Voyageur Creek 2013 Summary Report

Watershed Features	
Area	6.53 square kilometres 0.15% of the Rideau Valley watershed
Land Use	15% agriculture 51% urban 33% forest 1% rural land-use 0% wetlands 0% unclassified
Surficial Geology	53% clay 5% diamicton 3% organic deposits 10% bedrock 29% sand
Watercourse Length and Type	*Watercourse Type:* 86% natural 14% channelized *Flow Type:* 78% permanent 22% ephemeral
Invasive Species	There were eight invasive species observed by CSW staff in 2013: purple loosestrife, garlic mustard, Himalayan balsam, dog-strangling vine, Manitoba maple
Fish Community	Two fish species were captured in Voyageur Creek. No game fish species present

Wetland Cover
0% of the watershed is wetland
Wetlands make up 0% of the vegetation cover

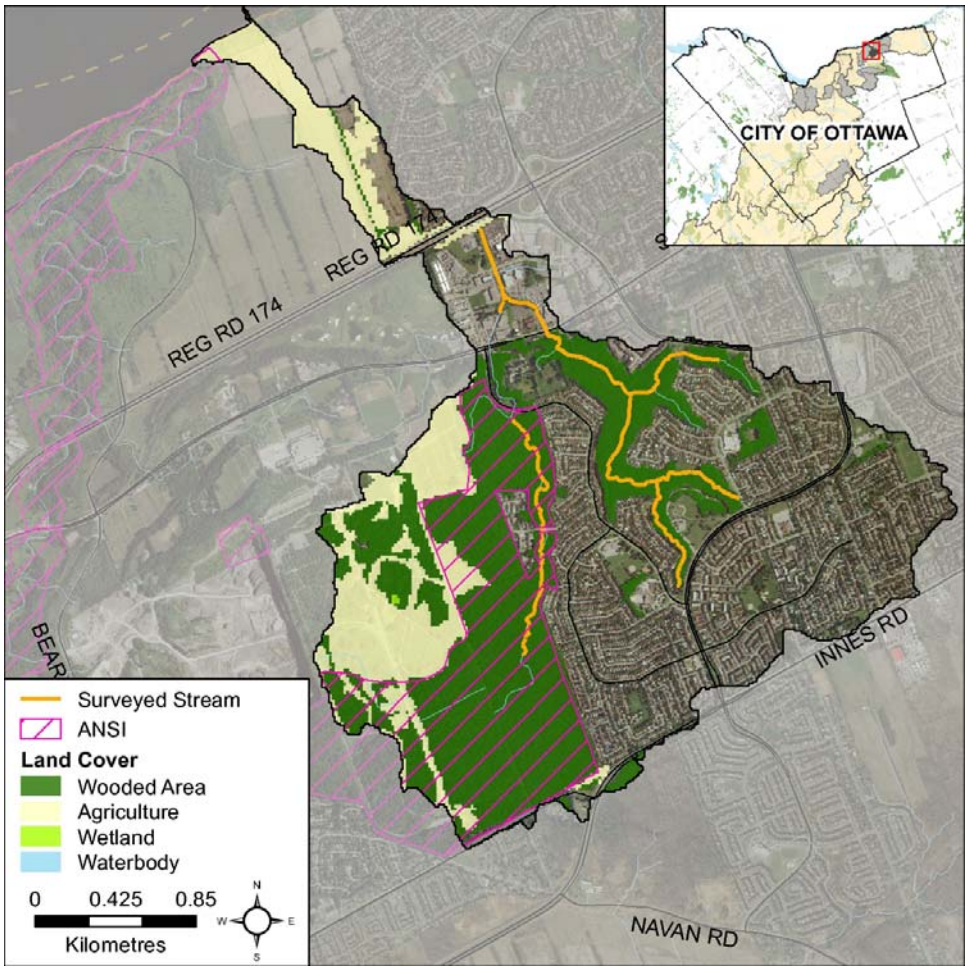


Figure 1 Land cover in the Voyageur Creek catchment

Vegetation Cover		
Types	**Hectares**	**% of Cover**
Wetlands	0	0
Wooded Areas	212	99
Hedgerow	2	1
Plantation	0	0
TOTAL COVER		**100%**

Woodlot Cover		
Size Category	**Number of Woodlots**	**% of Woodlot Cover**
<1 ha	20	1
1-9 ha	10	15
10-30 ha	1	6
>30 ha	5	78
TOTAL COVER		**100%**

The Rideau Valley Conservation Authority, in partnership with seven other agencies in Ottawa (City of Ottawa, Heron Park Community Association, Ottawa Flyfishers Society, Ottawa Stewardship Council, Rideau Roundtable, National Defence HQ - Fish and Game Club, and the National Capital Commission) form the 2013 City Stream Watch collaborative.

Introduction

Voyageur Creek is a tributary of the Ottawa river that is approximately six kilometers long. It is located in the Orleans neighborhood of Chapel Hill North. Receiving runoff from the surrounding areas, the headwaters of Voyageur Creek begin near Orleans Boulevard. The various branches of the creek flow through forested ravines between housing subdivisions before they come together and cross under St. Joseph Boulevard and Highway 174. From there, Voyageur Creek is piped underground before outletting into the Ottawa River. Included as one of three creeks listed in the City of Ottawa's Eastern Subwatersheds Stormwater Retrofit Plan, Voyageur Creek is known to be subject to flooding and erosion due to uncontrolled runoff.

In 2013, Voyageur Creek was monitored for the first time by the City Stream Watch Program. As part of the City Stream Watch monitoring activities, 59 sections along Voyageur Creek were surveyed by staff and volunteers. The following is a summary of the 59 macro stream assessments carried out on Voyageur Creek.

Voyageur Creek Overbank Zone

Riparian Buffer Width Evaluation

The riparian or shoreline zone is that special area where the land meets the water. Well-vegetated shorelines are critically important in protecting water quality and creating healthy aquatic habitats, lakes and rivers. Natural shorelines intercept sediments and contaminants that could impact water quality conditions and harm fish habitat in streams. Well established buffers protect the banks against erosion, improve habitat for fish by shading and cooling the water and provide protection for birds and other wildlife that feed and rear young near water. A recommended target (from Environment Canada's Guideline: How Much Habitat is Enough?) is to maintain a minimum 30 meter wide vegetated buffer along at least 75 percent of the length of both sides of rivers, creeks and streams. Figure 2 demonstrates the buffer conditions of the left and right banks separately. Voyageur Creek had a buffer of greater than 30 meters along 71 percent of the right bank and 63 percent along the left bank.

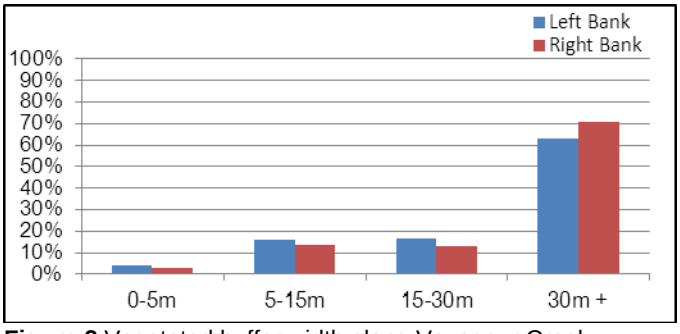


Figure 2 Vegetated buffer width along Voyageur Creek

Vegetated buffer along Voyageur Creek

Adjacent Land Use

The RVCA's Stream Characterization Survey identifies seven different land uses beside Voyageur Creek (Figure 3). Surrounding land use is considered from the beginning to end of the survey section (100m) and up to 100m on each side of the creek. Land use outside of this area is not considered for the surveys but is nonetheless part of the subwatershed and will influence the creek. Natural areas made up 71 percent of the stream, characterized mostly by forest, with some scrubland and meadow. Fourteen percent of the land use was residential and the remaining 15 percent of the land use consisted of a mix of recreational, industrial, and infrastructure.

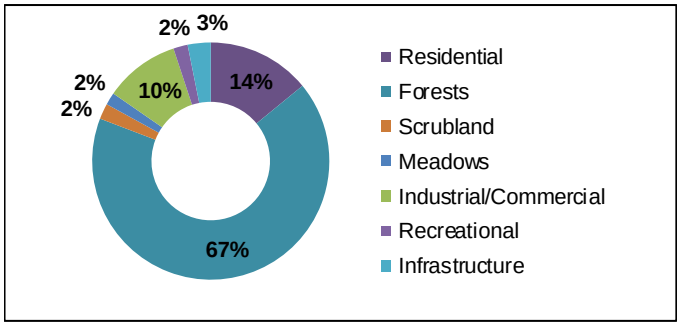


Figure 3 Land use along Voyageur Creek

Industrial/commercial land use along Voyageur Creek

Shoreline Zone

Erosion

Erosion is a normal, important stream process and may not affect actual bank stability; however, excessive erosion and deposition of sediment within a stream can have a detrimental effect on important fish and wildlife habitat. Poor bank stability can greatly contribute to the amount of sediment carried in a waterbody as well as loss of bank vegetation due to bank failure, resulting in trees falling into the stream and the potential to impact instream migration. Figure 4 shows that there were low to high levels of bank erosion observed along most of Voyageur Creek. High levels of erosion were seen in some sections especially approaching St. Joseph Boulevard.

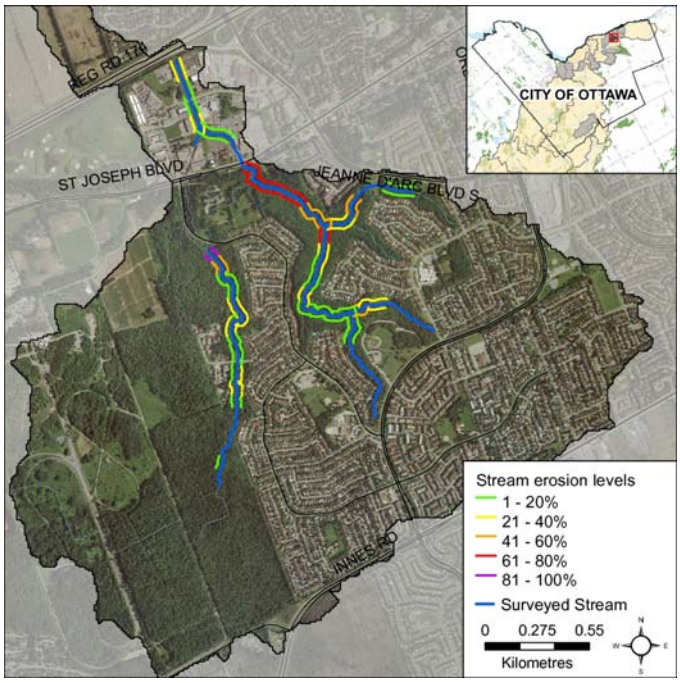


Figure 4 Erosion along Voyageur Creek

Undercut Stream Banks

Undercut banks are a normal and natural part of stream function and can provide excellent refuge areas for fish. Figure 5 shows that Voyageur Creek had low to moderate levels of undercut banks throughout most of the creek. Low levels of undercutting are observed because although Voyageur Creek is a flashy system that is subject to uncontrolled runoff, it banks are well vegetated which has helped to keep the banks relatively stable.

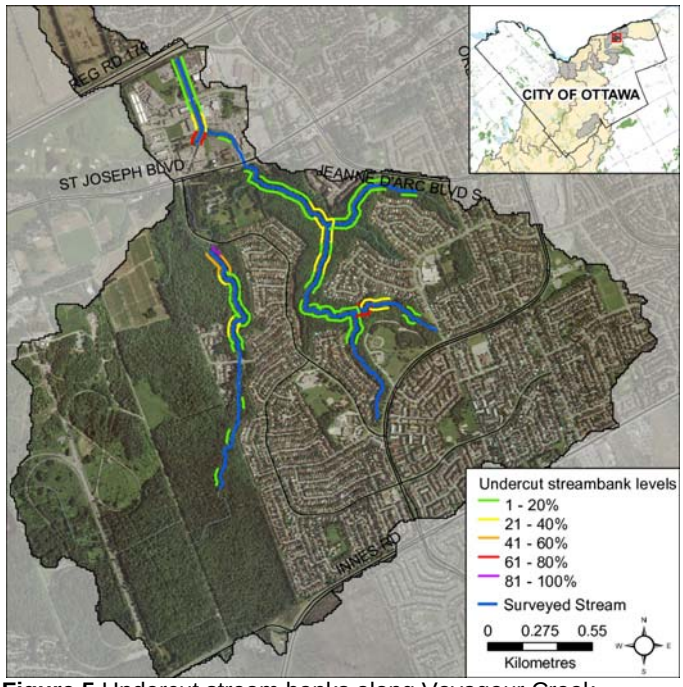


Figure 5 Undercut stream banks along Voyageur Creek

Stream bank undercutting typical along Voyageur Creek

Stream Shading

Grasses, shrubs and trees all contribute towards shading a stream. Shade is important in moderating stream temperature, contributing to food supply and helping with nutrient reduction within a stream. Figure 6 shows the extensive stream shading along Voyageur Creek where it flows through forested ravine.

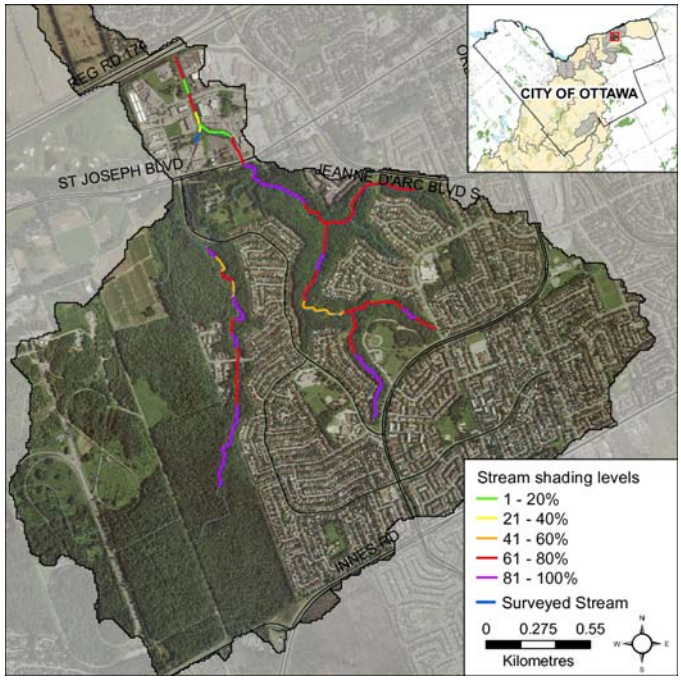


Figure 6 Stream shading along Voyageur Creek

Instream Woody Debris

Figure 7 shows that the majority of Voyageur Creek had moderate levels of instream woody debris in the form of branches and trees. Instream woody debris is important for fish and benthic habitat, providing refuge and feeding areas.

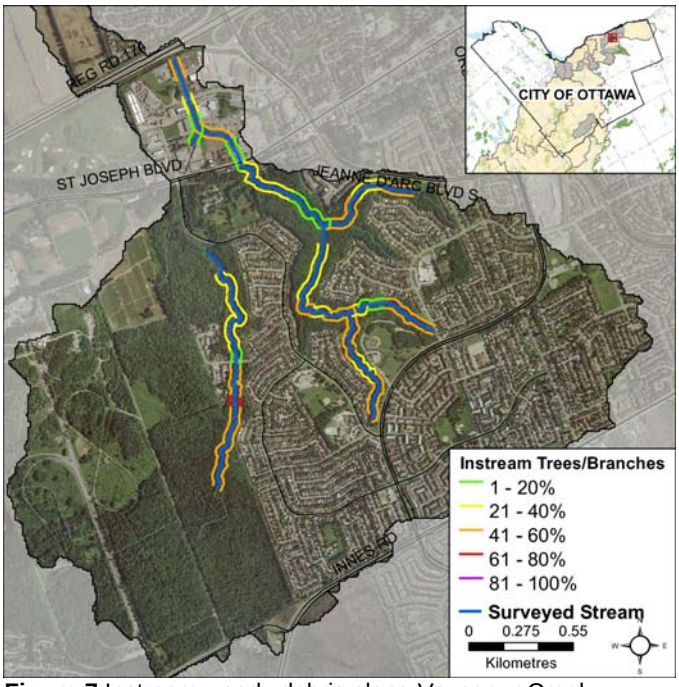


Figure 7 Instream woody debris along Voyageur Creek

Stream shade along Voyageur Creek

Instream woody debris along Voyageur Creek

Overhanging Trees and Branches

Figure 8 shows that the majority of Voyageur Creek had moderate to high levels of overhanging branches and trees. Overhanging branches and trees provide a food source, nutrients and shade which helps to moderate instream water temperatures.

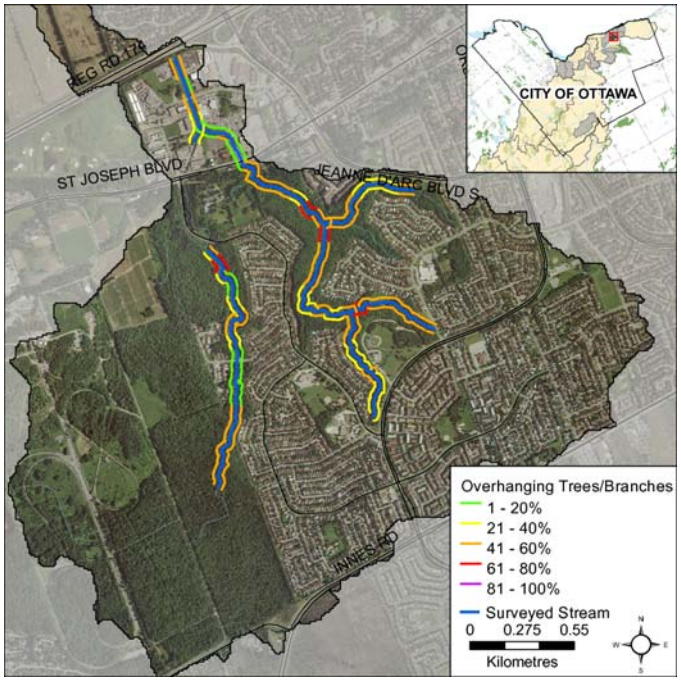


Figure 8 Overhanging trees and branches

Overhanging trees and branches on Voyageur Creek

Anthropogenic Alterations

Figure 9 shows that 68 percent of the sections on Voyageur Creek that remain “unaltered” or "natural". Sections considered "altered" account for 15 percent of the stream, and 17 percent of the sections sampled were considered “highly altered”. Areas classified as altered included existing road crossings, shoreline/instream modifications such as channelization and areas with little or no buffer.

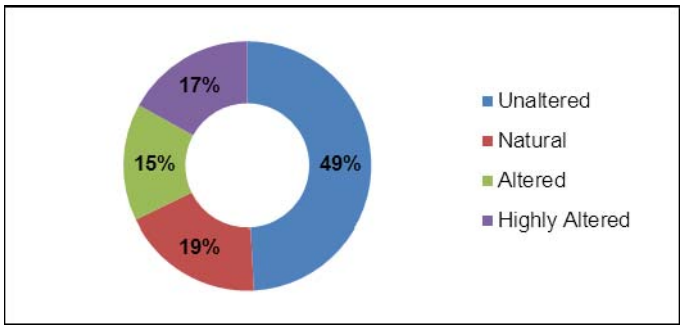
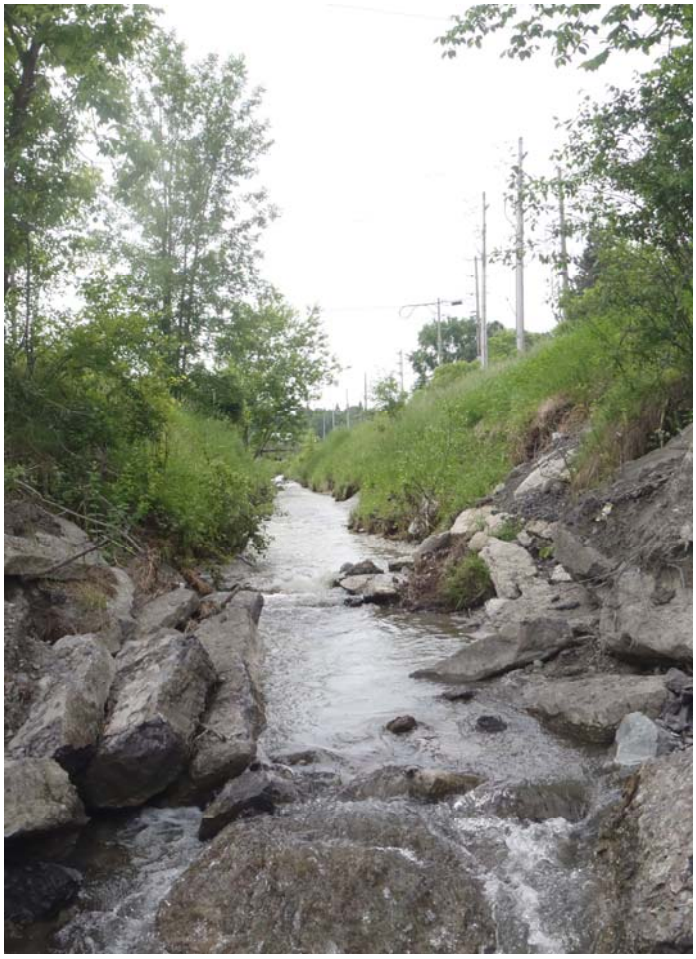


Figure 9 Anthropogenic alterations along Voyageur Creek



Stream channelization along Voyageur Creek near Youville Drive

Voyageur Creek Instream Aquatic Habitat

Habitat Complexity

Streams are naturally meandering systems and move over time; there are varying degrees of habitat complexity, depending on the creek. Examples of habitat complexity include variable habitat types such as pools and riffles as well as substrate variability and woody debris structure. A high percentage of habitat complexity (heterogeneity) typically increases the biodiversity of aquatic organisms within a system. Fifty -eight percent of Voyageur Creek was considered heterogeneous, as shown in Figure 10.

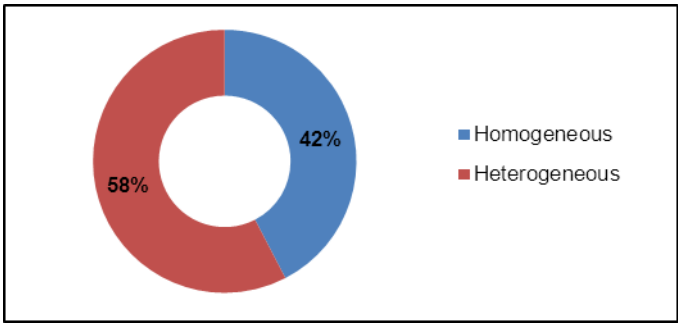


Figure 10 Instream habitat complexity in Voyageur Creek

Instream Substrate

Diverse substrate is important for fish and benthic invertebrate habitat because some species have specific substrate requirements and, for example, will only reproduce on certain types of substrate (figure 11).
Boulders create instream cover and back eddies for large fish to hide and/or rest out of the current. Cobble provides important over-wintering and/or spawning habitat for small or juvenile fish. Cobble can also provide habitat conditions for benthic invertebrates that are a key food source for many fish and wildlife species. Figure 12 shows that cobble and boulder substrate is found along much of Voyageur Creek.

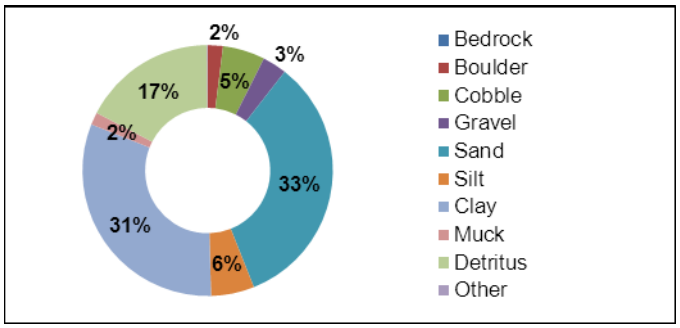


Figure 11 Instream substrate along Voyageur Creek

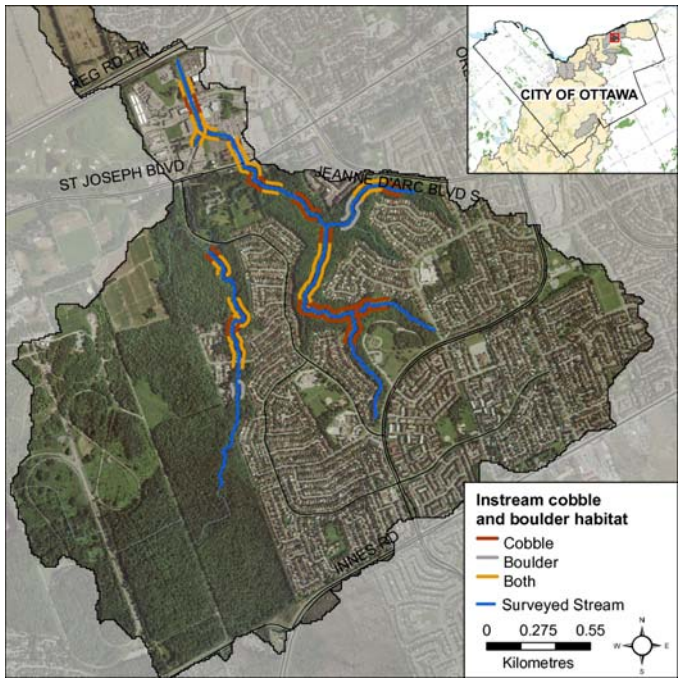


Figure 12 Instream substrate along Voyageur Creek

Instream Morphology

Pools and riffles are important habitat features for fish. Riffles are areas of agitated water and they contribute higher dissolved oxygen to the stream and act as spawning substrate for some species of fish, such as walleye. Pools provide shelter for fish and can be refuge areas in the summer if water levels drop and water temperature in the creek increases. Pools also provide important over-wintering areas for fish. Runs are usually moderately shallow, with unagitated surfaces of water and areas where the thalweg (deepest part of the channel) is in the center of the channel.

Figure 13 shows that Voyageur Creek has somewhat variable instream morphology; 78 percent consists of runs, five percent riffles and 14 percent pools.

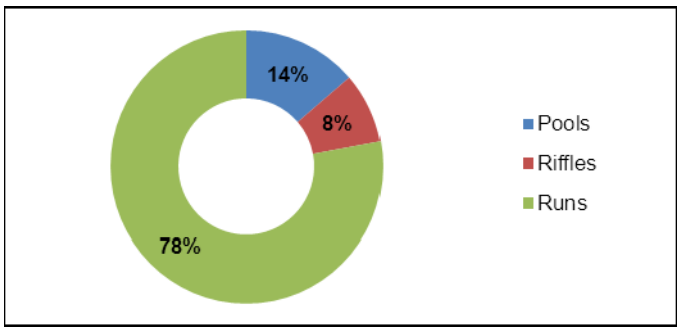


Figure 13 Instream morphology along Voyageur Creek

Vegetation Type

Instream vegetation provides a variety of functions and is a critical component of the aquatic ecosystem. For example emergent plants along the shoreline can provide shoreline protection from wave action and important rearing habitat for species of waterfowl. Submerged plants provide habitat for fish to find shelter from predator fish while they feed. Floating plants such as water lilies shade the water and can keep temperatures cool while reducing algae growth. Voyageur Creek has very low diversity of instream vegetation. This is probably in part due to the amount of shading along the creek, clay substrates found in the creek, and water level fluctuations (flushing) during storm events. The dominant vegetation type, recorded at 97 percent, is algae. Figure 14 depicts the limited plant community structure for Voyageur Creek.

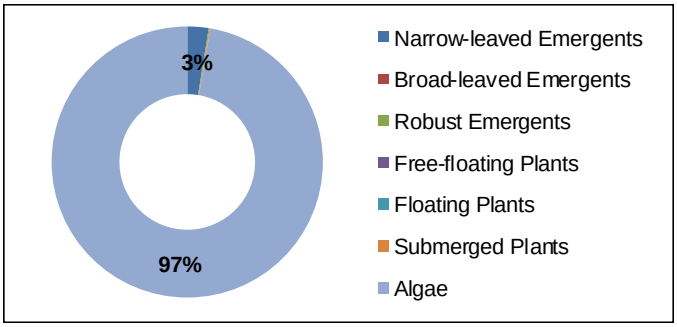


Figure 14 Vegetation types along Voyageur Creek

Instream Vegetation Abundance

Instream vegetation is an important factor for a healthy stream ecosystem. Vegetation helps to remove contaminants from the water, contributes oxygen to the stream, and provides habitat for fish and wildlife. Too much vegetation can also be detrimental. Figure 15 demonstrates that Voyageur Creek has extremely low levels of instream vegetation for its entire length with rare levels and no vegetation accounting for 79 percent of the sections.

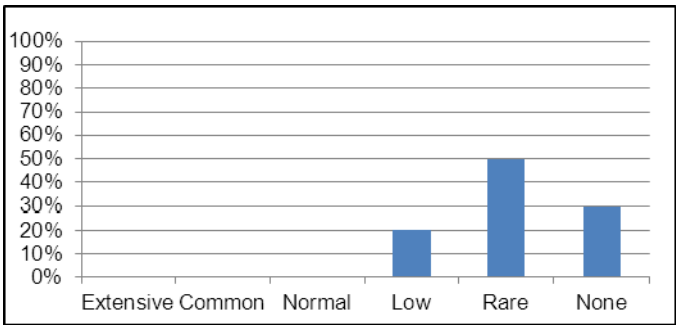


Figure 15 Instream vegetation abundance along Voyageur Creek

Invasive Species

Invasive species can have major implications on streams and species diversity. Invasive species are one of the largest threats to ecosystems throughout Ontario. They can outcompete native species, having negative effects on local wildlife, fish and plant populations. Thirty-seven percent of the sections surveyed along Voyageur Creek had invasive species (Figure 16). The invasive species observed along Voyageur Creek were Manitoba maple (*Acer negundo*), purple loosestrife (*Lythrum salicaria*), dog-strangling vine (*Cynanchum rossicum*), Himalayan balsam (*Impatiens glandulifera*) and garlic mustard (*Alliaria petiolata*).

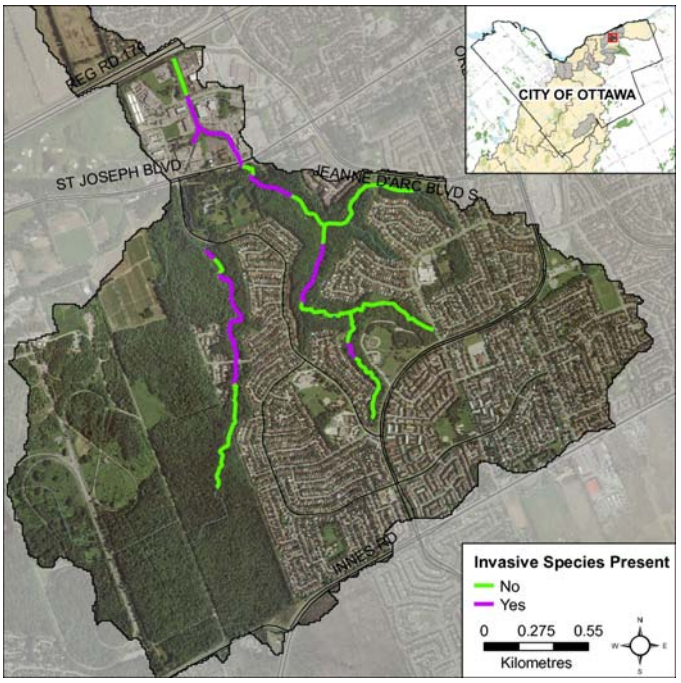


Figure 16 Invasive species along Voyageur Creek

Himalayan Balsam is an invasive species found on Voyageur Creek

Wildlife

The diversity of fish and wildlife populations can be an indicator of water quality and overall stream health. Table 1 is a summary of all wildlife observed during stream surveys.

Wildlife	Observed
Birds	red-winged blackbird, crow, sparrow, cardinal, red-eyed vireo, catbird, woodpecker, chickadee, ovenbird, robin, waxwing, eastern pheobe, chipping sparrow
Mammals	deer, deer tracks, raccoon tracks, beaver tracks, red squirrel, black squirrel
Reptiles/Amphibians	green frog, tadpoles, wood frog, snake skin
Aquatic Insects	water striders, cranefly, isopoda, leech, diving beetles, aquatic worm, caddisfly
Other	jewelwing damselfly, spiketatil dragonfly, cabbage white butterfly, mourning cloak butterfly, swallowtail butterfly, monarch butterfly, aquatic snail, purple loosestrife beetle, slug, cricket, spider, bumblebee, mosquito

Table 1 Wildlife observed along Voyageur Creek

Pollution

Figure 17 demonstrates the incidence of pollution/ garbage in Voyageur Creek. Pollution and garbage in the stream is assessed visually and noted for each section where it is observed. Only fourteen percent of the sections did not have any observable garbage. Thirty-nine percent had floating garbage, 76 percent had garbage on the stream bottom, two percent had oil or gas trails and 15 percent of the sections had discoloration on the channel bed. Sites identified for potential stream cleanups are listed in the restoration opportunities section on page 10.

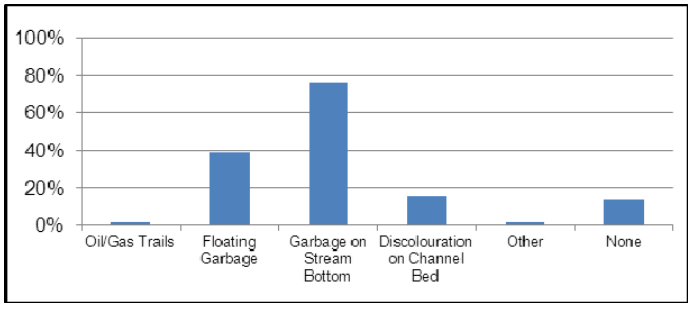


Figure 17 Pollution observed along Voyageur Creek

Water Chemistry

During the stream characterization survey, a YSI probe is used to collect water chemistry, as follows:

- Dissolved Oxygen is a measure of the amount of oxygen dissolved in water. The lowest acceptable concentration of dissolved oxygen is 6.0 mg/L for early stages of warm water fish and 9.5 mg/L for cold water fish (CCME, 1999).
- A saturation value (concentration of oxygen in water) of 90 percent or above is considered healthy. Saturation levels above one hundred percent are not uncommon in sections of stream where there are high amounts of algae and other aquatic plants.
- Conductivity is the ability of a substance to transfer electricity. This measure is influenced by the presence of dissolved salts and other ions in the stream. Very high conductivity readings were recorded on Voyageur Creek in the headwaters of one branch near Heritage Park off of Orleans Boulevard. The conductivity readings increased steadily moving upstream towards the headwaters of this branch. The flow also decreased significantly at this point and parts of the creek were reduced to isolated pools at times.
- pH is a measure of relative acidity or alkalinity, ranging from 1 (most acidic) to 14 (most alkaline/ basic), with 7 occupying a neutral point.

2013 data for these four parameters is summarized in Table 2.

Month	Range	DO (mg/L)	DO(%)	Conductivity (µs/cm)	pH
June 2013	Low	2.64	25.64	12.19	7.53
	High	12.92	125.50	4000.00	8.32
July 2013	Low	4.88	48.33	281.00	7.24
	High	12.61	124.89	1239.00	NA

Table 2 Water chemistry collected along Voyageur Creek

A volunteer using a YSI on Voyageur Creek

Thermal Classification

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 Stoneman and Jones method) to classify a watercourse as either warm water, cool water or cold water.

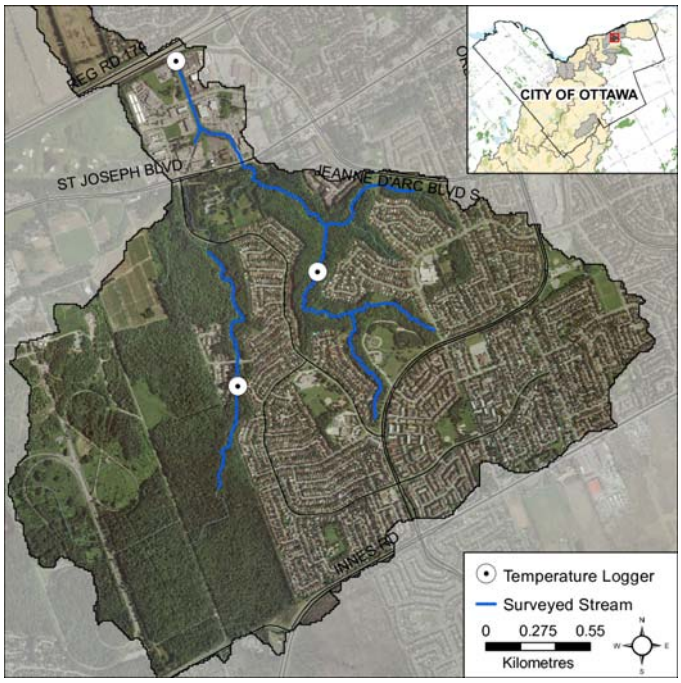


Figure 18 Temperature loggers along Voyageur Creek

Three temperature loggers were installed on Voyageur Creek: logger one upstream of Rivercrest Drive, logger two East of Forest Valley Drive, and logger three upstream of highway 174 (Figure 18). Logger three at highway 174 was not retrieved because it was washed away or stolen, so only data from the other two loggers is represented in Figure 19 below. Analysis of the data collected indicates that Voyageur Creek is classified as a cool water system. The water temperature of this creek is likely heavily influenced by the substantial amount of shading along most of its length as well as the piped sections of the creek.

Temperature logger installed near Highway 174

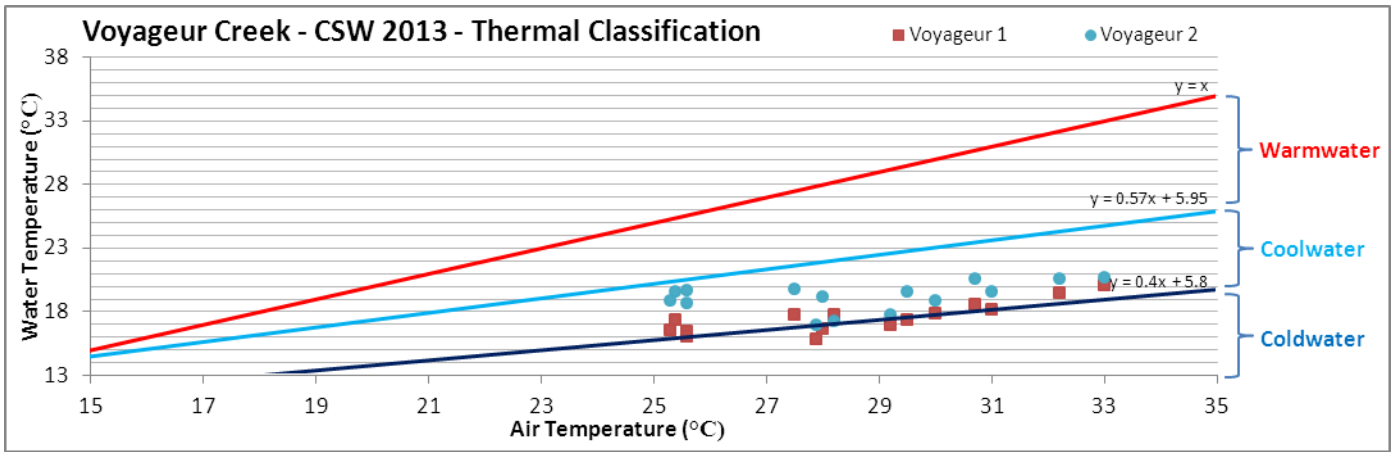


Figure 19 Thermal Classification for Voyageur Creek

Each point on the graph represents a temperature that meets the following criteria:

- Sampling dates between July 1st and September 7th
- Sampling date is preceded by two consecutive days above 24.5°C
- Water temperatures are collected at 4pm
- Air temperature is recorded as the maximum temperature for that day

Fish Sampling

Fish sampling sites located along Voyageur Creek are shown in Figure 20. The provincial fish codes shown on the following map are listed (in Table 3) beside the common name of those fish species identified in Voyageur Creek. Voyageur Creek is classified as a cool water system with only two fish species observed. The low number of species diversity is a direct result of the significant piped section to the Ottawa River which acts as a major barrier to fish migration.

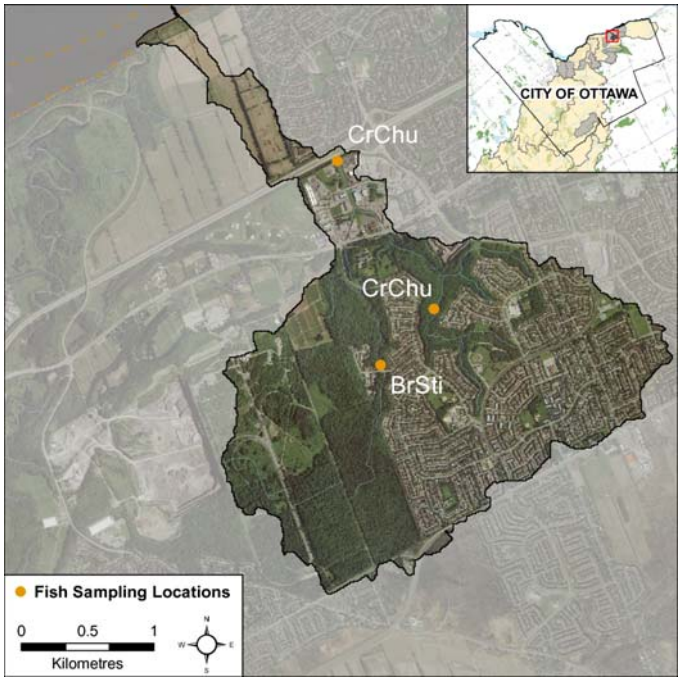


Figure 20 Voyageur Creek fish sampling

Species observed in Voyageur Creek (with fish code)
brook stickleback.....BrSti
creek chub.....CrChu

Table 3 Fish species observed in Voyageur Creek

Migratory Obstructions

It is important to know locations of migratory obstructions because these can prevent fish from accessing important spawning and rearing habitat. Migratory obstructions can be natural or manmade, and they can be permanent or seasonal. Figure 21 shows that Voyageur Creek has a variety of migratory obstructions including the piped lower reach of the creek, many debris dams, five grade barriers, one weir, and one perched culvert.

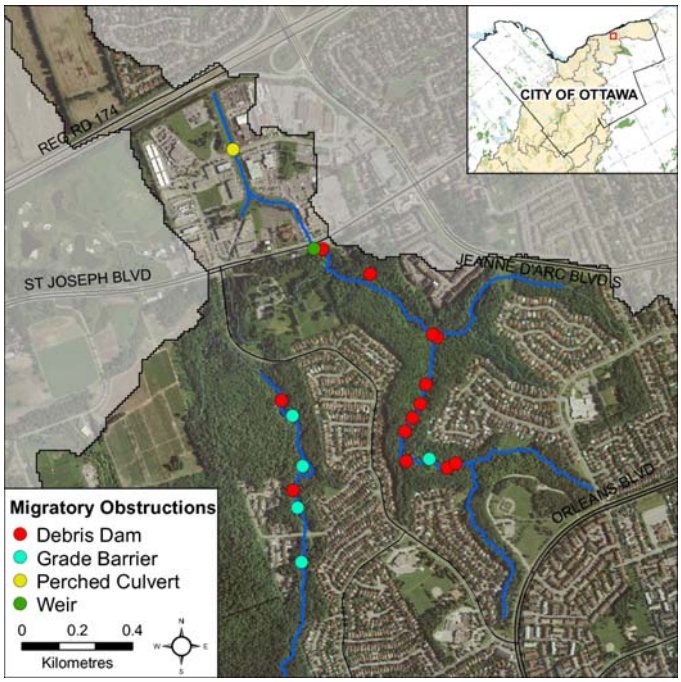


Figure 21 Migratory obstructions in Voyageur Creek

Headwater Drainage Feature Sampling

The Headwater Drainage Feature sampling protocol is a rapid assessment method characterizing the amount of water, sediment transport, and storage capacity within headwater drainage features (HDF). An HDF is a depression in the land that conveys surface flow. As a result of their importance and a lack of information for headwater drainage features City Stream Watch has incorporated monitoring of these systems at five sites in the Voyageur Creek catchment (Figure 22).

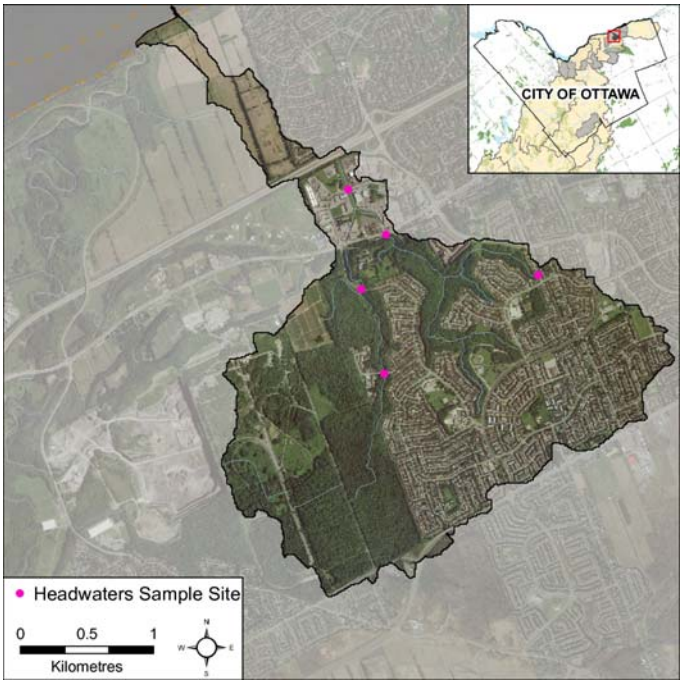


Figure 22 HDF sampling sites on Voyageur Creek

Monitoring and Restoration

Monitoring and Restoration Projects on Voyageur Creek

Table 4 below highlights the monitoring and restoration work that has been done on Voyageur Creek to date by the Rideau Valley Conservation Authority.

Accomplishment	Year	Description
City Stream Watch Monitoring	2013	59 stream surveys were completed by City Stream Watch volunteers and staff
City Stream Watch Fish Sampling	2013	Three sites were sampled on Voyageur Creek
City Stream Watch Thermal Classification	2013	Three temperature loggers were deployed from April until September
City Stream Watch Headwater Drainage Feature Sampling	2013	Five headwater drainage feature sites were sampled in the Voyageur Creek catchment

Table 4 Monitoring and Restoration on Voyageur Creek

Potential Riparian Restoration Opportunities

Figure 23 depicts the locations where City Stream Watch staff and volunteers made note of riparian restoration opportunities. As most the creek is well shaded and surrounded by a forested buffer, the potential riparian restoration opportunities are limited to sections in the more industrial areas north of St. Joseph Boulevard.

Potential Instream Restoration Opportunities

Figure 24 depicts the locations where City Stream Watch staff and volunteers made note of various instream restoration opportunities. Stream garbage cleanups are the main instream restoration activity that is recommended for Voyageur Creek.

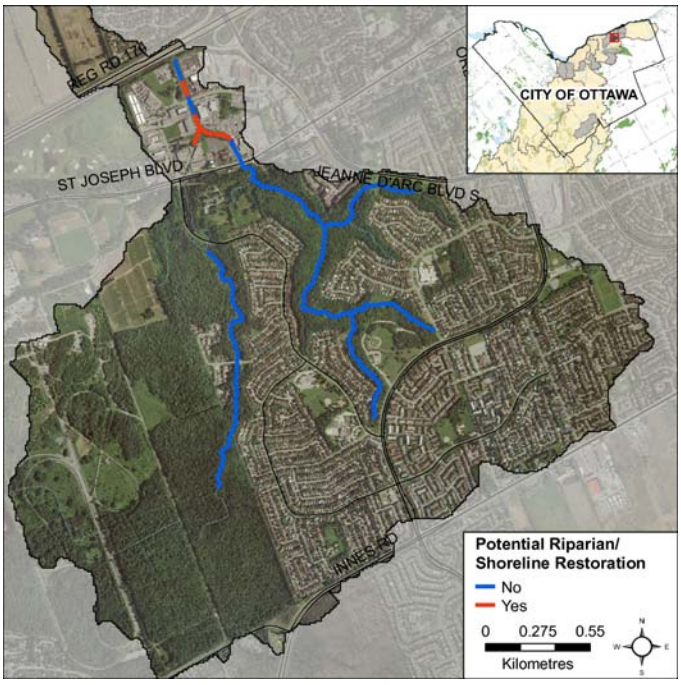


Figure 23 Potential riparian restoration opportunities

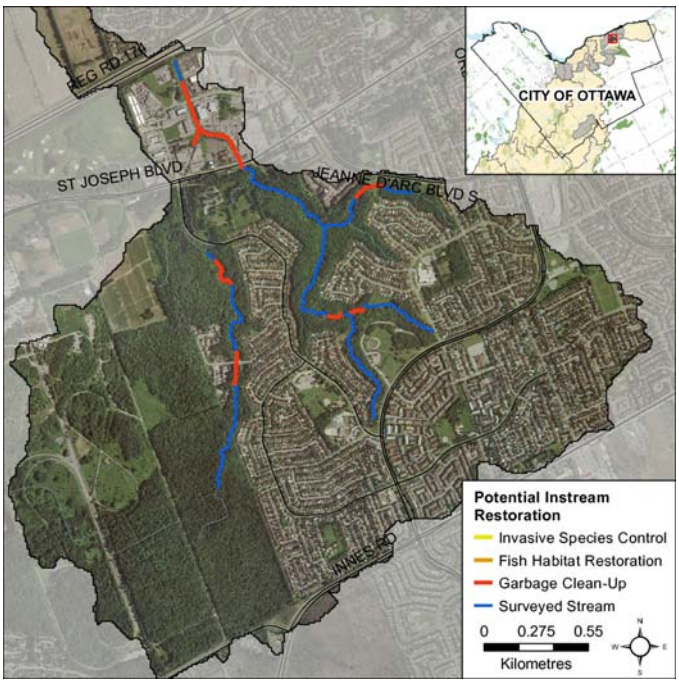


Figure 24 Potential instream restoration opportunities



References

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For more information of the overall 2013 City Stream Watch Program and the volunteer activities, please refer to the City Stream Watch 2013 Summary Report.

To view the stream characterization protocol used, please see the City Stream Watch website: http://www.rvca.ca/programs/streamwatch/index.html