Kizell Drain 2016 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 (CSW) 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 adopting the City Stream Watch program in 2013, MVCA staff and volunteers have surveyed more than 360 sections in 10 streams. 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 invasive species removal events. This year (2016), three streams were surveyed, Shirley's Brook, Kizell Drain and Carp C Tributary, for a total of 8.4kms. Separate reports are available for each stream on our website.

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

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

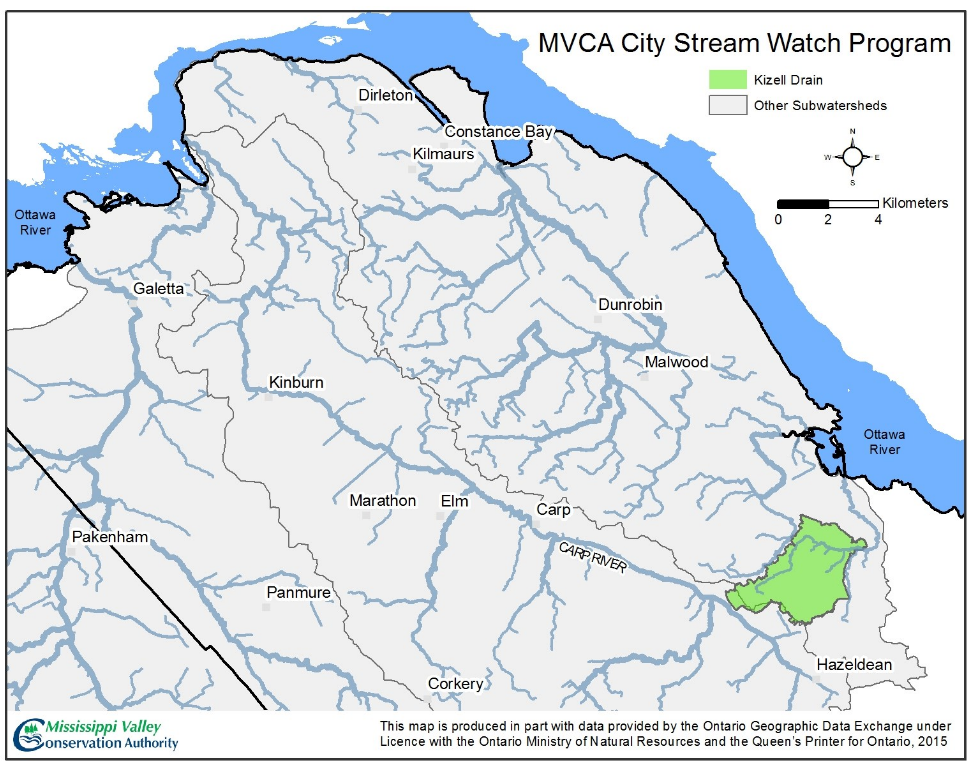


Figure 1: *MVCA's City Stream Watch area highlighting the location of the Kizell Drain subwatershed.*

Kizell Drain

Located in the west end of the City of Ottawa, Kizell Drain is a tributary to Watt's Creek which flows into the Ottawa River. It has a length of 7.4 kilometers (km) and drains an area of 7.1 square kilometers (km^2).

Kizell Drain`s headwaters originate in the South March Highlands west of Terry Fox Drive. From there it flows east and then north through urban residential areas, the March Road industrial area, agricultural land, and National Capital Commission (NCC) Green Belt before joining Watt's Creek and flowing into Shirley's Bay in the Ottawa River.

Table 1 presents a summary of some key features of the Kizell Drain subwatershed.

Table 1: Subwatershed Features	
Area	7.1 square kilometers
Land Use	49.9% urban land-use 16.9% roads 13.3% agriculture 9.8% wooded area 5.3% wetlands 0.4% water 0% aggregate sites 0% rural land-use
Surficial Geology	49.9% bedrock 30.8% clay 9.9% sand 9% organic deposits 0.3% diamicton 0% gravel
Watercourse Length and Type	*Total Length:* 7.4 kilometers *Watercourse Type:* 42% natural 58% channelized *Flow Type:* Permanent

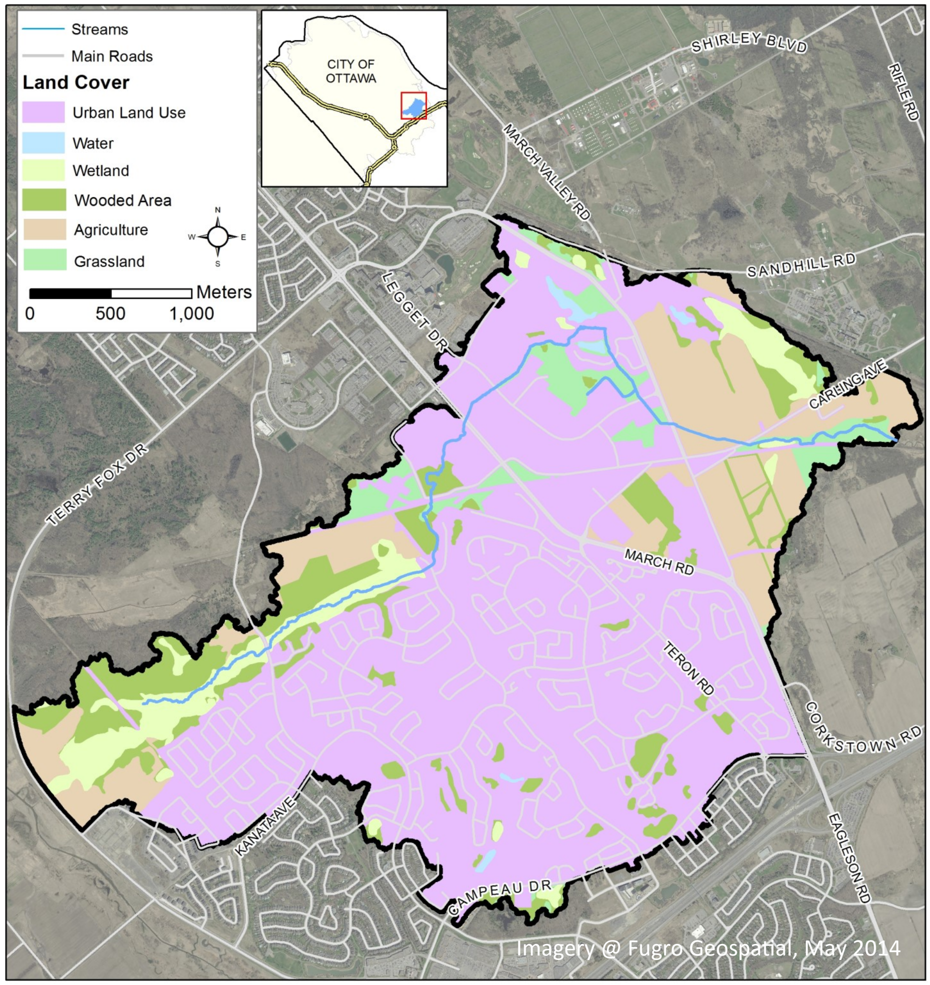


Figure 2: *Land Use in the Kizell Drain subwatershed.*

The Kizell Drain Subwatershed

As seen in Figure 2, the Kizell Drain subwatershed is predominantly an urban landscape. It includes dense suburban development, two golf courses, park land, a Provincially Significant Wetland (PSW), light industry, commercial development, and agricultural properties. Through these areas the creek provides a natural corridor and habitat for a range of aquatic and terrestrial species.

At the upstream end of the watercourse is the "Beaver Pond" which is an online storm water management facility that is also now designated a Provincially Significant Wetland due to its size, habitat features and the presence of the endangered Blanding's Turtle.

The downstream portion of the water course is designated a municipal drain, which permitted it's channelization and occasional clean outs to provide drainage to farm properties.

Fish Species found in Kizell Drain: Banded Killifish, Blackchin Shiner, Brook Stickleback, Central Mudminnow, Common Shiner, Creek Chub, Dace sp. Eastern Blacknose Dace, Finescale Dace, White Sucker, Bluntnose Minnow, Fathead Minnow, Pumpkinseed.

Monitoring in Kizell Drain

In 2016, permission was granted to survey 44 sections of Kizell Drain, shown on Figure 3, which cover approximately 4.4 km of the main channel. The portions of the drain 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 34 sampled sections. While these sections provide a good representation of the overall condition of Kizell Drain it should be noted that there are a few sections of the drain that are not represented in this assessment. These areas provide an additional diversity of habitat with valuable natural functions.

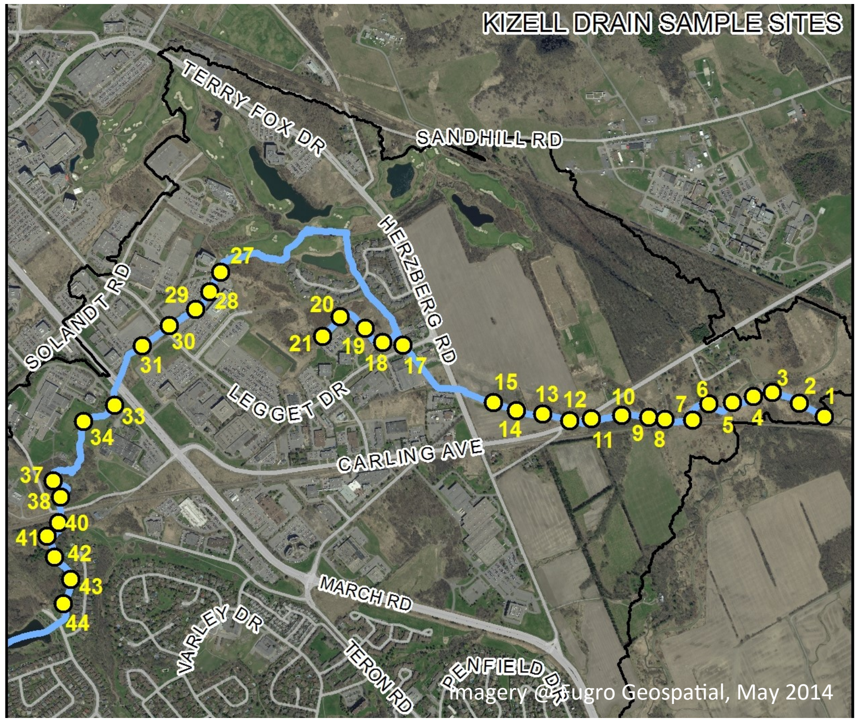


Figure 3: *Locations of the monitoring sites along Kizell Drain.*

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 100m 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, in-stream morphology, human alterations, water chemistry, plant life, and other features presented in this report.

Table 2 shows some basic assessment measurements for Kizell Drain. The surveyed sections had an average stream width of 3.94m and an average depth of 0.33m. When the field survey took place, the average water temperature was 22.9 °C.

Table 2: Kizell Drain Assessment Facts			
	Minimum	Maximum	Average
Air Temperature (°C)	14.1	30.5	22.9
Water Temperature (°C)	12.8	22.8	17.93
Wetted Width (m)	1.0	17.0	3.94
Stream Depth (m)	0.05	1.50	0.33

General Land Use Adjacent to Kizell Drain

General land use along each surveyed section of Kizell Drain is considered from the beginning to the end of each survey section (100m) 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 Kizell Drain.

Of the eleven categories, pasture, and abandoned agriculture were not found to be present. At 43%, meadow represents the most prominent category of land use followed by wetlands at 13%, and industrial at 12%.

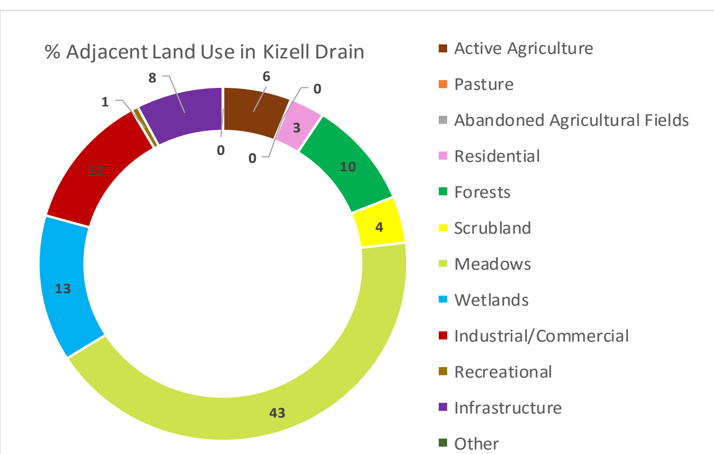


Figure 4: *Land use alongside Kizell Drain.*

As described on page 2, the land use in the overall subwatershed area is dominated by urban development, mostly residential but there is also business/commercial development. Bookending the watercourse is parkland surrounding wetland habitat. This is reflected well in the percentages seen in Figure 4. In particular we see a high percentage of meadow, wetland, industrial and forest land uses adjacent to the drain.

Human Alterations to Kizell Drain

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, 49% of Kizell Drain was found to be natural (with minor alterations), and 51% was altered (with considerable human impact).

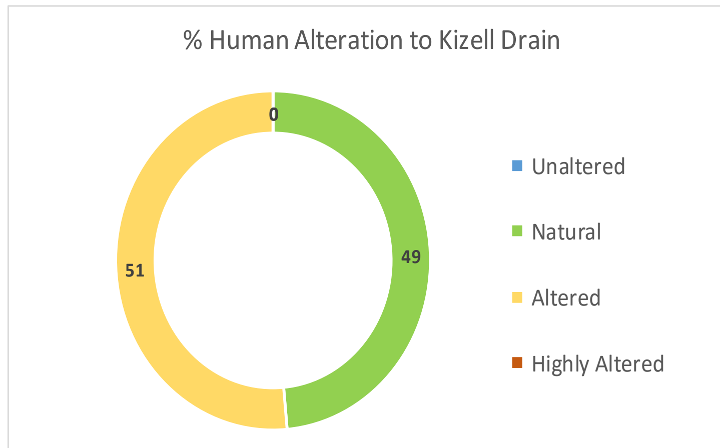


Figure 5: *Extent of human alterations to Kizell Drain.*

It is a positive attribute that so much of the creek is natural and exists within natural corridors or park lands. Unfortunately, there are sections that have had significant alterations, such as road crossings, channelization, and parking lot storm water outlets, and a housing development with a variety of shoreline buffer styles near the upstream end.

Riparian Buffer along Kizell Drain

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).

Environment Canada's Guideline: *How Much Habitat is Enough?* recommends a minimum 30m 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 30m of either side of the watercourse. As summarized in Figure 6, we found that the sections of Kizell Drain that were surveyed have a relatively good riparian buffer. Results show that 57% and 73% of the left and right bank respectively, has a buffer width of 5-15 meters. 31% and 27% of sections have a buffer of 5 m or less. The photo to the top right, shows a lack of buffer between agricultural lands and Kizell Drain in the red areas on the map. Another contributing factor to a reduced buffer is the alignment of the road network where Carling Avenue crosses Kizell Drain.

Figure 7 shows the differences in riparian buffer widths along Kizell Drain. The best buffers were seen along the surveyed sections, at the south where the stream flows through the NCC Green Belt, around a beaver created wetland.

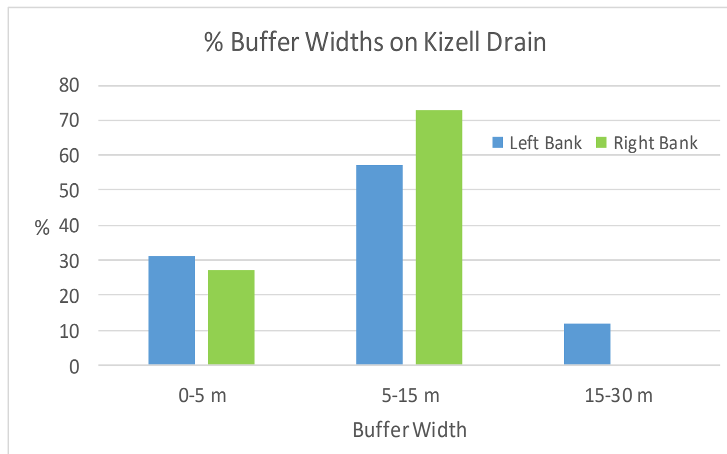


Figure 6: Riparian buffer widths along Kizell Drain.

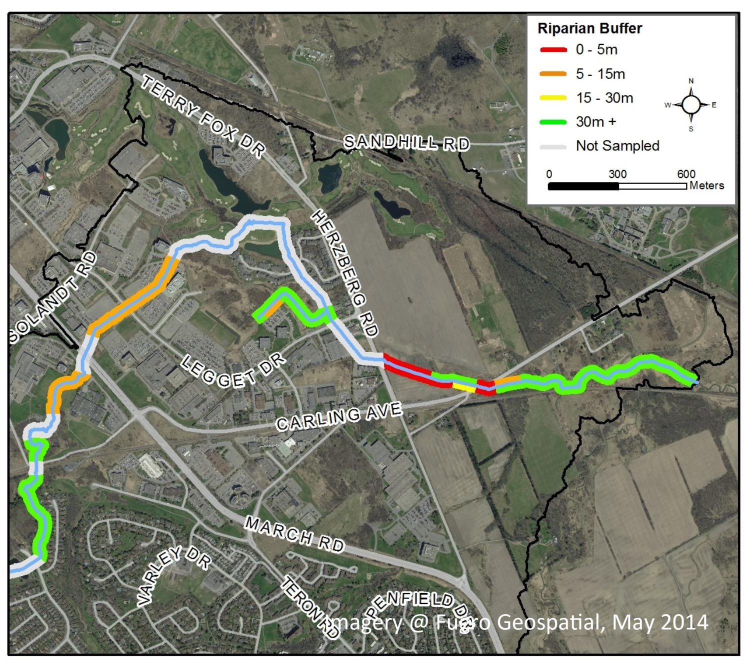


Figure 7: *Vegetated buffer width along Kizell Drain.*

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, Kizell Drain has a measurable lack of overhanging trees and branches, as seen in Figure 8. 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.

The contrast to all the open areas of grassed banks were sections with overhanging willows downstream of Carling Avenue and a small forested area near the upstream end of the survey (photo on page 7).

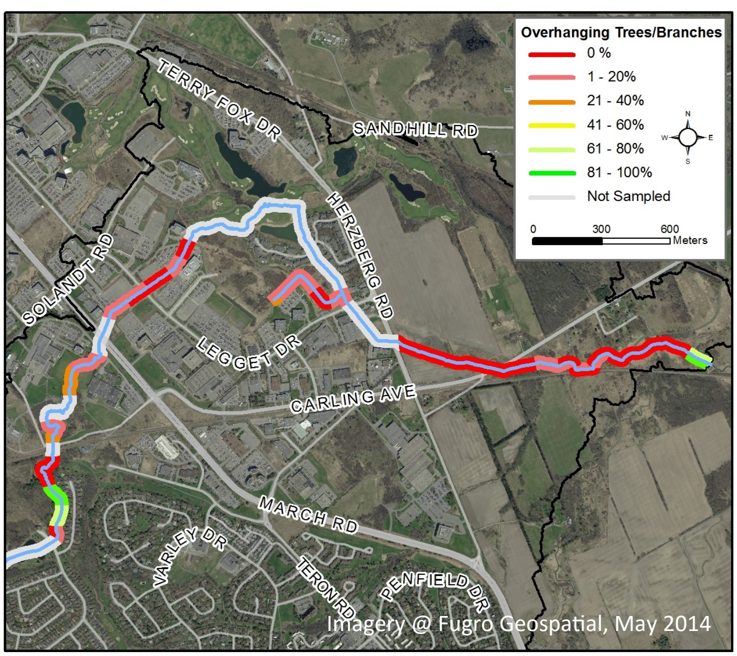


Figure 8: *Overhanging trees and branches along Kizell Drain.*

Figure 9 shows the data quantified as the percent of channel sections classified according to the various amounts of overhanging trees and branches. For example, 51-54% of the 34 surveyed stream sections were classified as having zero overhanging trees and branches along both the left and right bank.

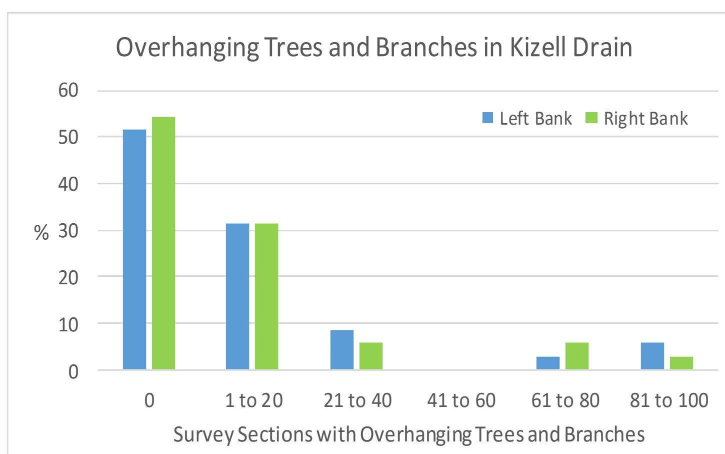


Figure 9: *Percentage of each surveyed section of Kizell Drain with overhanging trees and branches.*

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 10 shows the variability in the amount of stream shading along different sections of Kizell Drain. 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/wetland habitat in the lower reaches and dense forest cover near the Beaver Pond outlet as seen in the photos in the lower right.

Figure 11 shows the data quantified as the percent of channel sections classified according to the various levels of shading. For example, 51% of the 34 stream sections that were surveyed were classified as having low amounts of shade (1 to 20% shading) along the entire section. With 14% at zero shading, 23% of the sections had moderate shading and only 11% having dense shade cover.

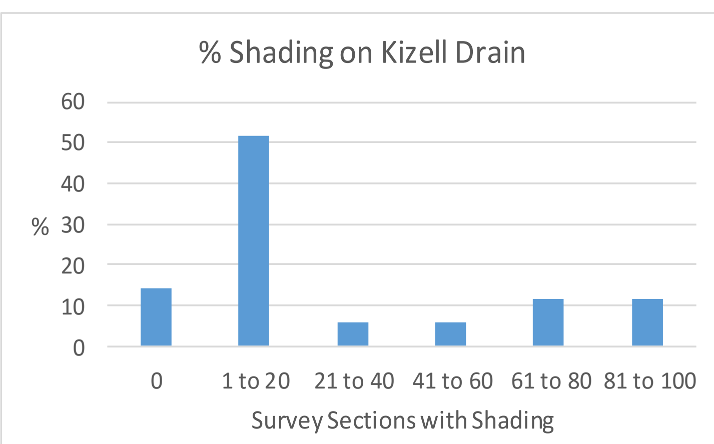


Figure 11: *Shading along Kizell Drain.*

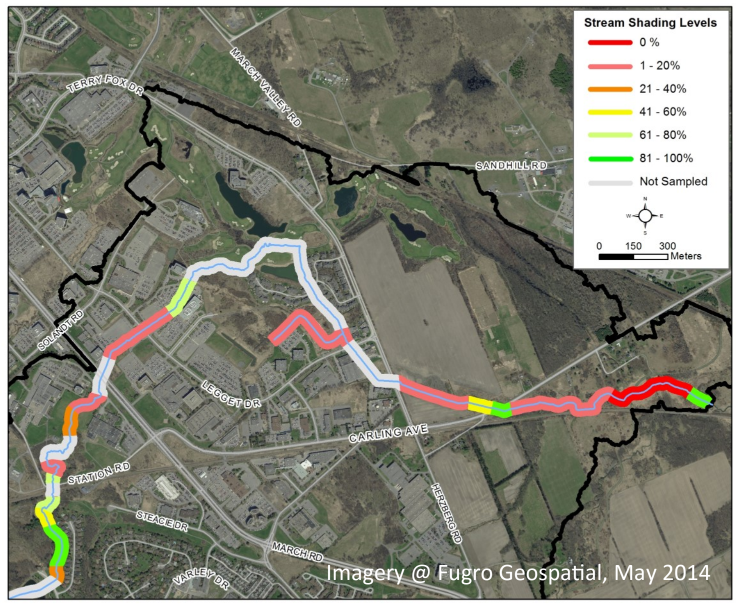


Figure 10: *Stream Shading along Kizell Drain.*

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.

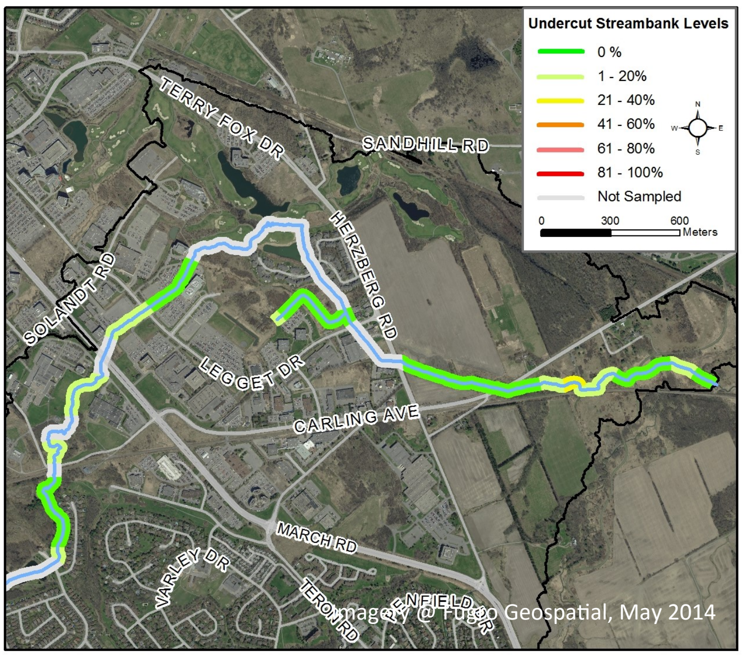


Figure 12: *Undercut stream banks along Kizell Drain.*

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 12 shows the percentage of undercut stream banks along each surveyed section of Kizell Drain. Overall, the sections of Kizell Drain 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 south of Carling Avenue, occurred at a bend 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.

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 Kizell Drain can be seen in Figure 13.

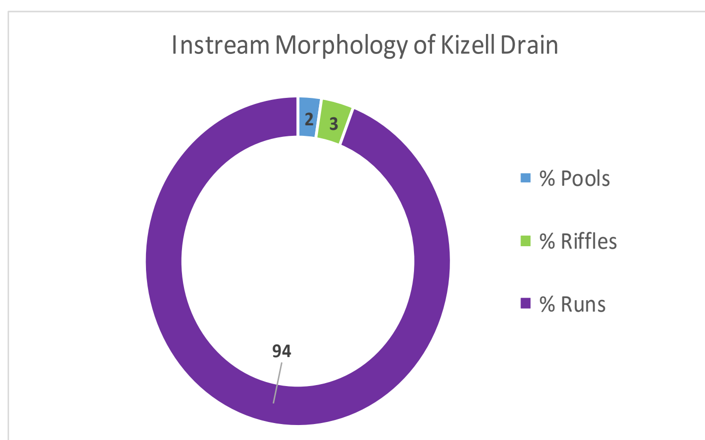


Figure 13: *In-stream morphology along Kizell Drain.*

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 13, Kizell Drain was found to consist of 94% runs, 3% riffles and 2% 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 14 summarizes the different types of substrate which make up the bed of Kizell Drain.

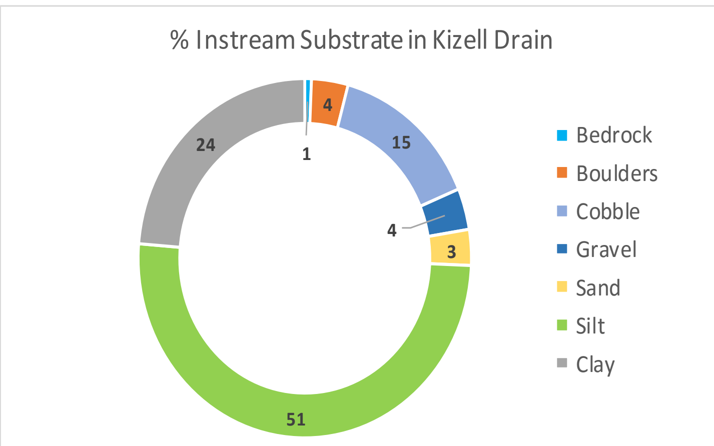


Figure 14: *Percentages of in-stream substrate types in Kizell Drain.*

Kizell Drain is composed of high percentages of silt, clay, and cobble, with smaller percentages of boulders, gravel and sand. Cobble, which makes up 15% 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 4% of Kizell Drain'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 15 shows the sections of Kizell Drain 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.

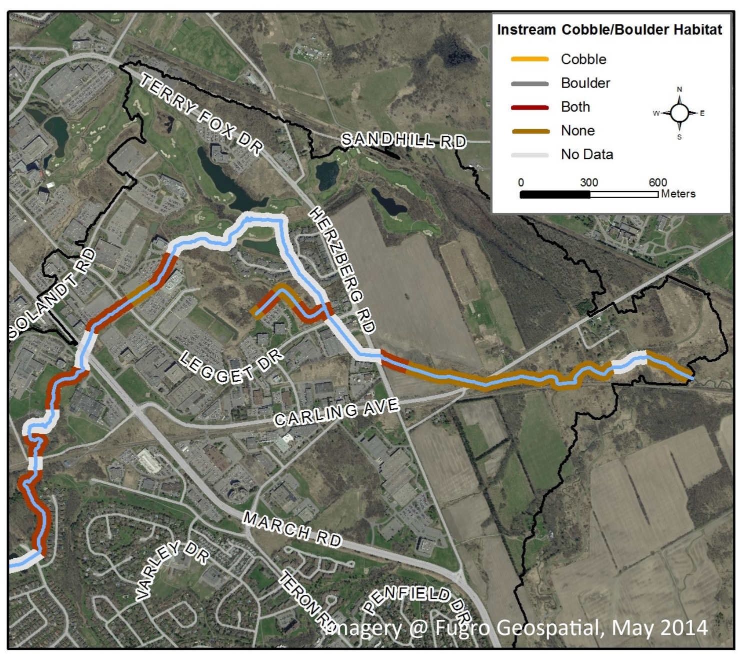


Figure 15: *Cobble and boulder habitat along Kizell Drain.*

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. As seen in Figure 16, 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.

Kizell Drain consists mostly of submerged plants with 44% abundance, 26% narrow leaved emergent plants (such as the thin grasses above) and only 8% algae. This is a good mix of habitats and food sources.

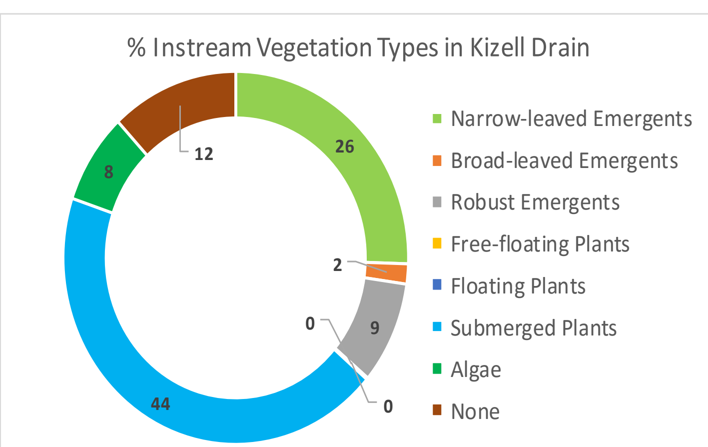


Figure 16: *Types of In-stream vegetation in Kizell Drain.*

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 Kizell Drain. 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 44% extensive vegetation, 21% common, 21% normal and 8% rare. Such high values of in-stream vegetation can make it hard for wildlife such as fish to access new habitat as conditions and needs change throughout the seasons.

High in-stream vegetation levels in Kizell Drain are likely due to substrate type. For example areas that are soft and mucky and in full sun facilitate easy plant growth. In particular the reaches adjacent to the agricultural land use (photo to the left) were sunny and likely received soil and nutrient inputs from the site as well as from upstream.

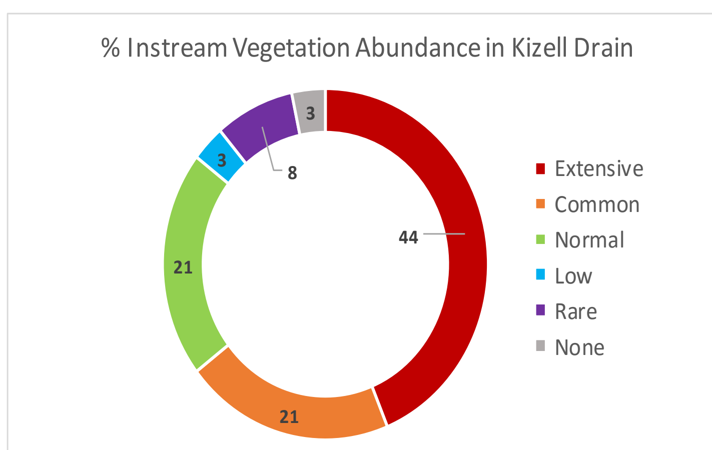


Figure 17: *Abundances of in-stream vegetation in Kizell Drain.*

Thermal Classification

Temperature is an important parameter in streams as it influences many aspects of physical, chemical and biological health. Figure 18 shows where the temperature datalogger was deployed in Kizell Drain from late May to mid September 2016 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 19 shows the thermal classifications of Kizell Drain.

Analysis of the data collected indicates that Kizell Drain should be classified as a cool stream with the upstream site in the cool-warm range and the downstream site in the cold-cool range.

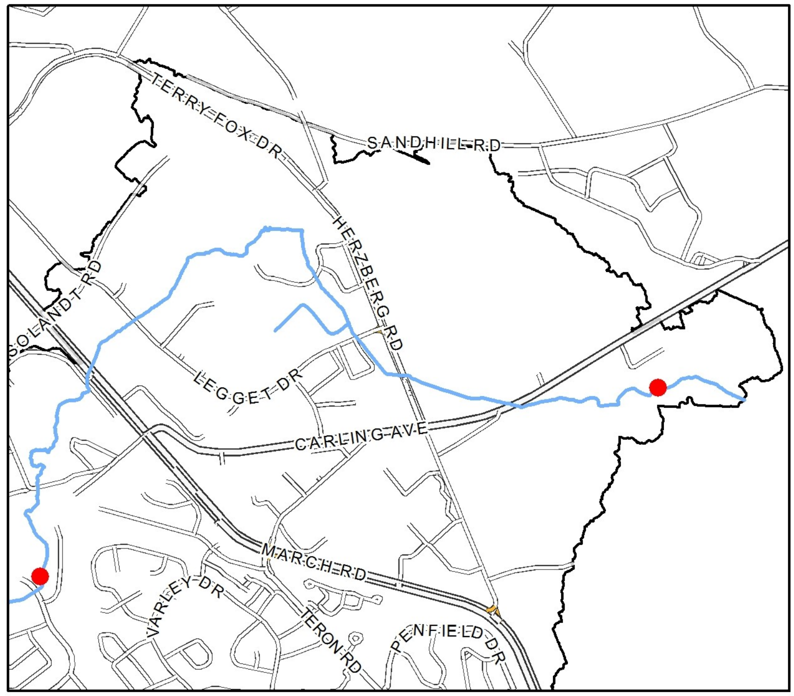


Figure 18: *Location of temperature loggers in Kizell Drain.*

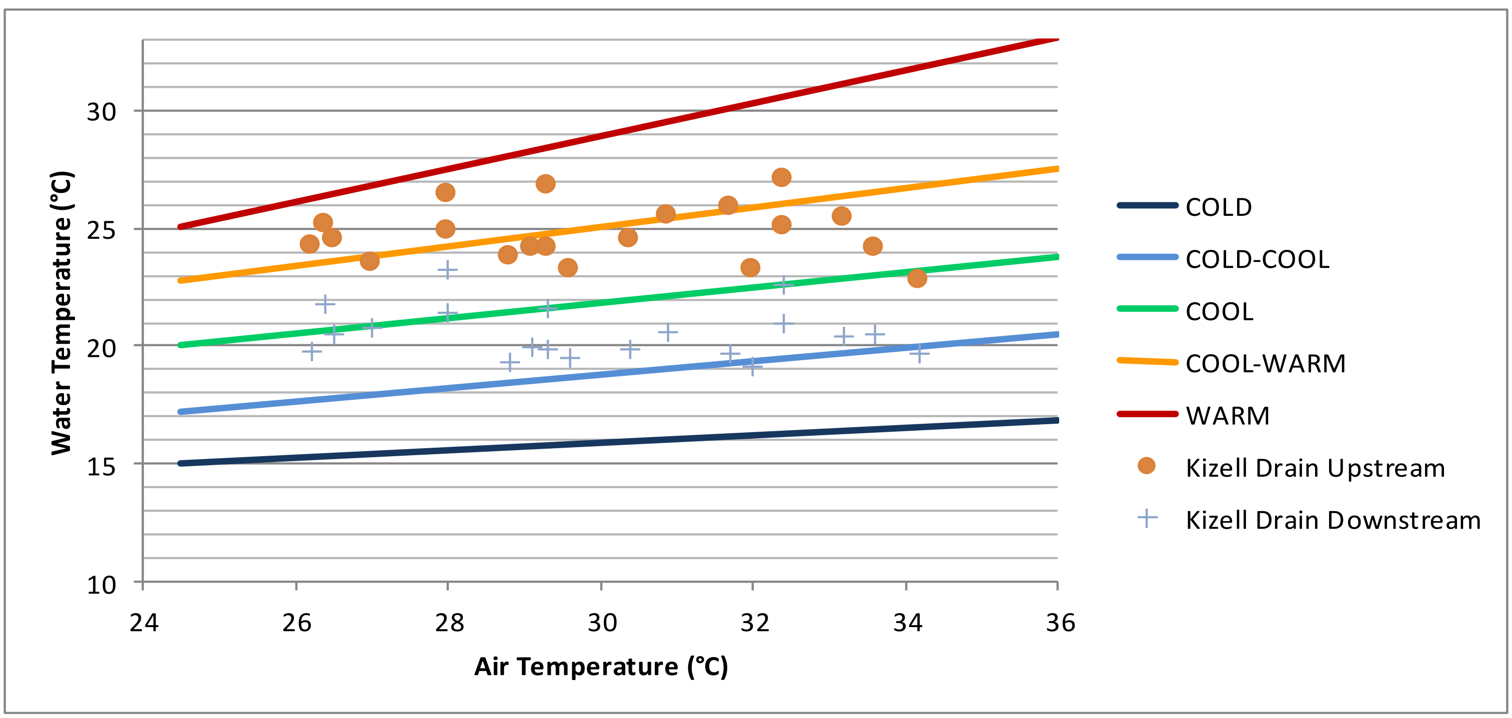


Figure 19: *Thermal classification of Kizell Drain.*

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 ^{0}C and was preceded by two consecutive days with a maximum air temperature ≥ 24.5 ^{0}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 Kizell Drain. Many raccoon tracks were seen, as well as green frogs, dragonflies, damselflies, minnows, a snail, various aquatic insects and evidence of an active beaver lodge. The highlights were spotting some deer and a painted turtle in the NCC Green Belt during our first few days of the survey.

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 Kizell Drain measured 9.88 mg/L, making it healthy for warm water fish, and slightly below the requirements for cold water fish.

Table 3: Kizell Drain Water Quality Data

	Minimum	Maximum	Average
pH	6.52	8.30	7.49
Dissolved Oxygen (mg/L)	1.45	14.60	9.88
Conductivity (µS/cm)	870	2480	1205

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 Kizell Drain is 1205 µS/cm, putting it well above the ideal range. This can have an effect on the wildlife present. At this level of study it is hard to determine the cause of the high values . However it does help provide a benchmark value and a notice about potential stressors to the in stream habitat.

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 Kizell Drain is 7.49, a nearly neutral condition, which is good for many species of fish to thrive.

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 20 depicts the locations identified by MVCA staff and volunteers, as areas for potential riparian restoration activities (planting along the shoreline). The areas shown in green would be ideal to target with planting trees and shrubs to help provide some shade to the stream corridor.

Other potential enhancement activities would involve removing a small stand of Yellow Iris, and doing a garbage clean up where a park pathway crosses the drain in the upstream reach.

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.

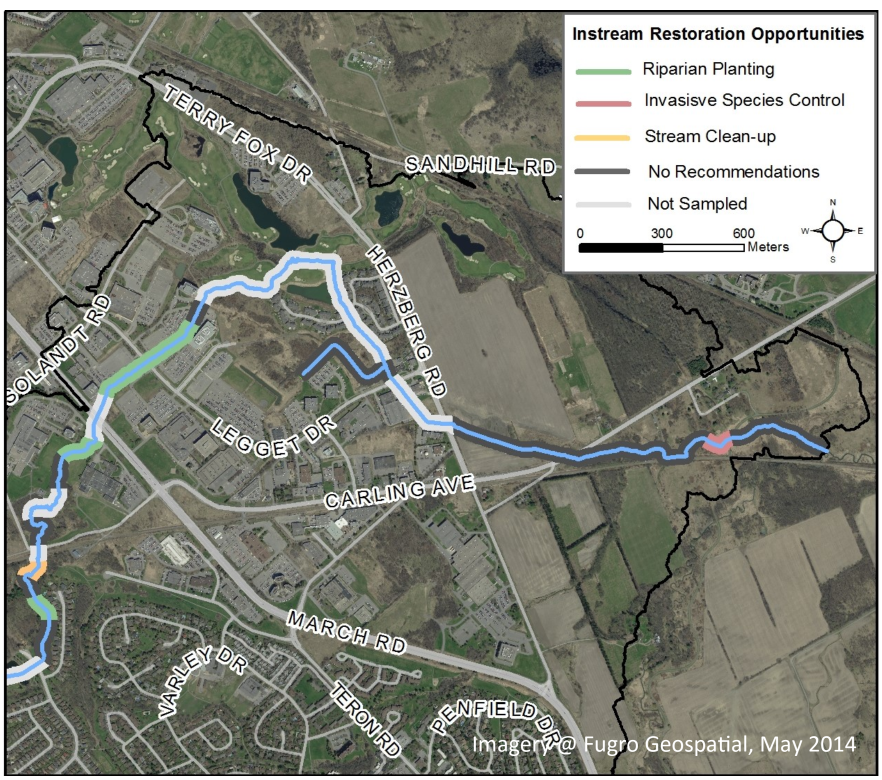


Figure 20: *Areas for potential restoration projects along Kizell Drain.*

Photos top to bottom: Invasive Purple Loosestrife, Invasive Yellow Iris, Native Blue-Flag Iris.

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.

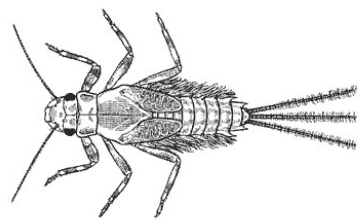
MVCA uses stream surveys to target specific areas that need restoration work. Stream garbage clean ups are carried out, blockages are removed, and shoreline planting, erosion control and habitat enhancements are organized.

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/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.

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.

United States Environmental Protection Agency. "*Water: Monitoring and Assessment: 5.9 Conductivity."* (Sep 2, 2015). Online.

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.