Ramsay Creek 2019 Catchment Report

Catchment Features	
Area	22.6 square kilometres 0.53% of the Rideau Valley watershed
Land Use	36.92% agriculture 7.98% urban 32.78% forest 8.70% meadow 2.40% rural 0.18% waterbody 11.05% wetlands
Surficial Geology	52.66% clay 3.03% organic deposits 44.31% sand
Watercourse Type	2019 thermal conditions **Cool-warm water**
Invasive Species	Sixteen invasive species were identified in 2019: bull thistle, common & glossy buckthorn, curly-leaved pondweed, dog strangling vine, flowering rush, garlic mustard, goldfish, Himalayan balsam, non-native honeysuckles, Manitoba maple, non-native *Phragmites,* wild parsnip, purple loosestrife, rusty crayfish, yellow iris
Fish Community	Twenty species of fish have been observed from 2007-2019. Game fish species include: largemouth bass, pumpkinseed, white sucker and yellow bullhead

Wetland Cover
11.05% of the watershed are wetlands
8.62% are unevaluated wetlands
2.43% are evaluated wetlands

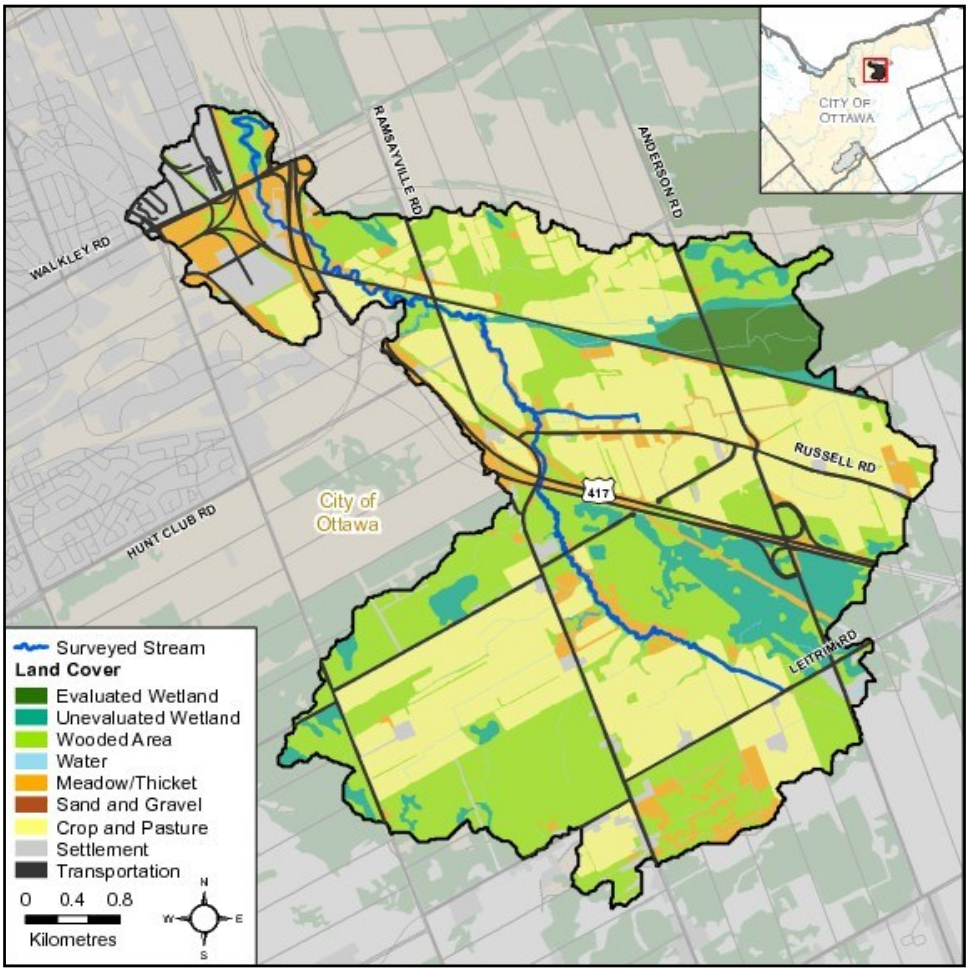


Figure 1 Land cover in the Ramsay Creek catchment

Vegetation Cover		
Type	**Hectares**	**Percent of Cover**
Wooded Areas:	**740**	**74.79%**
Hedgerow	22.34	2.26%
Plantation	254.94	25.75%
Treed	463.19	46.78%
Wetlands*	**250**	**25.21%**
Total Cover	**990**	**100%**
*Includes treed swamps		

Woodlot Analysis		
Size Category	**Number of Woodlots**	**Percent of Woodlots**
1 Hectare	75	53.57%
1 to <10 Ha	45	32.14%
10 to <30 Ha	14	10.00%
>30 Ha	6	4.29%
Total Cover	**140**	**100%**

The Rideau Valley Conservation Authority in partnership with the City of Ottawa, National Capital Commission, Ottawa Flyfishers Society, Canadian Forces Ottawa Fish and Game Club, Ottawa Stewardship Council, Rideau Roundtable, South Nation Conservation and Mississippi Valley Conservation Authority form the City Stream Watch 2019 collaborative.

Ramsay Creek 2019 Catchment Report

Introduction

Ramsay Creek is a tributary of Greens Creek located in the east end of the City of Ottawa. The approximately ten kilometer stream flows from its headwaters near Letrim Road to its confluence into Greens Creek north of Walkley Road. The catchment of Ramsay Creek measures 22.6 square kilometers of land, comprised of mainly wetlands, forest, and agricultural/rural land uses under the management of the National Capital Commission (NCC). The majority of the catchment is located within the City of Ottawa in the NCC Greenbelt.

In 2019 the City Stream Watch program surveyed 101 sections (10.1 km) of the main stem of Ramsay Creek and nine sections (0.9 km) of one of its tributaries. Five sites were sampled for fish community composition and data from one temperature logger was collected at one of these sites. Twenty two headwater drainage feature sites were assessed in the spring and in the summer. The following is a summary of our observations and assessment.

Low Water Conditions

After a cool and wet spring with significant flooding in certain areas, especially along the Ottawa River; hot dry weather with localized rainfall characterized the summer and early fall of 2019. In August, the climate stations in the watershed measured rainfall at 80 percent under normal levels for that time of year, passing the threshold for low water status. As of August 15, minor low water status in the Rideau Valley watershed was announced by the Rideau Valley Conservation Authority under the Ontario Low Water Response Program (RVCA, 2019). Water levels in lakes and large rivers were close to average for summer conditions however smaller creeks and streams, including headwater drainage features and wetlands, became dry under these drought conditions.

Several significant rainfall events in the last two weeks of October ended the drought conditions. The average 90-day rainfall measured were well above the 80 percent of normal for the time of year. As of October 30, the Rideau Valley watershed status retuned to normal water levels (RVCA, 2019). Water levels in the smaller rivers and streams across the watershed were restored from their prior below normal dry conditions.

Ramsay Creek Overbank Zone

Riparian Buffer Width Evaluation

The riparian buffer is the adjacent land area surrounding a stream or river. Naturally vegetated buffers are important to protect the health of streams and watersheds. Natural shorelines provide buffering capacity of contaminants and nutrients that would otherwise run off freely into aquatic systems. Well established shoreline plant communities will hold soil particles in place preventing erosion and will also provide the stream with shading and cover. Environment and Climate Change Canada recommends a guideline of 30 meters of natural vegetation on both sides of the stream for at least 75 percent of the stream length (Environment Canada, 2013).

Figure 2 demonstrates buffer conditions along the left and right banks of the surveyed sections of Ramsay Creek. Buffers greater than 30 meters were present along 65 percent of the left bank and 53 percent of the right bank. A 15 to 30 meter buffer was present along 13 percent of the left bank and 20 percent of the right bank. A 5 to 15 meter buffer was present along 11 percent of the left bank and 15 percent of the right bank. A five meter buffer or less was present along nine percent of the left bank and 12 percent of the right bank. Approximately half the buffer width evaluation on the sections surveyed of Ramsay Creek are within guidelines. Improvements can be made in the agricultural areas where buffers were less than the recommended 30 meter guideline.

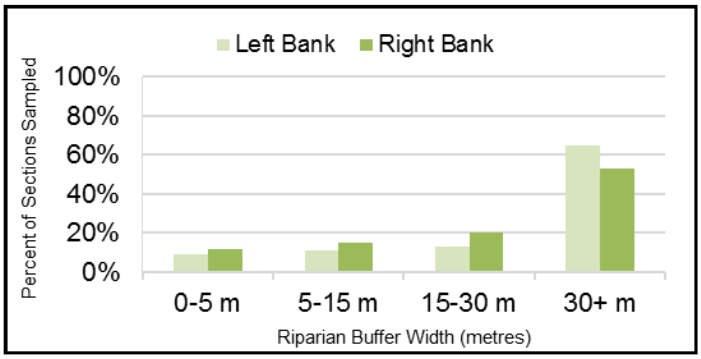


Figure 2 Vegetated buffer width along Ramsay Creek

Vegetated buffer greater than 30 meters in width along Ramsay Creek east of Ramsayville Road

Riparian Buffer Alterations

Alterations within the riparian buffer were assessed within three distinct shoreline zones (0-5 m, 5-15 m, 15-30 m), and evaluated based on the dominant vegetative community and/or land cover type. The evaluation of anthropogenic alterations to the natural riparian cover are shown in Figure 3.

Ramsay Creek surveyed riparian zones were primarily natural, with 63 percent of the right bank and 74 percent of the left bank having dominant natural riparian vegetative communities. Alterations to the riparian buffer accounted for 18 percent of the right bank and eight percent of the left bank. Highly altered conditions were observed on 19 percent of the right bank and 18 percent of the left bank. These alterations were associated with agricultural land uses as well as infrastructure, including roadways, highways and railway.

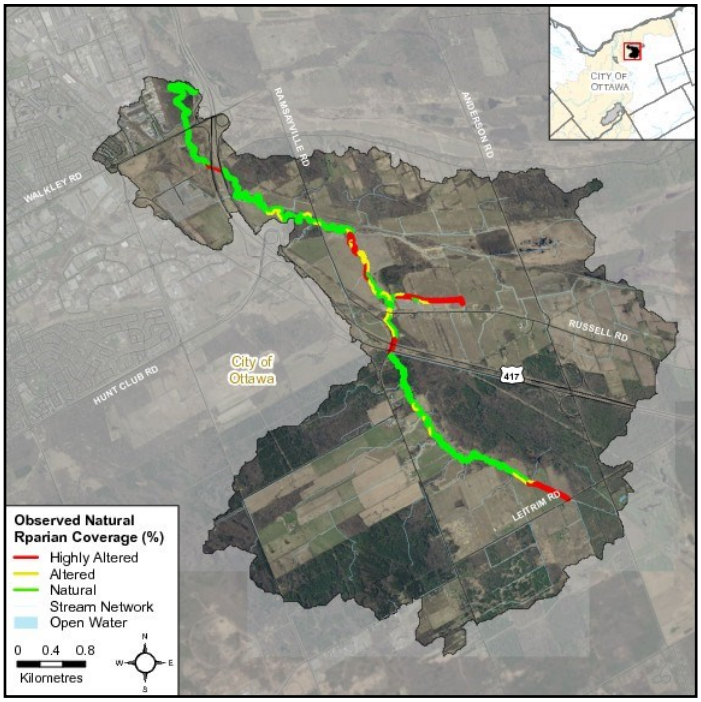


Figure 3 Riparian buffer alterations in Ramsay Creek

Roadway infrastructure at Highway 417 altering the riparian buffer along Ramsay Creek

Adjacent Land Use

Surrounding land use is considered from the beginning to the end of the survey section (100 m) and up to 100 meters on each side of the river. Land use outside of this area is not considered for the surveys but is nonetheless part of the subwatershed and will influence the creek. Figure 4 shows the percent of surveyed sections that contain each type of land use.

Meadows, scrubland and forests were present in 86 percent, 81 and 73 percent of the sections surveyed, being the most common land use observed. Wetlands were present in ten percent of the surveyed areas.

Aside from the natural areas, the most common land use in the catchment is active agriculture, with 55 percent of the sections having this adjacent land use. Abandoned agricultural land use was present in two percent of sections surveyed. Infrastructure including roads, highways, bridges, culverts and railway was observed in 40 percent of sections surveyed.

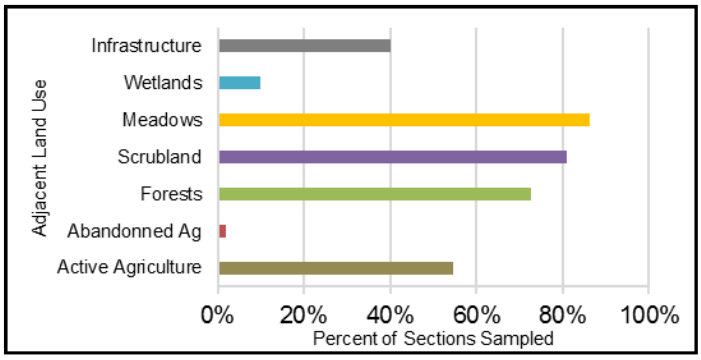


Figure 4 Adjacent land use 100 meters from each shoreline and percentage of presence along Ramsay Creek

Section along Ramsay Creek with forest, scrubland, meadow and railway infrastructure land uses west of Ramsayville Road

Ramsay Creek Shoreline Zone

Anthropogenic Alterations

Stream alterations were classified based on specific functional criteria associated with potential human influences on the riparian buffer, shoreline state, flow conditions and channel structure.

Figure 5 shows the level of anthropogenic alterations for the 110 sections surveyed in Ramsay Creek, with 45 sections remaining without any human alteration. Of the areas surveyed, 20 sections fell in the classification of natural. Natural sections had a riparian buffer greater than 15 meters in width and natural shorelines.

Twenty seven sections were classified as altered. They contained straightened sections and riparian buffers of five to 15 meters in width. Shoreline alterations included concrete bridges.

Eighteen of the sections surveyed were highly altered. The riparian buffers were less than five meters in width, shoreline alterations were found on most of the sections including rip rap and storm water outlets were present at road crossings. These sections were mostly found near road and highway infrastructure.

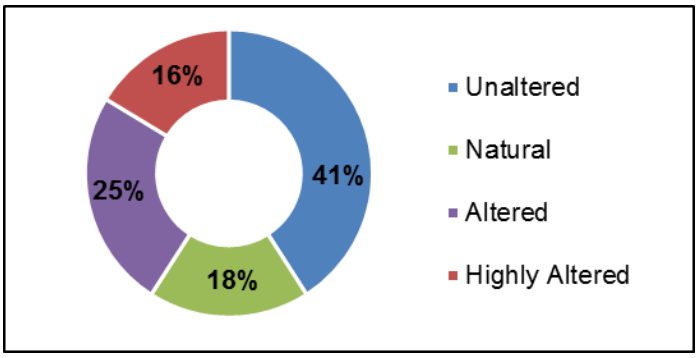


Figure 5 Anthropogenic alterations along Ramsay Creek

One of many unaltered sections of Ramsay Creek east of Ramsayville Road

Erosion

Stream erosion is the process by which water erodes and transports sediments, resulting in dynamic flows and diverse habitat conditions. Excessive erosion can result in drastic environmental changes, as habitat conditions, water quality and aquatic life are all negatively affected. Bank stability was assessed as the extent of each section with "unstable" shoreline conditions. These conditions are defined by the presence of significant exposed soils/roots, minimal bank vegetation, severe undercutting, slumping or scour and potential failed erosion measures (rip rap, gabion baskets, etc.). Figure 6 shows significant erosion was observed across the surveyed portions of the creek. Bank instability was observed in 90 percent of the left bank and 88 percent of the right bank of the sections surveyed.

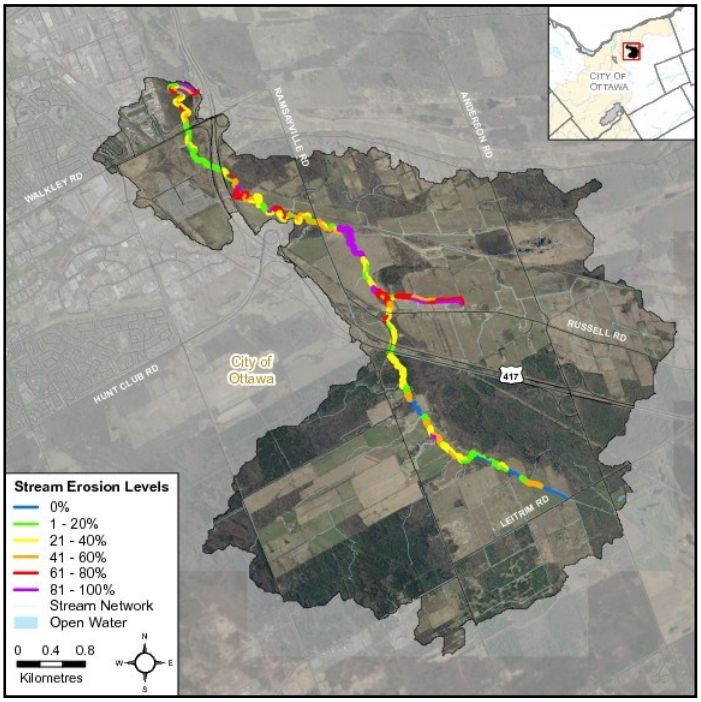


Figure 6 Erosion levels along Ramsay Creek

Bank erosion along Ramsay Creek east of Ramsayville Road

Ramsay Creek is a stream prone to slumping and erosion. The surficial geology of the catchment is comprised mostly clay. This along with increased flows from urban and agricultural impact (storm water and tile drainage) have shaped observed erosion levels on Ramsay Creek.

Undercut Stream Banks

Stream bank undercuts can provide excellent cover habitat for aquatic life, however excessive levels can be an indication of unstable shoreline conditions. Bank undercut was assessed as the extent of each surveyed section with overhanging bank cover present.

Figure 7 shows where undercut banks were present and to what extent each section contained them in Ramsay Creek. Along the left bank, 69 percent of sections had undercut banks; and the right bank had 70 percent of sections with undercut banks.

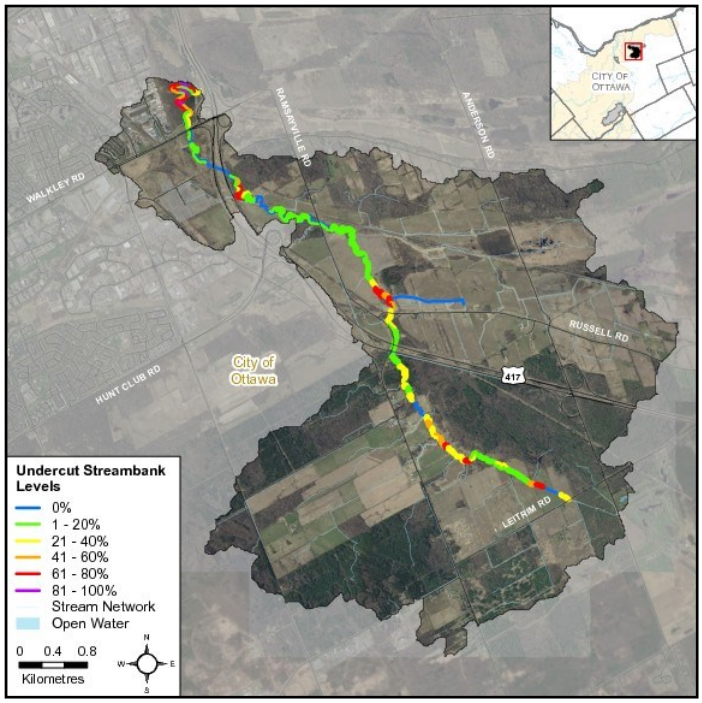


Figure 7 Undercut stream banks along Ramsay Creek

Undercut banks north of Letrim Road along Ramsay 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. Stream cover is assessed as the total coverage area in each section that is shaded by overhanging trees/grasses and tree canopy, at greater than one meter above the water surface.

Figure 8 shows the percentage of sections surveyed with various levels of stream shading. The majority of sections, 51 of them, had a shade cover of one to 20 percent. Out of the higher levels observed, 21 of the sections had 21 to 40 percent shade cover; 14 of sections had 41 to 60 percent shade cover; 10 sections had levels of 61 to 80 percent shading. The highest level of shading of 81 to 100 percent was observed in five of the sections surveyed. No cover was observed in eight percent of the sections. Figure 9 shows the distribution of these shading levels as a percentage of sections surveyed along Ramsay Creek.

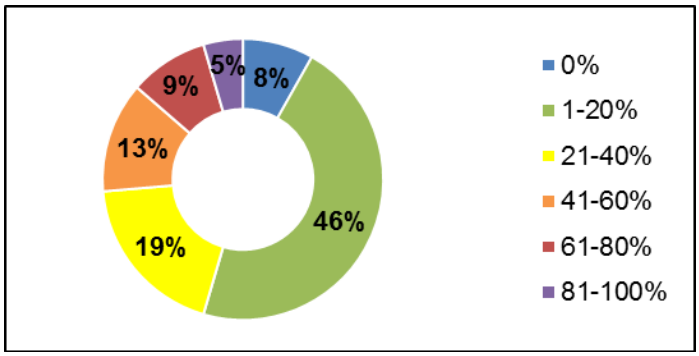


Figure 8 Stream shading along Ramsay Creek

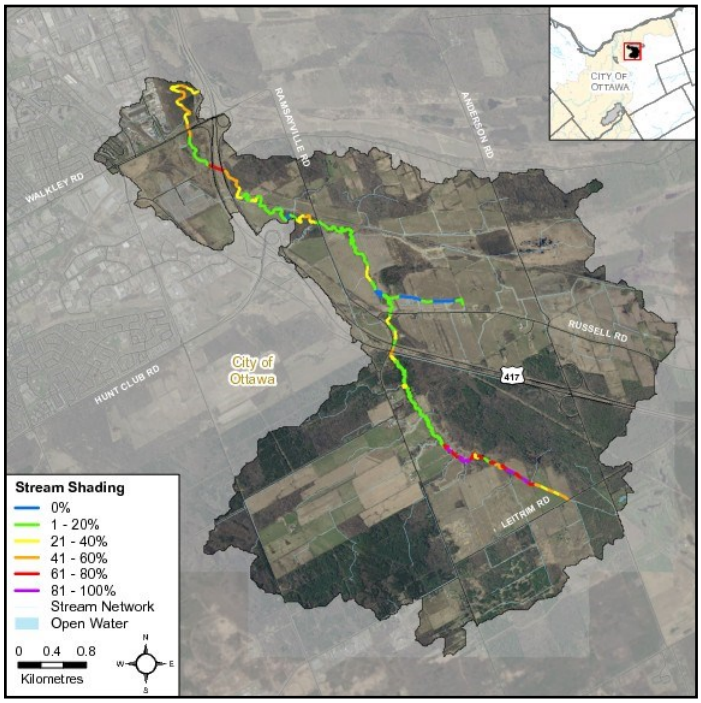


Figure 9 Stream shading along Ramsay Creek

A mix of trees and plants comprised the majority of shading. Overhanging plants, mainly grasses, broad leaved and robust emergent plants, were seen in 72 percent of the left banks and 75 percent of the right banks.

Overhanging Trees and Branches

Trees and branches that are less than one meter from the surface of the water are defined as overhanging. Overhanging branches and trees provide a food source, nutrients and shade which helps to moderate instream water temperatures.

Figure 10 shows the presence and percentage within each section of overhanging trees and branches that were observed along Ramsay Creek. Of the surveyed portions, 66 percent of the sections had overhanging trees and branches on the left bank, and 59 percent of the sections had overhanging trees on the right bank.

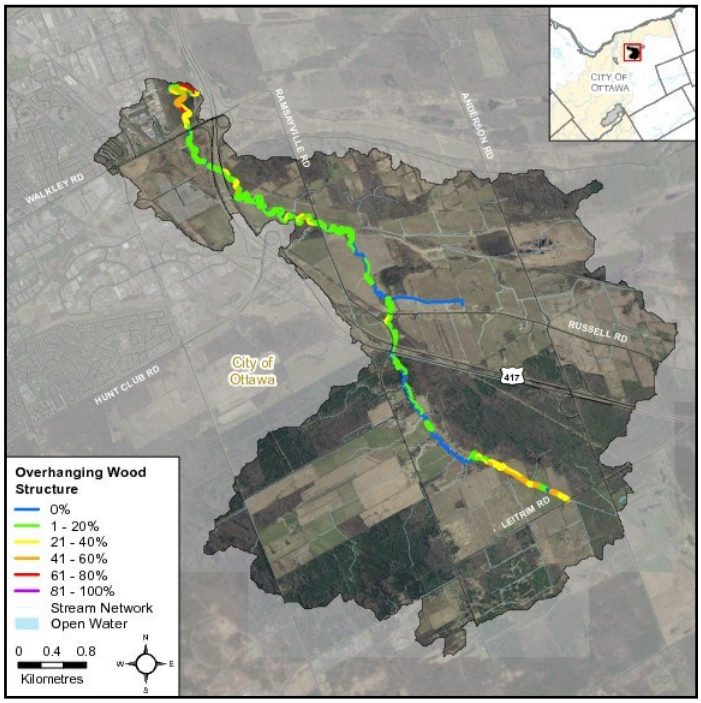


Figure 10 Overhanging trees and branches along Ramsay Creek

Overhanging trees and branches provide shading north of Walkley Extension Road along Ramsay Creek

Ramsay Creek Instream Aquatic Habitat

Habitat Complexity

Habitat complexity is a measure of the diversity of habitat types and features within a stream. Streams with high habitat complexity support a greater variety of species niches, and therefore contribute to greater diversity. Factors such as substrate, morphologic conditions (pools, riffles) and cover material (vegetation, wood structure, etc.) all provide crucial habitat to aquatic life. Habitat complexity is assessed based on the presence of boulder, cobble and gravel substrates, as well as the presence of instream wood structure. A higher score shows greater complexity where a variety of species can be supported. Figure 11 shows habitat complexity of the sections surveyed: 11 percent had no complexity; 23 percent had a score of one; 25 percent scored two; and 20 percent scored three; 21 percent of the sections surveyed scored four, the highest level.

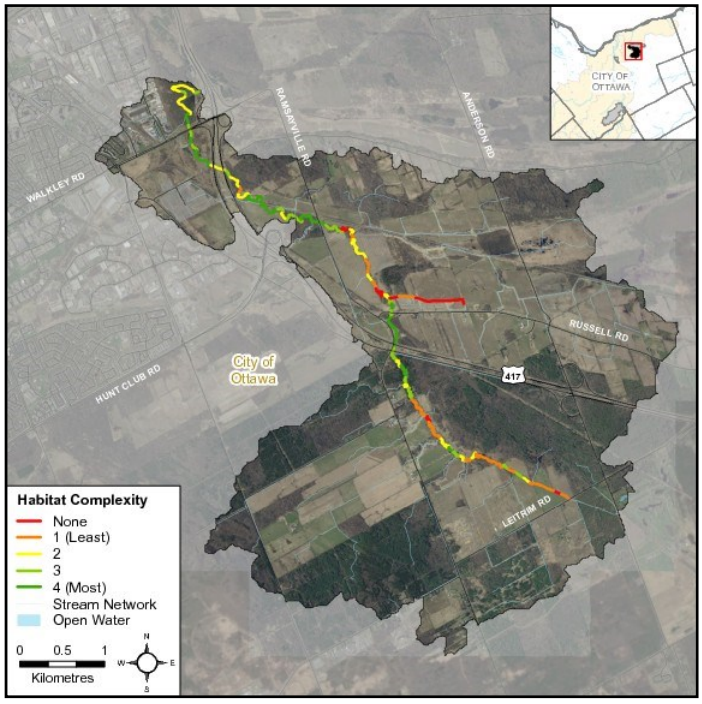


Figure 11 Instream habitat complexity along Ramsay Creek

Section of Ramsay Creek with complex habitat features including boulders, cobble, gravel and instream wood structure

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. The absence of diverse substrate types may limit the diversity of species within a stream.

Substrate complexity along Ramsay Creek was observed to be fairly homogenous in 76 percent of sections surveyed, and heterogenous in the remaining 24 percent. Figure 12 shows the substrate types observed. It is a system dominated by clay, with 99 percent of sections containing this type of substrate. Most sections surveyed, 93 percent, also contained silt. Other types of substrates observed included sand, gravel, cobble and boulders.

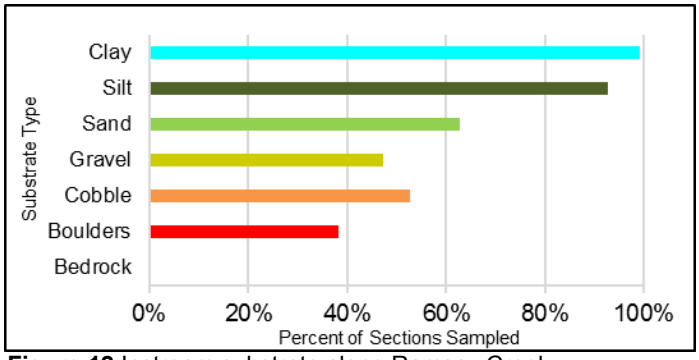


Figure 12 Instream substrate along Ramsay Creek

Figure 13 shows the dominant substrate types along the creek. Clay was the dominant substrate type in 75 percent of sections surveyed, silt was dominant in 22 percent, cobble in two percent and gravel was dominant in one percent of sections surveyed.

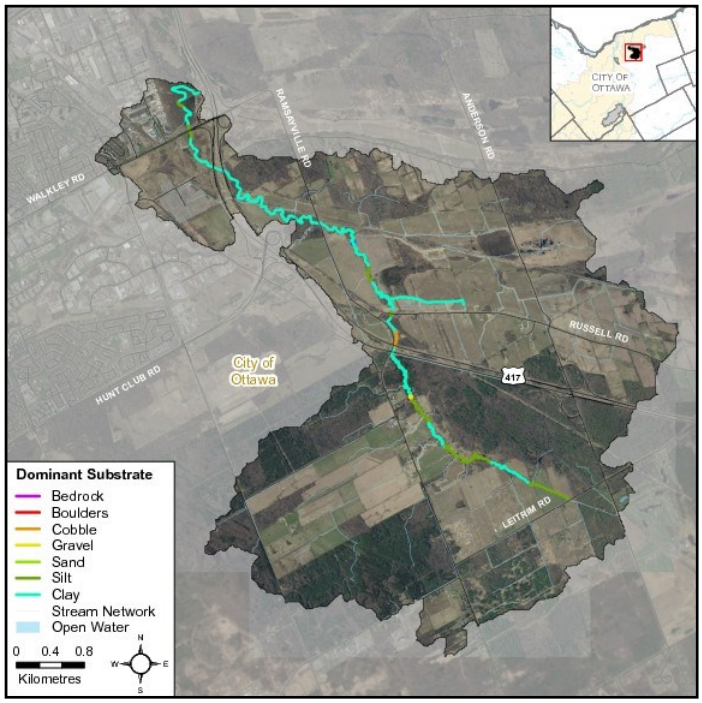


Figure 13 Dominant instream substrates along Ramsay Creek

Instream Morphology

Pools and riffles are important habitat features for aquatic life. Riffles are fast flowing areas characterized by agitation and overturn of the water surface. Riffles thereby play a crucial role in contributing to dissolved oxygen conditions and directly support spawning for some fish species. They are also areas that support diverse benthic invertebrate populations which are an important food source for many aquatic species. Pools are characterized by minimal flows, with relatively deep water and winter and summer refuge habitat for aquatic species. Runs are 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 14 shows that the surveyed portions of Ramsay Creek has moderate diversity of morphological conditions, suitable for a variety of aquatic species and life stages; 87 percent of sections contained pools, 44 percent of sections contained riffles and 100 percent contained runs. Figure 15 shows the locations of sections surveyed which contained riffle habitat and the extent of presence within each section. .

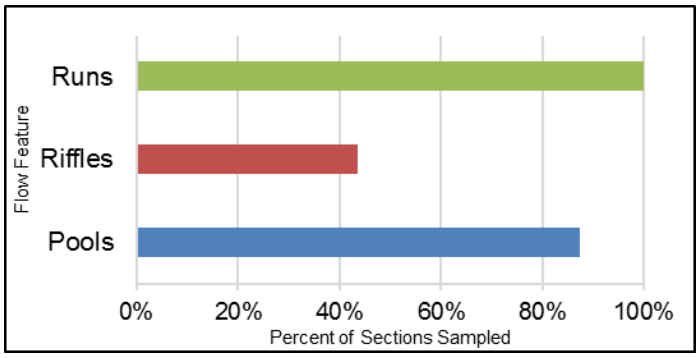


Figure 14 Instream morphology along Ramsay Creek

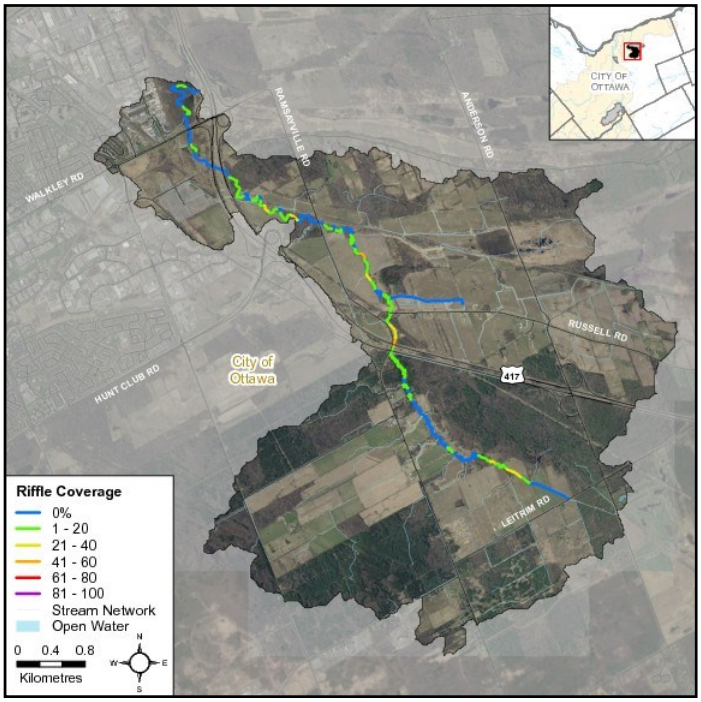


Figure 15 Riffle habitat locations along Ramsay Creek

Instream Wood Structure

Figure 16 shows that a portion of Ramsay Creek had moderate levels of instream wood structure in the form of branches and trees. Instream wood structure is important for fish and wildlife habitat, by providing refuge and feeding areas. Excessive amounts can result in temporary seasonal migration barriers.

Instream wood structures found along Ramsay Creek are important for fish and wildlife habitat

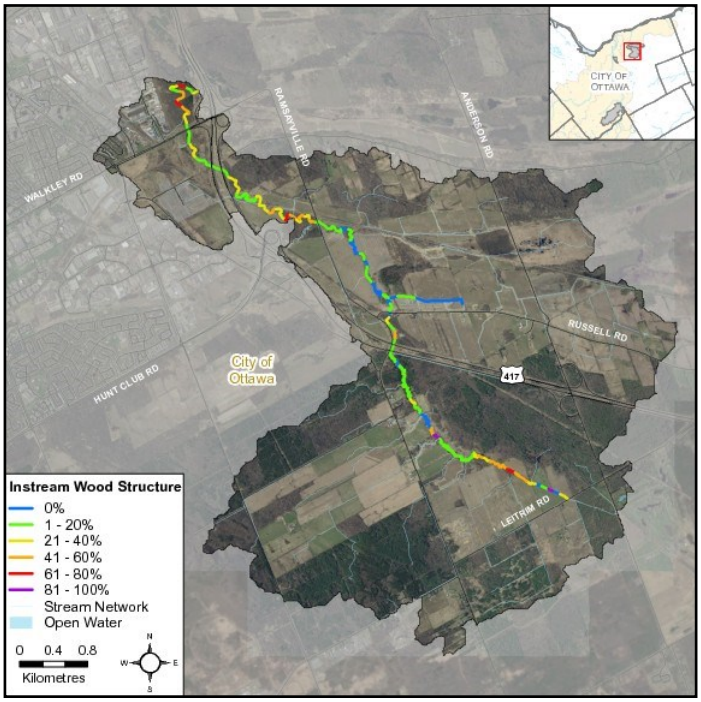


Figure 16 Instream wood structures along Ramsay Creek

Instream Aquatic Vegetation Type

Instream vegetation is a key component of aquatic ecosystems. It promotes stream health by:

- Providing riparian and instream habitat.
- Maintaining water quality by erosion control, nutrient cycling, and pollutant absorption.
- Stabilizing flows and reducing shoreline erosion.
- Contributing dissolved oxygen via photosynthesis.
- Moderating temperatures through shading.

Figure 17 shows the aquatic vegetation community structure along Ramsay Creek. Vegetation types included: narrow-leaved emergent vegetation present in 73 percent of sections surveyed; submerged vegetation in 55 percent; floating plants in 36 percent; robust emergent vegetation in 30 percent; broad-leaved emergent plants in 24 percent; free-floating plants in 11 percent; and algae present in 44 percent of sections.

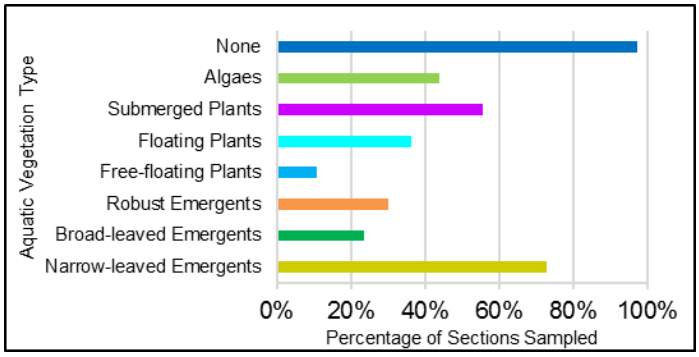


Figure 17 Aquatic vegetation presence along Ramsay Creek

Figure 18 shows the dominant vegetation type observed in Ramsay Creek. No vegetation was the most dominant type across 75 percent of sections. Submerged plants and algae were each dominant in nine percent of sections. Floating plants were dominant in four percent of sections; narrow-leaved and broad-leaved emergent plants were dominant in two and one percent.

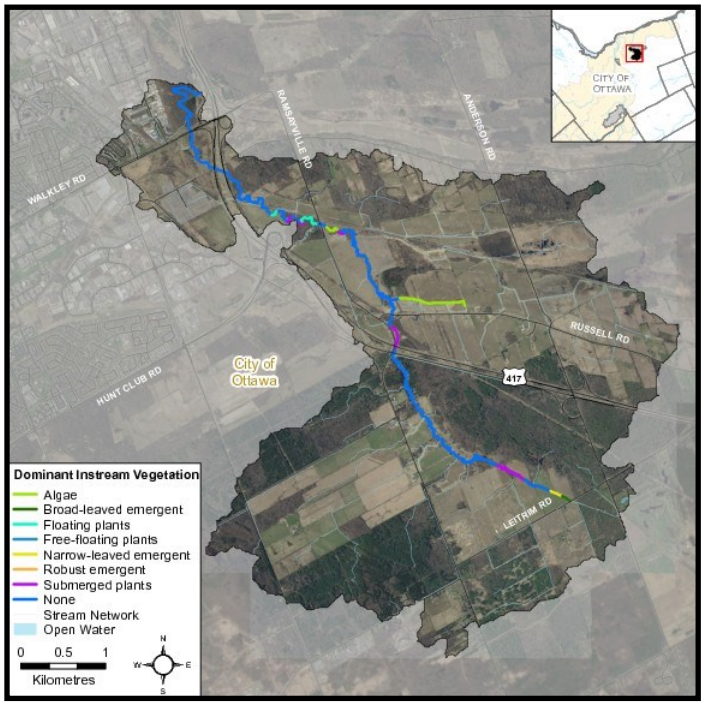


Figure 18 Dominant instream vegetation in Ramsay Creek

Instream Vegetation Abundance

The abundance of instream vegetation is also crucial for aquatic ecosystem health. Lack of vegetation, rare or low abundances can impair the ability of plants to contribute adequately to dissolved oxygen, provide habitat, and remove nutrients and contaminants. Extensive amounts of vegetation can also have negative impacts by lowering dissolved oxygen levels. It can act as a physical barrier for humans and wildlife, and it leads to a reduction in plant diversity. Invasive species in particular tend to have this extensive mode of growth.

Abundance of vegetation is classified by the amount of vegetation present along each section. Levels of vegetation are categorized based on the extent of coverage of a section from none and sparse to an entire section choked with vegetation. As seen in Figure 19, 98 percent of sections along Ramsay Creek had no vegetation in part; 47 percent had rare abundance; 51 percent had low; 39 percent had normal levels; 14 percent had common levels; and extensive amounts were found in 4 percent of sections.

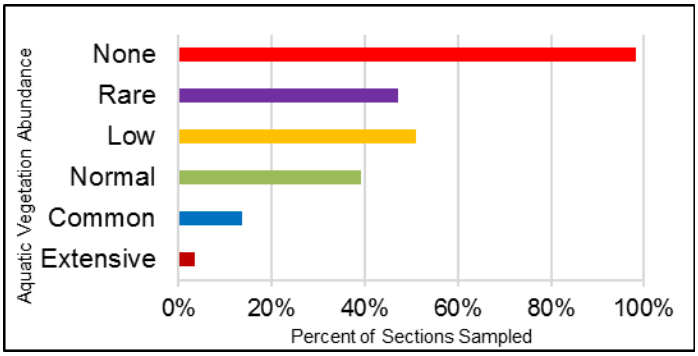


Figure 19 Instream vegetation abundance along Ramsay Creek

Floating-leaf pond weed and yellow water-lily are floating plants observed along Ramsay Creek south of Russel Road

Ramsay Creek Stream Health

Invasive Species

Invasive species are harmful to the environment, the economy and our society. They have high reproduction, quick establishment of dense colonies, tolerate a variety of environmental conditions and lack natural predators. They can have major implications on stream health and reduce species diversity (OMNR 2012). They can be difficult to eradicate, however it is important to continue to research, monitor and manage them.

Invasive species were observed in 92 percent of the sections surveyed along Ramsay Creek, Figure 20 shows diversity of species observed per section surveyed.

The following are a list of species observed in 2019 in the surveyed portions of Ramsay Creek:

- bull thistle (*Cirsium vulgare*)
- common buckthorn (*Rhamnus cathartica*)
- curly-leaved pondweed (*Potamogeton crispus*)
- dog strangling vine (*Cynanchum rossicum & C. louseae*)
- flowering rush (*Butmous umbellatus*)
- garlic mustard (*Allaria petiolata*)
- glossy buckthorn (*Rhamnus frangula*)
- goldfish (Carassius auratus)
- Himalayan balsam (*Impatiens glandulifera*)
- non-native honeysuckles (*Lonicera spp.)*
- Manitoba maple (*Acer negundo*)
- non-native *Phragmites* (*Phragmites australis*)
- poison/wild parsnip (*Pastinaca sativa*)
- purple loosestrife (*Lythrum salicaria*)
- rusty crayfish (*Orconectes rusticus*)
- yellow iris (*Iris pseudacorus*)

Invasive yellow iris observed along Ramsay Creek

To report and find information about invasive species visit

http://www.invadingspecies.com

Managed by the Ontario Federation of Anglers and Hunters

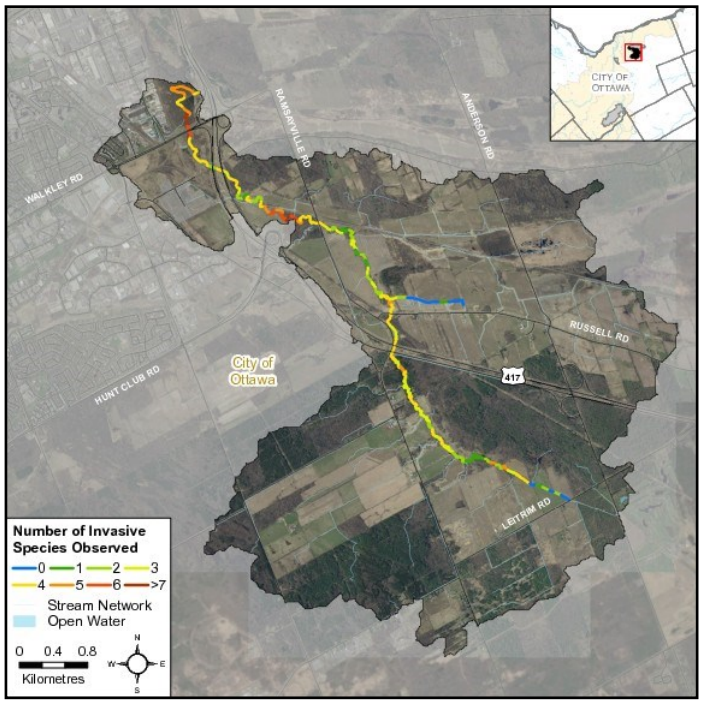


Figure 20 Invasive species diversity along Ramsay Creek

Pollution

Figure 21 shows where pollution was observed along Ramsay Creek. Garbage on the stream bottom was found in 34 percent of sections; floating garbage was observed in 12 percent; and unusual coloration was found in one section. Two percent of sections had other types of pollution. Types of garbage observed included tires, cans, drink bottles, plastic bags, small plastic fragments, Styrofoam, blankets, tents, engine blocks, metal drums, pipes, and other construction debris.

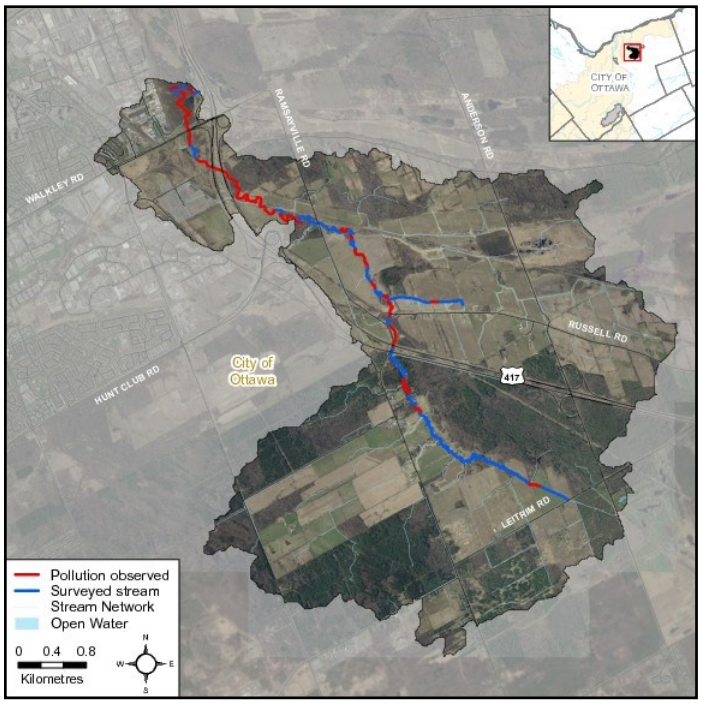


Figure 21 Pollution observed along Ramsay Creek

Wildlife

The diversity of fish and wildlife populations can be an indicator of water quality and stream health (Table 1). Wildlife observations are noted during monitoring and survey activities; they do not represent an extensive evaluation of species presence in the Ramsay Creek catchment.

Black swallowtail (above) and a red admiral (below) are some of the butterflies observed along Ramsay Creek

Honey bee on water hemlock (above) and various life stages of the American toad (below) observed along Ramsay Creek

Table 1 Wildlife observations along Ramsay Creek in 2019

Birds	American crow, American goldfinch, American redstart, American robin, Baltimore oriole, barn swallow, black-capped chickadee, blue jay, cedar waxwing, chipping sparrow, common raven, common yellowthroat, cliff swallow, double-crested cormorant, ducks, eastern phoebe, European starling, flycatchers, great blue heron, grey catbird, hooded warbler, indigo bunting, killdeer, mallard, northern cardinal, pileated woodpecker, song sparrow, spotted sandpiper, red-eyed vireo, red-tailed hawk, red-winged blackbird, ring-billed gull, sandpipers, scarlet tanager, thrushes, tree swallow, veery, warblers, wild turkey, woodpeckers, yellow warbler
Reptiles & Amphibians	American bullfrog, American toad, common gartersnake, gray treefrog, green frog, northern leopard frog, snapping turtle, wood frog
Mammals	American beaver, chipmunk, coyote tracks, deer tracks, fox tracks, groundhog, moose tracks, muskrat, raccoon tracks, red squirrel, skunk
Aquatic Insects & Benthic Invertebrates	crayfish, eastern floater, fingernail clam, giant floater, giant water bug, leeches, limpet, mucket, snails, unionid mussels, snails, whirligig beetle, water striders
Other	beetles, bees, black swallowtail, bluets, bumblebees, butterflies, damselflies, deer flies, dragonflies, earthworms, ebony jewelwing, honey bee, horse flies, mosquitoes, moths, red admiral, silvery blue, spiders, snails, twelve-spotted skimmer, viceroy

Common gartersnake (above) and a large snapping, a species of special concern (below) observed along Ramsay Creek

Ramsay Creek Water Chemistry

Water Chemistry Assessment

Water chemistry collection is done at the start and end of each 100 meter section with a multiparameter YSI probe. The parameters monitored are: air and water temperature, pH, conductivity, dissolved oxygen concentration and saturation.

Volunteer collecting water chemistry measurements with a multiparameter YSI probe

Dissolved Oxygen

Dissolved oxygen is essential for a healthy aquatic ecosystem, fish and other aquatic organisms need oxygen to survive. The level of oxygen required is dependent on the particular species and life stage. The lowest acceptable concentration for the early and other life stages according to the Canadian water quality guidelines for the protection of aquatic life are: 6.0 milligrams per liter in warm-water biota and 9.5 milligrams per liter for cold-water biota (CCME 1999).

Figure 22 shows the concentration levels found in the surveyed portions of Ramsay Creek. The two dashed lines depicted represent the Canadian water quality guidelines. Most of the surveyed portions were found to have oxygen levels within the Canadian water quality guidelines (sec. 1-60; 91-101; branch). Areas that had low oxygen levels (sec. 61-90) had no vegetation as the dominant type and four beaver dams, conditions that can lead to low oxygen levels. Average concentration levels across the system were 9.2 milligrams per liter.

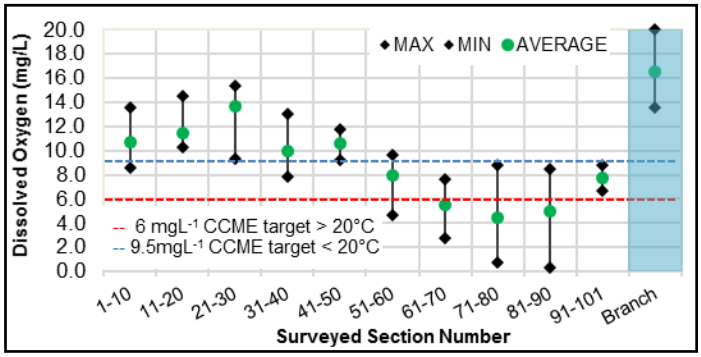


Figure 22 Dissolved oxygen ranges along surveyed sections of Ramsay Creek and in blue the branch (9 sections)

Conductivity

Conductivity is a measure of water's capacity to conduct electrical flow. This capacity is dictated by the presence of conductive ions that originate from inorganic materials and dissolved salts. Water conductivity in natural environments is typically dictated by the geology of the area, however anthropogenic inputs also have a profound effect. Currently there is no existing guideline for stream conductivity levels, however conductivity measurements outside of normal range across a system are good indicators of anthropogenic inputs including unmitigated discharges and storm water input.

Figure 23 shows specific conductivity levels in Ramsay Creek, the average level is depicted by the dashed line (954 µS/cm). Conductivity levels are lower in areas approaching headwater reaches. Higher levels were observed in the sections downstream of the confluence with McEwan Creek (sec. 34) and at the branch. A peak was recorded near highway 417, which was undergoing construction at the time of the survey (sec. 61-70).

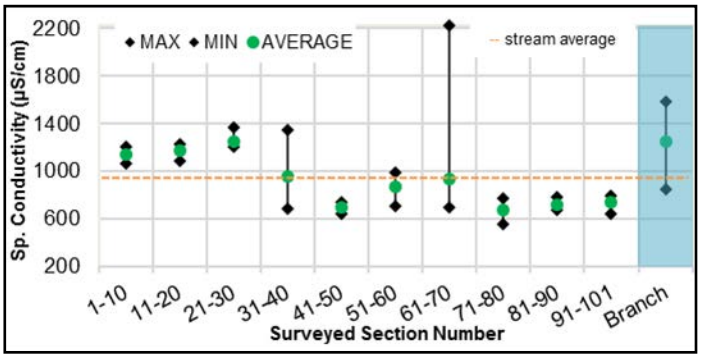


Figure 23 Specific Conductivity ranges along surveyed sections of Ramsay Creek and in blue the branch (9 sections)

pH

pH is a measure of alkalinity or acidity. This parameter is also influenced by the geology of the system but can also be influenced by anthropogenic input. For pH, the provincial water quality objective (PWQO) is the range of 6.5 to 8.5 to protect aquatic life (MOEE 1994).

Figure 24 shows Ramsay Creek had mostly pH levels that meet the PWQO, elevated pH were recorded along the branch. Across the system average pH was 7.83.

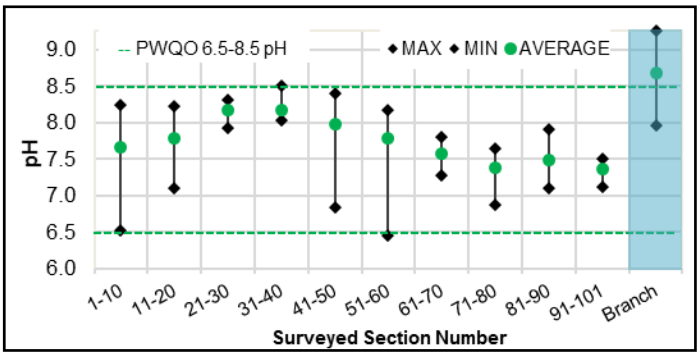


Figure 24 pH ranges along surveyed sections of Ramsay Creek and in blue the branch (9 sections)

Oxygen Saturation (%)

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 percent 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 percent to a maximum of 500 percent, depending on the productivity level of the environment. In order to represent the relationship between concentration and saturation, the measured values have been summarized into 6 classes:

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 and are limiting maximum saturation.

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 and are limiting maximum saturation.

6) >100% Saturation / >9.5 mg/L Concentration

Oxygen concentration and saturation levels are optimal for warm and cold-water biota.

Section on Ramsay Creek north of Letrim Road with **impaired** oxygen conditions (Dissolved oxygen levels of 0.33 mg/L and 6.2 % saturation)

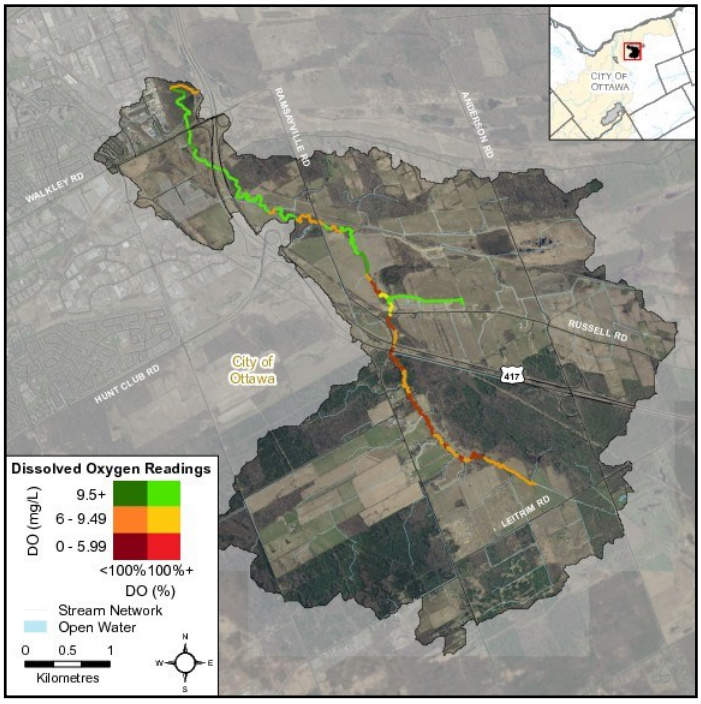


Figure 25 Bivariate assessment of dissolved oxygen concentration (mg/L) and saturation (%) along Ramsay Creek

Figure 25 shows the oxygen conditions across the areas that were surveyed in 2019. Dissolved oxygen conditions in Ramsay Creek were sufficient to sustain cold and warm-water biota. In areas near the confluence with Greens Creek all the way to Ramsayville Road, dissolved oxygen conditions were high. These areas contained riffles that are conducive to water oxygenation.

Sections shown in dark red and orange in Figure 25, had levels of impairment both in dissolved oxygen concentration and percent saturation. These areas had wetland features that have naturally lower oxygen levels, however these can be further limited by extensive vegetation growth of invasive species, and anthropogenic nutrient inputs.

Section on Ramsay Creek near Anderson Road with **optimal** oxygen conditions for cold-water biota (Dissolved oxygen levels of 10.4 mg/L and 107.7 % saturation)

Specific Conductivity Assessment

Specific conductivity (SPC) is a standardized measure of electrical conductance, collected at or corrected to a water temperature of 25°C. SPC is directly related to the concentration of ions in water, and is influenced by the area geology and anthropogenic input as it contributes to the presence of dissolved salts, alkalis, chlorides, sulfides and carbonate compounds. The higher the concentration of these compounds, the higher the conductivity. Common sources of elevated conductivity include stormwater, agricultural inputs as well as commercial and industrial effluents.

In order to summarize the conditions observed, levels were evaluated as either normal, moderately elevated or highly elevated. These categories are defined by the amount of variation (standard deviation) at each section compared to the system's average.

Average levels of specific conductivity measured in the surveyed portions of Ramsay Creek (954.0 µS/cm) were above guidelines (500 µS/cm) used for the Canadian Environmental Performance Index (Environment Canada 2011).

Figure 26 shows relative specific conductivity levels in Ramsay Creek. Normal levels were maintained for most of the surveyed portions. Moderately elevated conditions were observed downstream from the confluence of McEwan Creek, a tributary of Ramsay Creek, west of Ramsayville Road. McEwan Creek has storm water management ponds and run off influences from roadways, highways and industrial land use areas. The highly elevated area noted by Highway 417 was likely due to roadway construction work that was ongoing at the time of the survey.

Section of Ramsay Creek near highway 417 with highly elevated levels of specific conductivity

The other area that showed elevated levels of specific conductivity was a branch of Ramsay Creek that had agricultural land use. The branch contained eight agricultural drains as well as various tile discharge outlets. This branch was also prone to erosion, with soil particles also contributing to higher concentration levels of ions in the water.

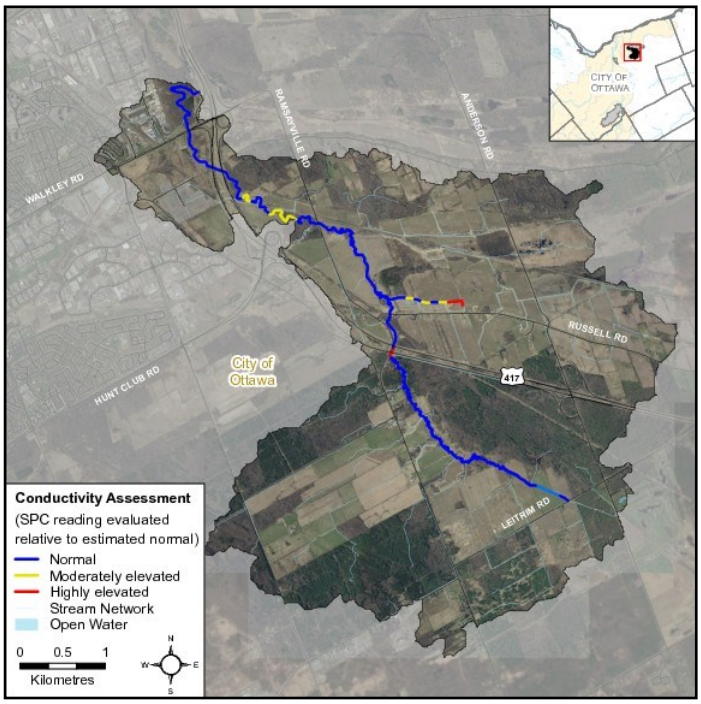


Figure 26 Relative specific conductivity levels along Ramsay Creek

Mc Ewan Creek confluence with Ramsay Creek, west of Ramsayville Road, sections downstream have moderately elevated specific conductivity levels

Ramsay Creek Thermal Classification

Thermal Classification

Instream water temperatures are influenced by various factors including, season, time of day, precipitation, storm water run off, springs, tributaries, drains, discharge pipes, stream shading from riparian vegetation and artificial shade created by infrastructure. To monitor water temperatures in Ramsay Creek, three temperature loggers were placed in April and retrieved in early November.

Figure 27 shows where thermal sampling sites were located. Due to loss of loggers, only data from one logger at Russell Road (#3) was retrieved. Analysis of data from one logger (using the Stoneman and Jones, 1996, method adapted by Chu et al., 2009), indicated Ramsay Creek, was classified as **cool-warmwater** at the Russell Road location (Figure 28). Fish species observed in that area have thermal preferences from cold to warm as indicated by Cocker at al. (2001).

Groundwater

Groundwater discharge areas can influence stream temperature, contribute nutrients, and provide important stream habitat for fish and other biota. During stream surveys and HDF assessments, indicators of groundwater discharge were noted when observed (Figure 29). Indicators included: springs/ seeps, watercress, iron staining, significant temperature changes and rainbow mineral film.

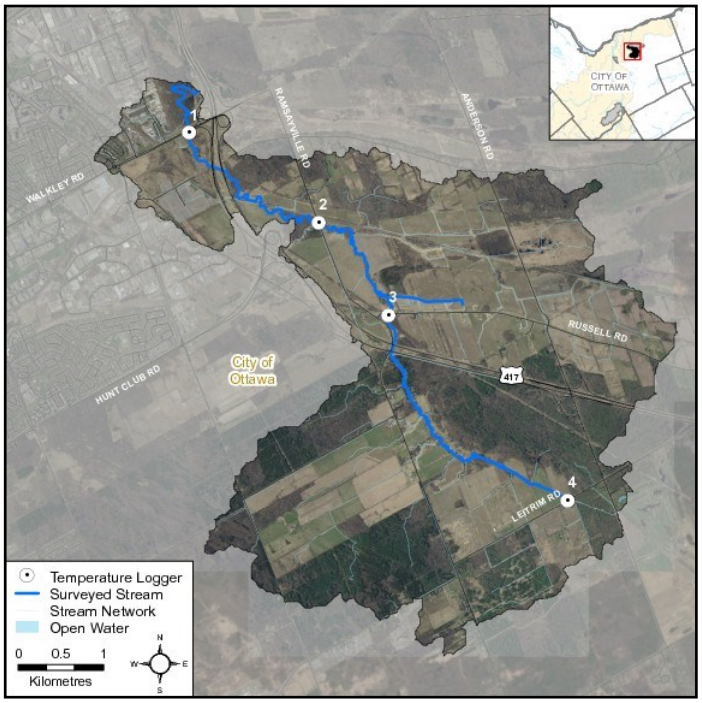


Figure 27 Temperature logger locations on Ramsay Creek

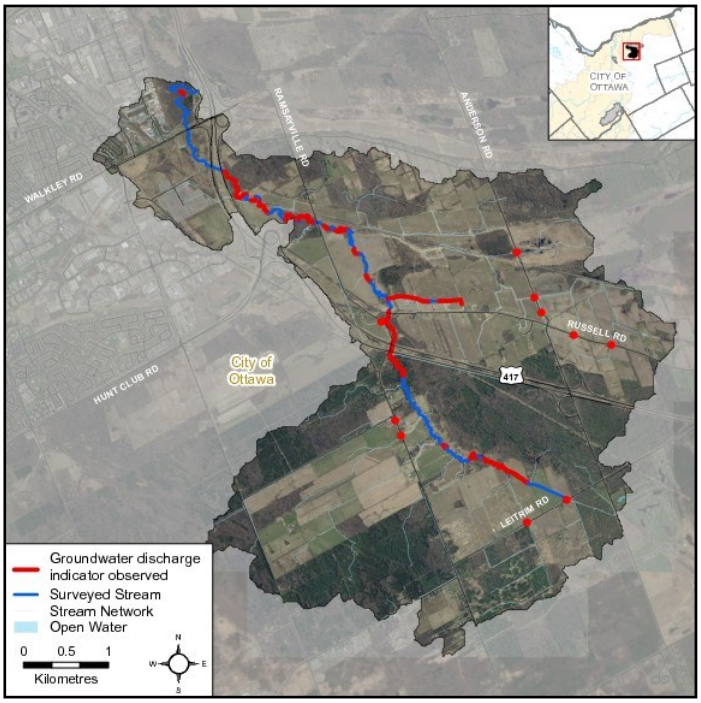


Figure 29 Groundwater indicators observed in the Ramsay Creek catchment

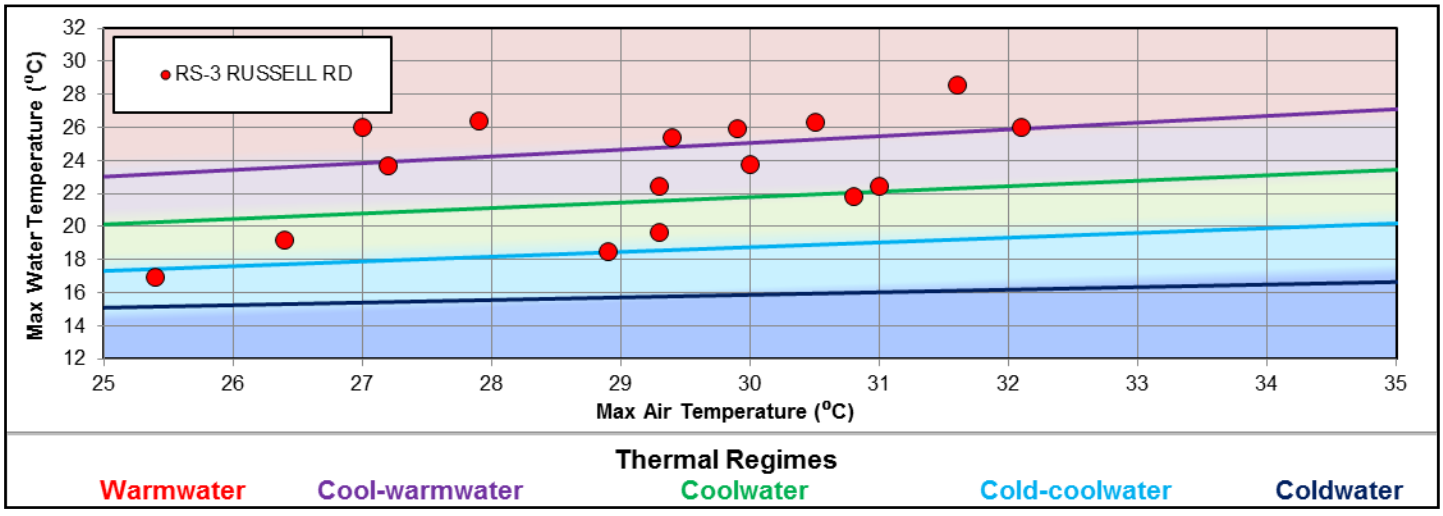


Figure 28 Thermal Classification for Ramsay Creek with the five thermal regimes adapted from Stoneman and Jones (1996) by Chu et al. (2009): **cool-warmwater** category for one site sampled on Ramsay Creek

Ramsay Creek Fish Community

Fish Community Summary

Five fish sampling sites were evaluated between May and July 2019. All site locations were sampled with the use of a backpack electrofishing unit.

Nineteen species were captured in 2019, they are listed in Table 2 along with their thermal classification preferences (Coker et al., 2001) and MNR species codes. Ramsay Creek had a mixed fish community ranging from cold to warm water species. The sampling locations where these species were observed, as well as RVCA historical sites, are depicted in Figure 30. The codes used in the figure are the MNR species codes provided in Table 2. For comparisons across sampling years and a complete list of RVCA historical fish records for Ramsay Creek refer to page 23 of this report.

Table 2 Fish species observed in Ramsay Creek in 2019

Species	Thermal Class	MNR Species Code
banded killifish *Fundulus diaphanus*	**Cool**	BaKil
blacknose dace *Rhinichthys atratulus*	**Cool**	BnDac
bluntnose minnow *Pimephales notatus*	**Warm**	BnMin
brassy minnow *Hybognathus hankinsoni*	**Cool**	BrMin
brook stickleback *Culaea inconstans*	**Cool**	BrSti
central mudminnow *Umbra limi*	**Cool**	CeMud
common shiner *Luxilus cornutus*	**Cool**	CoShi
creek chub *Semotilus atromaculatus*	**Cool**	CrChu
fathead minnow Pimephales promelas	**Warm**	FhMin
golden shiner *Notemigonus crysoleucas*	**Cool**	GoShi
goldfish *Carassius auratus*	**Warm**	Goldf
johnny/tessalated darter *Etheostoma spp.*	**Cool**	EthSp
longnose dace *Rhinichthys cataractae*	**Cool**	LnDac
northern pearl dace *Margariscus nachtriebi*	**Cold-Cool**	PeDac
northern redbelly dace *Chrosomus eos*	**Cool-warm**	NRDac
pumpkinseed *Lepomis gibbosus*	**Warm**	Pumpk
troutperch *Percopsis omiscomaycus*	**Cold**	TrPer
white sucker *Catostomus commersonii*	**Cool**	WhSuc
yellow bullhead *Ameiurus natalis*	**Warm**	YeBul
Total Species		**19**

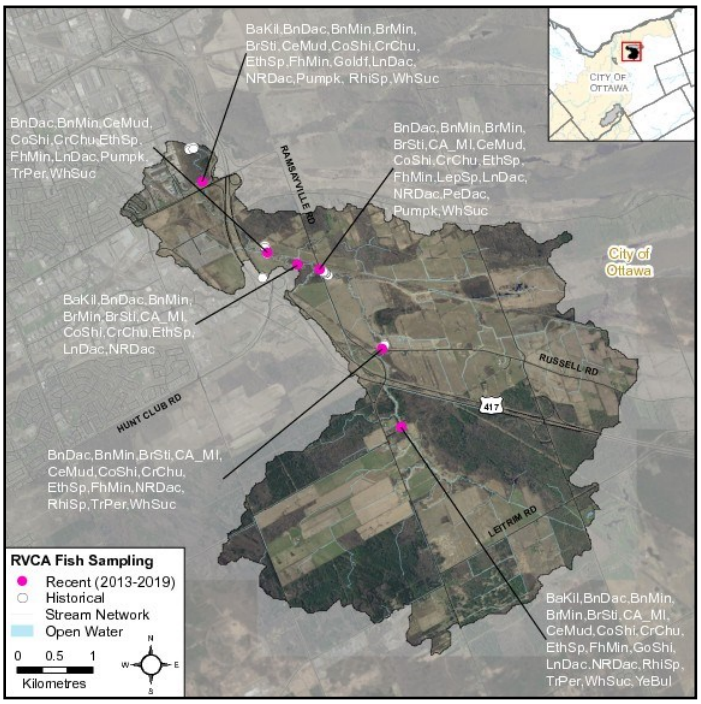


Figure 30 Ramsay Creek fish sampling locations and fish species observations from 2013-2019

Fish community sampling by electrofishing (above) and troutperch (below) observed in Ramsay 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.

The locations of two migratory obstructions observed in the surveyed portion of Ramsay Creek and in two headwater drainage features assessed in 2019 are shown in Figure 31. The obstructions on Ramsay Creek are natural, the obstructions on the headwater reaches are caused by anthropogenic changes in the features.

Debris dams, such as the one north of Russell Road (above) can create seasonal fish migratory obstructions

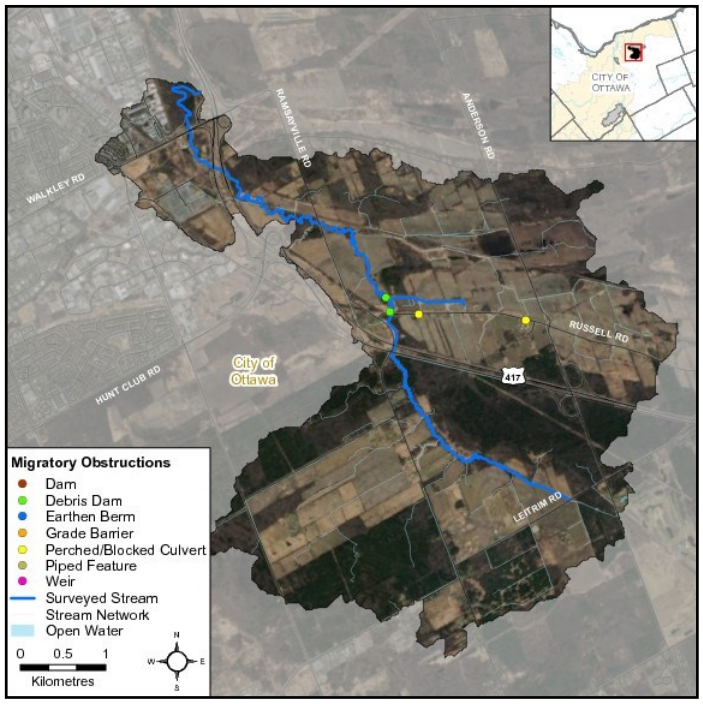


Figure 31 Locations of migratory obstructions along Ramsay Creek catchment

Beaver Dams

Beaver dams create natural changes in the environment. Some of the benefits include providing habitat for wildlife, flood control, and silt retention. Additional benefits come from bacterial decomposition of wood material used in the dams which removes excess nutrient and toxins. Beaver dams may be seasonal barriers to fish migration.

In 2019 a total of nine beaver dams were identified on the surveyed portions of Ramsay Creek and are shown in Figure 32.

An active beaver dam along Ramsay Creek near Generation Court

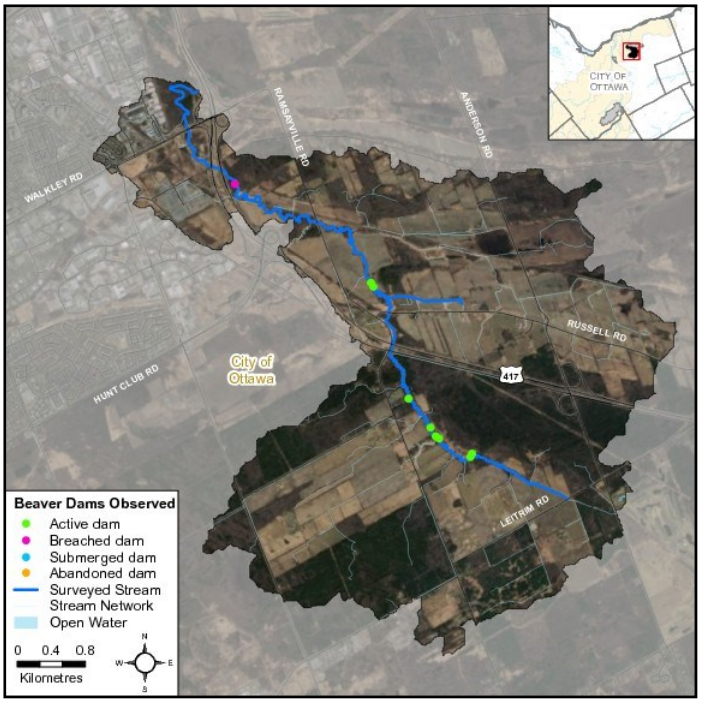


Figure 32 Locations of beaver dams along Ramsay Creek

Headwater Drainage Feature Assessment

Headwater drainage features (HDF) represent the origin from which water enters a watershed. These are small depressions, stream and wetland features that capture flows from groundwater discharge, rain and snow melt water and transport it to larger streams and rivers. In their natural state, they provide (OSAP, 2019):

- flood mitigation as water storage capacity
- water purification and groundwater discharge
- seasonal and permanent habitat refuge for fish, including spawning and nursery areas
- wildlife migration corridors/breeding areas
- storage and conveyance of sediment, nutrients and food sources for fish and wildlife

Headwaters Sampling

RVCA 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.

Features were evaluated as per the Ontario Stream Assessment Protocol (OSAP, 2019). This protocol measures zero, first and second order headwater drainage features. It is a rapid assessment method characterizing the amount of water, sediment transport, and storage capacity within headwater drainage features. In 2019 a total of 22 HDF sites were assessed in the Ramsay Creek Catchment (Figure 33).

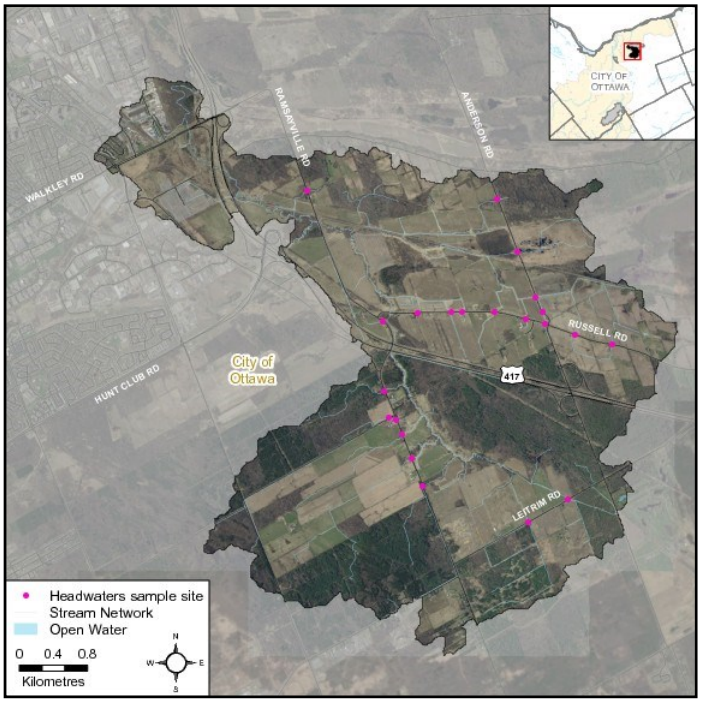


Figure 33 Location of headwater drainage feature sampling sites in the Ramsay Creek catchment

Feature Type

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.

Figure 34 shows the feature type of the primary feature at the sampling locations. The natural features included eleven defined natural channels, two wetlands, and one undefined feature. Seven features were channelized or constrained and one was a roadside ditch.

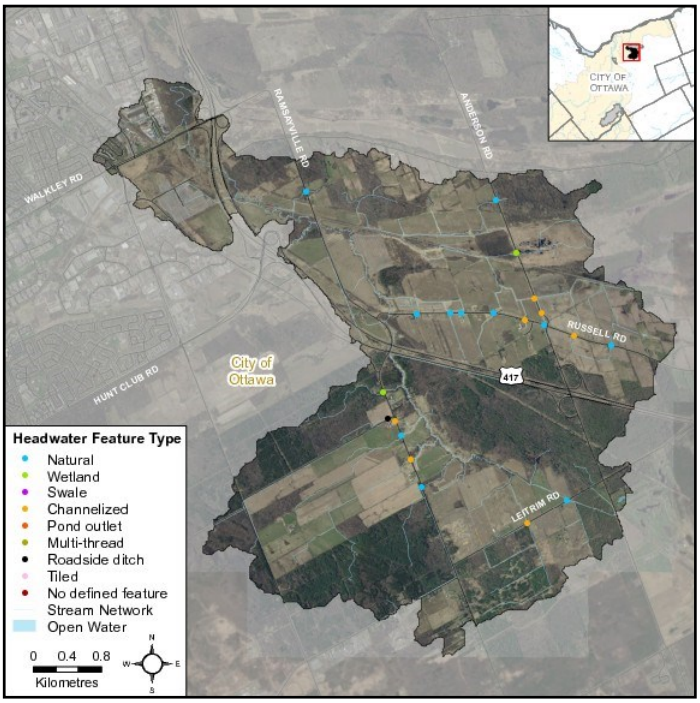


Figure 34 Map of Ramsay Creek catchment headwater drainage feature types

Natural wetland headwater drainage feature type on Anderson Road

Headwater Feature Flow

Flow conditions in headwater features can be variable throughout the year in response to yearly seasonal weather conditions. This protocol targets features that are perennial or intermittent. Intermittent flow conditions are those where water typically flows at least six months of the year. Perennial systems flow year round. Sites were observed in the spring and summer; flow conditions were compared. Drought conditions were experienced in 2019 which influenced flow conditions in the summer.

Flow conditions in the Ramsay Creek catchment area are shown in Figure 35.

Intermittent headwater drainage feature with spring and summer conditions along Anderson Road

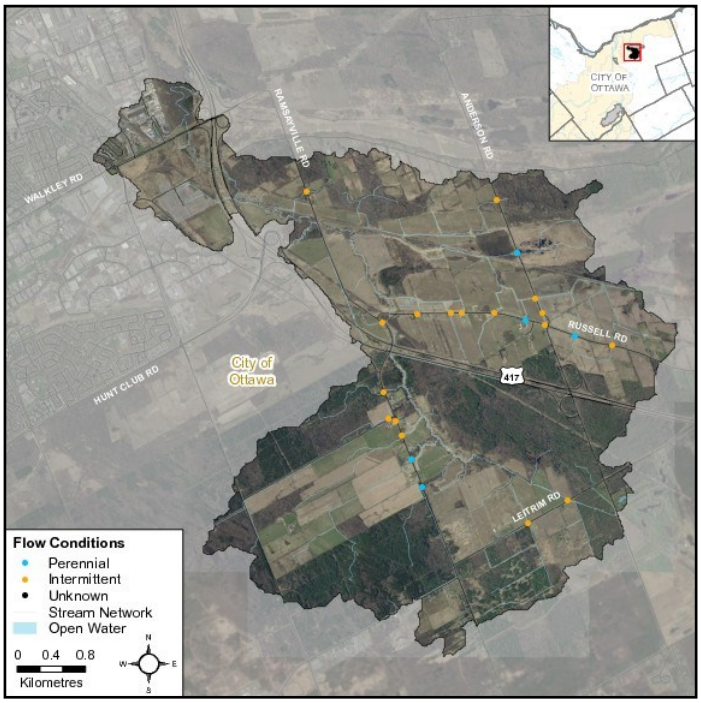


Figure 35 Headwater drainage feature flow conditions in the Ramsay Creek catchment

Feature Channel Modifications

Channel modifications can influence HDF conditions and function. Modifications that were of focus included dredging (and historical channel straightening), hardening (e.g. rip-rap, armourstone, gabion baskets) or on-line ponds.

Figure 36 shows channel modifications observed in Ramsay Creek headwater drainage features. Modifications in this catchment for its headwater drainage features include channel hardening with rip rap or gabion baskets, as well as dredging of channels.

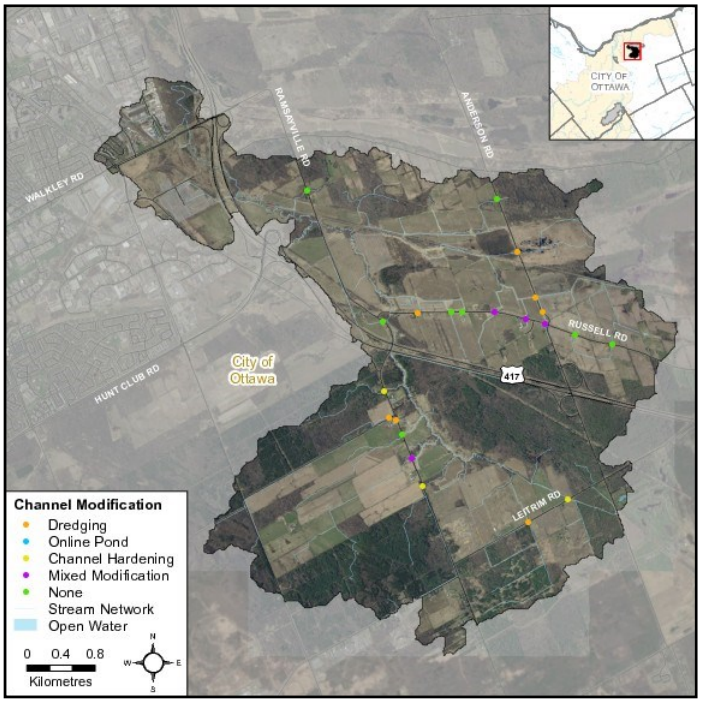


Figure 36 Headwater drainage feature channel modifications in the Ramsay Creek catchment

An example of a dredged headwater drainage feature on Russell Road

Headwater Feature Vegetation

Headwater feature vegetation evaluates the type of vegetation that is found within the drainage feature. The type of vegetation within the channel influences the aquatic and terrestrial ecosystem values that the feature provides. For some types of headwater features the vegetation within the feature plays an important role in flow, sediment movement and provides wildlife habitat. The following classifications are evaluated: none, lawn, wetland, meadow, scrubland and forest.

Figure 37 depicts the dominant vegetation observed at the sampled sites in the Ramsay Creek catchment. The majority of the features, 12, had dominant wetland vegetation, both water tolerant trees and shrubs as well as plants, including cattails and rushes. Four features were dominated by meadow vegetation. One feature had scrubland vegetation. Five features had no vegetation, where flows and sediment transport are unmitigated by the lack of vegetation.

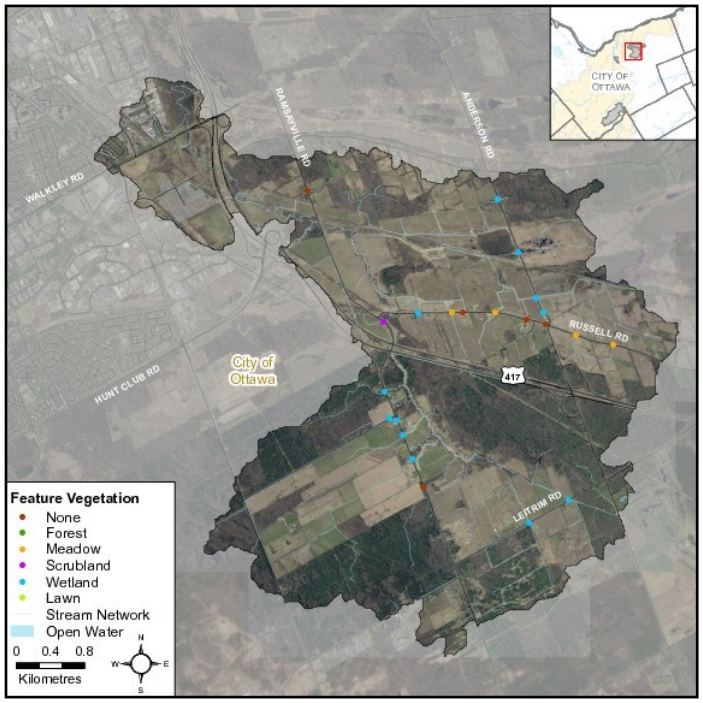


Figure 37 Headwater drainage in feature vegetation in the Ramsay Creek catchment

Meadow feature vegetation in a headwater drainage feature on Ramsayville Road

Headwater Feature Riparian Vegetation

Headwater riparian vegetation evaluates the type of vegetation that is found along the adjacent lands of a headwater drainage feature. The type of vegetation within the riparian corridor influences the aquatic and terrestrial ecosystem values that the feature provides to the watershed.

Figure 38 shows the type of riparian vegetation observed at the sampled headwater sites in the Ramsay Creek catchment. They are grouped as natural, and other riparian zones which have anthropogenic influences from agricultural areas, residential areas as well as infrastructure.

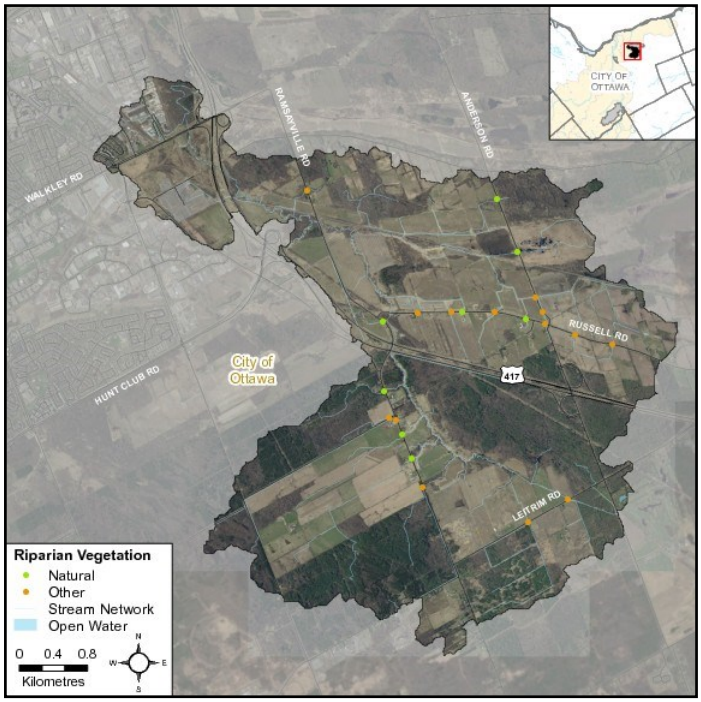


Figure 38 Riparian vegetation types along headwater drainage features in the Ramsay Creek catchment

Headwater drainage feature with some scrubland and cropped land as riparian vegetation on Russel Road

Headwater Feature Sediment Deposition

Assessing the amount of recent sediment deposition in a channel provides an index of the degree to which the feature could be transporting sediment downstream (OSAP, 2019). Sediment transport is a natural process, however, excessive sedimentation can be indicative of higher erosion than a natural system can accommodate. High sediment deposition can indicate the need for further assessment and potential implementation of best management practices.

From the features assessed, sediment deposition ranged from none to substantial. Six features had no evidence of sediment deposition. Six features had minimal sediment deposits. Four had moderate deposition levels. One feature had substantial amounts of deposition and five had extensive amounts. Figure 39 shows the levels of sediment deposition observed in the catchment headwaters.

Headwater Feature Upstream Roughness

Feature roughness is a relative measure of the amount of material within the feature that diffuses flows (OSAP, 2019). Materials on the channel bottom that provide roughness include vegetation, wood material as well as boulders and cobble substrates. Roughness can reduce erosion downstream of the feature, as well as providing important habitat to a variety of aquatic organisms, and producing food sources.

This parameter is categorized depending on the amount of roughness coverage in a channel: minimal (less than 10 %), moderate (10-40 %), high (40-60 %), and extreme (more than 60 %). In the Ramsay Creek catchment, four of the sites had minimal roughness, five had moderate, seven had high, and six had extreme coverage. Figure 40 shows the various feature roughness across the area.

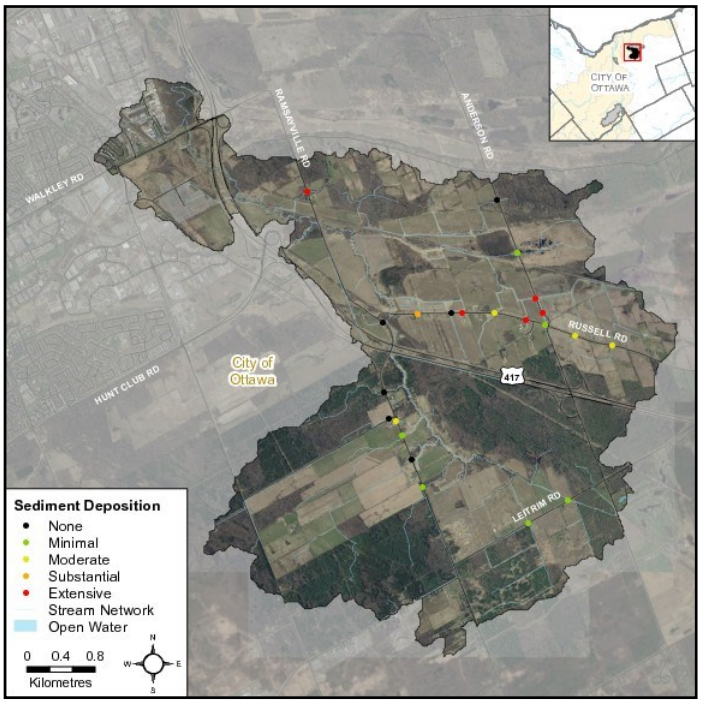


Figure 39 Headwater drainage feature sediment deposition in the Ramsay Creek catchment

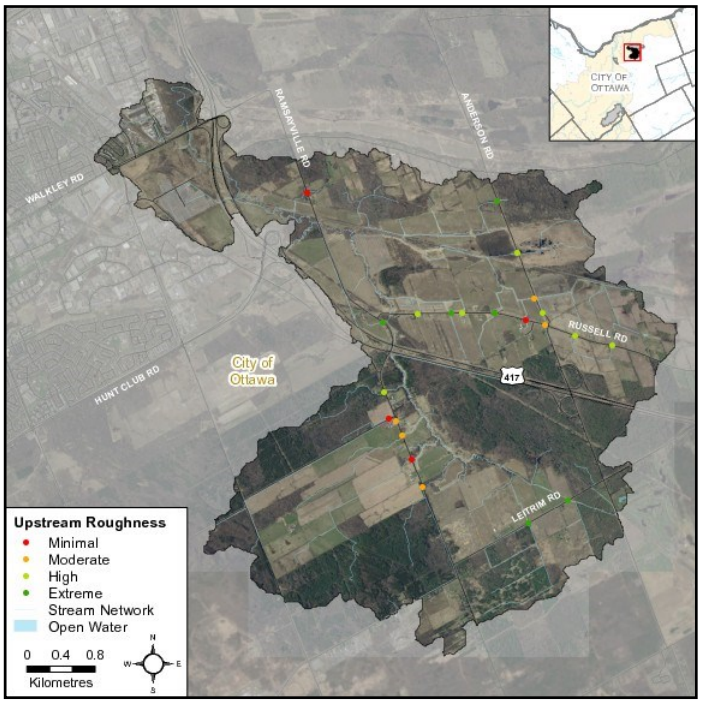


Figure 40 Headwater drainage feature roughness in the Ramsay Creek catchment

Substantial sediment deposition observed in a headwater drainage feature on Anderson Road

Extreme roughness due presence of materials that diffuse flow

Stream Comparison Between 2007, 2013 and 2019

The following tables provide a comparison of observations on Ramsay Creek between the 2007, 2013 and 2019 survey years (RVCA 2007, RVCA 2013). Monitoring protocols since 2007 have been modified and enhanced, only certain data from that year can be compared to later years. In order to accurately represent current and historical information, the data was only compared for those sections which were surveyed in both 2013 and 2019. This results in changes to our summary information, averages presented in this section differ from ones in previous pages of this report. This information is a comparative evaluation and doesn't represent the entirety of our assessment.

Water Chemistry

Water chemistry parameters are collected throughout all the sections surveyed in the stream. This criteria reflects the conditions and changes in the environment. Variation in these conditions can be attributed to environmental and ecological changes. Some can be in part due to natural variability within the system from various weather, seasonal, and annual conditions. Table 3 shows a comparison of these water chemistry parameters between 2013 and 2019.

Average pH increased from 2013 to 2019 by 0.08 units; specific conductivity increased by 139.7 µS/cm. The larger change observed is in specific conductivity indicating more ions present in 2019 compared to 2013. This variation could be attributed to the highway 417 repairs which were ongoing in 2019. Average dissolved oxygen levels were found to be higher by 0.3 milligrams per liter from 2013 to 2019. These levels are comparable across both cycle years with little difference.

Average summer water temperatures range from cooler water in 2019 (17.9°C) to warmer values in 2013 (18.2° C), with 0.3 degrees centigrade of variation. Temperatures in both cycle years are similar. Observations from 2013 were made from June to July, whereas observations in 2019 were made in June. Aside from these general temperature observations, loggers provide a detailed recording of stream thermal conditions. Standardized stream temperature assessments account for climatic factors including air temperatures and precipitation. With the data collected from temperature loggers at Ramsayville Road, standardized stream temperature factors were calculated and summarized in Table 3. This factor increased by 0.1° C for every degree of air temperature from 2013 to 2019. In both cycle years, Ramsay Creek at this site was classified as cool-warm water (methods from Chu et al., 2009).

Table 3 Water chemistry comparison (2013/2019)

Water Chemistry (2013/2019)				
Year	**Parameter**	**Unit**	**Average**	**STND Error**
2013	pH	-	7.67	± 0.03
2019	pH	-	7.75	± 0.04
2013	Sp. Conductivity	us/cm	786.3	± 25.1
2019	Sp. Conductivity	us/cm	926.0	± 27.1
2013	Dissolved Oxygen	mg/L	8.4	± 0.23
2019	Dissolved Oxygen	mg/L	8.7	± 0.35
2013	Water Temperature	ºC	18.2	± 0.24
2019	Water Temperature	ºC	17.9	± 0.40
2013	Standardized Stream Temperature Factor[1]	ºC Water / 1ºC Air	0.79	± 0.00
2019	Standardized Stream Temperature Factor[1]	ºC Water / 1ºC Air	0.80	± 0.28

[1] ***Standardized Stream Temperature:*** Temperature data is collected via logger and standardized based on the following conditions:

- Daily maximum air temperatures must exceed 24.5 ºC
- No precipitation for 3 days preceding measurement
- Measurements to be taken between 4:00PM—6:00PM
- Water temperature points collected from July 1st —September 10th
- Logger must be deployed in flowing waters

Invasive Species

The percentage of sections surveyed where invasive species were observed had a significant increase of 36 percent (Table 4). Purple loosestrife and curly-leaved pondweed had a reduction of observations. Other invasive species have expanded their range including buckthorn, dog strangling vine, garlic mustard, Himalayan balsam, Manitoba maple and yellow iris. There are also several species that were not previously reported, including wild parsnip, flowering rush, *Phragmites*, and goldfish.

Table 4 Invasive species presence (% of sections) observed in 2013 and 2019 (NPR are Not Previously Reported species)

Invasive Species	2013	2019	+/-
bull thistle	NPR	1%	▲
common & glossy buckthorn	18%	73%	▲
curly-leaved pondweed	8%	1%	▼
dog strangling vine	1%	18%	▲
flowering rush	NPR	15%	▲
garlic mustard	4%	27%	▲
goldfish	NPR	1%	▲
Himalayan balsam	4%	17%	▲
honey suckle (non-native)	NPR	32%	▲
Manitoba maple	26%	62%	▲
Phragmites	NPR	2%	▲
poison/wild parsnip	NPR	13%	▲
purple loosestrife	48%	35%	▼
rusty crayfish	NPR	2%	▲
yellow iris	3%	13%	▲
Total percent of sections invaded	**56%**	**92%**	▲

Pollution

Garbage accumulation on Ramsay Creek was found to decrease from 2007 to 2013 and remained similar in 2019. Table 5 shows pollution levels in all three monitoring years. The fact that some 33% fewer section, which had higher proportion of pollution, were surveyed in 2007 may have influenced this discrepancy.

Table 5 Pollution levels (presence in % of sections surveyed) comparison between2007-2019

Pollution/Garbage	2007	2013	2019	+/-
oil or gas trails	1%	0%	0%	▼
floating garbage	38%	27%	12%	▼
garbage on stream bottom	32%	33%	37%	▲
unusual colouration	0%	2%	1%	▼
other	69%	1%	2%	▲
Total polluted sections	**72%**	**42%**	**48%**	▲

Instream Aquatic Vegetation

Table 6 shows decreases in instream aquatic vegetation from 2013-2019. Narrow-leaved emergent plants (e.g. sedges), robust emergent plants (e.g. cattails), free-floating plants (e.g. duckweed), and floating plants (e.g. water lilies) were present in comparable abundance in both survey years. Broad leaved emergent plants (e.g. arrowhead), submerged plants (e.g. pondweed) and algae had lower observations in the number of sections surveyed. Declines seen may be associated with different seasonal plant emergence.

Table 6 Instream aquatic vegetation (presence in % of sections) comparison between 2013 and 2019

Instream Vegetation	2013	2019	+/-
narrow-leaved emergent plants	69%	76%	▲
broad-leaved emergent plants	70%	25%	▼
robust emergent plants	37%	32%	▼
free-floating plants	17%	12%	▼
floating plants	35%	40%	▲
submerged plants	74%	57%	▼
algae	48%	39%	▼

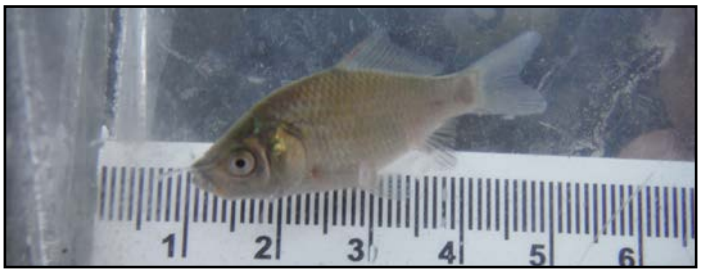
Fish Community

Fish sampling was carried out by the City Stream Watch program in 2007, 2013 and 2019 to evaluate fish community composition in Ramsay Creek (see Table 7). In total 20 species have been observed in Ramsay Creek. In 2007, 11 fish species were captured at two sites; in 2013, 16 species were observed at four sites; and 19 species were observed at five sites in 2019. Sample locations in 2019 were replicates of some of the previously sampled sites in 2007 and 2013.

The majority of species observed in 2019 had been captured in previous years, with the norther pearl dace, yellow bullhead and goldfish as new observations. It is also important to note goldfish are an invasive species (Scott and Crossman 1998), this species was not observed in 2007 and 2013.

Table 7 Comparison of fish species caught between 2007-2019

Species	2007	2013	2019
banded killifish *Fundulus diaphanus*		X	X
blacknose dace *Rhinichthys atratulus*	X	X	X
bluntnose minnow *Pimephales notatus*		X	X
brassy minnow *Hybognathus hankinsoni*		X	X
brook stickleback *Culaea inconstans*	X	X	X
central mudminnow *Umbra limi*	X	X	X
common shiner *Luxilus cornutus*	X	X	X
creek chub *Semotilus atromaculatus*	X	X	X
fathead minnow Pimephales promelas	X	X	X
golden shiner *Notemigonus crysoleucas*		X	X
goldfish *Carassius auratus*			X
johnny/tessalated darter *Etheostoma spp.*	X	X	X
largemouth bass *Micropterus salmoides*	X		
longnose dace *Rhinichthys cataractae*		X	X
northern pearl dace *Margariscus nachtriebi*			X
northern redbelly dace *Chrosomus eos*	X	X	X
pumpkinseed *Lepomis gibbosus*		X	X
troutperch *Percopsis omiscomaycus*	X	X	X
white sucker *Catostomus commersonii*	X	X	X
yellow bullhead *Ameiurus natalis*			X
Total Species 20	**11**	**16**	**19**



Invasive goldfish observed in Ramsay Creek north of Walkley Extension Road

Monitoring and Restoration

Monitoring on Ramsay Creek

Table 8 highlights recent and past monitoring that has been done on Ramsay Creek by the Rideau Valley Conservation Authority's City Stream Watch program. Monitoring activities and efforts have changed over the years.

Table 8 City Stream Watch monitoring on Ramsay Creek

Accomplishment	Year	Description
City Stream Watch Stream Monitoring	2007	7.4 km of stream was surveyed
	2013	10.1 km of stream was surveyed
	2019	11.0 km of stream was surveyed
City Stream Watch Fish Sampling	2007	Two fish community sites were sampled
	2013	Four fish community sites were sampled
	2019	Five fish community sites were sampled
City Stream Watch Thermal Classification	2007	Two temperature probes were deployed from June to September
	2013	Four temperature probes were deployed from June to September
	2019	One temperature probe was deployed from April to October
Headwater Drainage Feature Assessment	2013	24 headwater drainage feature sites were sampled in the catchment (included main stem of Ramsay Creek)
	2019	22 headwater drainage feature sites were sampled in the catchment
City Stream Watch Stream Garbage Clean-ups	2019	Volunteers assisted in cleaning over 200m of stream over one clean-up session
City Stream Watch Invasive Species Removal	2019	Volunteers assisted in the removal of Himalayan balsam over one removal session

Volunteers assisting on a stream survey along Ramsay Creek

Volunteer co-op student installing a temperature logger on Ramsay Creek at Letrim Road

Instream Restoration Opportunities

Instream opportunities include channel modification and garbage clean ups. Opportunities were identified along Ramsay Creek surveyed areas (Figure 41).

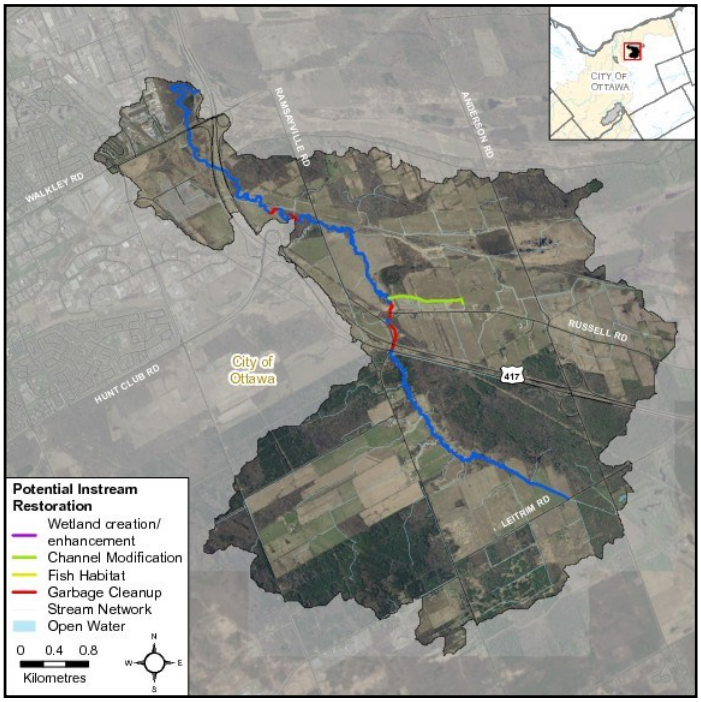


Figure 41 Potential instream restoration opportunities along Ramsay Creek and its headwater reaches

Channel Modification

The branch of Ramsay Creek that was surveyed could benefit from channel enhancement. This area would benefit from modifying the channel to reflect a more natural channel design.

Branch of Ramsay Creek that would benefit from channel enhancement north of Russel Road

Garbage Clean up

Tire pollution was prevalent along surveyed portions of Ramsay Creek. Many areas near Russell Road (Figure 41) had a high concentration of tires. Efforts to remove these tires as well as other car parts including an engine block and other debris were employed.

Tires found along surveyed portions of Ramsay Creek (above) were removed by volunteers and staff (below)

Other Enhancement Opportunities

Down lines were observed along surveyed portions of Ramsay Creek west of Ramsayville Road. The communication lines were abandoned by Canadian National Railway in 1999 after the ice storm. Maintenance staff from Rail-Term removed the lines after being advised of the findings by the National Capital Commission.

Before (left) and after (right) the removal of abandoned communications lines on Ramsay Creek near Ramsayville Rd

Potential Riparian Restoration Opportunities

Riparian restoration opportunities include potential enhancement through riparian planting, mitigation, tile outlet control and invasive species management. Opportunities were identified in the Ramsay Creek catchment (Figure 41).

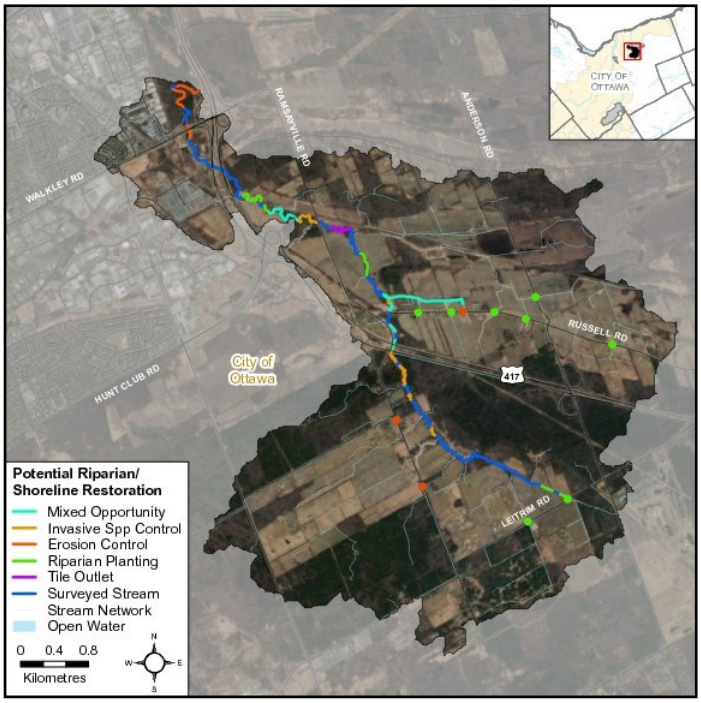


Figure 42 Potential riparian/shoreline restoration opportunities along Ramsay Creek and its headwater reaches

Erosion Mitigation

Some sections of Ramsay Creek can benefit from bank stabilization using bioengineering methods. During stream surveys the use of rip rap and gabion baskets was observed, other methods that would be benefit the creek include the installation of fascines, brush mattresses, soil wrapping and live-staking.

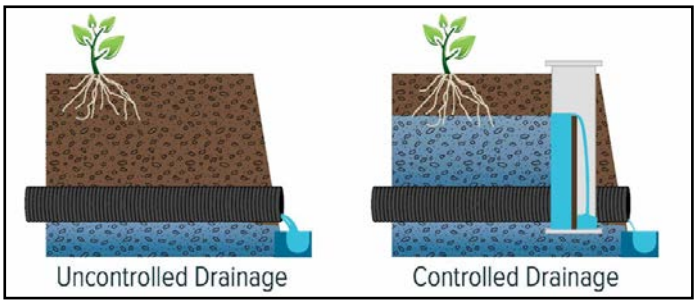
Section of Ramsay Creek that would benefit from erosion mitigation west of Ramsayville Road

Riparian Planting

Various riparian areas of Ramsay Creek and its tributaries can benefit from planting to increase plant diversity. Many sections had riparian buffers of low plant diversity. Additional planting would increase shading, enhance wildlife habitat, prevent soil erosion and mitigate negative impacts from runoff and anthropogenic input.

Tile Outlet Control

Due to the high agricultural land use in the Ramsay Creek catchment, many areas could benefit from tile outlet control. This involves placing structures at the head of tile drains to retain water and nutrients in the field during growing season. It has been demonstrated through research that water quality and crop yields increase with the use of these structures. On average fields of corn see a three percent yield increase and soy can have up to four percent (Agriculture & Agri-food Canada, 2010).



Tile Outlet Control Schematic, image courtesy of Ontario Soil and Crop Improvement Association (above), and an aerial photo of a field with tile outlet control, photo courtesy of South Nation Conservation (below)

Invasive Species Control

Invasive species management is recommended in the most upstream locations to reduce the areas affected. Himalayan balsam in particular has a known vector source, McEwan Creek, this tributary would also need to be included in a management plan. Some efforts were implemented in 2019 to remove plants, however seeds and new plant emergence should be targeted in the future.

Yellow Iris is another invasive plant that was observed in small clusters throughout, these plants may be effectively managed due to their isolated state.

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For more information on the 2019 City Stream Watch Program and the volunteer activities, please refer to the City Stream Watch 2019 Summary Report:

https://www.rvca.ca/rvca-publications/city-stream-watch-reports

RVCA City Stream Watch would like to thank all the **volunteers** who assisted in the collection of information; as well as the many **landowners** who gave us property access to portions of the stream; and to our **City Stream Watch Collaborative members**: City of Ottawa, National Capital Commission, Ottawa Flyfishers Society, Canadian Forces Ottawa Fish and Game Club, Ottawa Stewardship Council, Rideau Roundtable, South Nation Conservation, Mississippi Valley Conservation Authority and Rideau Valley Conservation Authority