Huntley Creek
2017 Catchment Report

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, MVCA joined the working group and adopted the program. Since implementing the CSW program MVCA staff and volunteers have surveyed more than 470 sections across 10 watercourses. This information has fed into the planning of 13 riparian planting sites, 4 habitat improvements, stream garbage pick-ups in Poole Creek and the Carp River, and invasive species removal events.

The City Stream Watch Program has three broad 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 and assessing headwater drainage features.

Seasonal weather conditions were very wet in 2017 with sustained high water conditions for most of the season. This hampered field surveys as sections would become too deep or fast for wading. However, with the perseverance of the crew and the volunteers, 117 sections in two catchments were assessed.

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

2017 marks the first return to streams previously surveyed and where possible this report will reflect on the differences found since our last visit to these waterways.

Given the atypical conditions, all assessments were subject to the effects of high water and may not reflect the overall health of the systems.

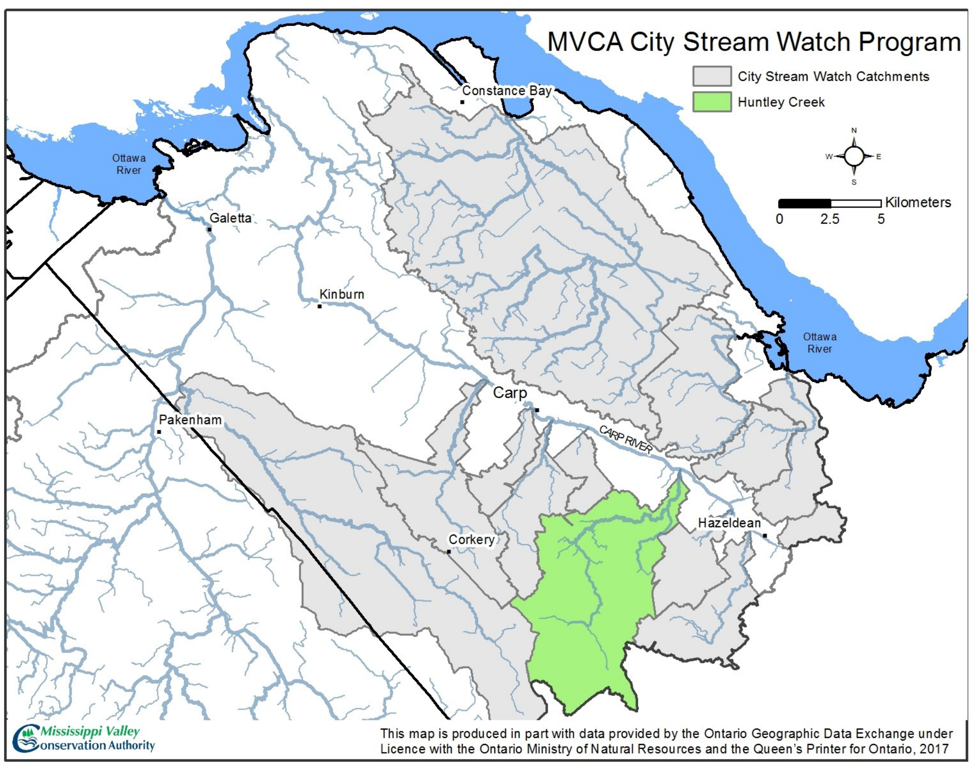


Figure 1: *MVCA's City Stream Watch area highlighting the location of the Huntley Creek subwatershed.*

Huntley Creek

Located in the west end of the City of Ottawa, Huntley Creek is one of eight major tributaries of the Carp River. With a length of 20.7 kilometers (km) and draining an area of 55 square km, it is the largest of the Carp River's tributaries.

Huntley Creek's headwaters originate in a grouping of small wetlands located north of Highway 7 and west of Highway 417. From there it flows to the north and then to the east under the 417, continuing to flow east and northeast. Huntley Creek ends where it enters the Carp River to the west of Huntmar Drive. Table 1 present a summary of some key features of the Huntley Creek Subwatershed.

Table 1: Subwatershed Features

Area	55.48 Square Kilometers
	21.7% of the Carp River Watershed
Length	20.7 Kilometers
Type	100% Permanent
	Thermal: Main Branch is cool-warm
	South Branch is cool water habitat
	80% Natural
	20% Channelized
Land Use	14% Agriculture
	2% Aggregate sites
	44% Wooded area
	10% Rural land-use
	18% Wetlands
	9% Grassland
	4% Roads
Surficial Geology	3% Clay
	9% Diamicton
	22% Organic deposits
	39% Bedrock
	19% Sand
	8% Gravel

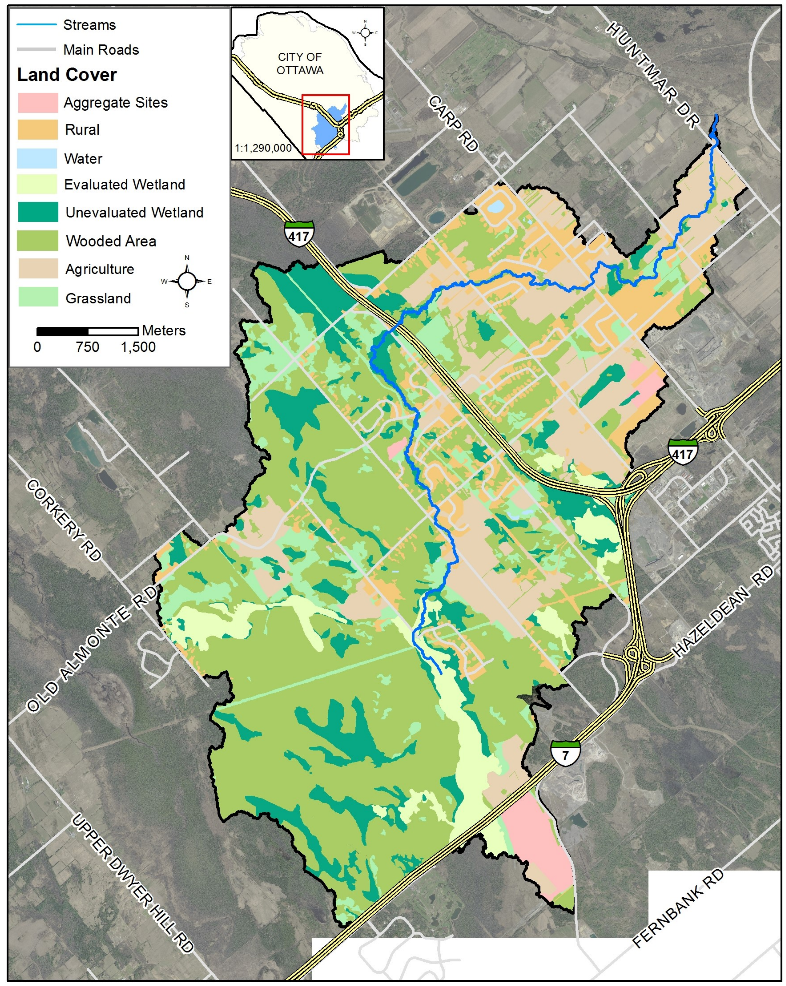


Figure 2: *Land Use in the Huntley Creek subwatershed.*

The Huntley Creek Subwatershed

As shown in Figure 2, the Huntley Creek subwatershed is dominated by a mix of forest and wetland areas. Concentrated mostly in the southwest (upstream) part of the subwatershed, wooded areas make up 44% and wetlands make up 18% of the overall land cover. Of note is the Huntley Provincially Significant Wetland in the headwaters as well as many large riparian wetlands along the creek. Pockets of agricultural (14%) and rural residential (10%) are scattered throughout the watershed.

Crossing a mixture of wetland, woodland, farmland and rural residential areas, the creek provides a natural corridor and habitat for a range of aquatic and terrestrial species. The City of Ottawa's Carp River Watershed Subwatershed Study describes the upper reach of Huntley Creek as being in good condition and able to support a cold water fishery.

Among the many natural features on Huntley Creek is a three meter high waterfall located on the former Bradley Farm just upstream from Huntmar Rd. This feature is a natural migratory obstruction for fish which influences the differences between the composition of fish populations upstream and downstream of the waterfall. Downstream of the waterfall is likely to provide habitat to larger fish that can swim up from the Carp River, while upstream of the falls supports mostly minnow species.

Monitoring in Huntley Creek

In 2017, permission was granted to survey 96 sections of Huntley Creek, shown on Figure 3, which cover approximately 9.6 km of the main creek. The portions of the creek that were not sampled represent mostly the wetland areas that could not be assessed using the macro stream assessment protocol and areas where permission was not granted.

This report presents a summary of the observations made along the 96 sampled sections. While these sections provide a good representation of the overall condition of Huntley Creek, it should be noted that there are a few sections of the creek that are not represented in this assessment. These areas provide an additional diversity of habitat with valuable natural functions.

Table 2 shows some basic assessment measurements for Huntley Creek. The surveyed sections had an average stream width of 6.9 m, an average depth of 0.70 m, an average hydraulic head of 12mm which is an indicator of surface water velocity.

Table 2: Huntley Creek Assessment Facts

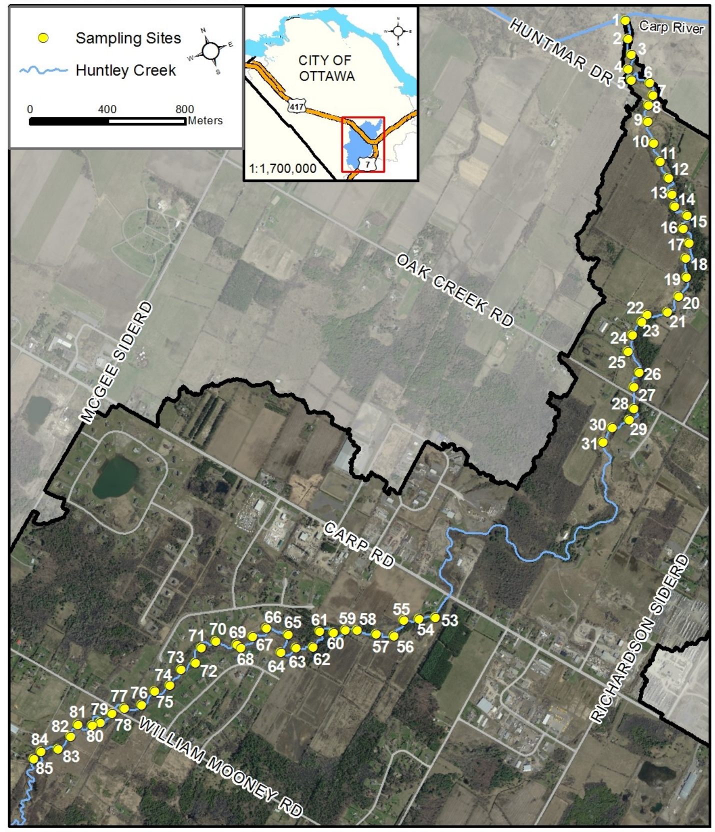
	Minimum	Maximum	Average
Stream Wetted Width (m)	2.4	18.2	6.9
Stream Depth (m)	0.09	1.41	0.70
Hydraulic Head (mm)	0	200	12

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 at the end of each 100 meter 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 that are assessed include general land use, instream morphology, human alterations, water chemistry, plant life, and other features presented in this report.

MVCA sampled 7 more reaches and deploy 3 more temperature loggers in 2017 making for a more robust review of conditions this time around. Sampling was also enhanced with two fish sampling sites and two benthic sampling sites.

HUNTLEY CREEK NORTH SAMPLE SITES



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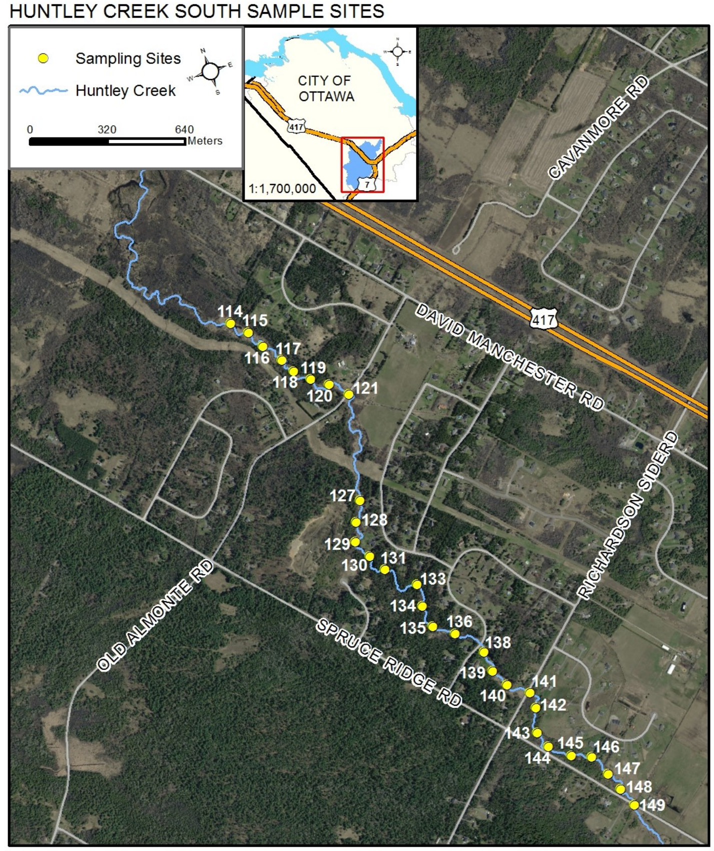


Figure 3: *Locations of the monitoring sites along Huntley Creek.*

General Land Use Adjacent to Huntley Creek

General land use along each surveyed section of Huntley Creek 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 Huntley Creek.

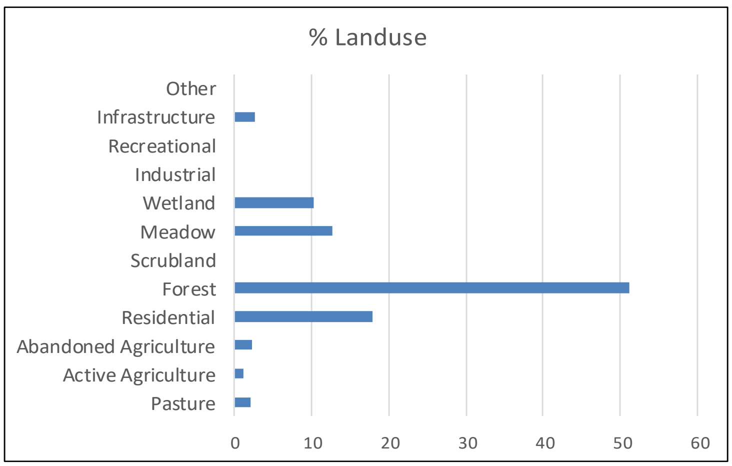
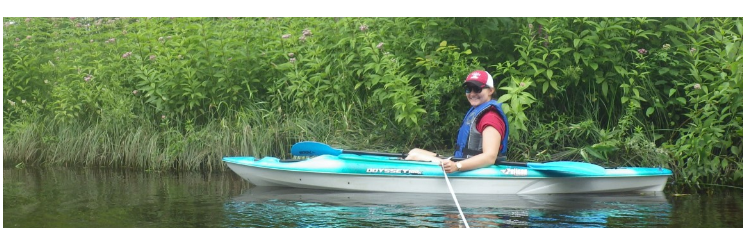


Figure 4: *Land use alongside Huntley Creek.*

Of the eleven categories, scrubland, industrial and recreational were not found to be present along surveyed sections. At 51%, forest represents the most prominent category of land use followed by residential at 18%, and meadow at 13%.

As described on page 2, the land use in the watershed is dominated by forest and wetland cover with smaller portions of agriculture, rural development, grasslands and aggregate extraction. This is reflected well in the percentages seen in Figure 4. In particular, we see a high percentage of Forest (51%) which is a benefit to the creek as well as the surrounding landscape as this forest cover provides shade, habitat and food for a wide variety of animals, cools the water and protects the shores from erosion.



Human Alterations to Huntley Creek

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, to allow navigation of large boats, and to minimize natural erosion caused by the meandering pattern of flowing water. As seen in Figure 5, 20% of Huntley Creek was found to be completely unaltered, 60% was natural (with minor alterations), and 20% was altered (with considerable human impact). No surveyed sections were considered highly altered.

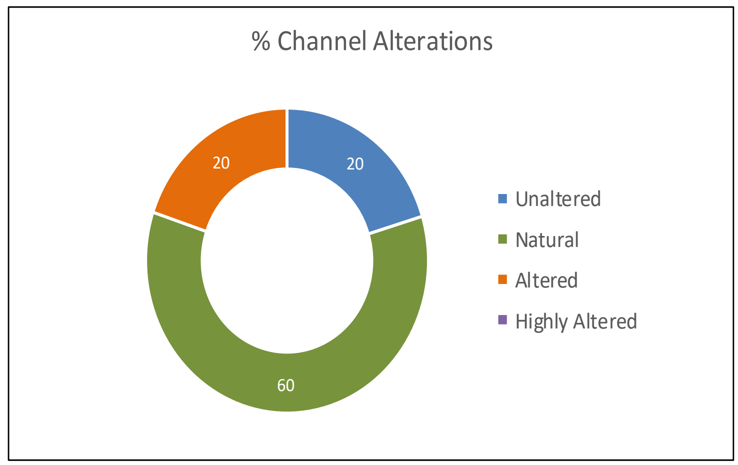


Figure 5: *Extent of human alterations to Huntley Creek.*

It is beneficial to the overall health of the system that so much of the creek is in an unaltered or natural condition and has not been channelized. There are a large number of sections that have significant alterations which are mostly associated with the number of road crossings.

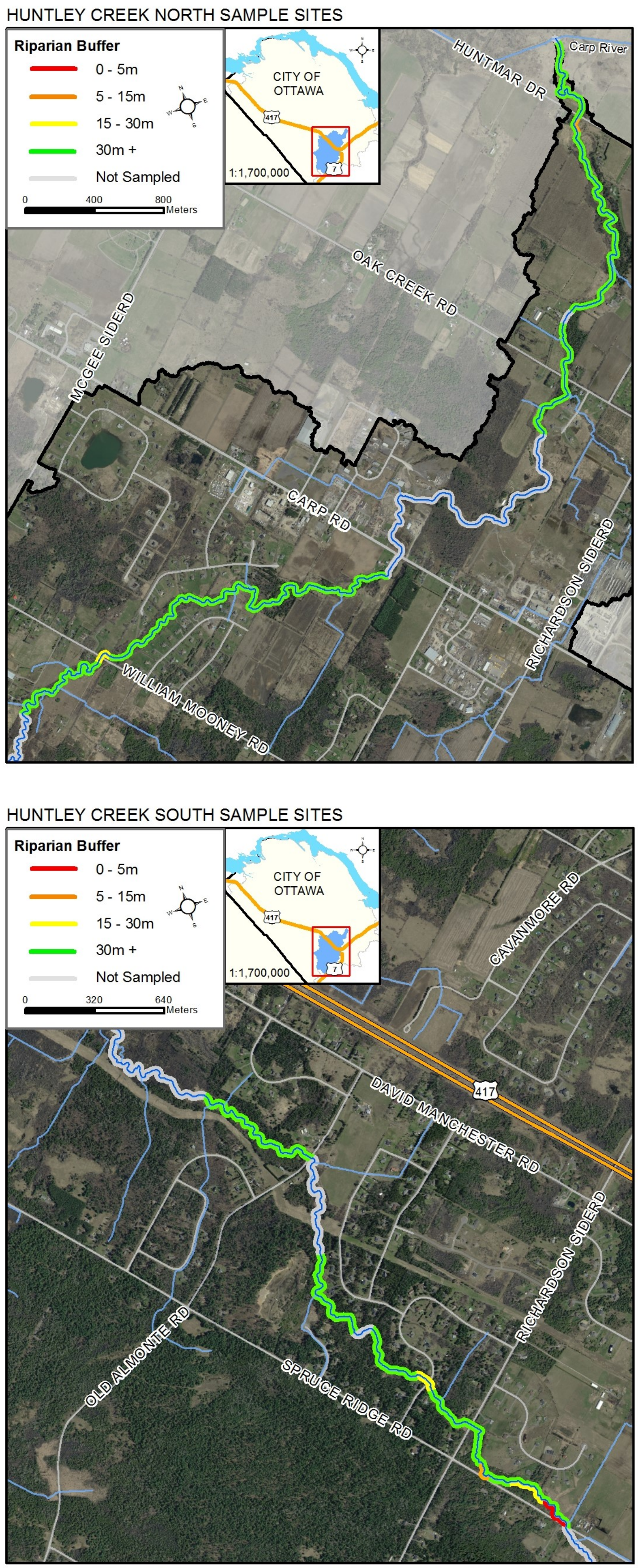


Figure 7: Vegetated buffer widths along Huntley Creek.

Riparian Buffer along Huntley Creek

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 and dispersal. 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).

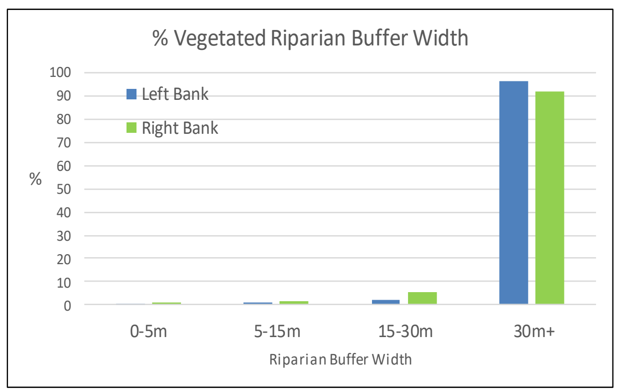


Figure 6: *Riparian buffer widths along Huntley Creek.*

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, we found that the sections of Huntley Creek that were surveyed have a really good riparian buffer. Results for surveyed sections are very positive with 97% of the left bank and 92% of the right bank has a buffer width greater than 30 meters. Only 1% of sections on the left bank and 3% of sections on 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 Huntley Creek. The few reaches with smaller buffers were found in the residential areas and along a road.

Overhanging Trees and Branches

Overhanging branches and trees, 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, Huntley Creek has a low percent coverage of overhanging trees and branches, as seen in Figure 8 with 72% of the reaches having less than 41% over coverage. This reflects the surrounding natural vegetative community, where the creek passes through sections of open wetland, areas dominated by tall grasses or shrubs, and in some areas it reflects clearing of the vegetation too close to the creek.

Figure 8 shows the data quantified as the percent of creek sections classified according to the various amounts of overhanging trees and branches. For example, 21% of the 96 surveyed stream sections were classified as having zero overhanging trees and branches along both the left and right bank. 28% of the surveyed stream was found to have greater than 41% overhanging branches providing food and shade to the creek.

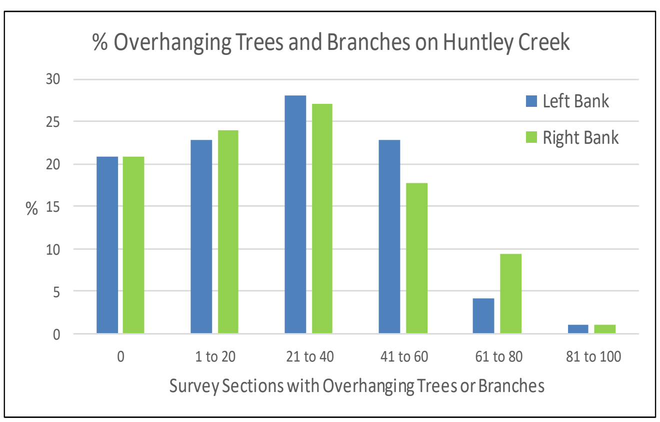
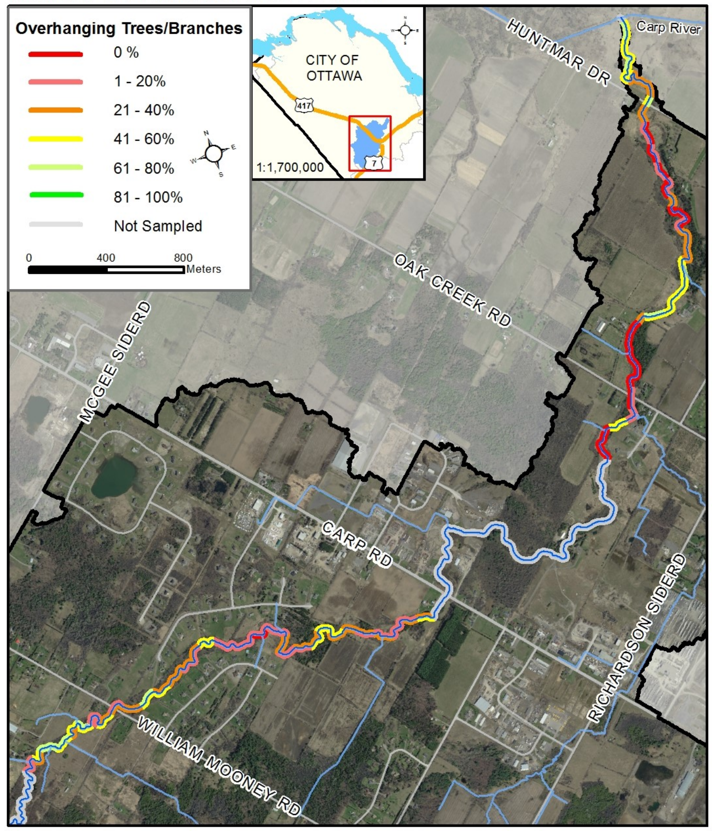


Figure 8: *Percentage of each surveyed section of Huntley Creek with overhanging trees and branches.*

HUNTLEY CREEK NORTH SAMPLE SITES



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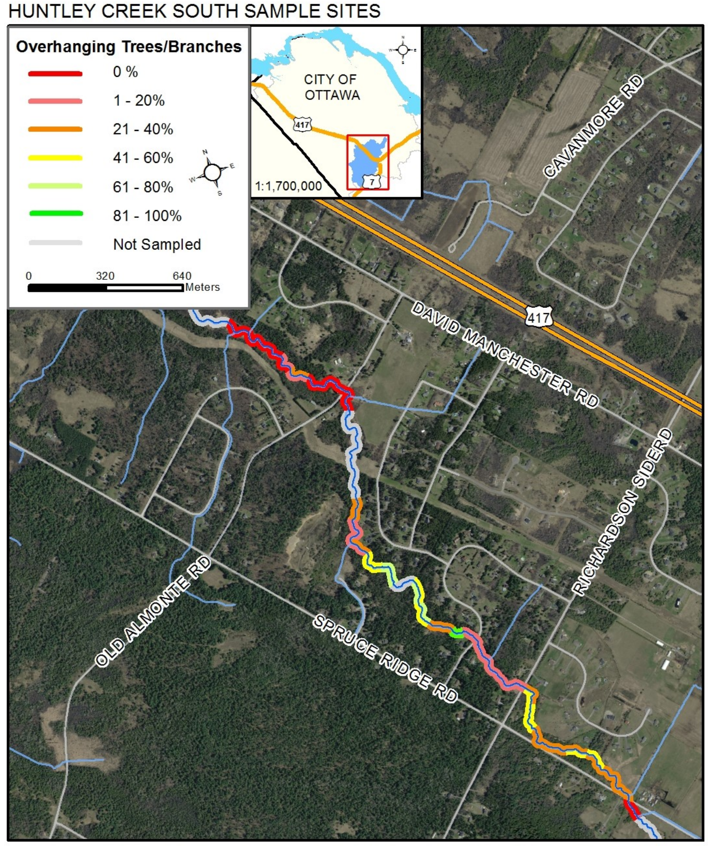
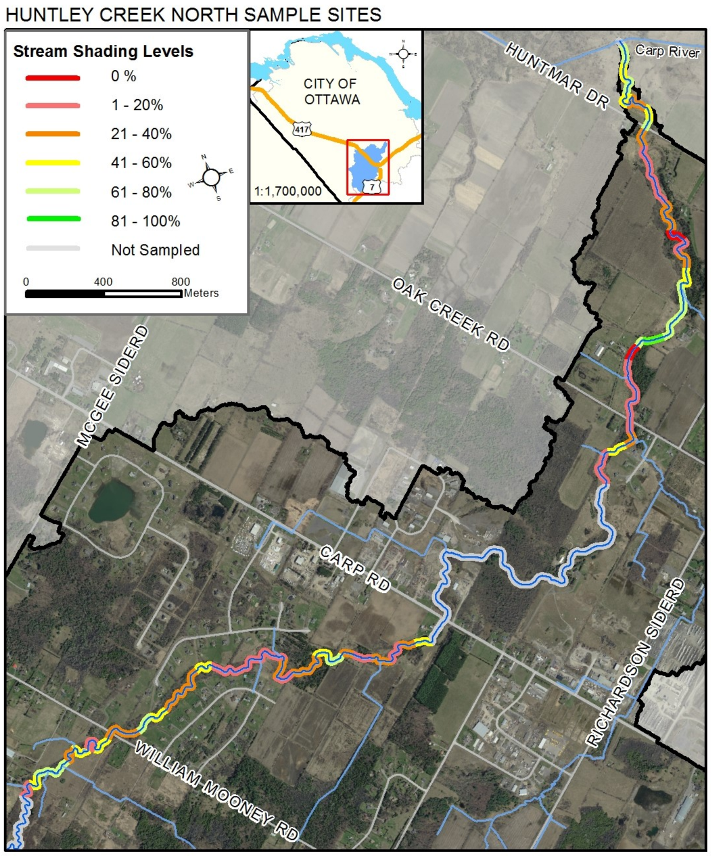


Figure 9: *Overhanging trees and branches along Huntley Creek.*



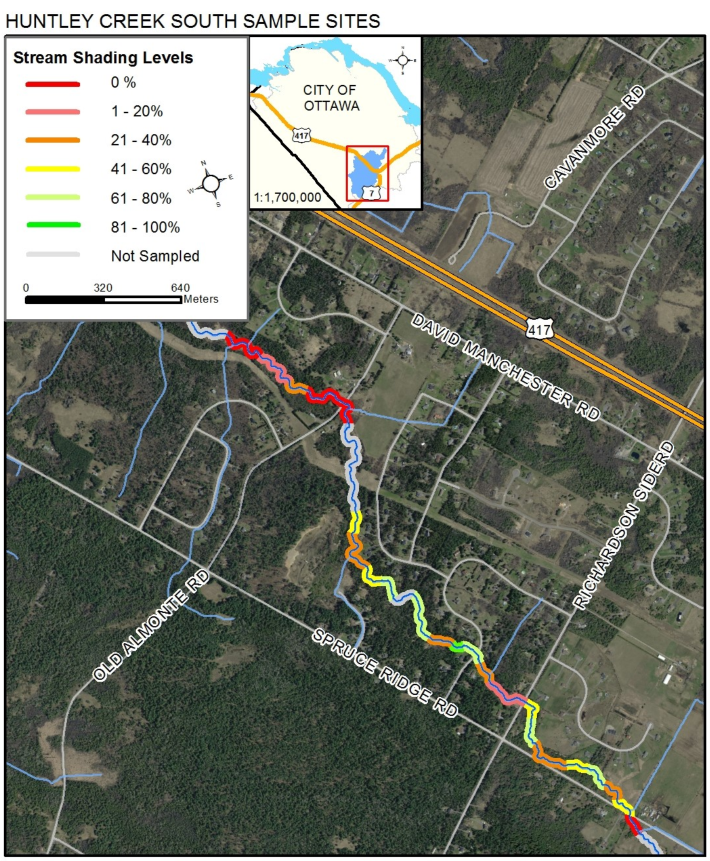


Figure 10: *Stream Shading along Huntley Creek.*

Stream Shading

Shade is important in moderating stream temperature, contributing to food supply and helping with 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 where shading from trees may not be available.

Figure 10 shows the variability in the amount of stream shading along different sections of Huntley Creek. We can see that the shading is extremely variable. This is due to the diversity of riparian vegetation along the creek, with large sections of open meadow or shrub land interspersed with areas of dense forest. Huntley Creek is also fairly wide in certain areas and well forested banks do not provide 100% shade.

Figure 11 shows the data quantified as the percent of creek sections classified according to the various levels of shading. For example, 10% of the 96 stream sections that were surveyed were classified as having 0% shading, 25% having 1-20% shading and 27% having 21 to 40 percent, more than half of the surveyed stream has less than 41% shading.

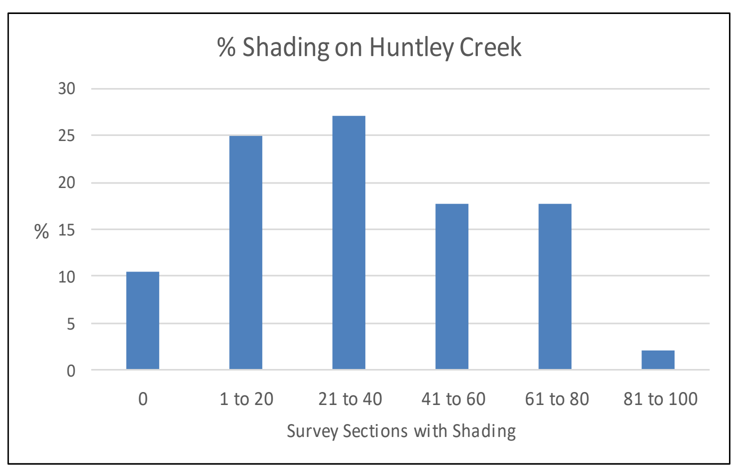


Figure 11: *Shading along Huntley Creek.*

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.

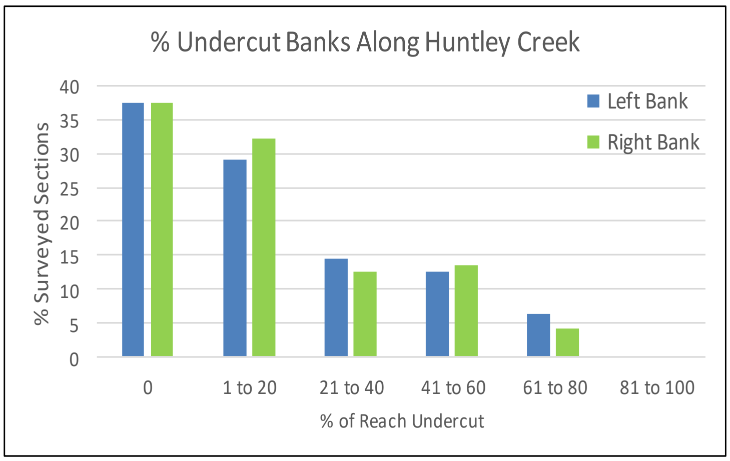
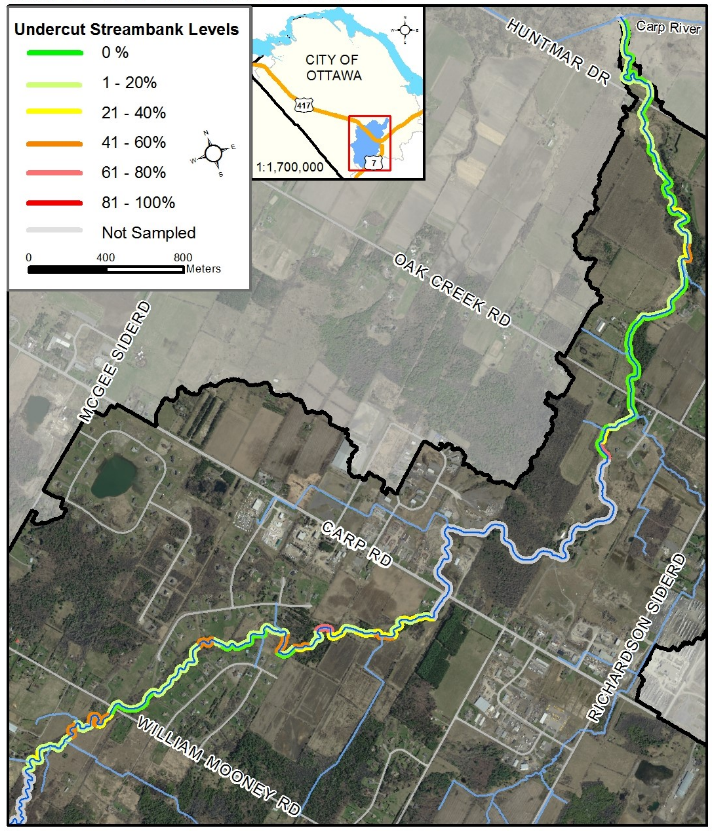


Figure 12: *Percent undercut stream banks along Huntley Creek.*

Erosion also has the ability to create undercut stream banks. While some undercutting of stream banks can be a normal stream function and can provide excellent refuge for fish, too much undercutting can become harmful if it results in instability, erosion and sedimentation.

Figure 12 shows the percentage of undercut stream banks along each surveyed section of Huntley Creek. Overall, the sections of Huntley Creek that were surveyed were found to have very little undercutting, most with either less than 20% or with no undercutting at all.

HUNTLEY CREEK NORTH SAMPLE SITES



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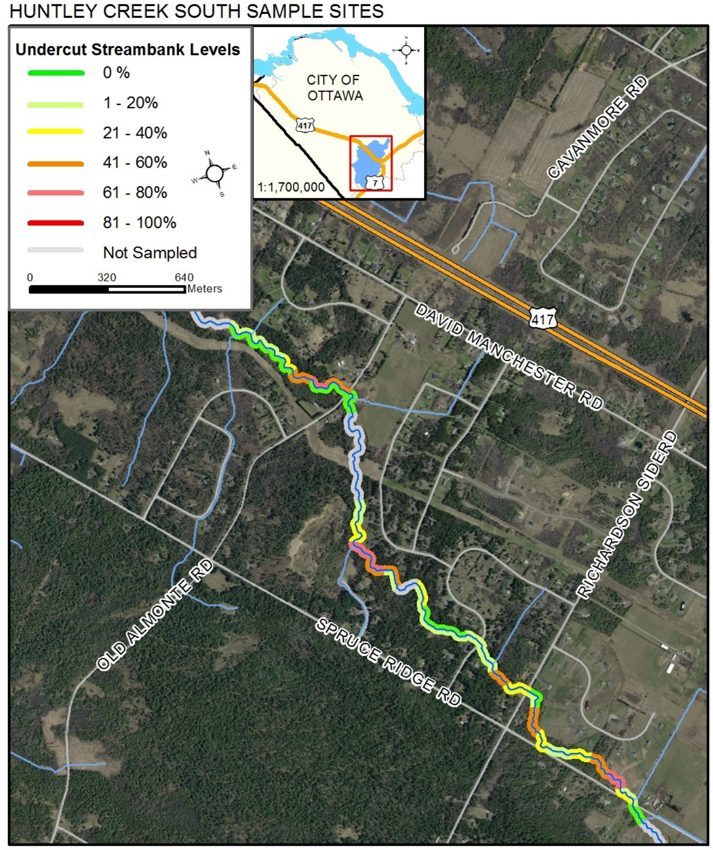

Figure 13: *Map of undercut banks in Huntley Creek.*

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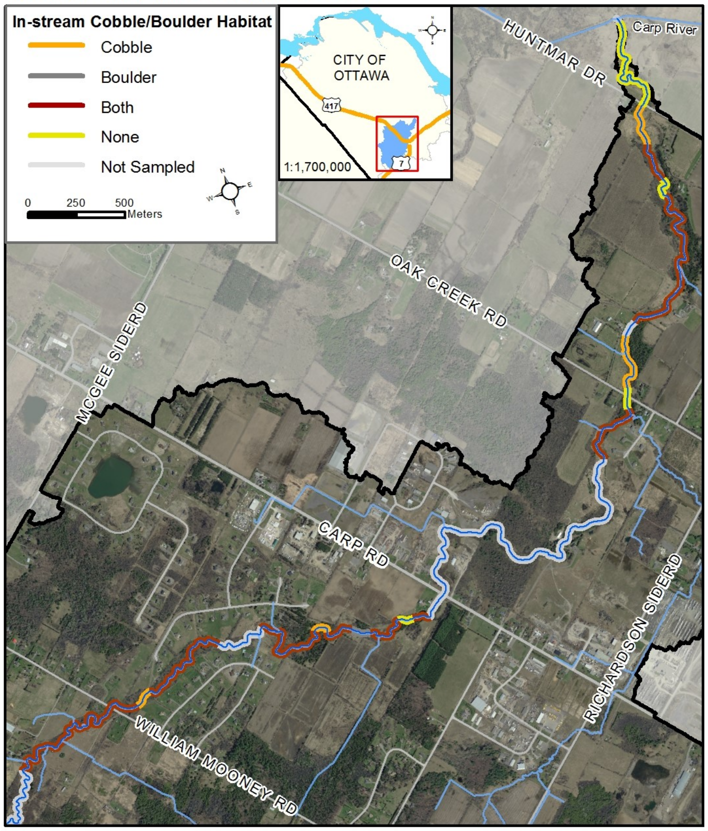

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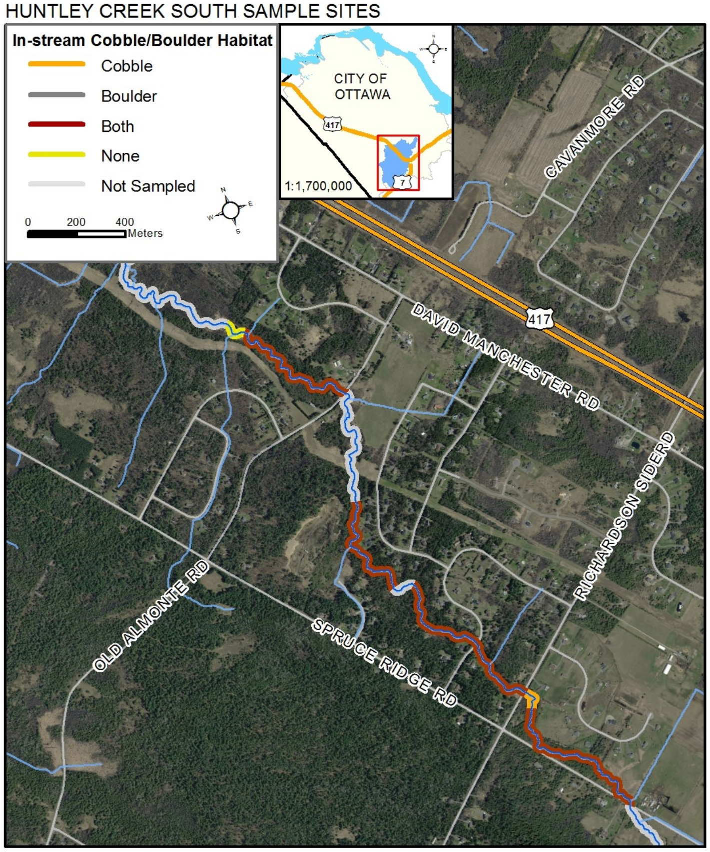


Figure 14: *Cobble and boulder habitat along Huntley Creek.*

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 15 summarizes the different types of substrate which make up the bed of Huntley Creek.

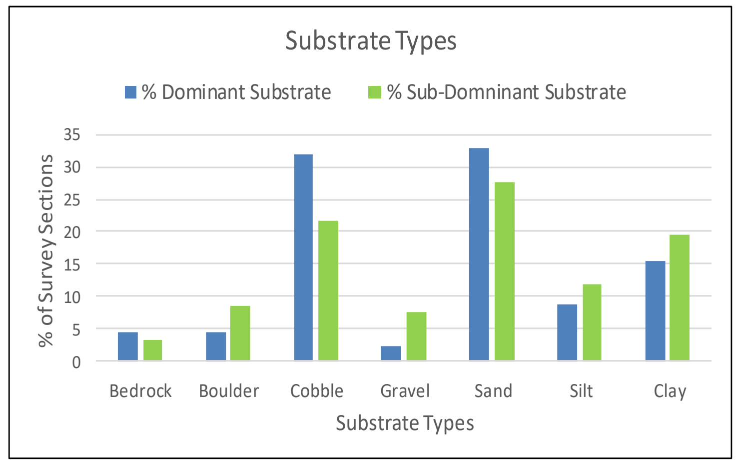


Figure 15: *Percentages of in-stream substrate types in Huntley Creek.*

Huntley Creek is composed of high percentages of sand, cobble and clay, with smaller percentages of silt, boulder, gravel and bedrock. Cobble, which makes up 32% of the dominant and 22% of the 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) that are a key food source for many fish and wildlife species. Boulders, which make up 4% of Huntley Creek's dominant and 8% sub-dominant in-stream substrate, creates cover and back eddies for larger fish to hide and to rest out of the current.

Cobble and Boulder Habitat

As discussed above, cobble and boulders both provide important fish habitat. Figure 14 shows the sections of Huntley Creek where cobble and boulders were found to either be present or not present on the stream bed and shows that the creek has a healthy distribution of cobble and boulder substrate with a large number of sections containing both features.

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 material in each surveyed reach of Huntley Creek. The presence of one of the variables carries a score of 1. A reach with all four features receives a score of 4 for high habitat complexity.

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, Huntley Creek was found to consist of 62% runs, 18% riffles and 20% pools. Stewardship efforts could be focused at creating more in-stream pool/riffle sequences to enhance fish habitat.

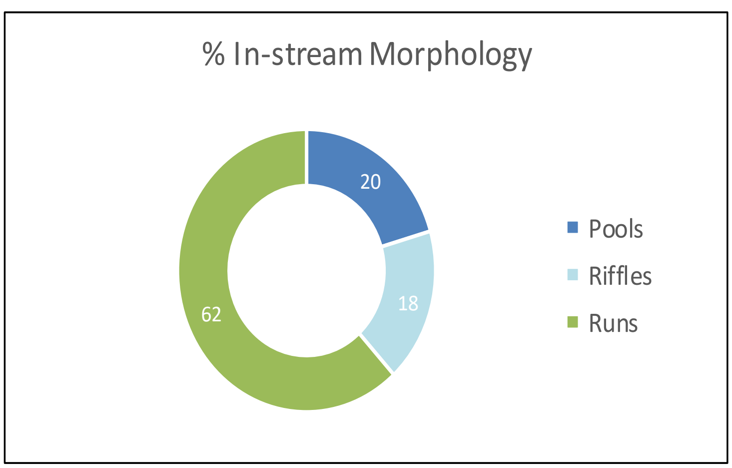


Figure 16: *In-stream morphology along Huntley Creek.*

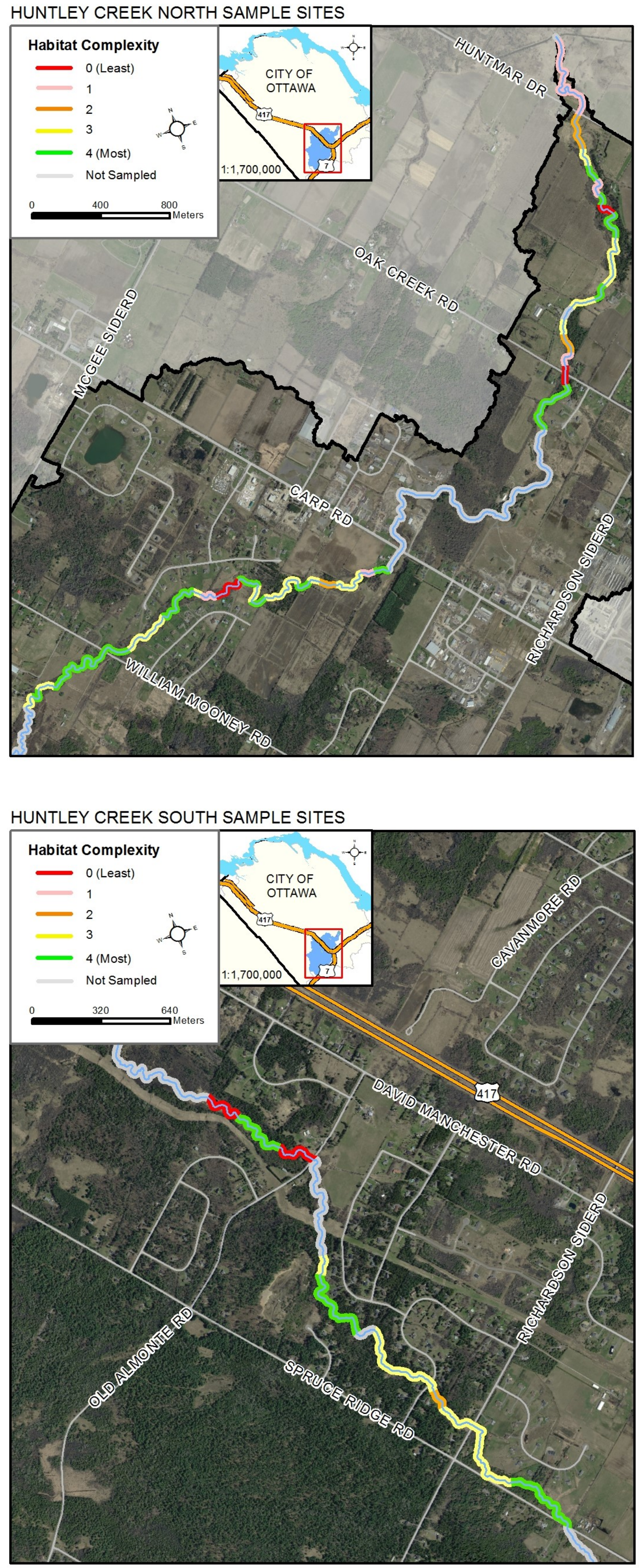


Figure 17: *Habitat Complexity Scores for Huntley Creek.*

In-Stream Vegetation

A well-balanced amount and 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 by type into eight categories; narrow-leaved emergent, broad-leaved emergent, robust emergent, free floating plants, floating plants, submerged plants, algae and no plants. Narrow-leaved emergents (14%), algae (12%) and submerged plants (9%) were the top three types of in-stream vegetation in Huntley Creek.

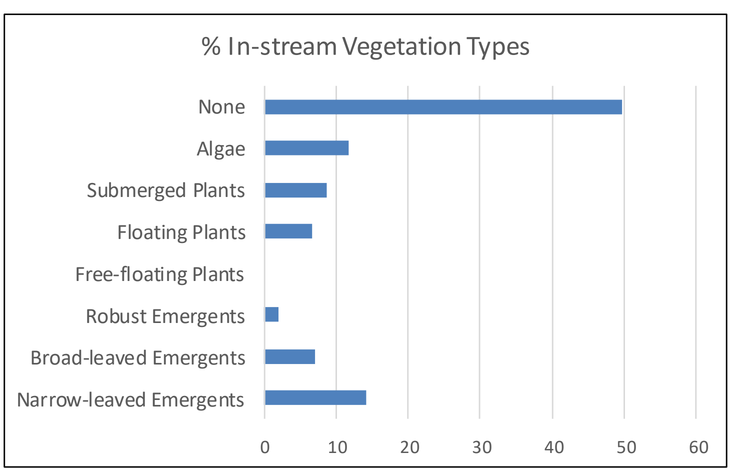


Figure 18: *Types of in-stream vegetation in Huntley Creek.*

Amount of In-stream Vegetation

In-stream vegetation helps to remove contaminants from the water, contribute oxygen to the stream, provide habitat for fish and wildlife, and reduce current velocities, however too much vegetation can be detrimental. 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 Huntley Creek. The creek was found to have a good diversity of vegetation abundance with each category being represented. Overall the creek had more sections with low vegetation amounts, with 11% low, 5% rare, and 52% no vegetation.

Low in-stream vegetation levels in Huntley Creek are likely due to substrate type. For example areas that are rocky with cobble and gravel do not facilitate easy plant growth. As discussed on Page 9, Huntley Creek’s substrate is dominated by bedrock, boulder, cobble or gravel for 43% of the surveyed sections. A lack of aquatic vegetation may also be the result of water depths or currents creating conditions that limit plant growth.

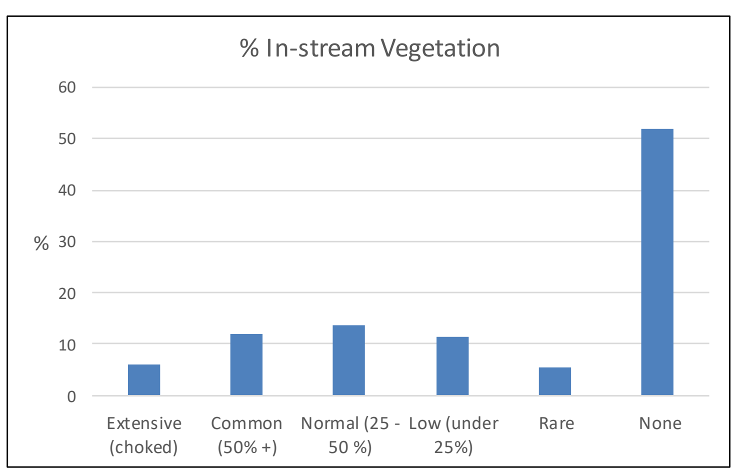


Figure 19: *Abundances of in-stream vegetation in Huntley Creek.*

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 Huntley Creek is 623 µS/cm, putting it very close to the ideal range.

Since background conductivity can vary between systems, results have been compared to the surveyed average, one and two standard deviations above average (represented by Moderate and High Conductivity) as seen in Figure 20.

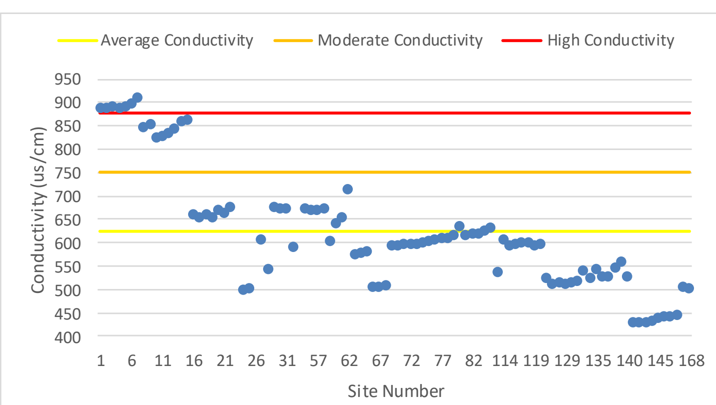


Figure 20: *Specific conductivity results from Huntley Creek.*

The measurement of **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 Huntley Creek stay within this ideal range. The average pH of Huntley Creek is 7.81, a nearly neutral condition, which is good for many species of fish to thrive.

Table 3: Huntley Creek Water Quality Data			
	Minimum	Maximum	Average
Water Temperature (°C)	16.3	24.3	20.9
Specific Conductivity (µS/cm)	430	910	625
pH	7.43	8.30	7.81
Dissolved Oxygen Concentration (mg/L)	5.86	10.46	8.10

Dissolved oxygen concentration measures the amount of available oxygen within the water that is accessible to wildlife. According to the Canadian Water Quality Guidelines for the Protection of Aquatic Life, the guideline value for the concentration of 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 Huntley Creek measured at 8.10 mg/L, making it healthy for warm water fish, and slightly below the requirements for cold water fish for most of the stream. The majority of the sites fall within the range supporting warm water fish, but there are a number of sections that also have suitable concentrations for supporting warm and cold water fish as seen in Figure 21. A few sections can also be seen to be near the lower threshold for warm water biota indicating a potentially stressed environment in these locations. This will be discussed further on the following pages.

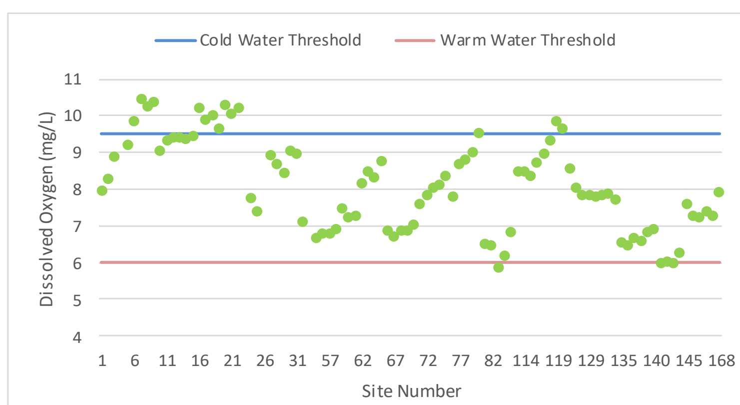


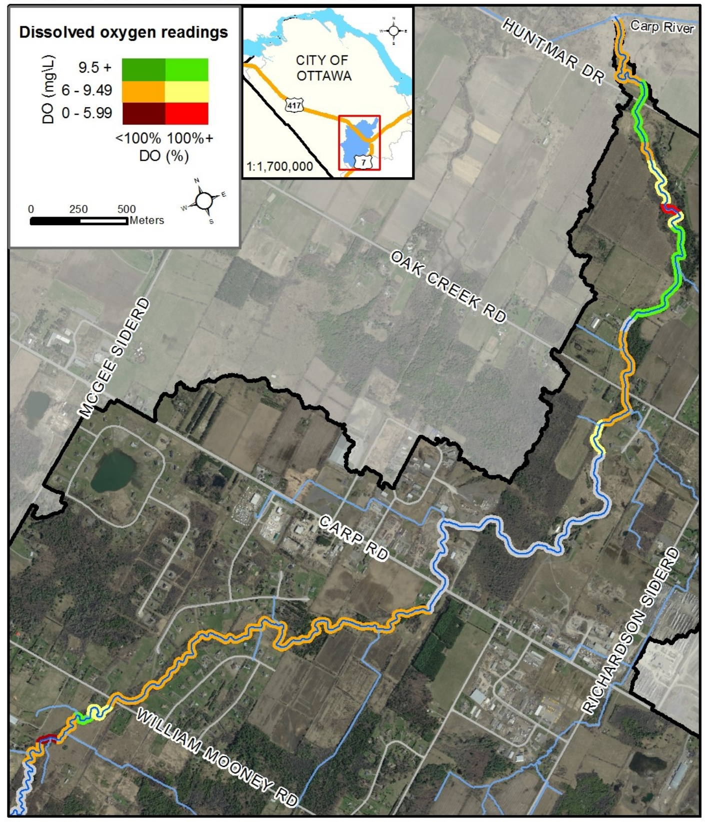
Figure 21: *Dissolved oxygen concentration results from Huntley Creek.*

Dissolved Oxygen Saturation is measured as the ratio of dissolved oxygen relative to the maximum amount of oxygen that will dissolve based on the temperature and atmospheric pressure. Well oxygenated water will stabilize at or above 100% saturation, however the presence of decaying matter/ pollutants 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 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.

HUNTLEY CREEK NORTH SAMPLE SITES



HUNTLEY CREEK SOUTH SAMPLE SITES

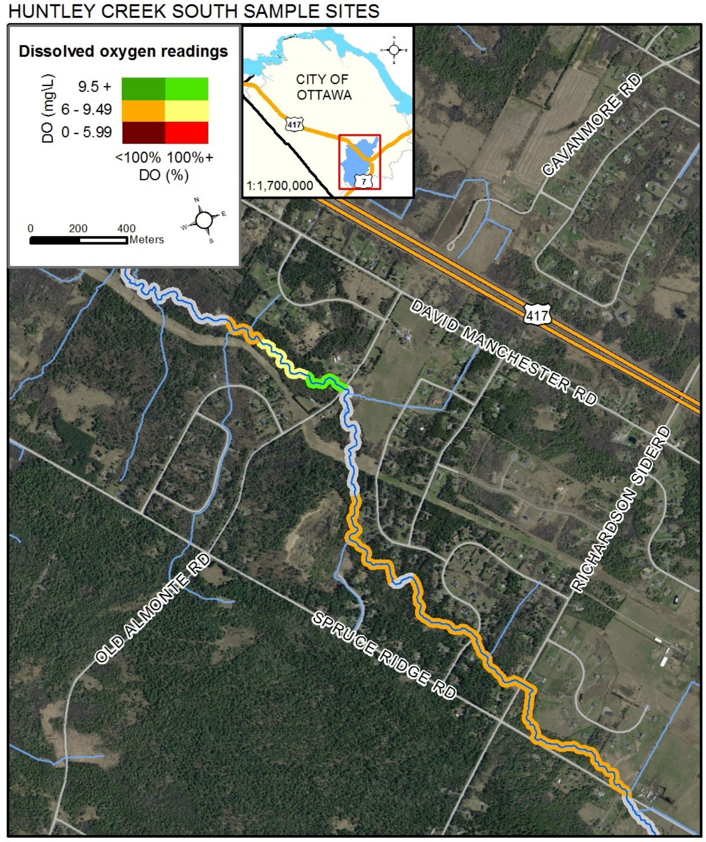
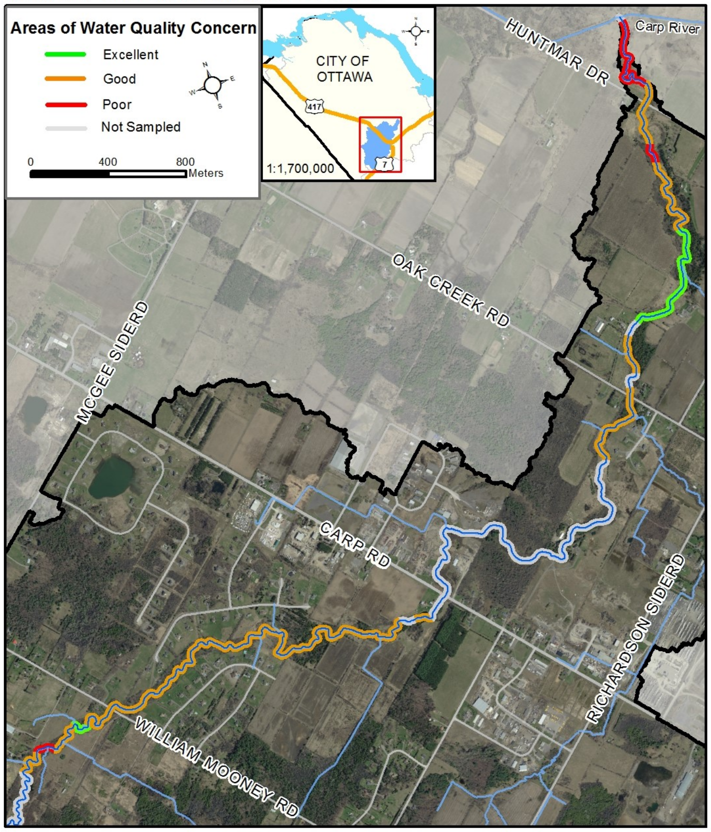


Figure 22: *Dissolved oxygen concentration and saturation results for Huntley Creek.*

HUNTLEY CREEK NORTH SAMPLE SITES



HUNTLEY CREEK SOUTH SAMPLE SITES

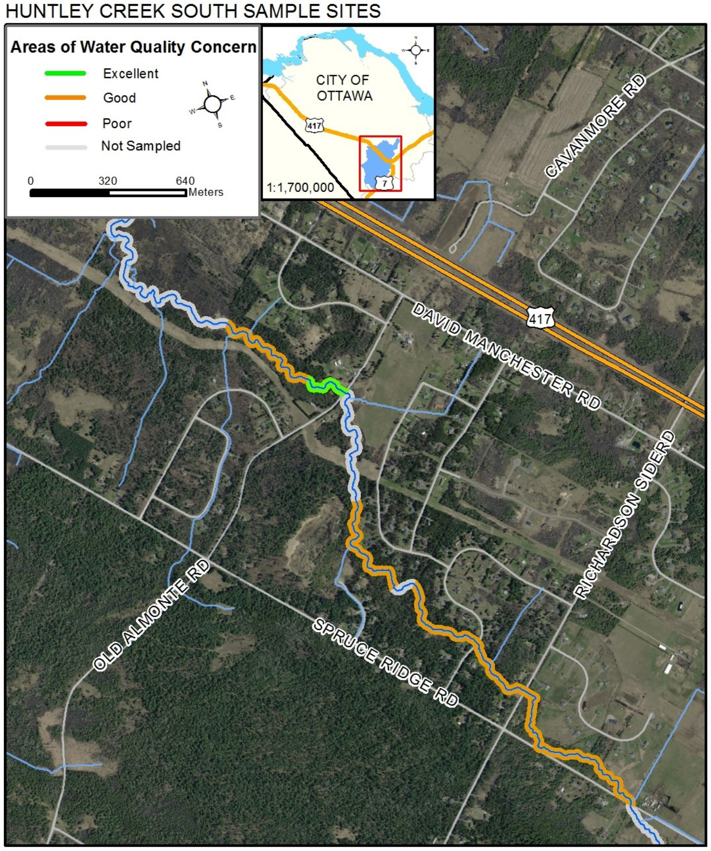


Figure 23: *Areas of Water Quality Concern in Huntley Creek.*

Areas of Water Quality Concern

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 on page 12, Huntley Creek's pH values did not exceed the ideal range and therefore doesn't impact the ranking for Areas of Concern. Conductivity values were fairly low throughout with values increasing as the water moves downstream, with the biggest increases downstream of the waterfall. Lastly oxygen concentration levels were also fairly good for warm water fish throughout however there are a number of areas of lower oxygen saturation found throughout the system as shown on page 13 indicating some areas have less than ideal conditions for aquatic organisms.

The poor scores shown in Figure 23 reflect areas where lower oxygen concentration and saturation scores combine with higher than average conductivity readings.

The sections receiving a good score reflect the areas that had moderate oxygen concentration and saturation scores combined with average or slightly above average conductivity scores.

The sections with an excellent score had moderate to low conductivity readings and high dissolved oxygen and concentrations values.

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 temperature datalogger was deployed in Huntley Creek from May to October 2017 to give 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 Huntley Creek for 2017.

Analysis of the data collected indicates that Huntley Creek should be classified as a cool-warm water stream, and that the south branch should be classified as a cool water stream.

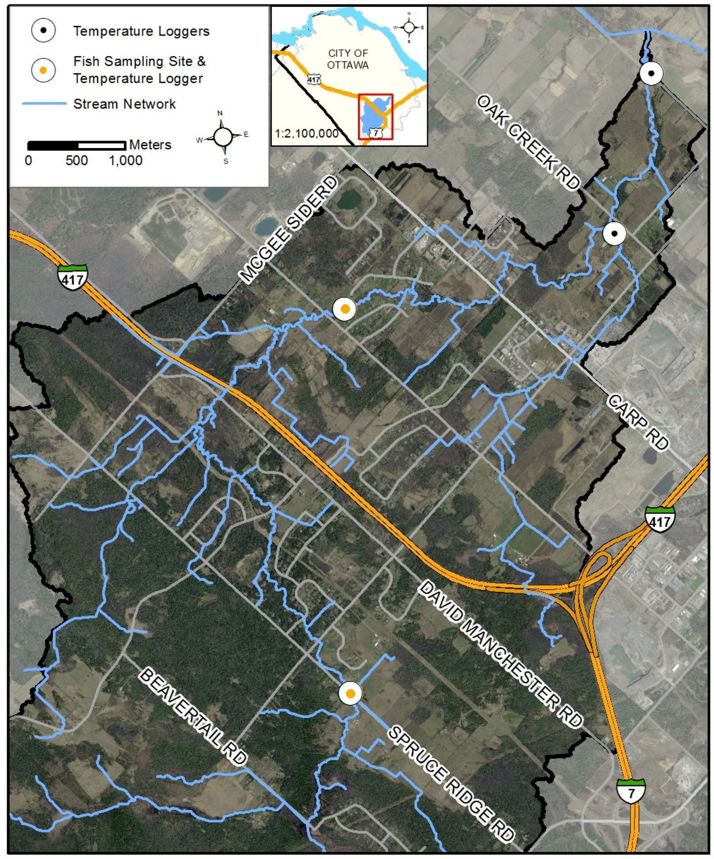


Figure 24: *Location of temperature loggers and fish sampling sites on Huntley Creek.*

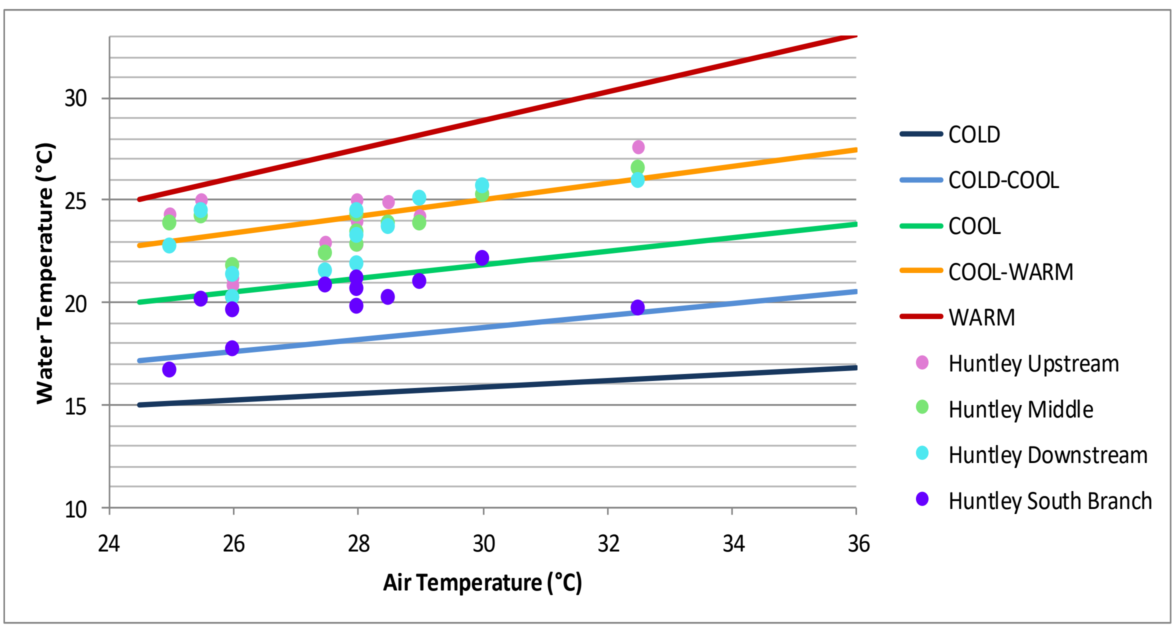


Figure 25: *Thermal classification of Huntley Creek.*

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

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

Fish Sampling

In 2017, MVCA used a method called electrofishing to sample Huntley Creek's fish population in two of the locations where we had launched temperature probes, Huntley Middle at Cyd Street and Huntley Upstream at Spruce Ridge Road. The same eight species of fish were found in both locations. Water levels were too deep this year for electrofishing the other temperature logger sites near Huntmar Road and Newill Place.

In 2014, MVCA electrofished Huntley's central site and found 10 species of fish, four of which were not represented in the 2017 sampling. It is hard to know why the species were not seen again but it is possible the frequent high water flows throughout 2017 could have been an issue limiting our ability to catch these species.

Various environmental consultants have also surveyed Huntley Creek's fish population in 2006 and 2014 and identified 11 fish spices. The only additional species added to the list is the Fathead Minnow found in the South Branch.

The total known species list for Huntley Creek can be found in Table 4 below. (Thermal classes from Coker, 2001)

Table 4: Fish Species Found In Huntley Creek

Species Common Name	Thermal Class
Blacknose Dace	Cool
Bluntnose Minnow	Warm
Brook Stickleback	Cool
Central Mudminnow	Cool
Common Shiner	Cool
Creek Chub	Cool
Fathead Minnow	Warm
Finescale dace	Cool
Greater Redhorse	Warm
Hornyhead Chub	Cool
Mottled Sculpin	Cool
Northern Redbelly Dace	Cool
White Sucker	Cool

Migratory Obstructions

Migratory obstructions are features in a water way that prevent fish from freely swimming up and downstream. This can effect successful migration to breeding or foraging habitats as well as restricts 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 Huntley Creek revealed that there is 1 waterfall in the lower reach, 1 debris jam near William Mooney Road, and 20 beaver dams acting as migratory obstructions.

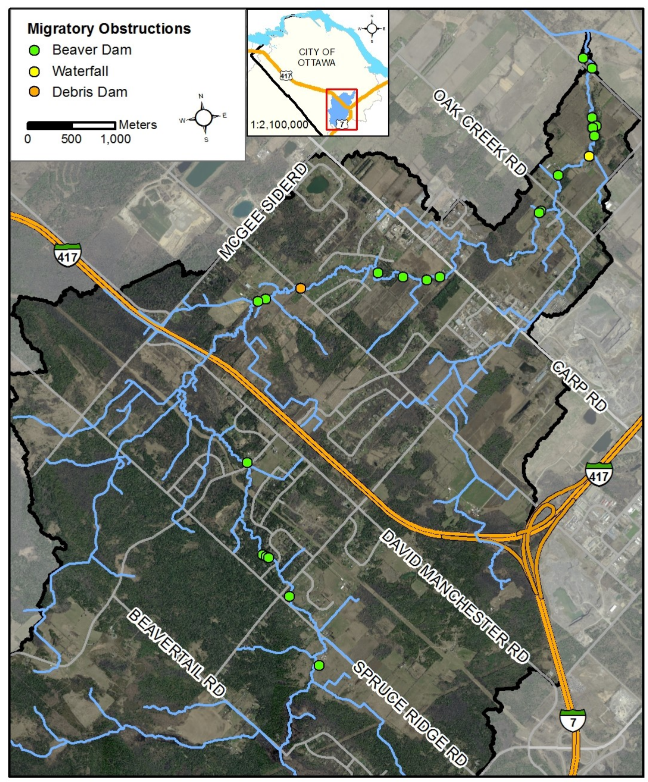


Figure 26: *Map of migratory obstructions in Huntley Creek.*

Wildlife Observed

There were many species of wildlife observed during this assessment of Huntley Creek. Abundant raccoon tracks were seen, especially near a culvert at the downstream end. Green frogs, dragonflies, damselflies, minnows, snails, various aquatic insects and numerous beavers were also present.

Table 5: Huntley Creek Wildlife Observed	
Birds	Crow, Hawk, Blue Jay, Chickadee, Goldfinch, Woodpecker, Sparrow
Mammals	Raccoon, Deer, Beaver
Reptiles and Amphibians	Bull Frog, Green Frog, other frogs
Aquatic Insects	Dragonfly, Damselfly, Butterfly, Water Strider, Water Beetle
Other	Mussel, Crayfish, Snail, Leech, small unidentified fish

Pollution

Pollution in the form of litter, such as cans, plastic, and tires was occasionally found in Huntley Creek.

Benthic Organisms

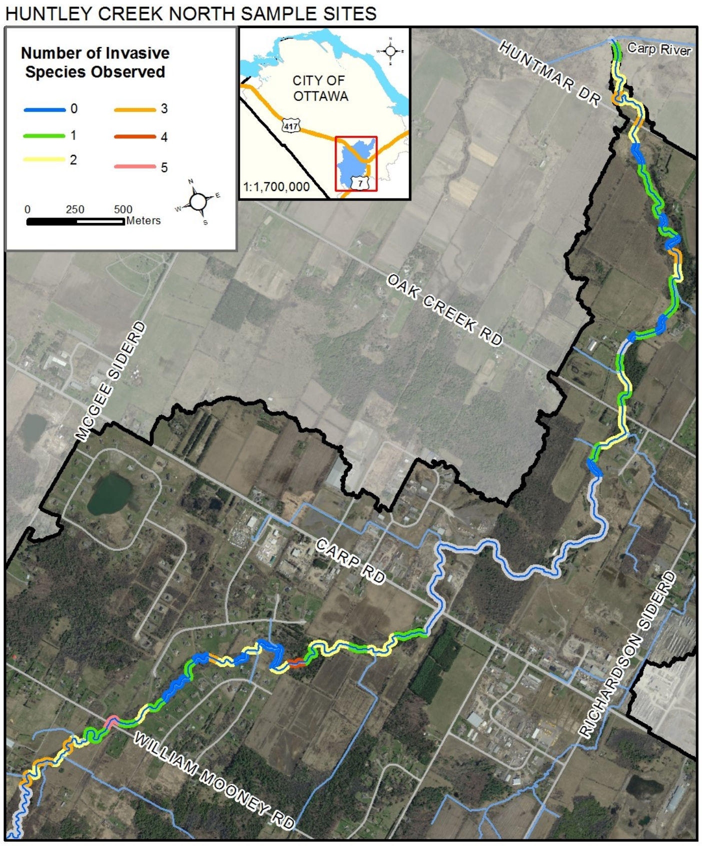
MCVA conducted benthic sampling in Huntley Creek following the Ontario Benthic Biomonitoring Network (OBBN) Protocol in October of 2017. Benthic sampling assesses the aquatic insect population at a site as they are less mobile and easier to catch than other aquatic organisms. Also, due to their small habitat range and sensitivity to water chemistry (such as available dissolved oxygen) benthic organisms are good indicators of aquatic habitat conditions. Sampling was conducted at the same two sites where fish sampling was conducted (Figure 24). Results are shown below in Table 6.

The three metrics MVCA uses to classify a benthic population are Species Richness, % EPT and Average FBI. Species Richness is the number of species found at each site. %EPT is the proportion of the benthic invertebrate community belonging to the Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) families as they are indicator species of good water quality conditions. The higher the % the better the water quality. FBI stands for the Hilsenhoff Family Biotic Index which is derived by giving each benthic family a score based on their sensitivity to pollution (on a scale of 0-10). A higher score represents a benthic population high in families tolerant of low oxygen conditions, and therefore likely to have poorer water quality conditions. FBI scores were averaged across the 2 riffle samples taken at each site, whereas %EPT is an average of 1 pool and 2 riffle samples.

Each site had a good diversity of species, with a total of 20 different species found in Huntley Creek. However, the proportions of sensitive species required for the other two indices were low. The upstream site has a shallow cobble riffle substrate while the middle site was deeper and dominated by sand. This habitat variability is likely the contributing factor for the species compositions found at each site and thus the resulting condition summary.

Table 6: Benthic Results Summary

Site	Species Richness	Average % EPT	Average FBI	Condition
Huntley Middle	13	11.70	6.41	Fairly poor
Huntley Upstream	17	15.94	5.37	Fair



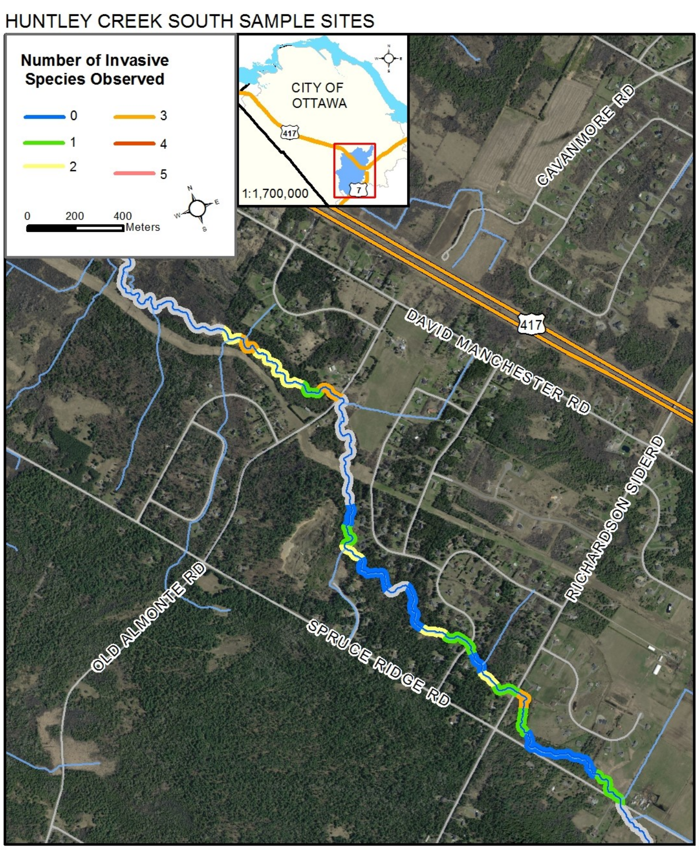


Figure 27: *Abundance of identified invasive species along Huntley Creek.*

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 27 shows that although there are 11 identified invasive species in the Huntley Creek Corridor, there are a large number of sections with 1 or fewer identified invasive species. The photo above (showing both Wild Parsnip and Purple Loosestrife growing together) is an example of a site with more than one invasive species present along Huntley Creek.

The list of species identified while surveying Huntley Creek is as follows: Banded Mystery Snail, Buckthorn (Common and Glossy), Curly Leaf Pondweed, European Frogbit, Garlic Mustard, Himalayan Balsam, Norway Maple, Wild Parsnip, Purple Loosestrife and Rusty Crayfish.

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

Potential Stewardship Opportunities

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

Eight reaches were identified as having a riparian buffer less than 30m on at least one side, with 3 of them having less than a 15m buffer. Additionally, 35% of the stream surveyed has less than 20% shade cover.

The next steps will be to contact landowners and explore the potential for collaboration with them on a voluntary basis to enhance their shorelines through a number of potential activities, such as increasing the width of unmowed areas along the shore and/or agreeing to plant and maintain native shoreline species of trees or shrubs. This will improve shoreline buffer widths as well as improve stream shading as the trees and shrubs mature.

The photos above and below are examples of sites where MVCA has made a partnership with property owners along Huntley Creek to improve their riparian buffer zones.

Stream Comparison Between 2013 and 2017

Water Chemistry

Water chemistry parameters are tracked throughout the entire surveyed system and reflect the general conditions of the environment. Shifts in these conditions can be indicative of general ecological changes within the environment. However due to the limited number of sampling years completed it is difficult to determine if a change in surveyed values is part of the system's natural variability or if it is due to impairment.

As seen in Table 7, there has been little change in the mean results for Huntley's water chemistry in the 3 years since the last survey. F-Tests were run to compare the results from 2014 to those of 2017 and only water temperature and pH were found to be significantly different. All the variables have smaller variance ranges in 2017 with the exception of conductivity. There was a big difference in the weather experienced between these two years with increased rainfall and increased frequency of rainfall events contributing to the observed stream conditions in 2017. It is unclear at this time if there are additional factors contributing to the recorded differences.

Table 7: Comparison of Water Quality Parameters in Huntley Creek

	2014 Mean Results	2014 Variance	2017 Mean Results	2017 Variance	Significant Difference?
Water Temperature (°C)	19.90	4.82	20.78	3.66	Yes
Water Depth (m)	0.57	0.07	0.66	0.07	No
pH	7.93	0.09	7.81	0.04	Yes
Dissolved Oxygen (mg/L)	8.63	2.05	8.10	1.52	No
Specific Conductivity (µS/cm)	591	15166	623	16123	No

Headwater Drainage Features

The City Stream Watch program assessed 10 Headwater Drainage Features in the upper half of the Huntley Creek watershed in 2017 to add to the 5 sites that were previously completed closer to the outlet in 2015. (Refer to Figure 28).

This protocol measures zero, first and second order headwater drainage features (HDF). It is a rapid assessment method characterizing the amount of water, sediment transport, and storage capacity within HDFs. MVCA is working with other Conservation Authorities and the Ministry of Natural Resources and Forestry to implement the protocol with the goal of providing standard datasets to support science development and monitoring of headwater drainage features.

An HDF is defined as a depression in the land that conveys surface flow. Additionally, this module provides a means of characterizing the connectivity, form and unique features associated with each HDF (Stanfield, 2017).

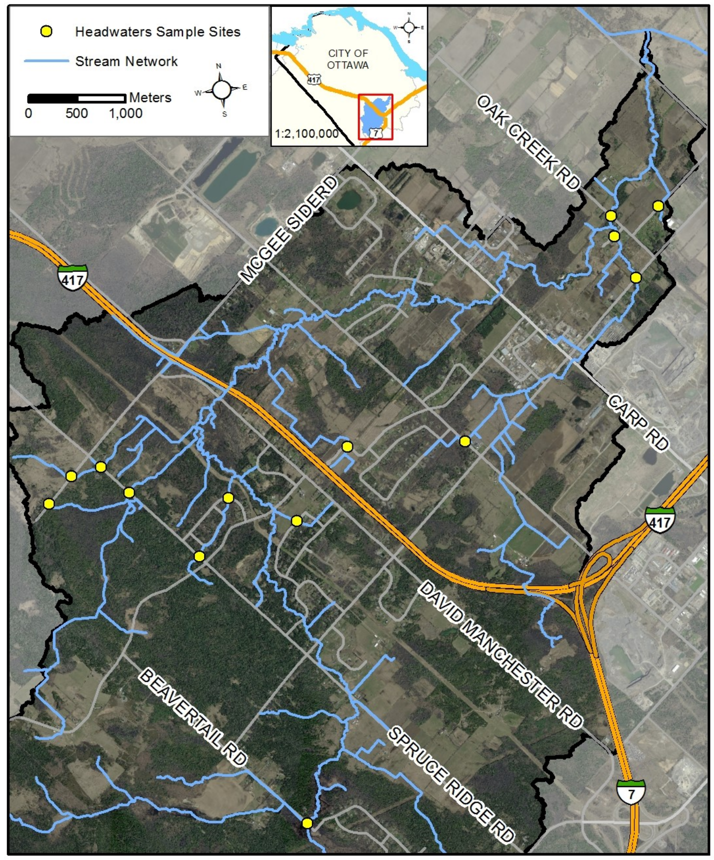


Figure 28: Headwater drainage feature sampling sites in the Huntley Creek watershed.

HDF Feature Types

The headwater 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 values 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 15 headwater sites surveyed in the Huntley Creek watershed consist of 8 of the 9 feature types excluding pond outlets. The top three feature types are defined natural channels, wetlands and roadside ditches making up 79% 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 in the 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.

Thanks to the extended wet season experienced in 2017 all but one of the Huntley headwater sites were still flowing when they were revisited at the end of June.

HDF Channel Modifications

Channel modifications are assessed at each headwater drainage feature site. Modifications include dredging, hardening, realignments, entrenchment and anthropogenic online ponds..

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

HDF Vegetation

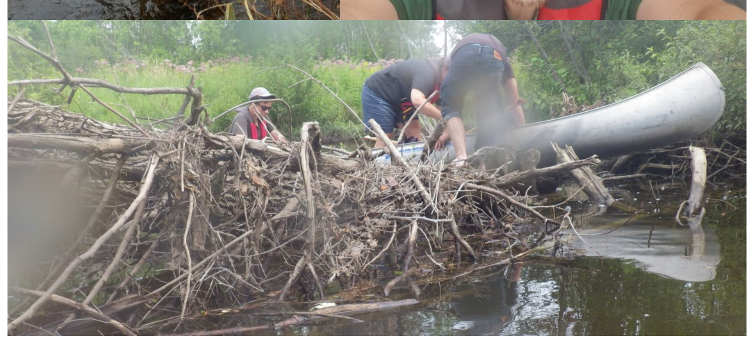
Feature vegetation type is evaluated as the dominant vegetation type found directly within each headwater feature channel, whereas riparian vegetation type is evaluated as the dominant vegetation within 3 zones from the shoreline of each headwater feature (0-1.5 m, 1.5-10 m and 10-30m).

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

Forest and Wetland were the dominant feature vegetation types. Wetland, Forest, Scrubland and Meadow were the dominant riparian vegetation types. Lawn and crops were present near a few features as can be seen in the photo above.

Land Owners & Volunteers

A big **"Thank You!"** needs to go out to the 39 landowners as well as the 15 dedicated volunteers, 4 summer students and 1 intern who came out in 2017 and helped make this monitoring program happen.



Report Summary

The results in the table below are a summary of the highlights from each of the report sections. Huntley Creek has high amounts of natural shoreline vegetation, good shade coverage, and few areas of water quality concern. The stream is classified as cool water and 8 species of fish were found across two sampling sites. The benthic populations found reflect their substrate and available habitats. The majority of sections have good to high habitat complexity which will lead to good diversity of habitats available for benthic organisms, fish and other aquatic animals that call Huntley Creek home.

The main cause of the water quality concern rating is that there is a trend of increasing conductivity as the creek nears the downstream reaches, with the highest readings being downstream of Huntmar Road. This area also has poor oxygen saturation levels making it a less than ideal habitat for aquatic organisms. The source of this increase in conductivity is unclear as there is a general accumulation as the water flows through the catchment. The biggest increase in conductivity happens below the waterfall which is not correlated with a road crossing or agricultural drain outlet. This pattern in the conductivity result is consistent with the 2014 findings. Further assessment for trends and potential causes will have to be done on these water chemistry variables the next time Huntley Creek is surveyed.

Summary Of City Stream Watch Results for Huntley Creek 2017	
Sample Variable	**Huntley Creek**
Number of Sections Surveyed	96
Average Stream Width (m)	6.9
Average Stream Depth (m)	0.70
Average Hydraulic Head (mm)	12
Average Water Temperature (^{o}C)	20.8
Average Conductivity (µS/cm)	625
Average pH	7.81
Average Dissolved Oxygen Concentration (mg/L)	8.10
Average Dissolved Oxygen Saturation (%)	90.3
Areas of Water Quality Concern with a Poor Score	6
Dominant Adjacent Land Uses	Forest 51%, Residential 18%
% Channel Alterations	60% Natural
% Vegetated Riparian Buffer Width (>30m)	97% Left Bank, 92% Right Bank
% Overhanging Trees & Branches >40%Section Coverage	28% Left Bank, 28% Right Bank
% Stream Shading >40% Section Coverage	38%
% of Undercut Banks >60% Section Coverage	6% Left Bank, 4% Right Bank
Dominant Substrate Type	Sand 33%, Cobble 32%
Sub-Dominant Substrate Type	Sand 28%, Cobble 22%
# Sections with a Habitat Complexity Score ≥3 variables	70
Dominant In-stream Morphology	62% Runs
Dominant In-stream Vegetation Types	Narrow-leaved Emergent 33%, Submerged Plants 25%
Dominant Amount of In-stream Vegetation	None 52%, Normal 14%
Thermal Class	Cool Water
# Fish Species Found	8 of 13 Previous Recorded Species
# Benthic Species Found	20 of 27 Benthic Groups
Benthic Organism Scores	Fair to Fairly Poor
Migratory Obstructions	1 Waterfall, 1 Debris Jam, 20 Beaver Dams
# of Identified Invasive Species	11
Potential Stewardship Activities	Improve Shoreline Buffers, Invasive Species Pull
# Head Water Drainage Features Sampled	10

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, identification and wildlife identification
- Learning about and participating in benthic invertebrate sampling and identification
- Participating in natural photography

References

Brooks, A.P., Gehrke, P.C., Jansen, J.D., Abbe, T.B. " Experimental reintroduction of woody debris on the Williams river, NSW: Geomorphic and Ecological responses". *River Research and Applications.* (2004). 513-536 Online

Canada. Environment Canada. "How Much habitat is Enough? A Framework for Guiding Habitat Rehabilitation in Great Lakes Areas of Concern". *Minister of Public Works and Government Services Canada.* (2004). Print.

Canadian Council of Ministers of the Environment. "Canadian water quality guidelines for the protection of aquatic life: Dissolved oxygen (freshwater)". *Canadian Council of Ministers of the Environment.* (1999).

Castelle A.J., Johnson, A. W., Conolly, C. "Wetland and Stream Buffer Size Requirements—A Review". *Journal of Environmental Quality.* 23 (1994): 878-882. Print.

Chu, C., Jones, N.E., Piggott, A.R. and Buttle, J.M. "Evaluation of a Simple Method to Classify the Thermal Characteristics of Streams Using a Nomogram of Daily Maximum Air and Water Temperatures." *North American Journal of Fisheries Management* 29. (2009). 1605-1619, Online.

Coker, G.A, C.B. Portt, and C.K. Minns. 2001. Morphological and Ecological Characteristics of Canadian Freshwater Fishes. Can. MS Rpt. Fish. Aquat. Sci. 2554: iv+89p.

Environment Canada, 2011. Canada's Freshwater Quality in a Global Context Indicator. Data sources and methods. ISBN: 978-1-100-17978-0 . Available online: http://publications.gc.ca/collections/collection_2011/ec/En4-144-3-2011-eng.pdf

Stanfield, L. W., Kilgour, B.W. "How Proximity of Land Use Affects Stream Fish and Habitat." *River Research and Application*. Wiley Online Library. (2012). Online.

Stanfield, L. (editor). 2017. Ontario Stream Assessment Protocol. Version 10. Section 4: Module 10. Ontario Ministry of Natural Resources. Peterborough, Ontario. 548 Pages.

Vannote, R.L., Minshall, G.W., Cummins, K.W., Sedell, J.R. and Cushing, C.E. "The River Continuum". *Canadian Journal of Fisheries and Aquatic Sciences* 37. (1980): 130-137. Print.

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.