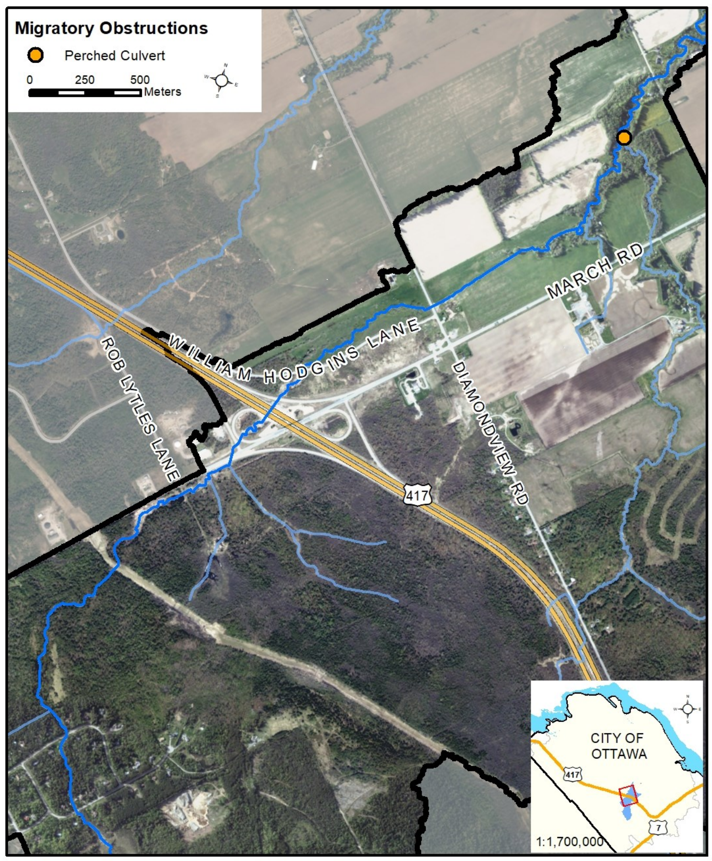


Figure 26: Map of migratory obstructions in Carp B.

Wildlife Observed

There were many species of wildlife observed during this assessment of Carp B. A highlight from the site visits was having a snapping turtle swim by. A complete list of species observed during the 2019 survey is shown in Table 5.

Table 5: Carp B Wildlife Observed	
Birds	Blue Jay, Chickadee, Common Yellow Throat, Goldfinch, Grackle, Robin, Song Sparrow
Mammals	Deer tracks, Muskrat, Racoon tracks
Reptiles and Amphibians	Green Frogs, Snapping Turtle
Insects	Dragonflies, Damselflies, crayfish, iso-pods, leeches, mosquitos, mussels, wa-ter strider
Fish	Cyprinids, unidentified young of the year

Pollution

Pollution in the form of litter, such as wheels, plastic, ply-wood, tins etc. were occasionally found in Carp B, however other forms of visible pollution were rarely observed in the surveyed sections (Figure 27). 56% of the surveyed sections of the Carp B Tributary had no visible pollution. This is a very beneficial attribute of the creek.

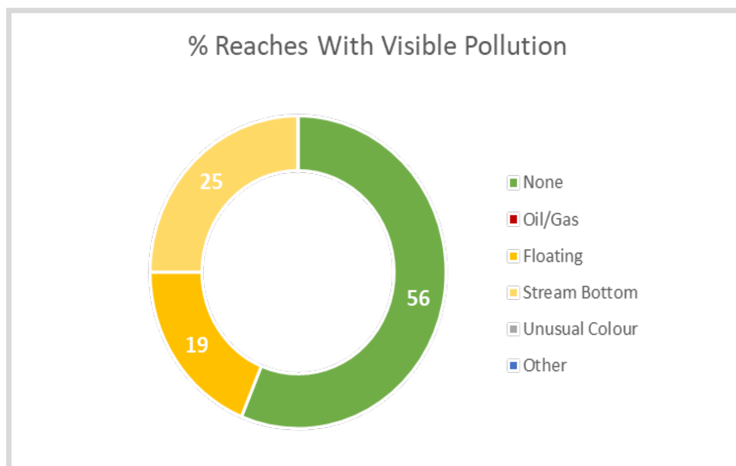
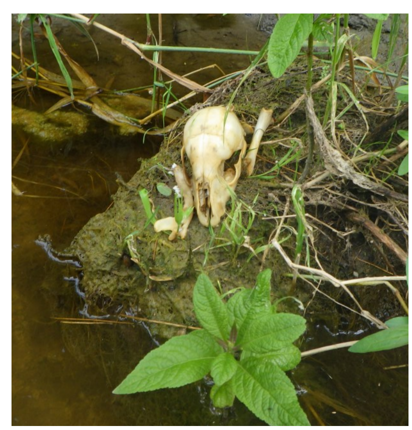


Figure 27: *Percentage of reaches with visible pollution from Carp*



Agricultural Impacts

Agricultural land uses represent 18.6% of the Carp B watershed, and as such had an important role to play in the health of the tributary.

Cattle access

As part of the CSW protocol, the level of livestock (predominantly cattle) access within each 100 m section was classified as either low (<10 m of access), moderate (10-20 m of access) or extreme (>20 m of access).

While none of the surveyed portions of Carp B showed signs of livestock having direct access to the water feature it is known that other portions of the creek are adjacent to livestock pastures.

Field Erosion

The presence of livestock along the banks of the tributary increase the potential for shoreline erosion of the fields. Foot traffic along the banks as well as the close grazing of the vegetation makes it hard for the plants to grow deep strong root systems that would help hold the predominately clay soils together during high water level or flow events. Tilling too close to the top of the bank can have a similar impact by disrupting the presence of deep rooting vegetation.

Potential Stewardship Opportunities

Naturally vegetated shorelines help reduce erosion, filter pollutants from entering the watercourse and assist in flood control while also providing food and habitat for a variety of wildlife.

19% of left bank and 26% of the right bank of surveyed reaches has less than a 15 m vegetated buffer. 71% of the stream surveyed has less than 20% shade cover.

Stewardship activities can include but are not limited to; restoring eroded banks and enhancing stream shading by planting trees within 5 meters of the top of bank (particularly the east or south banks to increase shade). Or widening and improving riparian buffers through reduced tilling near the top of bank and planting the area with native species of trees, shrubs, grasses or wild flowers.

The next steps will be to contact landowners in these areas and explore the potential for collaboration with them on a voluntary basis to enhance their shorelines.

City of Ottawa programs such as the Rural Clean Water Program and the Green Acres fund are available to help financially support some of these undertakings. For more information about these programs, please contact the Stewardship Coordinator at MVCA.

European Frog-bit

Purple Loosestrife

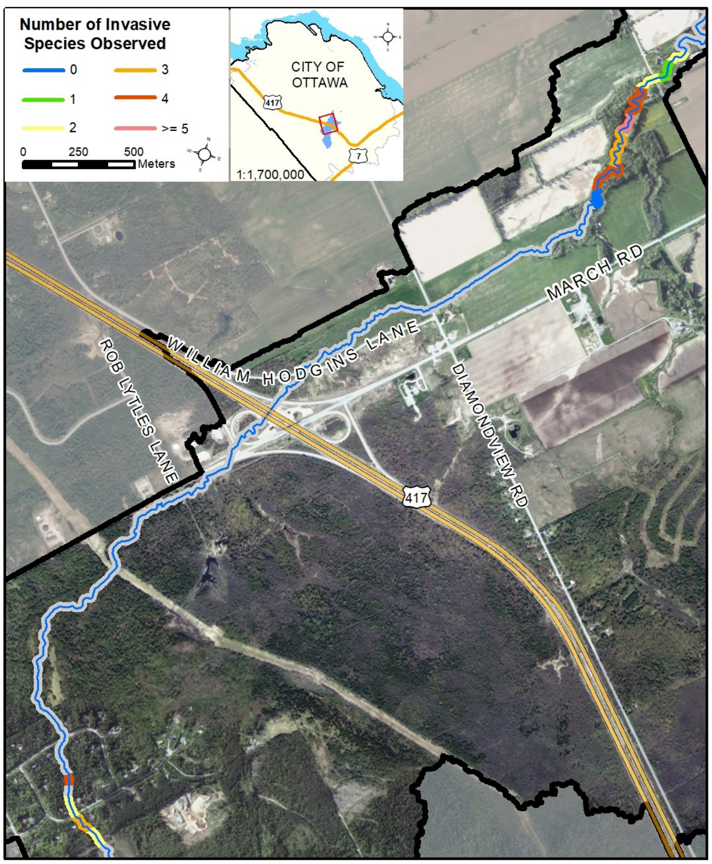


***Figure 28:** Abundance of identified invasive species along Carp B.*

Invasive Species

Invasive species are a concern as they can impact local species diversity and richness by outcompeting native species. This can result in the reduction of available food and habitat that our native plants and animals rely upon. Species such as Giant Hogweed and Poison Parsnip are also a human health concern as the sap from these plants can cause chemical burns to skin.

Figure 28 shows that invasive species were identified in 14 of the 15 reaches surveyed. Five of the sections had 2 or fewer invasive species identified adjacent to the creek.

Invasive species identified while surveying Carp B are: Bird Vetch, European Alder, European Frog-bit, Glossy Buckthorn, Honey Suckle, Manitoba Maple, Norway Maple, Poison Parsnip, Purple Loosestrife.

Consistent identification and mapping of invasive species will aid in improving our understanding of these results.

For more information on identifying and reporting invasive species visit www.invadingspecies.com managed by the Ontario Federation of Anglers and Hunters.

For information on choosing local native species as part of your gardening and landscaping choices please read the Ontario Invasive Plants Council Document "Grow Me Instead" found here: www.ontarioinvasiveplants.ca

For information about promoting pollinators with local native plant species refer to: www.pollinator.org/canada

Headwater Drainage Features

The City Stream Watch program assessed seven Headwater Drainage Features (HDF) in the Carp B subwatershed in 2019 (Figure 29).

This protocol measures zero, first and second order headwater drainage features. An HDF is defined as a depression in the land that conveys surface flow. The protocol used is a rapid assessment method for characterizing the amount of water, sediment transport, and storage capacity within HDFs. Site visits are performed twice, once during the spring melt (high-water conditions) and once in mid-summer once the vegetation has grown in and water levels have receded. Assessing a feature in multiple seasons provides a broader understanding of the HDF's flow capacity and habitat variability.

This Ontario Stream Assessment Protocol module provides a means of characterizing the connectivity, form and unique features associated with each HDF (Stanfield, 2017).

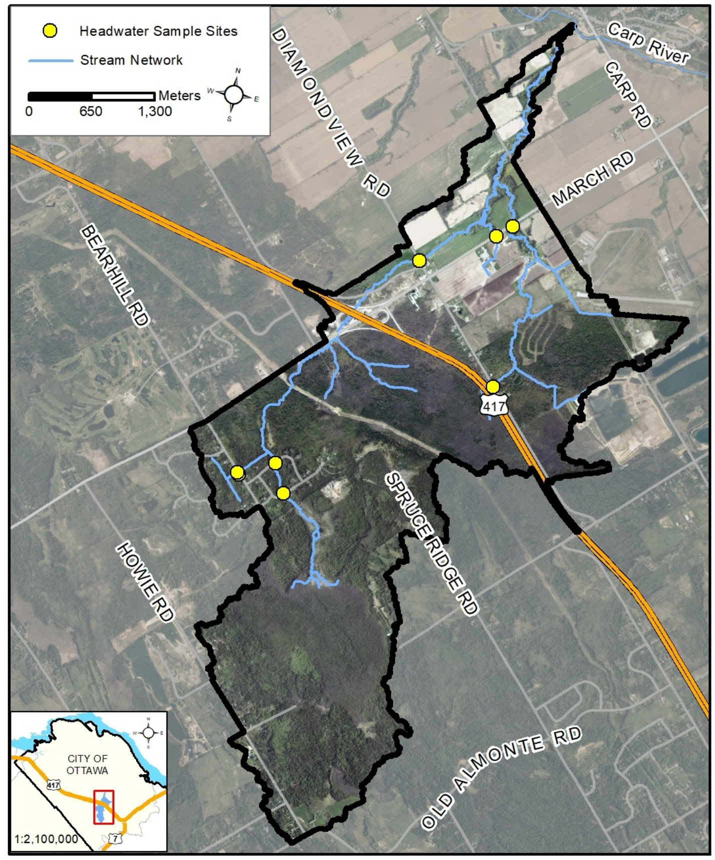


Figure 29: Headwater drainage feature sampling sites in the Carp B watershed.

HDF Feature Types

The HDF sampling protocol assesses the feature type in order to understand the function of each feature. The evaluation includes the following classifications: defined natural channel, channelized or constrained, multi-thread, no defined feature, tiled, wetland, swale, roadside ditch and pond outlet. By assessing the conditions associated with the headwater drainage features in the catchment area, we can understand the ecosystem services that they provide to the watershed in the form of hydrology, sediment transport, and aquatic and terrestrial functions.

The seven headwater sites surveyed in the Carp B watershed consist of 6 of the 9 feature types. The top three feature types are roadside ditch, natural channel and channelized making up 100% of the total features.

HDF Feature Flow

Flow conditions within a HDF can be highly variable as a result of changing seasonal factors. Flow conditions are assessed in the spring and summer to determine if features are perennial (flowing year round), or if they are intermittent (drying up during the summer). Flow conditions in headwater systems will change year-to-year depending on local precipitation patterns.

All four sites had either minimal flow or substantial flow during the spring visit and had the same result during the summer visit .

HDF Channel Modifications

Channel modifications are assessed at each headwater drainage feature site. Modifications include dredging, hardening, realignment, entrenchment and anthropogenic on-line ponds.

Channel modifications noted at the Carp B HDF sites include channelization and roadside ditch maintenance.

HDF Vegetation

Feature vegetation type is the dominant vegetation type found directly within each headwater feature channel, whereas riparian vegetation type is evaluated as the dominant vegetation within 3 zones from the shoreline of each headwater feature (0-1.5 m, 1.5-10 m and 10-30m).

There are 7 vegetation classifications: None, Lawn, Crops, Meadow, Scrubland, Wetland, and Forest.

Meadow, scrubland and forest were the dominant feature vegetation types. Meadow, scrubland and none were the dominant riparian vegetation types.

Land Owners & Volunteers

A big **"Thank You!"** needs to go out to the landowners as well as dedicated volunteers, three summer students and one co-op student who came out in 2019 and helped make this monitoring program happen.

Report Summary

The results in Table 6 are a summary of the highlights from each of the report sections. Carp B has high amounts of natural shoreline vegetation consisting of meadow, woodland and wetland habitat. Over 60% of the surveyed sections had vegetated shoreline buffers greater than 15 m, and 73% of the surveyed channel is considered to be in a natural condition. Despite the wide natural buffers the amount of shade reaching the tributary is low. The stream is classified as cool-warm water fish habitat. Twelve of the 15 sections have good to high habitat complexity which creates a good diversity of habitats available for the benthic organisms, fish and other aquatic animals that call Carp B home. Just under half of the areas received a poor areas of concern score.

The main cause of the water quality concern rating is that four of the 15 monitored sections have lower than 6 mg/L dissolved oxygen. This combined with five other reaches that had poor oxygen saturation levels makes nine of the surveyed reaches less than ideal habitat for aquatic organisms. The source of this stress is unclear however, agricultural impacts such as livestock access and shoreline erosion may have an impact. Further assessment for trends and potential causes will have to be done on a variety of water chemistry variables as MVCA continues to monitor the Carp B Tributary.

Table 6: Summary Of City Stream Watch Results for Carp B 2019

Sample Variable	Results Summary
Number of Sections Surveyed	15
Average Stream Width (m)	3.38
Average Stream Depth (m)	0.32
Average Hydraulic Head (mm)	2
Average Water Temperature (°C)	21.5
Average Conductivity (µS/cm)	592.39
Average pH	7.73
Average Dissolved Oxygen Concentration (mg/L)	7.60
Average Dissolved Oxygen Saturation (%)	85.4
# of Areas of Water Quality Concern with a Poor Score	7
Dominant Adjacent Land Uses	Meadow, Forest, Wetland
% Channel Alterations	27% Unaltered, 73% Natural
% Vegetated Riparian Buffer Width (>30 m)	13
% Overhanging Trees & Branches >40% Section Coverage	0
% Stream Shading >40% Section Coverage	7
% of Undercut Banks >60% Section Coverage	7
Dominant Substrate Type	Clay
Sub-Dominant Substrate Type	Clay
# Sections with a Habitat Complexity Score ≥3 variables	12
Dominant In-stream Morphology	84% Runs
Dominant In-stream Vegetation Types	Algae, None
Dominant Amount of In-stream Vegetation	None
Thermal Class	Cool-warm
Migratory Obstructions	1
# of Identified Invasive Species	9
Potential Stewardship Activities	Improve buffers, garbage clean-ups
# Head Water Drainage Features Sampled	7

How Does This Information Get Used?

The City Stream Watch Program is an excellent monitoring program that allows MVCA to assess the condition of subwatersheds over time. Stewardship activities in areas that need further work are completed and improve the health of the ecosystem.

MVCA uses stream surveys to target specific areas that need restoration work. Stream garbage clean ups are carried out, blockages are removed, and shoreline planting, erosion control and habitat enhancements are organized.

MVCA is always looking for volunteers to help with monitoring and stewardship programs!

Call 613-253-0006 ext. 234, if you are interested.

Volunteer projects that are carried out as a result of the City Stream Watch Program are:

* Planting trees and shrubs along the shoreline
* Removing invasive plant species
* Stream garbage clean ups
* Learning about and participating in monitoring the streams
* Learning about and participating in fish sampling and wildlife identification
* Learning about and participating in benthic invertebrate sampling and identification
* Participating in nature photography

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The City Stream Watch Collaborative is made up of: Rideau Valley Conservation Authority, Mississippi Valley Conservation Authority, South Nation Conservation Authority, The City of Ottawa, National Capital Commission, Ottawa Flyfishers Society, Ottawa Stewardship Council, Rideau Roundtable, and the Canadian Forces Fish and Game Club.