Mississippi Valley Conservation Authority

Feedmill Creek 2015 Summary Report

Monitoring Activity in the City of Ottawa

In 2012, Mississippi Valley Conservation Authority (MVCA) and the Friends of the Carp River (FCR) collaborated to undertake a broad scale assessment of potential restoration and stewardship opportunities along the Carp River and to test the implementation of a citizen science based volunteer monitoring program. The following year, with funding from Shell Canada, MVCA initiated a pilot City Stream Watch Program which uses a combination of detailed monitoring, education and outreach, and targeted rehabilitation to improve the overall understanding of and guardianship over the health of the watershed. Volunteer “citizen scientists” are trained to collect technical information on creek conditions. Volunteers also participate in special stewardship initiatives that include shoreline planting, fish habitat enhancement projects, stream clean-up 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
- To use the information collected to encourage community driven restoration projects

Since 2013, the first year of our City Stream Watch Program, MVCA staff and volunteers have surveyed more than 200 sections of Poole Creek, Carp Creek, Huntley Creek, Watts Creek, Corkery Creek and an Unnamed Tributary of the Carp River near the carp airport. This information has fed into the planning of 13 riparian planting sites, 4 habitat improvements, a stream garbage pick-up in Poole Creek and the Carp River and an invasive species removal event along Carp Creek. This year (2015), 3 riparian plantings, an invasive species removal, a stream garbage pick-up, and more than 50 sections of stream were surveyed.

MVCA will continue to expand the City Stream Watch Program by implementing a six year monitoring and reporting rotation on a number of main tributaries within the City.

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

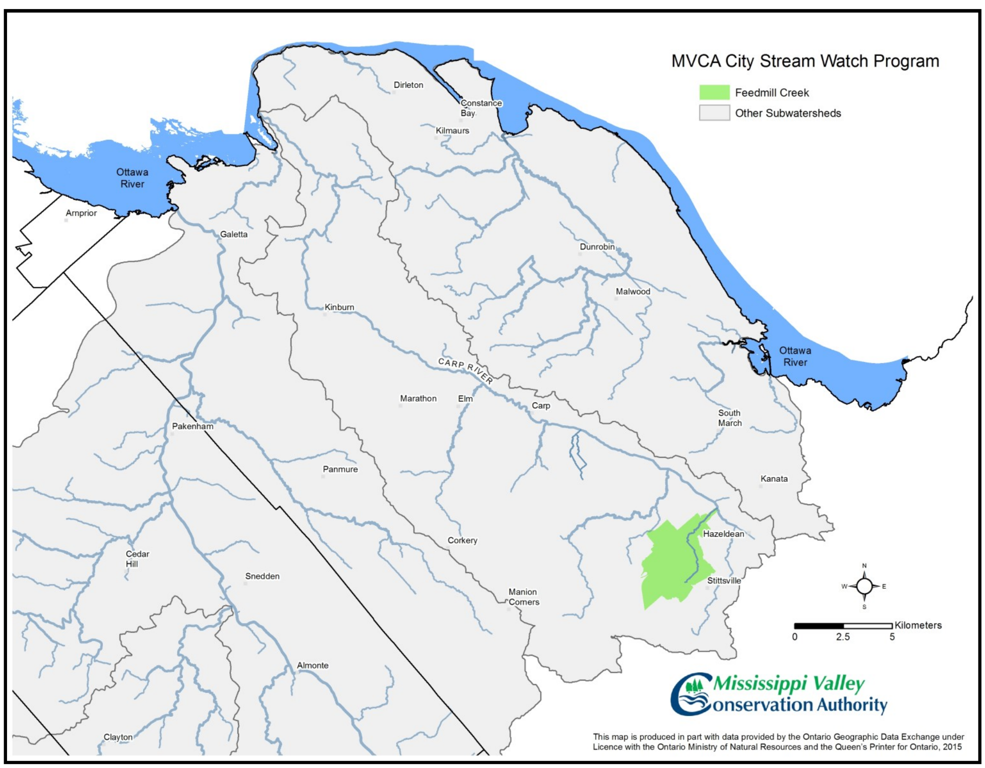


Figure 1: *MVCA’s City Stream Watch area highlighting the location of the Feedmill Creek subwatershed.*

Feedmill Creek

Located in the west end of the City of Ottawa, Feedmill Creek is one of eight major tributaries of the Carp River. It has a length of 5.9 kilometers (km) and drains an area of 11.8 square kilometers (km^2).

Feedmill Creek's headwaters originate in a small wetland located just north of Hazeldean Rd and west of Carp Rd. From there it flows to the northeast, under Hwy 417, and then through the Tanger outlet mall property. Feedmill Creek ends where it reaches the Carp River just east of Huntmar Dr.

Table 1 presents a summary of some key features of the Feedmill Creek subwatershed.

Table 1: Subwatershed Features	
Area	11.8 square kilometers
Land Use	27.4% agriculture
	17.3% aggregate sites
	10% urban land-use
	9.6% wooded area
	13.4% rural land-use
	12.6% wetlands
	9.2% roads
	0.5% water
Surficial Geology	15.1% clay
	12.4% diamicton
	31% organic deposits
	18.2% bedrock
	4% sand
	19.4% gravel
Watercourse Length and Type	*Total Length:* 5.9 kilometers
	Watercourse Type:
	29.5% natural
	70.5% channelized
	Flow Type:
	100% permanent

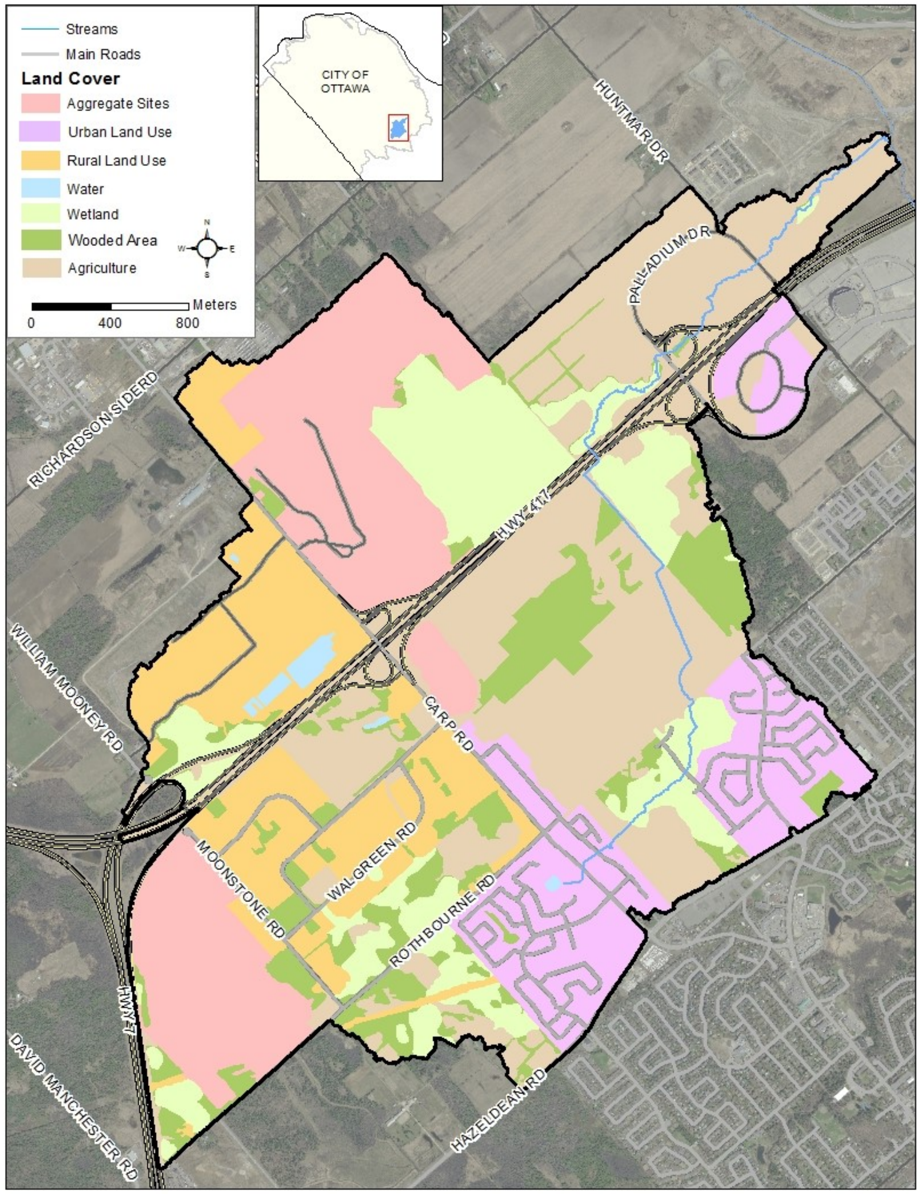


Figure 2: *Land Use in the Feedmill Creek subwatershed*

The Feedmill Creek Subwatershed

As seen in Figure 2, the Feedmill Creek subwatershed is a fairly evenly distributed mix of agriculture (27.4%), aggregate sites (17.3%), urban land-use (10%), rural land-use (13.4%), wetland (12.6%), and wooded area (9.6%). The remaining area is attributable to roads and water. As a general overview, Feedmill begins in an urban subdivision, moves through a pocket of wetland, followed by a large field area interspersed with woodlands. From there it runs through another wetland area before crossing the Tanger outlet area and another subdivision, finally outletting into the Carp River.

Crossing a mixture of wetland, woodland, and rural and urban residential areas, the creek provides a natural corridor and habitat for a range of aquatic and terrestrial species. It also plays an important role as the outlet for a storm water pond located near its headwaters.

Monitoring in Feedmill Creek

In 2015, permission was granted to survey 22 sections of Feedmill Creek, shown on Figure 3, which cover approximately 2.2 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 22 sampled sections. While these sections provide a good representation of the overall condition of Feedmill 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.

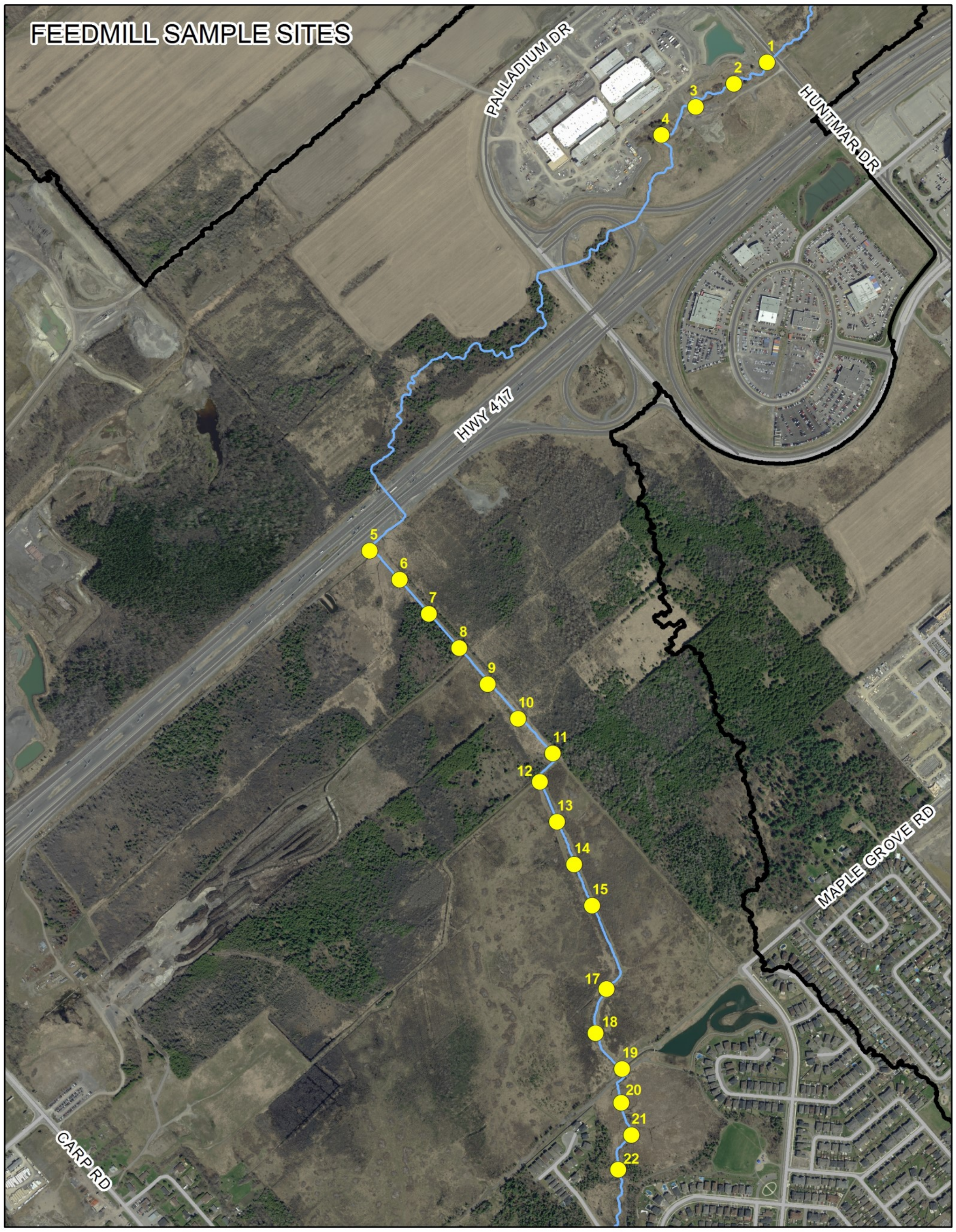


Figure 3: *Locations of the monitoring sites along Feedmill Creek.*

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 un-wadeable, 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.

Table 2 shows some basic assessment measurements for Feedmill Creek. The surveyed sections had an average stream width of 1.95 meters and an average depth of 0.24 m. When this monitoring took place, the average air temperature and water temperature were both around 23°C.

Table 2: Feedmill Creek Assessment Facts

	Minimum	Maximum	Average
Air Temperature (°C)	20.1	27	23.8
Water Temperature (°C)	17.8	26.6	22
Stream Width (m)	0.4	3.4	1.95
Stream Depth (m)	0.07	1.07	0.24

General Land Use Adjacent to Feedmill Creek

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

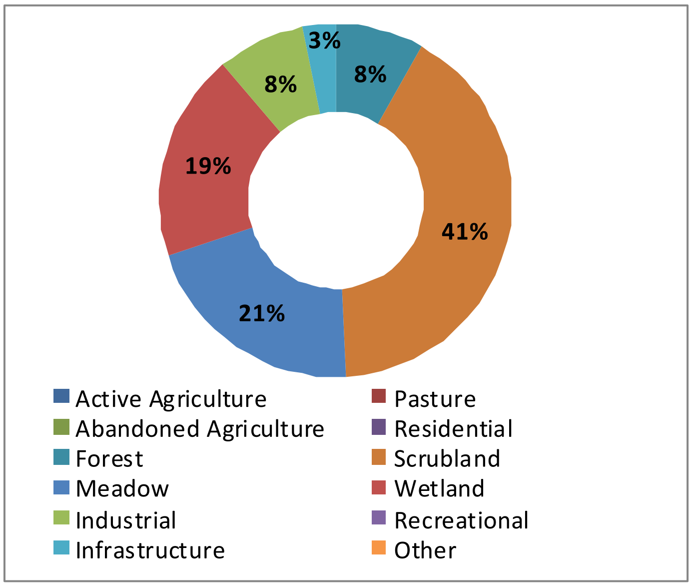


Figure 4: *Land use alongside Feedmill Creek.*

Of the eleven categories, active agriculture, pasture, abandoned agriculture, residential and recreational were not found to be present. At 41%, scrubland represents the most prominent category of land use followed by meadow at 21%, and wetland at 19%.

As described on page 2, the land use in the overall subwatershed area is not dominated by one type but rather distributed fairly evenly between agriculture, aggregate sites, urban and rural land use, wetland and wooded areas. This is reflected well in the percentages seen in Figure 4. In particular we see a high percentage of wetland, which is a result of the pocket of wetland in the most upstream sections, and a high percentage of scrubland which was dominant in the undeveloped middle sections.

Human Alterations to Feedmill 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, 5% of Feedmill Creek was found to be completely unaltered, 68% was natural (with minor alterations), and 27% was altered (with considerable human impact). No surveyed sections were considered highly altered.

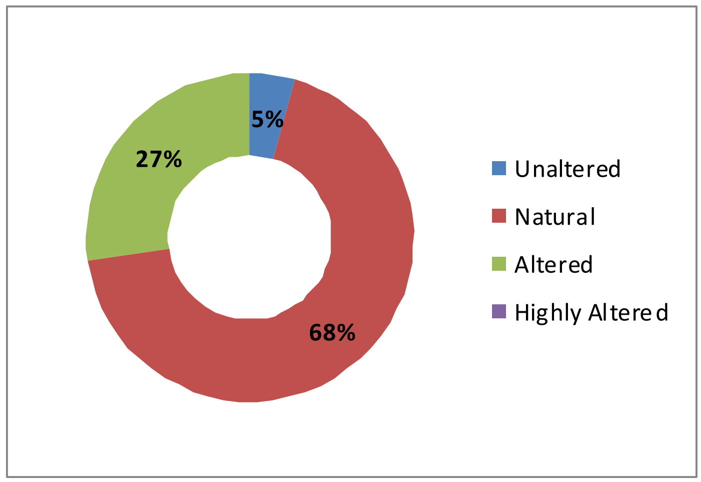


Figure 5: *Extent of human alterations to Feedmill Creek.*

It is a positive attribute that so much of the creek is natural and has not been channelized. Unfortunately, there are large sections that have significant alterations. In particular, the Tanger mall development, an adjacent storm water pond, and housing developments at both the upstream and downstream ends.

A culvert on Feedmill Creek, near Tanger outlet mall

Riparian Buffer along Feedmill 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 riparian buffer 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).

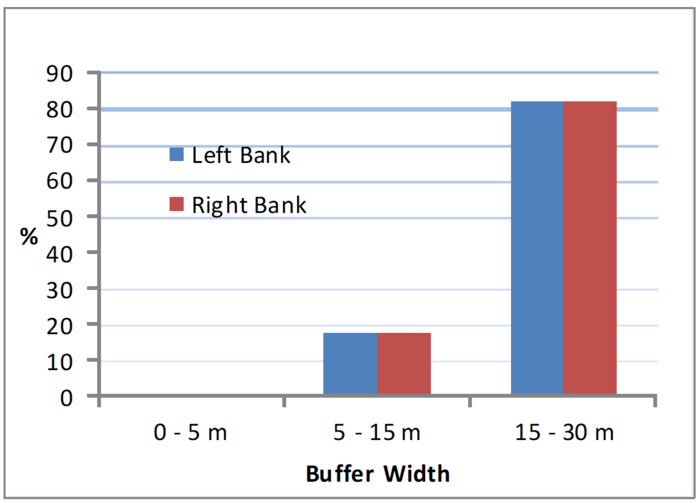


Figure 5: Riparian buffer widths along Feedmill Creek.

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 5, we found that the sections of Feedmill Creek that were surveyed have a relatively good riparian buffer. Results show that 82% of the left and right bank has a buffer width greater than 15 meters, and no sections have a buffer of 5 m or less.

Figure 6 shows the differences in riparian buffer widths along Feedmill Creek. The best buffers were seen along the surveyed sections at the south where the stream flows through uncultivated wetland. Through the middle section, the creek flows through large open fields with a mix of meadow and scrubland buffers, consistently 15-30 m wide. At the downstream end the buffer decreases to 5-15 m, as it passes through the Tanger mall property.

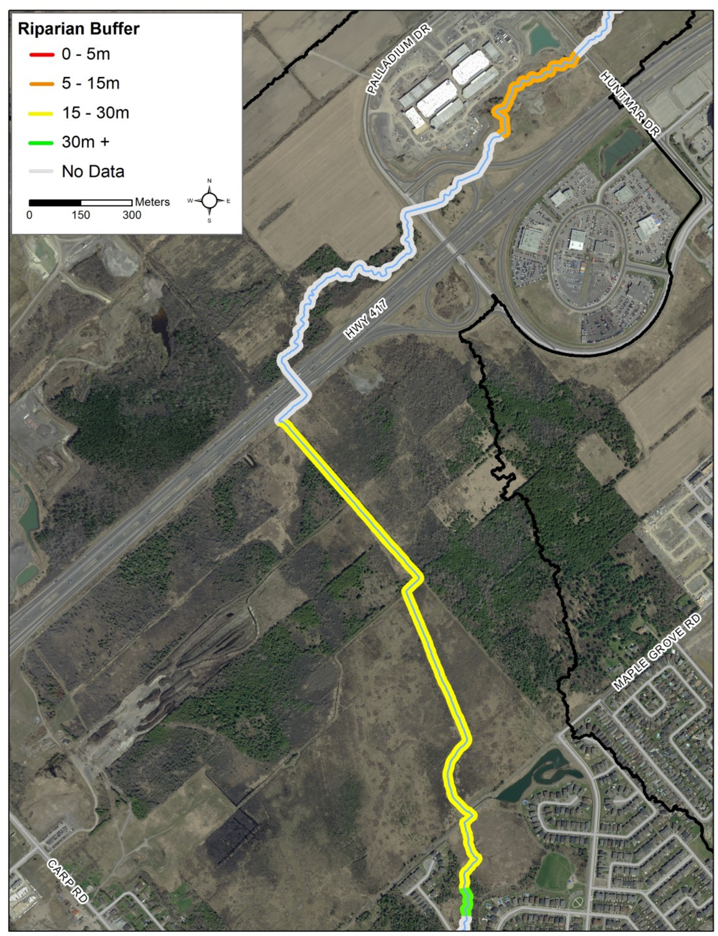


Figure 6: *Vegetated buffer width along Feedmill Creek.*

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 important prey items of fish and wildlife. Overhanging branches also provide stream shading, and fallen logs create excellent habitat for fish.

Overall, Feedmill Creek has a measurable lack of overhanging trees and branches, as seen in Figure 7. In some areas this reflects the surrounding natural vegetative community, where the creek passes through sections of open wetland, or areas dominated by tall grasses, and in some areas it reflects over clearing of the vegetation too close to the creek.

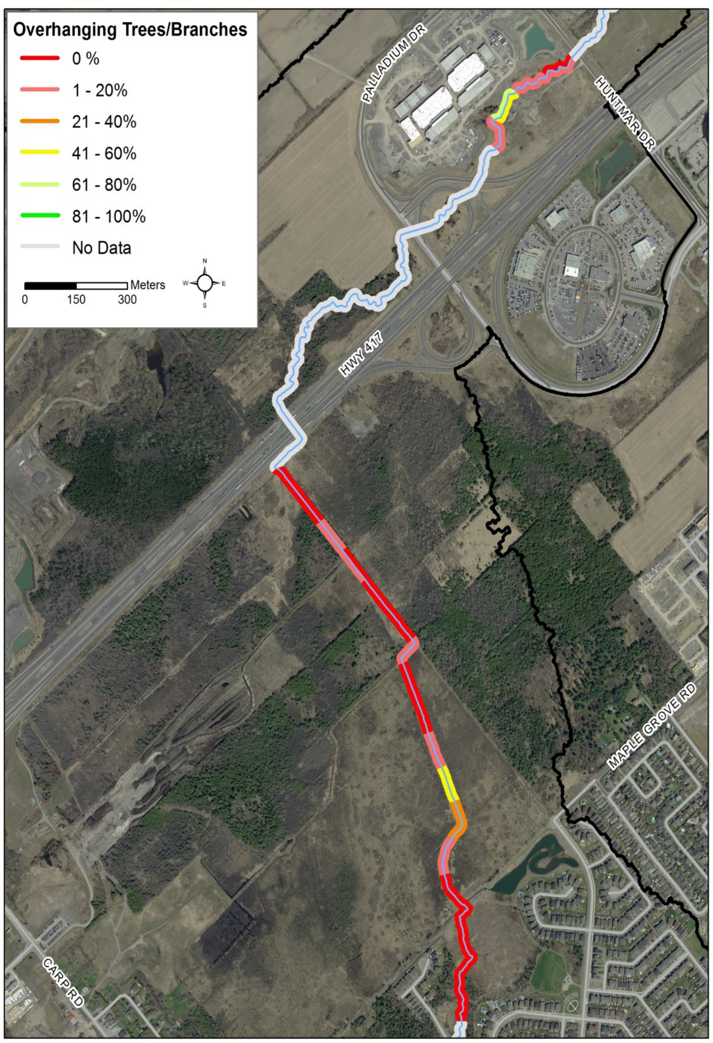


Figure 7: *Overhanging trees and branches along Feedmill Creek.*

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, 55% of the 22 surveyed stream sections were classified as having zero overhanging trees and branches along both the left and right bank. 32% of the surveyed stream was found to have less than 21% overhanging branches.

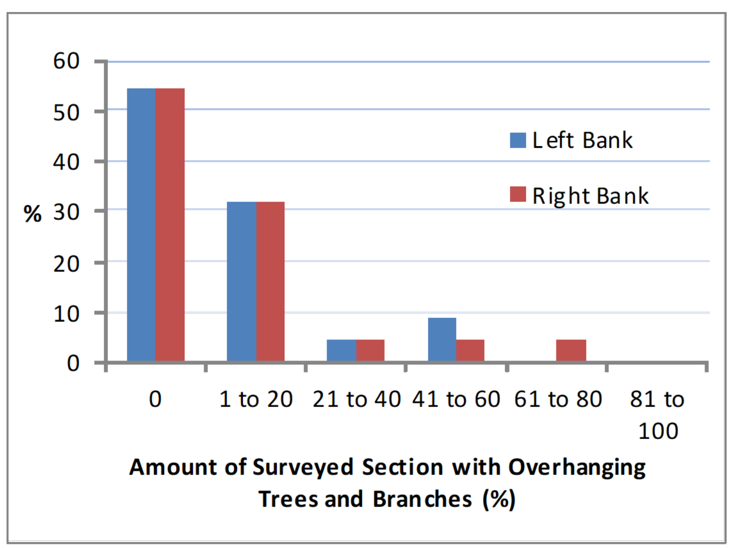


Figure 8: *Percentage of each surveyed section of Feedmill Creek with overhanging trees and branches.*

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 9 shows the variability in the amount of stream shading along different sections of Feedmill 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 interspersed with areas of dense scrubland or forest. The wetland area in the south also provides a lot of shade because of the height of its vegetation, namely cattails.

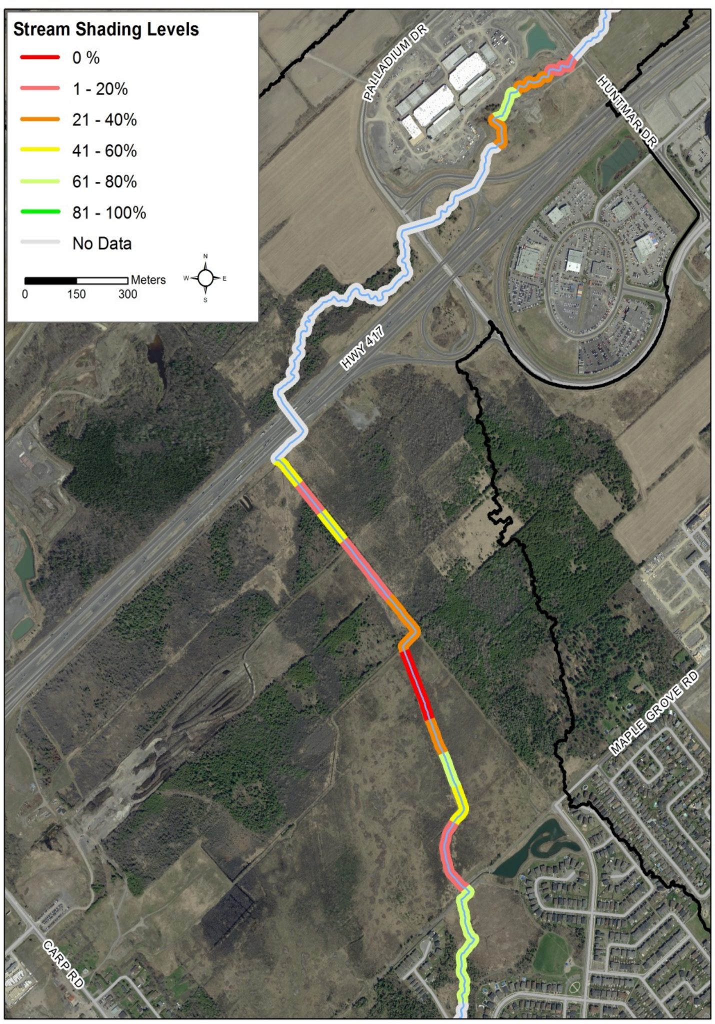


Figure 9: *Stream Shading along Feedmill Creek.*

Figure 10 shows the data quantified as the percent of creek sections classified according to the various levels of shading. For example, 27% of the 22 stream sections that were surveyed were classified as having 1 to 20% shading along the entire section. With 9% at zero shading, 27% at 1 to 20 percent, and 23% at 21 to 40 percent, more than half of the surveyed stream has less than 41% shading.

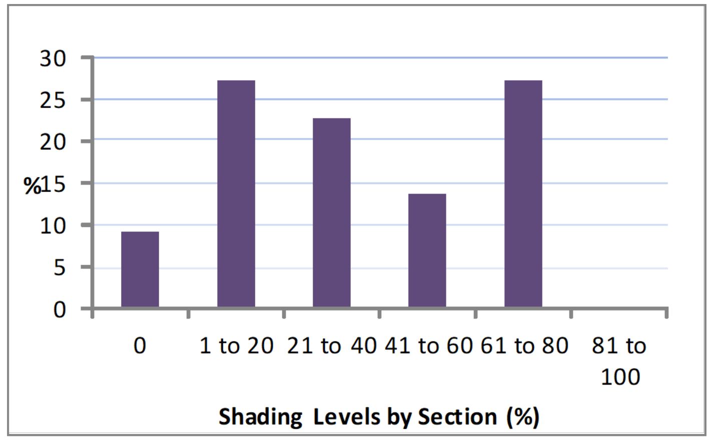


Figure 10: *Shading along Feedmill Creek.*

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.

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 is resulting in instability, erosion and sedimentation.

Figure 11 shows the percentage of undercut stream banks along each surveyed section of Feedmill Creek. Overall, the sections of Feedmill Creek that were surveyed were found to have very little undercutting, most with either less than 20% or with no undercutting at all. The one isolated pocket of undercutting, just north of Maple Grove Rd, occurred in an area of high flow. This pocket provides a habitat function and, if relatively stable, should be left to provide refuge and shelter habitat.

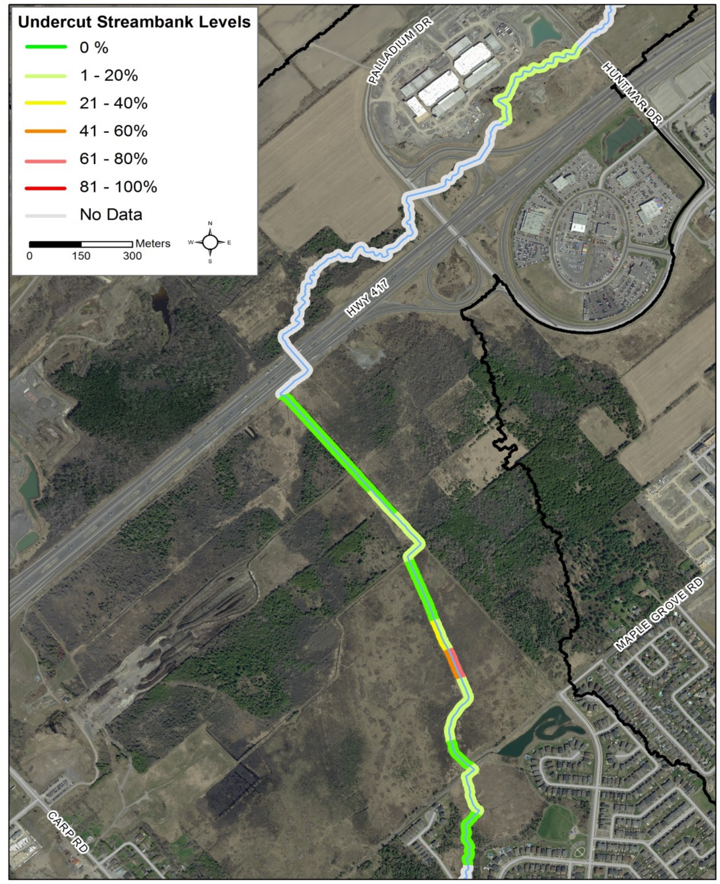


Figure 11: *Undercut stream banks along Feedmill Creek.*

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. The in-stream morphology for Feedmill Creek can be seen in Figure 12.

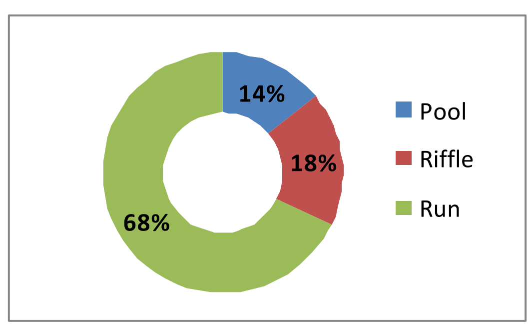


Figure 12: *In-stream morphology along Feedmill Creek.*

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 12, Feedmill Creek was found to consist of 68% runs, 18% riffles and 14% pools. Stewardship efforts could be focused at creating more in-stream pool/riffle sequences to enhance fish habitat.

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 13 summarizes the different types of substrate which make up the bed of Feedmill Creek.

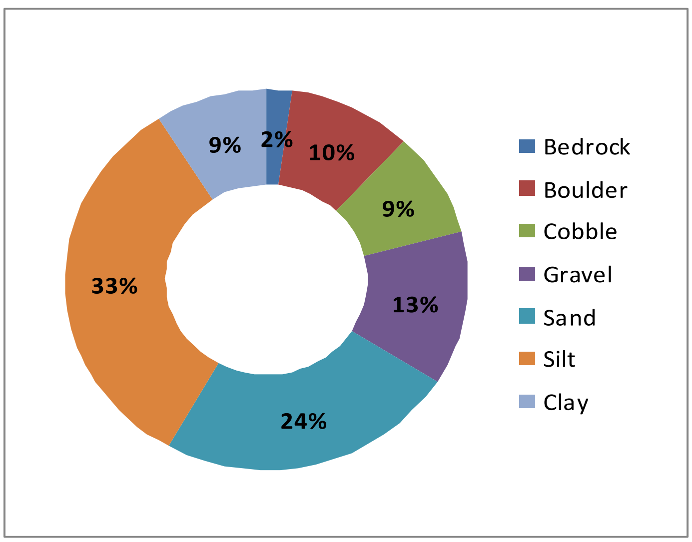


***Figure 13:** Percentages of in-stream substrate types in Feedmill Creek.*

Feedmill Creek is composed of high percentages of silt, sand, and gravel, with smaller percentages of cobble and boulder. Cobble, which makes up 9% of the 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 10% of Feedmill Creek's in-stream substrate, will create cover and back eddies for larger fish to hide and to rest out of the current.

Cobble and Boulder Habitat

As discussed, cobble and boulders both provide important fish habitat. Figure 14 shows the sections of Feedmill 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.

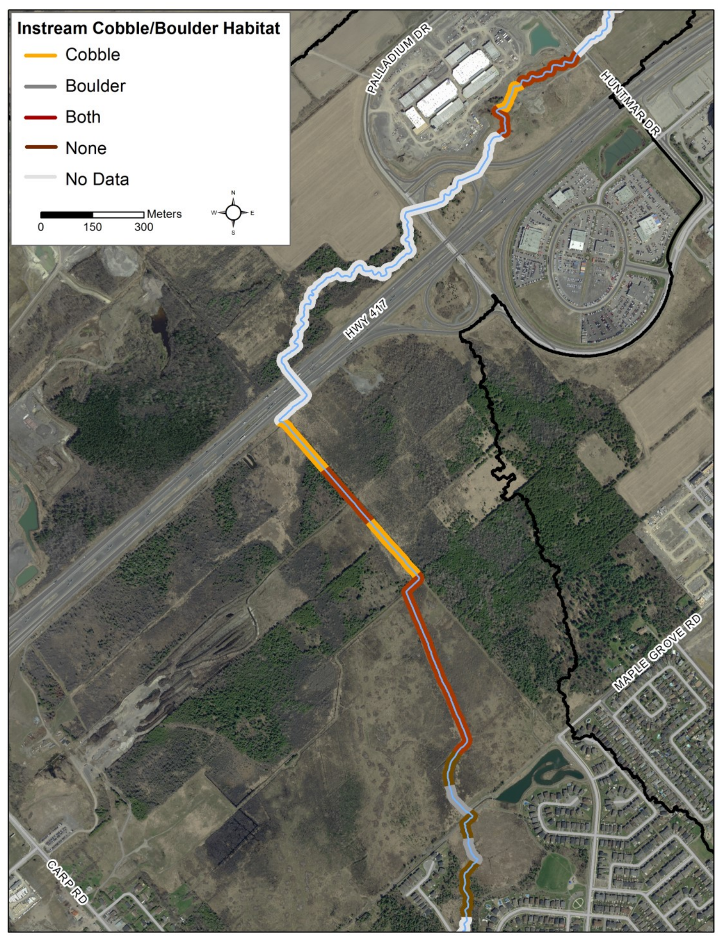


***Figure 14:** Cobble and boulder habitat along Feedmill Creek.*

Type and Abundance of 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 phosphorous 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. 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.

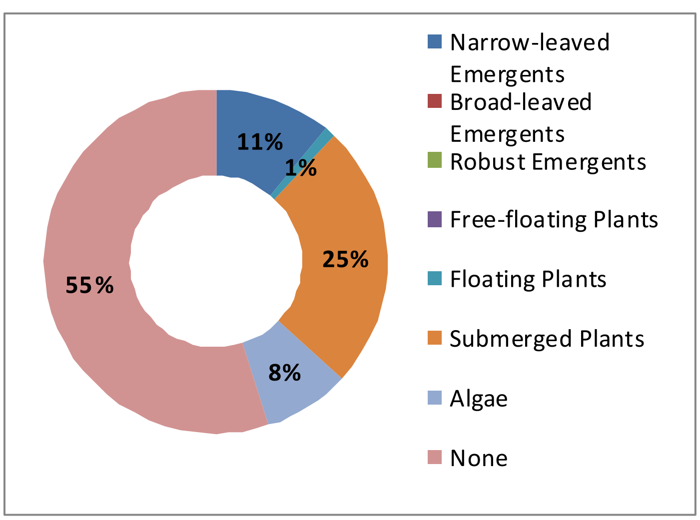


Figure 13: *Types of In-stream vegetation in Feedmill Creek.*

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 14 shows the amounts of in-stream vegetation in Feedmill Creek. The creek was found to have a good diversity of vegetation abundance with each category being represented. Overall however, the creek had more sections with low vegetation amounts, with 11% low, 33% rare, and 11% no vegetation.

Low in-stream vegetation levels in Feedmill Creek are likely due to substrate type. For example areas that are overloaded with silt do not facilitate easy plant growth. It may also be the result of water depths or currents creating conditions that limit plant growth.

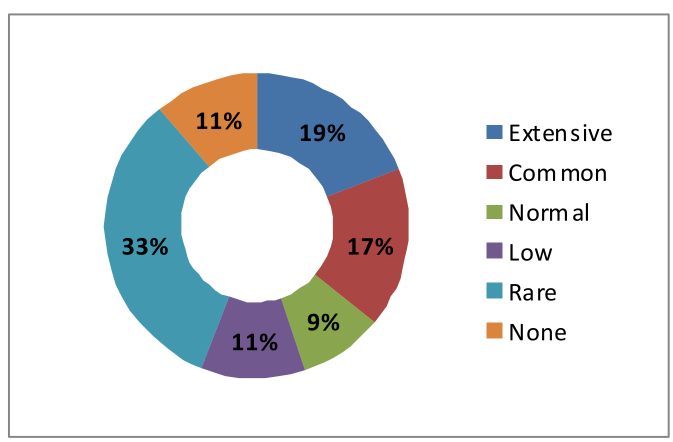


Figure 14: *Abundances of in-stream vegetation in Feedmill Creek.*

Thermal Classification

Temperature is an important parameter in streams as it influences many aspects of physical, chemical and biological health. Figure 15 shows where the temperature datalogger was deployed in Feedmill Creek from March to late November 2015 to give a representative sample of how water temperature fluctuates.

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 16 shows the thermal classifications of Feedmill Creek.

Analysis of the data collected indicates that Feedmill Creek should be classified as a cool to cool-warm water stream. All water temperature data from Fermi Creek courtesy of the City of Ottawa.

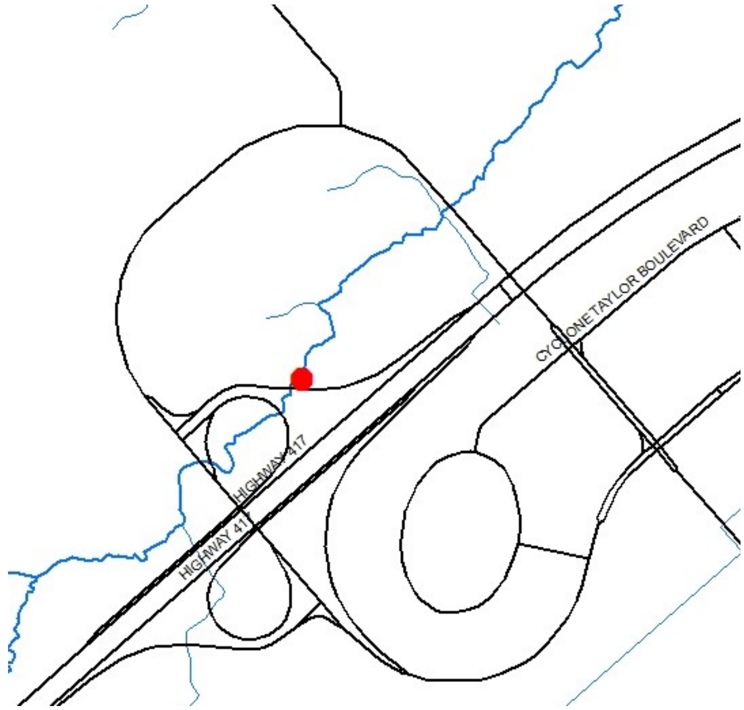


Figure 15: *Location of temperature logger on Feedmill*

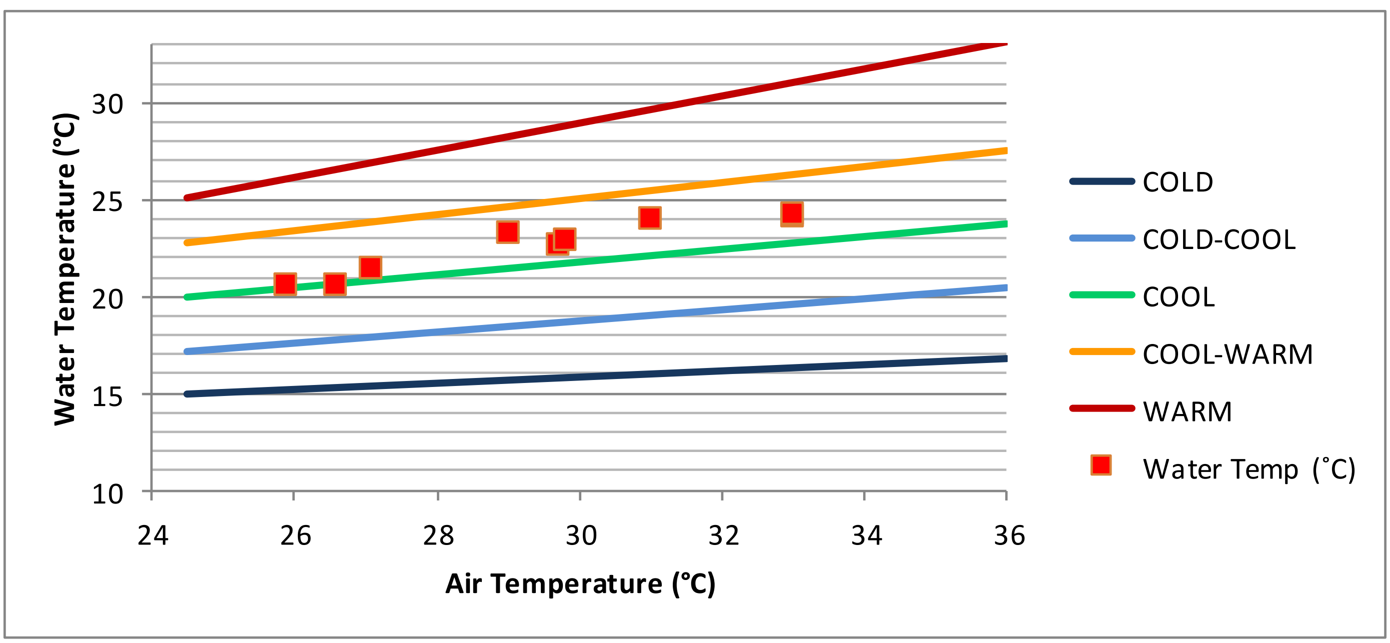


Figure 16: *Thermal classification of Feedmill Creek downstream of Palladium Drive.*

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 °C and was preceded by two consecutive days with a maximum air temperature ≥ 24.5 °C during which time no precipitation occurred.
- Water temperature is taken at 4:00 pm

Wildlife Observed

There were many species of wildlife observed during this assessment of Feedmill Creek. Many raccoon tracks were seen, especially near a culvert at the downstream end. Green frogs, dragonflies, damselflies, minnows, a snail, and various aquatic insects were also present. The highlight was an up close sighting of a great blue heron around a bend in the creek, seen in the photo below.

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.

Dissolved oxygen 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 Feedmill Creek measured at 8.85 mg/L, making it healthy for warm water fish, and slightly below the

requirements for cold water fish.

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 saltiness 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 salt in and 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). The United States Environmental Protection Agency notes that streams supporting good mixed fisheries generally fall between 150 and 500 µS/cm. The average conductivity of Feedmill Creek is 1555 µS/cm, putting it well above the ideal range. This can have an effect on the wildlife present.

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. The average pH of Feedmill Creek is 8.08, a nearly neutral condition, which is good for many species of fish to thrive.

Table 3: Feedmill Creek Water Quality Data

	Minimum	Maximum	Average
pH	7.61	8.36	8.08
Dissolved Oxygen (mg/L)	7.57	11.2	8.85
Conductivity (µS/cm)	1036	1917	1555

Potential Riparian Restoration 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.

Figure 17 depicts the locations identified by MVCA staff and volunteers, as areas for potential riparian restoration activities (planting along the shoreline). There was only one site near the middle of Feedmill creek that was identified as a potential restoration site. It was observed to have a large number of purple loosestrife which could be removed.

The next steps will be to approach the landowners and work with them on a voluntary basis to enhance their shorelines through a number of potential activities, such as increasing the unmowed areas along the shore or agreeing to plant and maintain native shoreline species of trees or shrubs.

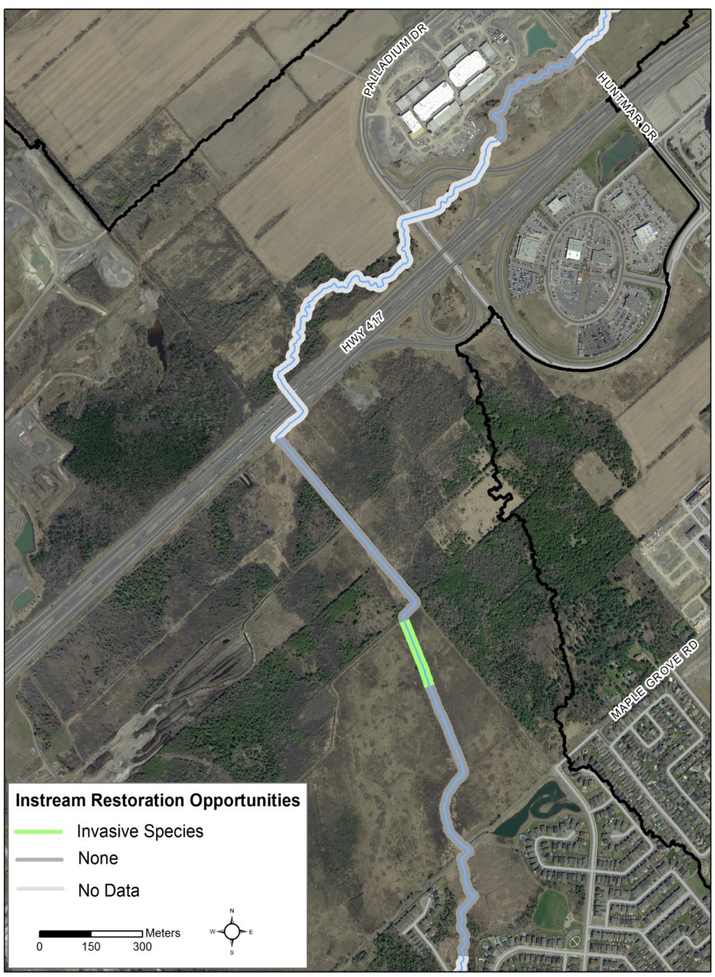


Figure 17: *Areas for potential restoration projects along Feedmill Creek.*

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.

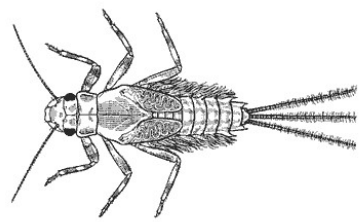
MVCA uses stream surveys to target specific areas that need restoration work. Stream garbage clean ups are carried out, blockages are removed, and shoreline planting, erosion control and habitat enhancements are organized.

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

Call 613-253-0006 ext. 272, 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/identification
* Participating in natural photography



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