Taylor Creek 2018 Catchment Report

Watershed Features	
Area	10.35 square kilometres 0.24% of the Rideau Valley watershed
Land Use	1.79% agriculture 62.61% urban 7.32% forest 4.05% meadow 2.71% rural 0.09% waterbody 21.44% wetland
Surficial Geology	70.46% clay 1.69% diamicton 3.09% organic deposits 4.78% Paleozoic bedrock 9.72% sand 10.25% unknown in the Ottawa River area
Watercourse Type	2018 thermal conditions Coolwater system
Invasive Species	Five invasive species were identified in 2018: bull thistle, Himalayan balsam, Manitoba maple, purple loosestrife, yellow iris
Fish Community	8 species of fish have been observed from 2012-2018. Game fish species include: rock bass and yellow perch

Wetland Catchment Cover
20.04% evaluated wetland
1.40% unevaluated wetland

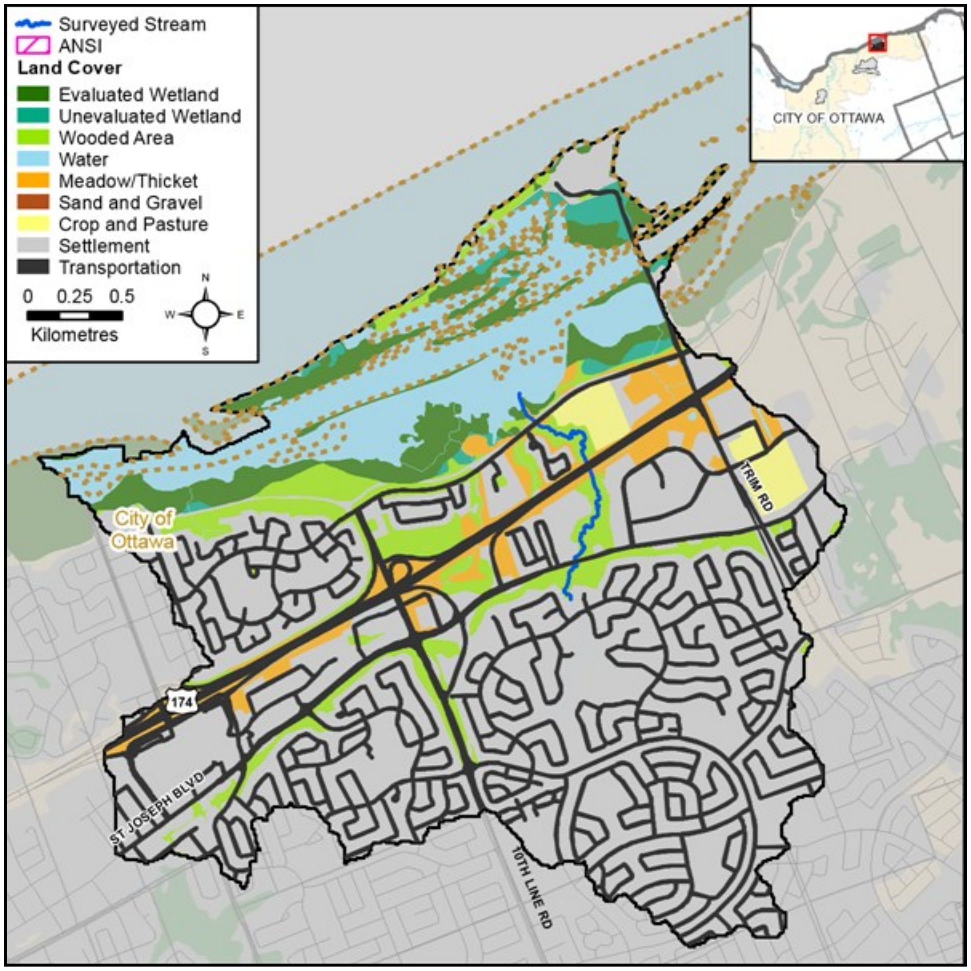


Figure 1 Land cover in the Taylor Creek catchment

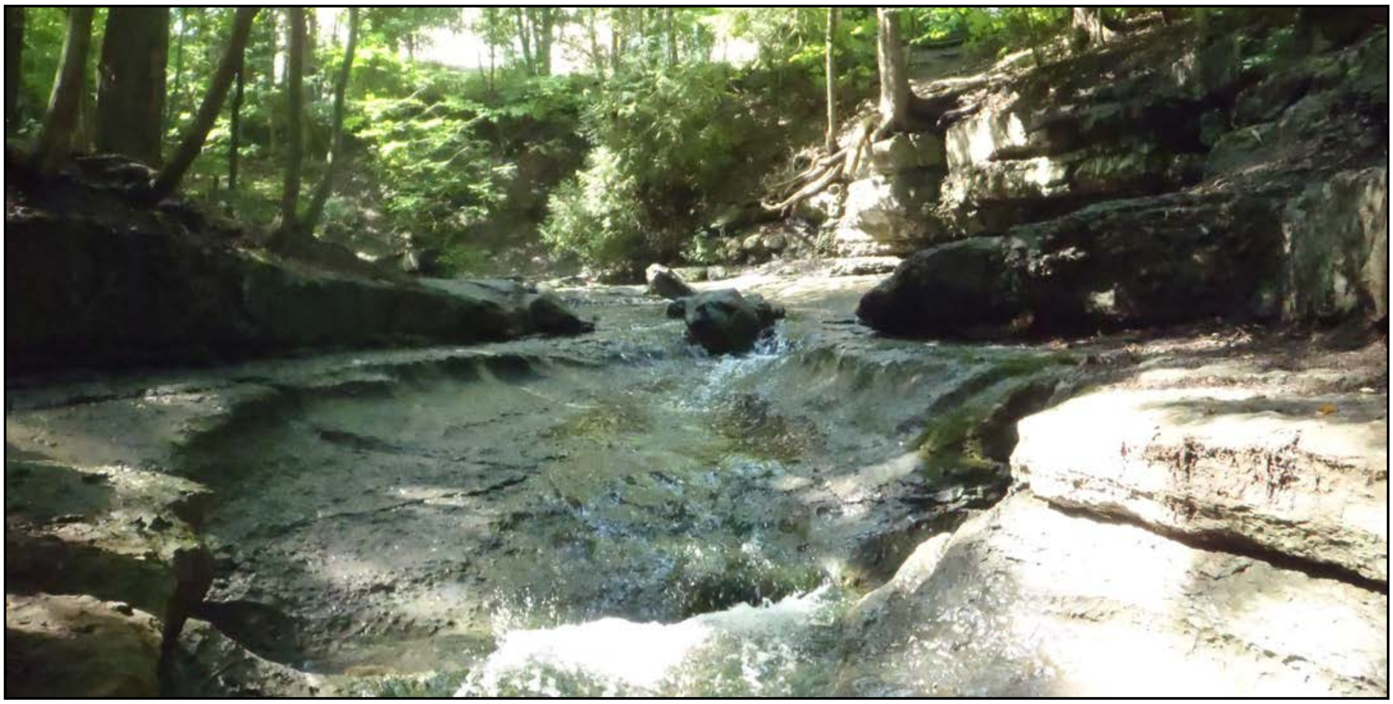
Mouth of Taylor Creek near the Ottawa River

The Rideau Valley Conservation Authority, in partnership with eight other agencies in Ottawa, form the 2018 City Stream Watch Collaborative: South Nation Conservation Authority, Mississippi Valley Conservation Authority, City of Ottawa, Ottawa Flyfishers Society, Ottawa Stewardship Council, Rideau Roundtable, Canadian Forces Fish and Game Club, and the National Capital Commission.

Introduction

Taylor Creek is a tributary of the Ottawa River located just west of Trim Road in the east end of the City of Ottawa. The creek originates in the Fallingbrook Community east of 10th Line road and empties into the Ottawa River at Petrie Island, a provincially significant wetland. The upper reaches of Taylor Creek are entombed, with water surfacing north of Princess Louise Drive. From that point the creek quickly flows into an area of karst topography including the Princess Louise Falls south of St. Joseph boulevard. This section of the creek is a popular recreation destination with pathways connecting it to nearby residential areas. From St. Joseph Boulevard, Taylor Creek flows north crossing Highway 174 and Jeanne D'arc Boulevard before it reaches the Ottawa River. Due to increased development pressure in the area, in 2009 and 2010 the City of Ottawa carried out erosion control measures on Taylor Creek to help remediate some of the severe erosion on the Creek.

In 2018, the City Stream Watch program surveyed fourteen 100 meter sections of Taylor Creek. Four sites were sampled for fish community composition.



Low Water Conditions - Rideau Valley Watershed

Low Water Conditions

Prolonged periods of hot dry weather punctuated by heavy rainfall events characterized 2018. The year began close to normal however March had less than normal precipitation. The spring freshet in early April was significant but the forecasted rain didn't materialize and peak flows were only slightly above average. The dry weather came on through May, continued through June and as of July 10th 2018, the conditions in the Rideau Valley Watershed were declared to be at the minor low water status. At this time, stream flows were below normal but still above critical thresholds. (RVCA, 2018) Twenty five days with temperatures above 30 degrees, 15 of those in July, contributed to the overall drought condition in the watershed. As of July 19th the status within the watershed reached moderate severity.

On August 2nd this status was reduced back to minor severity with significant rainfalls measured through eastern Ontario in late July. Rain in the lower reaches of the watershed continued through August and into September. As of September 27th 2018, the low water status in the lower Rideau River Watershed returned to normal.

Taylor Creek Overbank Zone

Riparian Buffer Width Evaluation

The riparian buffer is the adjacent land area surrounding a stream or river. Naturally vegetated buffers are very important to protect the overall 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 Taylor Creek. Buffers greater than 30 meters were present along 84 percent of the left bank and 75 percent of the right bank. A five meter buffer or less was present along 16 percent of the left banks and 25 percent of the right bank. These sections with reduced buffer width were found in the last few sections downstream and upstream of St. Joseph Boulevard.

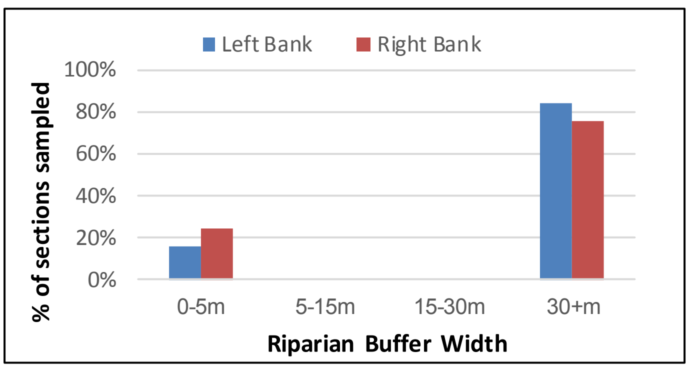


Figure 2 Vegetated buffer width along Taylor Creek

Vegetated buffer along Taylor Creek

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 percentage of anthropogenic alterations to the natural riparian cover are shown in Figure 3.

Taylor Creek riparian zones have primarily natural vegetative communities; alterations are associated with channel straightening and infrastructure, including roadways, and pedestrian pathway crossings.

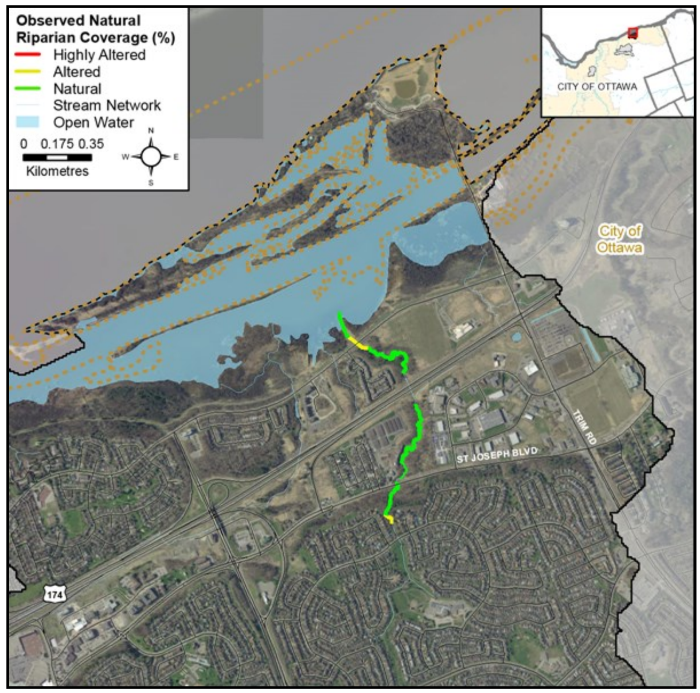


Figure 3 Riparian buffer alterations in Taylor Creek

Gabion baskets altering the left bank of Taylor 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.

The most common land uses found were forest and scrubland, each present in 79 percent of the sections surveyed. Meadows were present in 71 percent of the surveyed areas, and wetland was present in seven percent of the sections.

Aside from the natural areas, the most common land uses in the catchment were infrastructure, industrial/commercial and residential uses each present in 43 percent of the sections. Other uses observed included 7 percent of surveyed areas with recreational uses. These sections were found upstream of Princess Louise Falls.

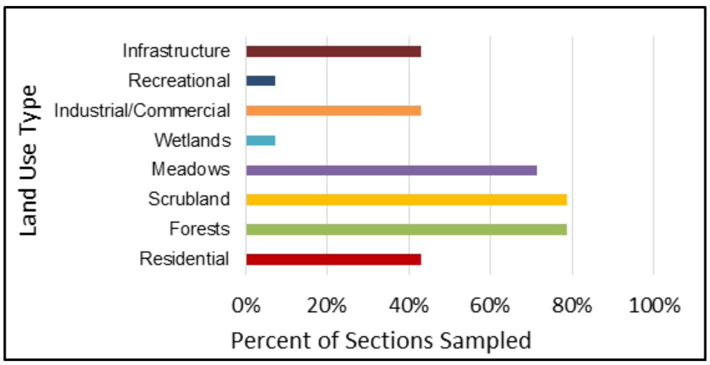


Figure 4 Adjacent land use 100 meters from each shoreline and percentage of presence along Taylor Creek

Taylor Creek Shoreline Zone

Anthropogenic Alterations

Stream alterations are classified based on specific functional criteria associated with the flow conditions, the riparian buffer and potential human influences.

Figure 5 shows the level of anthropogenic alterations for Taylor Creek, with 21 percent remaining without any human alteration. Of the sections surveyed, 29 percent fall in the classification of natural. Natural sections have not been straightened or diverted, have a riparian buffer greater than 15 meters, contain few lawns, ornamental gardens, beaches, rip rap or constructed wooden structures.

Altered sections account for 21 percent of surveyed areas, they may contain diverted or straightened sections and riparian buffers of five to 15 meters.

Highly altered sections account for 29 percent of surveyed sections. These sections pass through culverts, have multiple storm water outlets are straightened and a riparian buffer less than 5 meters.

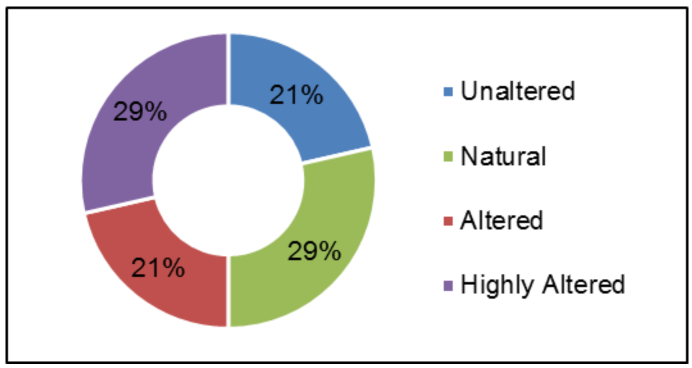


Figure 5 Anthropogenic alterations along Taylor Creek

Section along Taylor Creek with scrubland and forest land uses

A highly altered section in the upper reaches of Taylor Creek

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 overall 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 the levels of stream erosion observed across the surveyed portions of Taylor Creek.

Erosion was observed in 50 percent of the surveyed portions of Taylor Creek. The majority of these sections showed low levels of erosion. Higher levels of erosion were observed downstream of Highway 174 and downstream of Princess Louise Falls at St. Joseph Blvd.

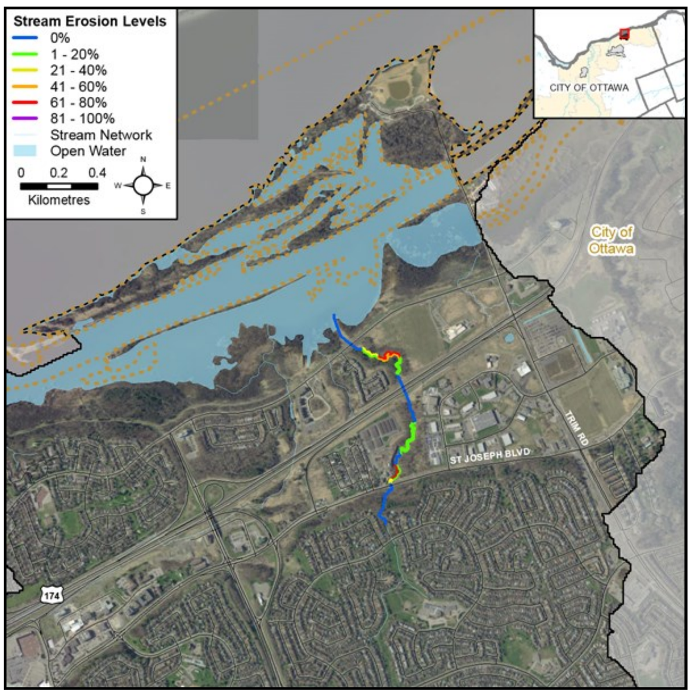


Figure 6 Erosion levels along Taylor Creek

Bank erosion observations along Taylor Creek

Undercut Stream Banks

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

Figure 7 shows that undercut banks were present in over half of the sections surveyed in Taylor Creek. Sixty-four percent of the sections had undercutting in the left bank and 57 percent of the right bank.

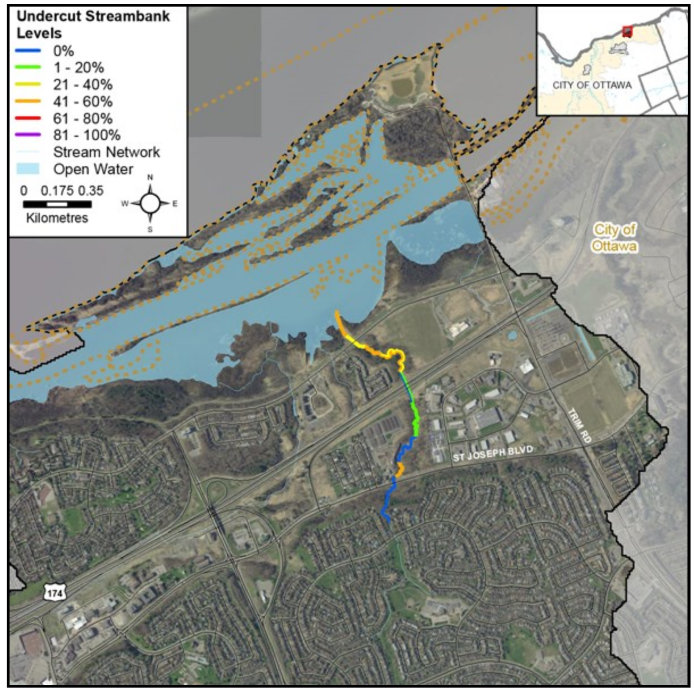


Figure 7 Undercut stream banks along Taylor Creek

Undercutting along Taylor 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 shading 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 (29 percent) had a shade cover of one to 20 percent. The highest shading of 81 to 100 percent was not observed in any of the sections. Shading of 61 to 80 percent was present in 21 percent of the sections; 21 percent of the sections had 41 to 60 percent shading; 14 percent had 21 to 40 percent shading and 14 percent had no shading. Figure 9 shows the distribution of these shading levels along Taylor Creek.

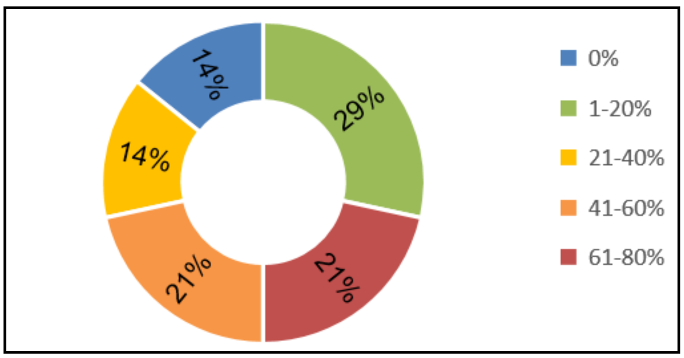


Figure 8 Stream shading along Taylor Creek

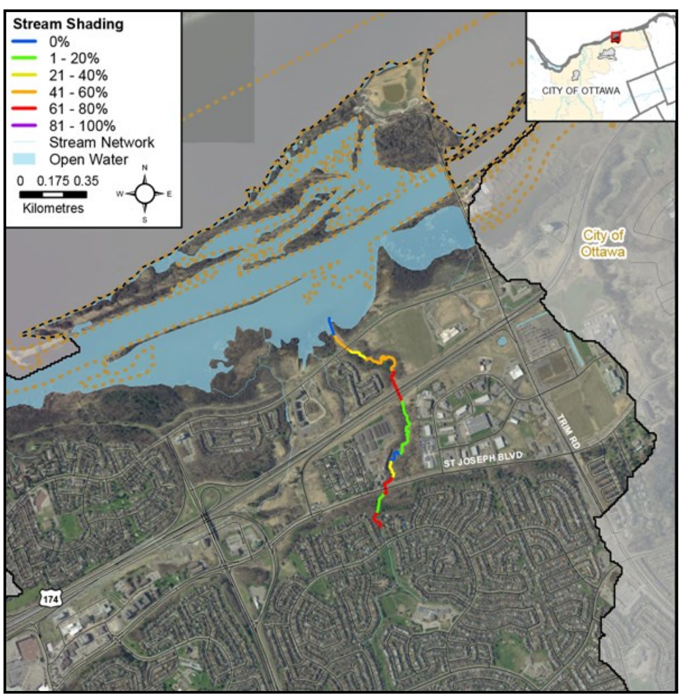


Figure 9 Stream shading along Taylor Creek

A mix of trees and plants comprised the majority of shading. Overhanging plants, mainly grasses were seen in 43 percent of the left bank and 43 percent of the right bank.

Overhanging Wood Structure

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 of overhanging wood structure observed along Taylor Creek. Seventy one percent of the sections had overhanging trees and branches on the left bank, and 57 percent of the sections had overhanging trees on the right banks.

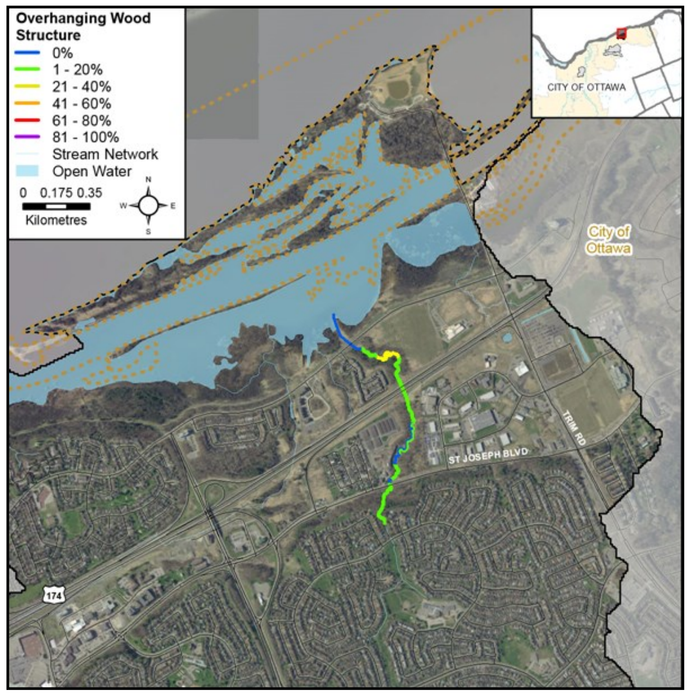


Figure 10 Overhanging wood structure along Taylor Creek

Overhanging trees and branches along the left bank of Taylor Creek

Taylor Creek Instream Aquatic Habitat

Habitat Complexity

Habitat complexity is a measure of the overall 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, flow 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: zero percent had no complexity; 7 percent had a score of one; 43 percent scored two; 43 percent scored three; and 7 percent, or just one section, had high habitat diversity.

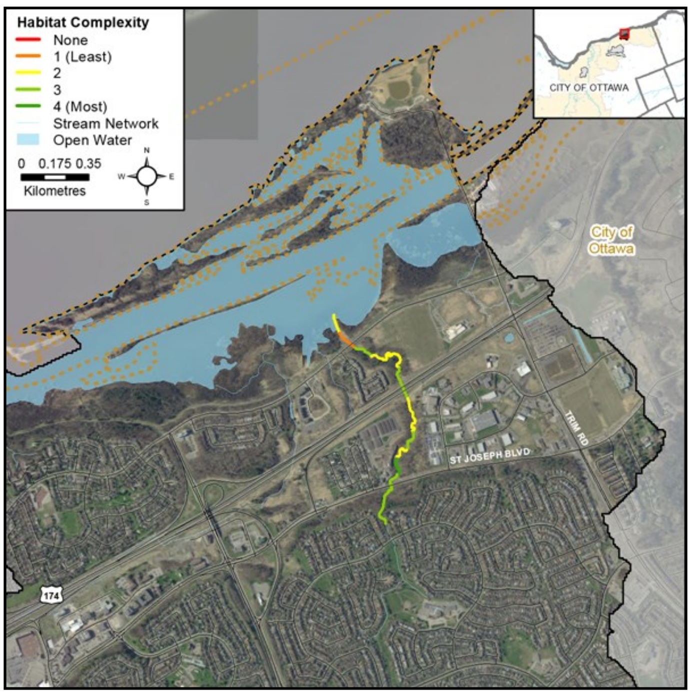
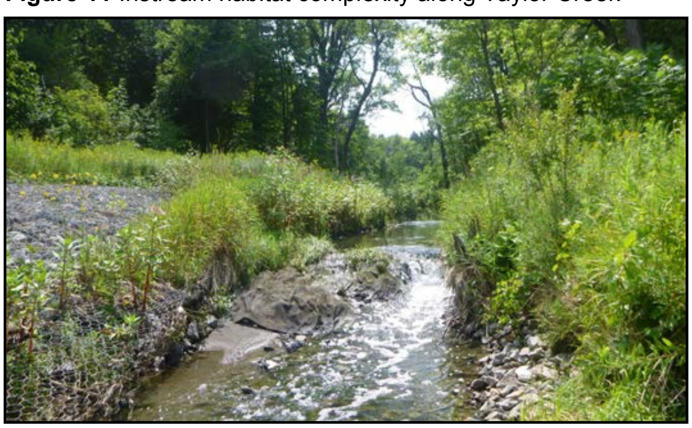


Figure 11 Instream habitat complexity along Taylor Creek



Section of Taylor Creek featuring riffle and run habitat

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 overall diversity of species within a stream.

Figure 12 shows the substrates present in the sections of Taylor Creek. It is a system dominated by clay, with 86 percent of sections containing this type of substrate. It also has substantial amounts of sand, gravel, silt and cobble and the presence of boulders and bedrock.

Figure 13 shows the dominant substrates along the creek. Gravel was the dominant substrate type in 36 percent of sections. Clay was dominant in 29 percent of sections; silt and bedrock were both dominant in 14 percent of sections; and cobble was dominant in 7 percent.

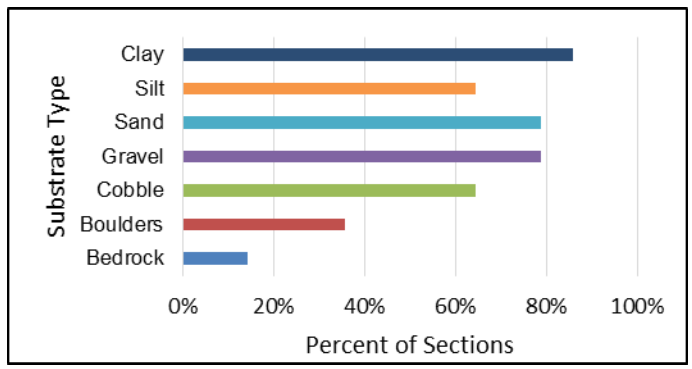


Figure 12 Instream substrate along Taylor Creek

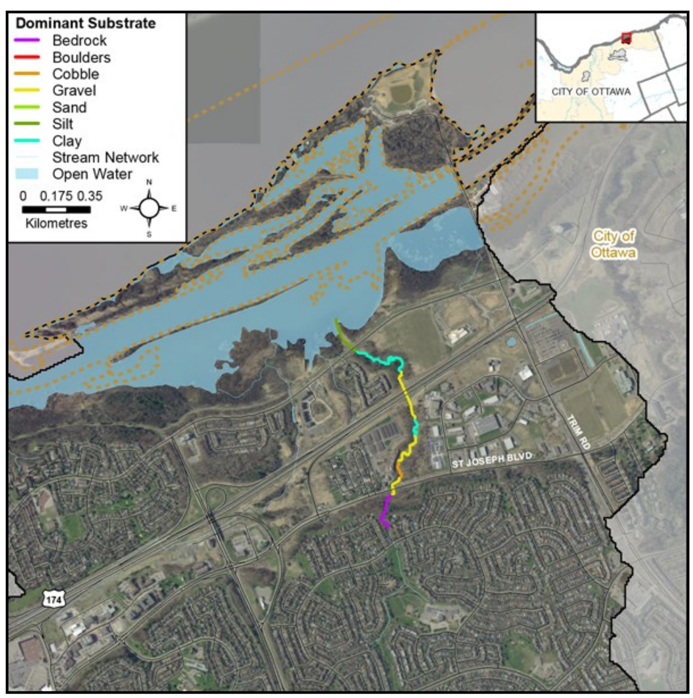


Figure 13 Dominant instream substrate along Taylor Creek

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 high 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 Taylor Creek has a diversity of morphological conditions, suitable for a variety of aquatic species and life stages; 71 percent of sections contained pools, 86 percent contained riffles and the majority, 93 percent, contained runs. Figure 15 shows the locations of riffle habitat along Taylor Creek.

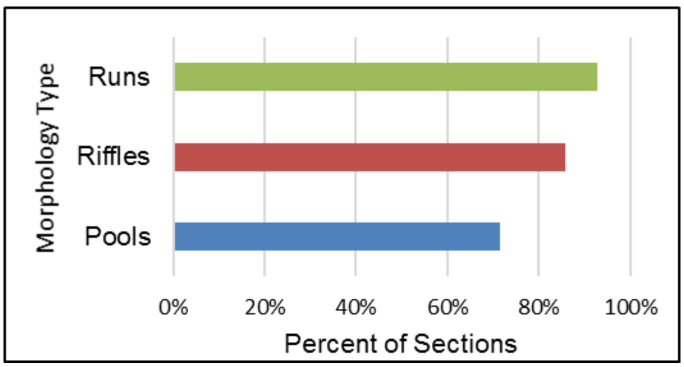


Figure 14 Instream morphology along Taylor Creek

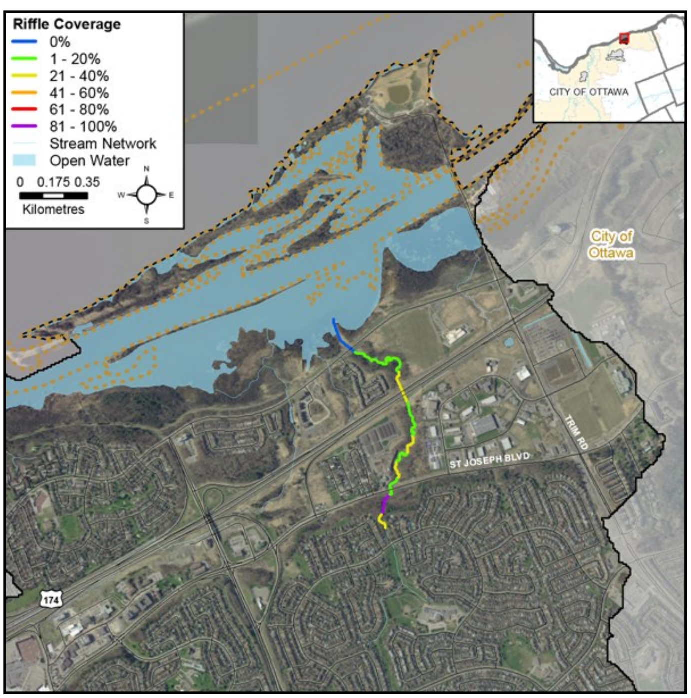


Figure 15 Riffle habitat locations along Taylor Creek

Instream Wood Structure

Figure 16 shows that many sections of Taylor Creek had low levels of instream wood structure in the form of branches and trees. There were also sections in the upper and lower reaches which had no wood structure present. Instream wood structure is important for fish and wildlife habitat, by providing refuge and feeding areas. Excessive amounts can create temporary migration barriers.

Instream wood structure found along Taylor Creek

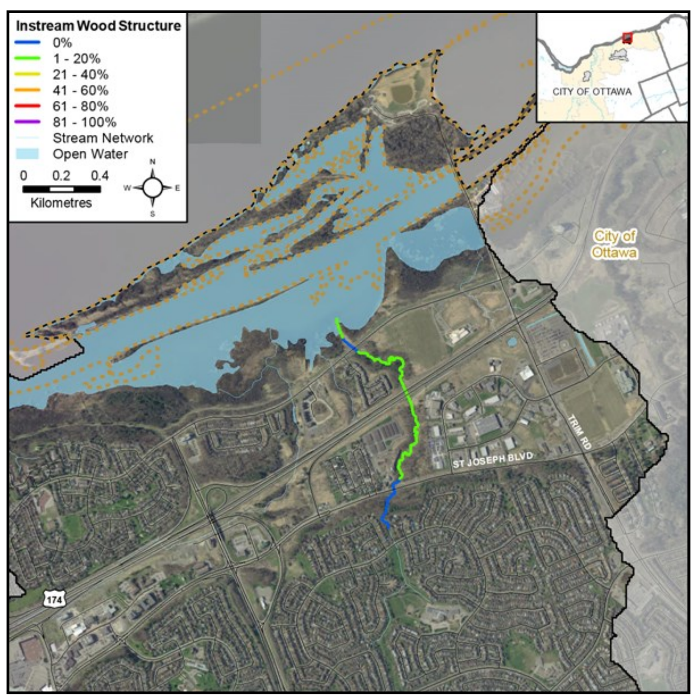


Figure 16 Instream wood structure along Taylor Creek

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. Taylor Creek is a very flashy stormwater fed system which makes it difficult for vegetation to become established. No vegetation was found in 86 percent of sections. The two types most commonly present were narrow-leaved emergents found in 71 percent of sections, and algae present in 57 percent of sections surveyed. Floating vegetation was also present in seven percent of sections.

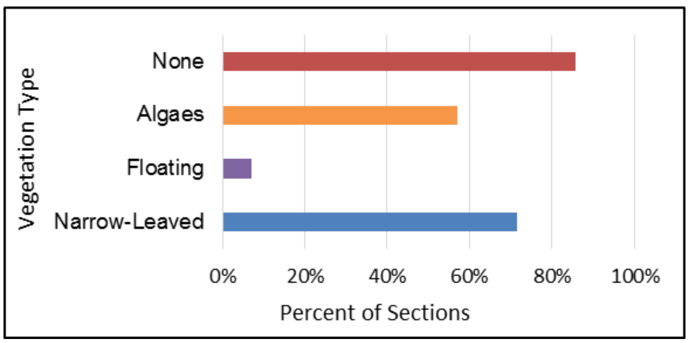


Figure 17 Aquatic vegetation presence along Taylor Creek

Taylor Creek does not have a large diversity of instream aquatic vegetation, and as seen in Figure 18, it is the dominant type in 57 percent of sections.

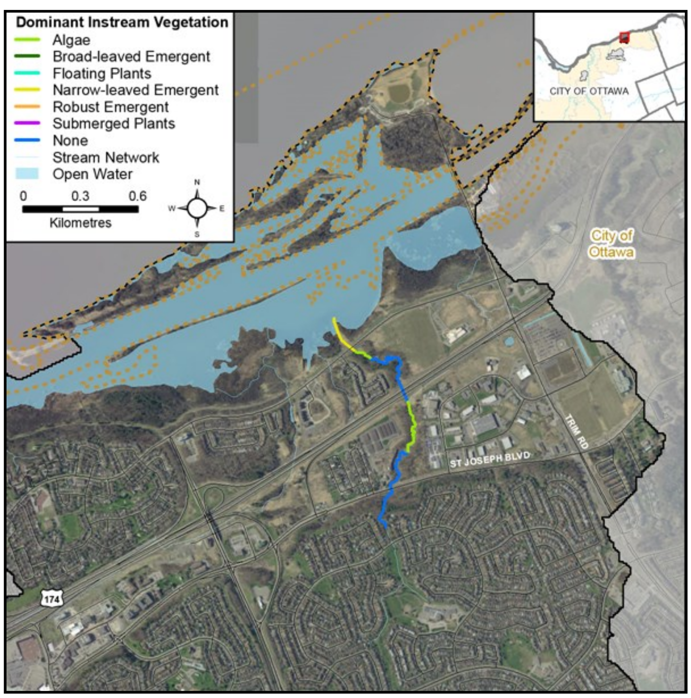


Figure 18 Dominant instream vegetation distribution in Taylor Creek

Instream Vegetation Abundance

The abundance of instream vegetation is also crucial for overall 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.

As seen in Figure 19, 64 percent of Taylor Creek sections had rare levels of vegetation, 64 percent of sections had no vegetation, seven percent had normal, and 14 percent had low levels of vegetation.

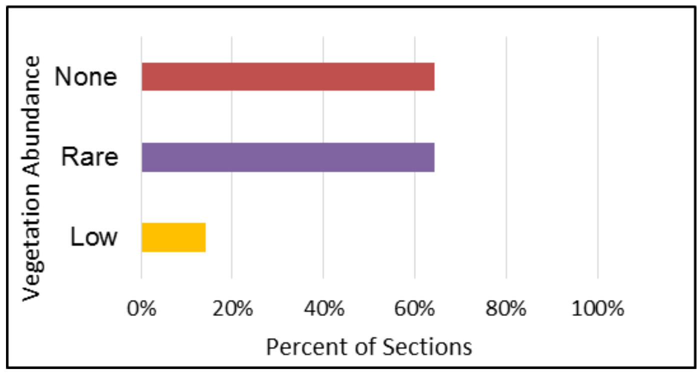


Figure 19 Instream vegetation abundance along Taylor Creek

Narrow leaved vegetation found along Taylor Creek

Section of Taylor Creek with no vegetation due to bedrock substrate

Taylor Creek Stream Health

Wildlife

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

Table 1 Wildlife observed along Taylor Creek in 2018

Birds	mallard ducks, great blue heron, red-winged blackbird, song birds, sparrows
Reptiles & Amphibians	green frog, bullfrog, leopard frog, turtle egg, garter snake
Mammals	vole, chipmunks, squirrels
Benthic Invertebrates	water striders, whirligig bee-tles
Other	butterflies, dragonflies, mos-quitoes, spiders, snails

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.

Figure 20 shows abundance of species observed per section. Five invasive species were observed in 2018:

- Manitoba maple (*Acer negundo*)
- purple loosestrife (*Lythrum salicaria*)
- Himalayan balsam (*Impatiens glandulifera*)
- yellow iris (*Iris pseudacorus*)
- bull thistle (*Cirsium vulgare*)

Himalayan balsam found along Taylor Creek

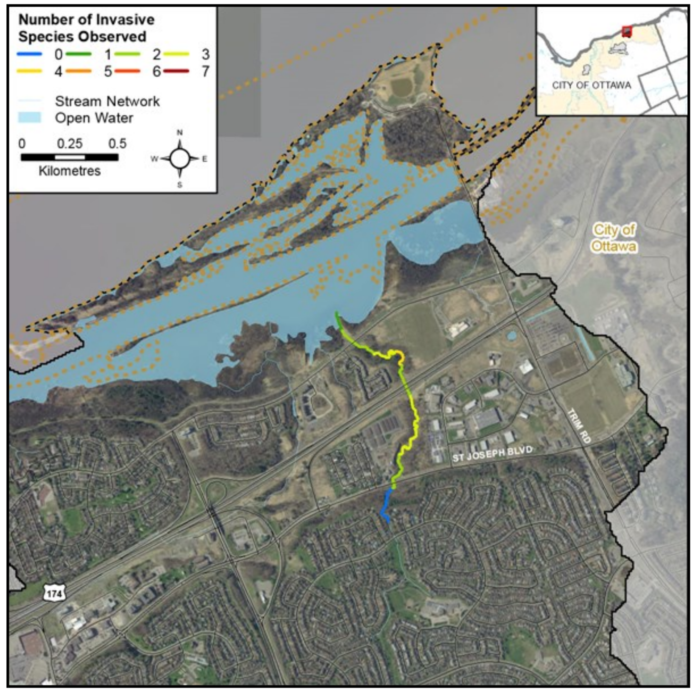


Figure 20 Invasive species abundance along Taylor Creek

To report and find information about invasive species visit

http://www.invadingspecies.com

Managed by the Ontario Federation of Anglers and Hunters

Pollution

Figure 21 shows the types of pollution observed in Taylor Creek. The levels of garbage found in the main portion of the stream were high, with 93 percent of sections containing garbage on the stream bottom and 71 percent of sections containing floating garbage. Seven percent of the sections surveyed had unusual coloration.

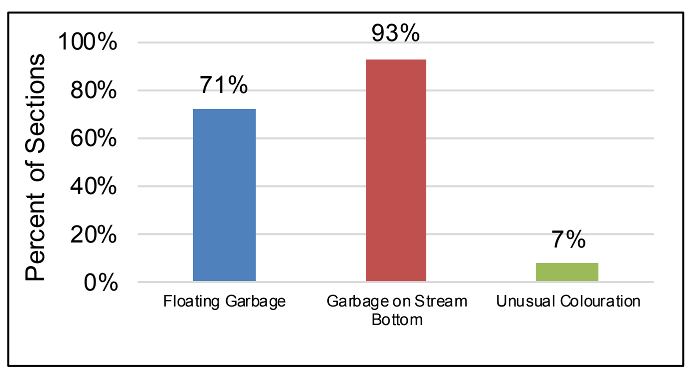


Figure 21 Pollution observed along Taylor Creek

Taylor 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.

A volunteer collecting water chemistry measurements with a 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 Taylor Creek. The two dashed lines depicted represent the Canadian water quality guidelines. All of the surveyed portions had adequate oxygen levels to support warm and cool water aquatic life, with two sections having oxygen levels adequate to support cold -water biota. Average levels across the system were 9.0 milligrams per liter.

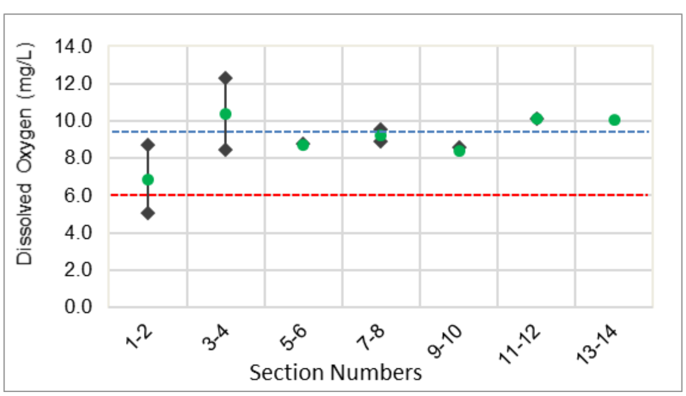


Figure 22 Dissolved oxygen ranges along Taylor Creek

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 Taylor Creek, the average level is depicted by the dashed line (1546 µS/cm). Notable variability was observed in the upper reaches of the creek from downstream of St. Joseph Blvd. to Princess Louise Drive (sections 11-14).

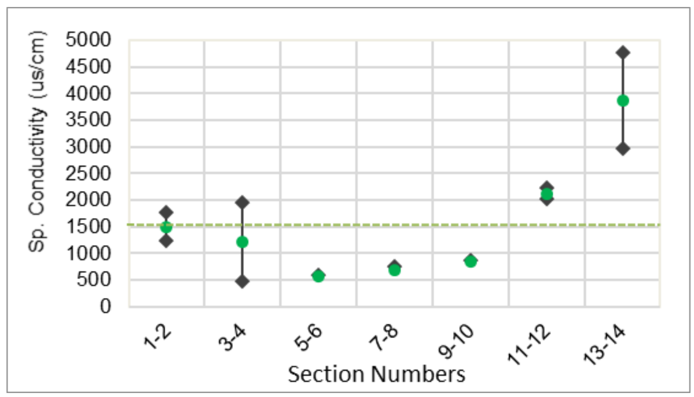


Figure 23 Conductivity ranges along sections of Taylor Creek

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 Taylor Creek had pH levels that meet the PWQO, depicted by the dashed line. Average levels across the system were pH 7.91.

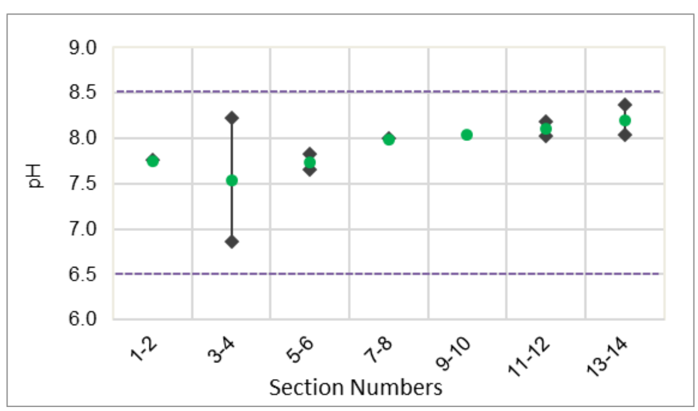


Figure 24 pH ranges along Taylor Creek

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.

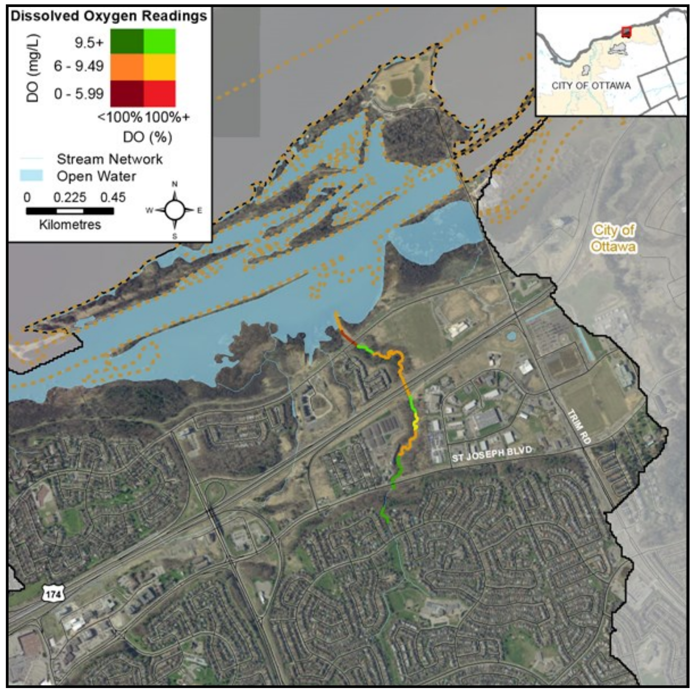


Figure 25 Bivariate assessment of dissolved oxygen concentration (mg/L) and saturation (%) along Taylor Creek

Figure 25 shows the oxygen conditions across the areas that were surveyed in 2018. Overall dissolved oxygen conditions in Taylor Creek are sufficient to sustain warm-water biota in areas near the confluence to the Ottawa River, downstream of Highway 174 and between Highway 174 and St. Joseph Blvd. Sections downstream of Jeanne D'Arc Blvd., shown in dark red Figure 25, have levels of impairment both in concentration and percent saturation. These areas have wetland features that have naturally lower oxygen levels, however these can be further limited by extensive vegetation growth of invasive species, and anthropogenic nutrient input.

In the upper reaches near Princess Louise Falls and upstream of Highway 174, there are conditions sufficient to support cold-water biota. These areas are shaded and contain riffle habitat that is conducive to oxygenation.

Site on Taylor Creek with **impaired** oxygen conditions (Dissolved oxygen levels of 4.75 mg/L and 53.1% saturation)

Site on Taylor Creek with **optimal** oxygen conditions (Dissolved oxygen levels of 10.17 mg/L and 100.6% 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 storm water, 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 conductivity in Taylor Creek (1546.5 µS/cm) exceed the federal guidelines for freshwater (500 µS/cm) used for the Canadian Environmental Performance Index (Environment Canada 2011).

Figure 26 shows relative specific conductivity levels in Taylor Creek. Normal levels were maintained for most of the surveyed portions. Moderately elevated conditions were observed upstream of the waterfall where there is high levels of input from stormwater. Highly elevated conditions were present in the upper reaches of the creek, directly downstream of a stormwater outlet that feeds the creek.

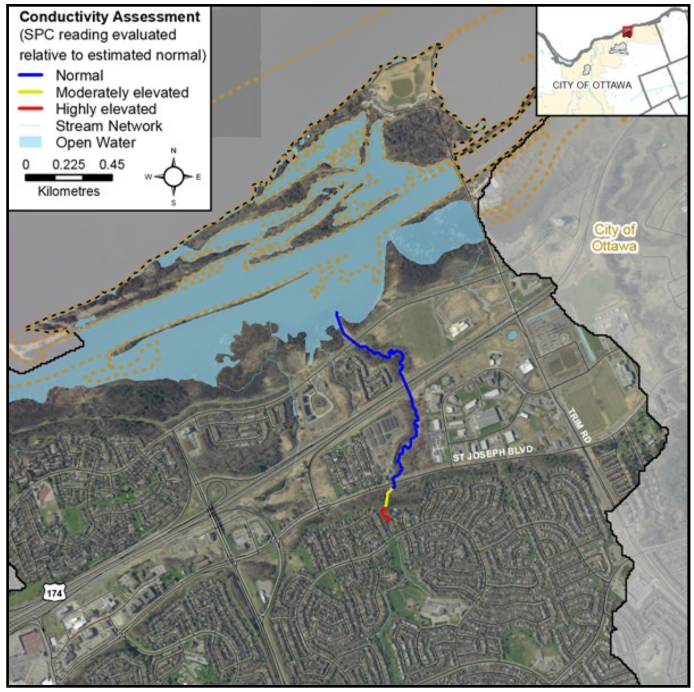


Figure 26 Relative specific conductivity levels along Taylor Creek

Section of Taylor Creek upstream of Princess Louise Falls with moderately elevated levels of specific conductivity

Section of Taylor Creek near Princess Louise Drive with highly elevated levels of specific conductivity

Taylor 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 Taylor Creek, two temperature loggers were placed in April. One logger was retrieved in November, the second logger was no longer present at the site location and could not be retrieved.

Figure 27 shows where the thermal sampling sites were located. Analysis of data from the logger (using the Stoneman and Jones, 1996, method adapted by Chu et al., 2009), Taylor Creek is classified as **Coolwater**. (Figure 28).

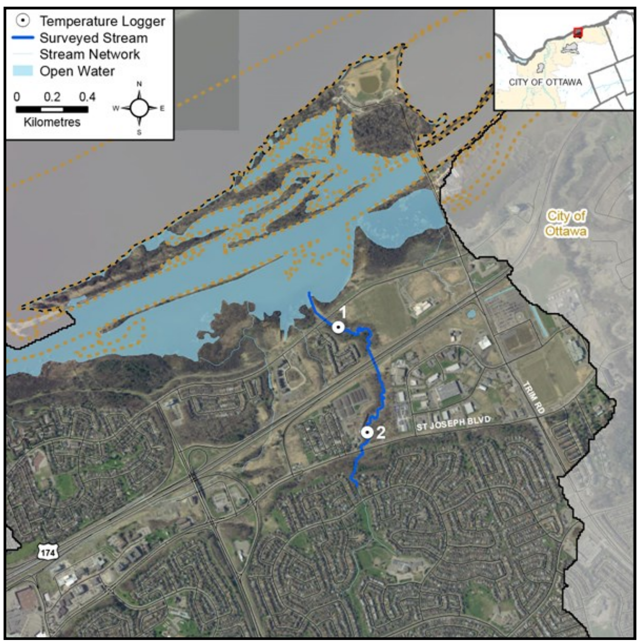


Figure 27 Temperature logger location on Taylor Creek

Within those two sites, cold-cool and cool water fish species were present, with fish thermal preferences 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, indicators of groundwater discharge are noted when observed. Indicators include: springs/ seeps, watercress, iron staining, significant temperature change and rainbow mineral film. Figure 29 shows areas were one or more groundwater indicators were observed during stream surveys and headwater assessments.

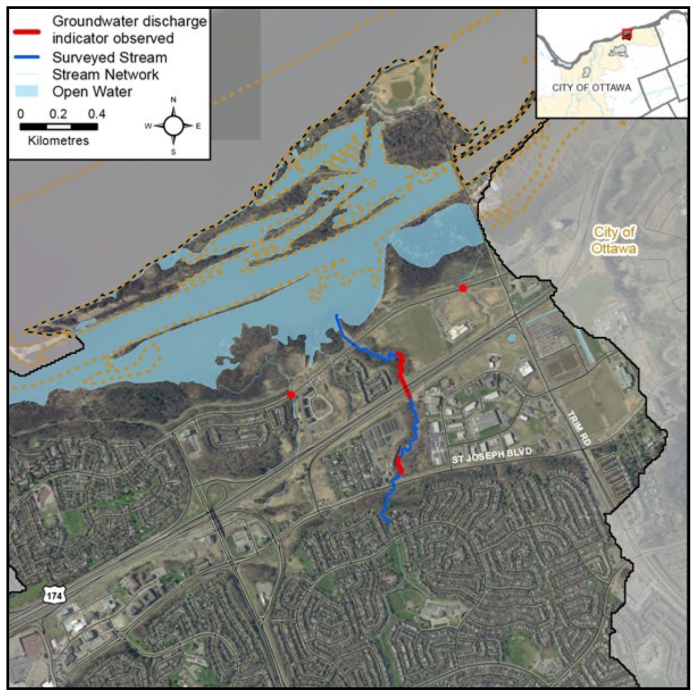


Figure 29 Groundwater indicators observed in Taylor Creek

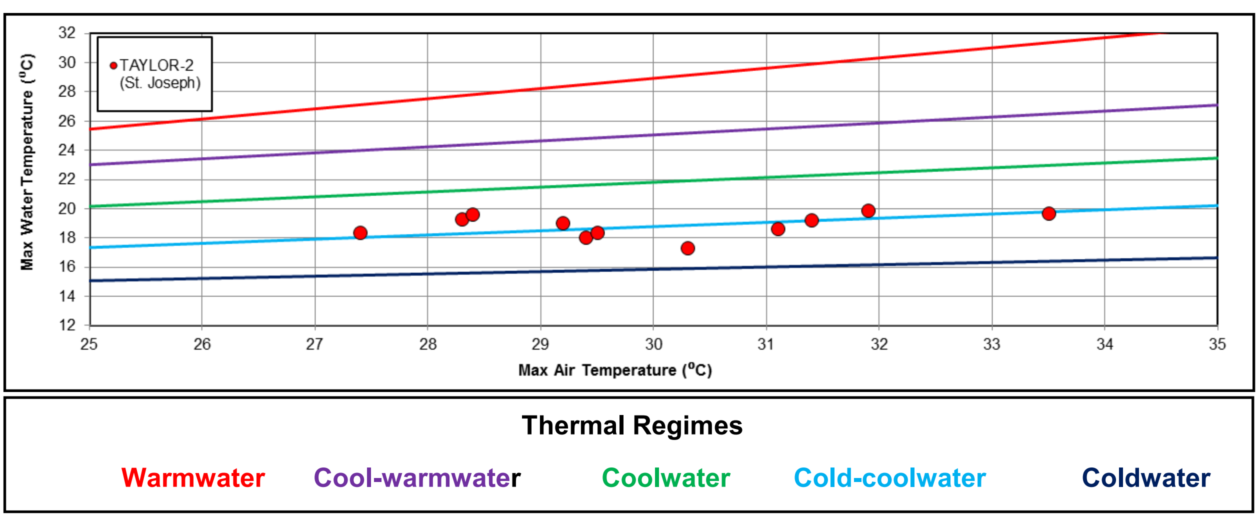


Figure 28 Thermal Classification for Taylor Creek with the five thermal regimes adapted from Stoneman and Jones (1996) by Chu et al. (2009): **Coolwater** category for the thermal site sampled on Taylor Creek

Taylor Creek Fish Community

Fish Community Summary

Four fish sampling sites were evaluated between May and July 2018. Three sites were sampled by electrofisher; upstream of Jeanne D'Arc Boulevard, downstream of St. Joseph Boulevard, and upstream of St. Joseph Boulevard. One site was sampled using a seine net; downstream of St. Joseph Boulevard.

Table 2 Fish species observed in Taylor Creek in 2018

Species	Thermal Class	MNRF Species Code
banded killifish *Fundulus diaphanus*	Cool	BaKil
rock bass *Ambloplites rupestris*	Cool	RoBas
white sucker *Catostomus commersonii*	Cool	WhSuc
yellow perch *Perca flavescens*	Cool	YePer
Total Species		**4**

Four species were captured in 2018, they are listed in Table 2 along with their thermal classification preferences (Coker et al., 2001) and MNRF species codes. At two of the four fish sampling sites, no fish were caught. This was at the sites both upstream and downstream of St. Joseph Boulevard.

The fish community in Taylor Creek is composed of cool water species. This coincides with the thermal classification of Taylor Creek being a cool-water system.

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 MNRF codes provided in Table 2. For comparisons across sampling years and a complete list of RVCA historical fish records from Taylor Creek refer to page 21 of this report.

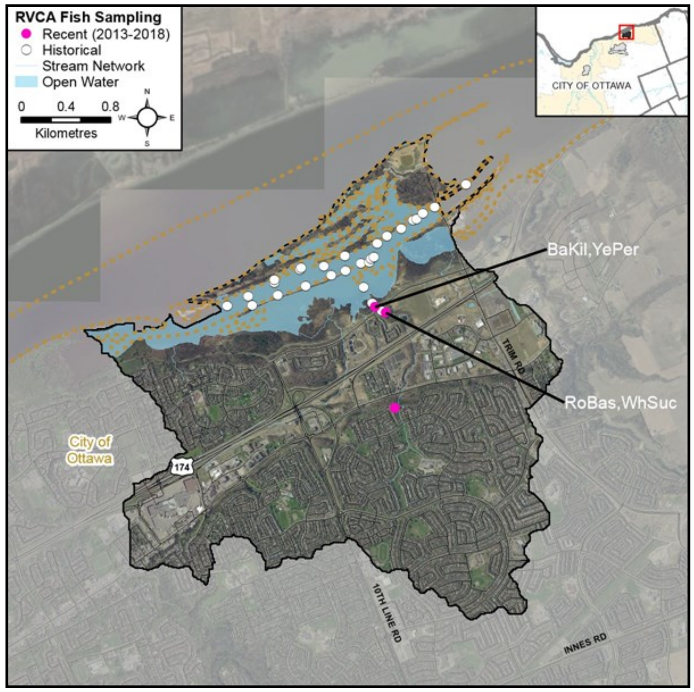


Figure 30 Taylor Creek fish sampling locations and 2018 fish species observations

Fish sampling site upstream of St. Joseph Boulevard

Fish sampling site upstream of Jeanne D'Arc Boulevard

Yellow perch captured in Taylor 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.

There is a natural grade barrier in Taylor Creek which results in the Princess Louise Falls, a small waterfall downstream of Princess Louise Dr. There is also a weir just upstream of the waterfall, directing stormwater flow downstream. There was also a perched culvert observed during headwater drainage feature assessments. The locations of migratory obstructions observed during headwater drainage feature assessment and stream surveys in 2018 are shown in Figure 31.

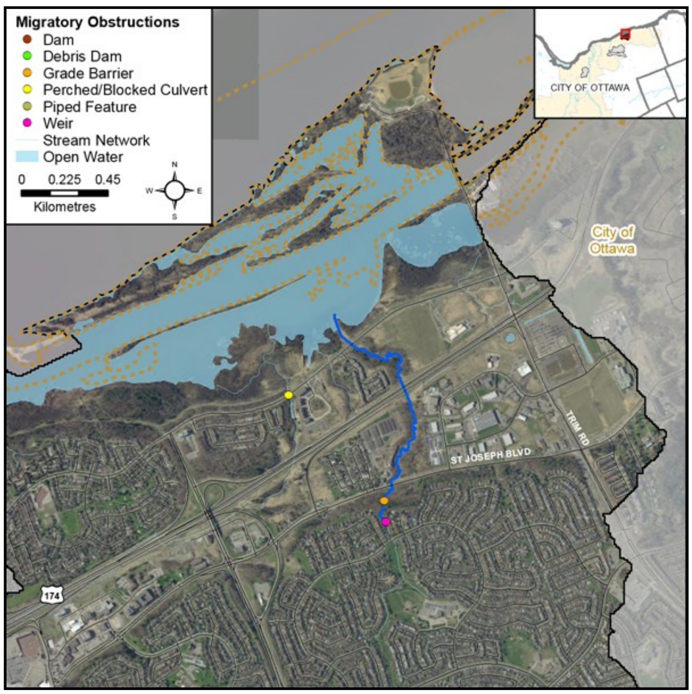
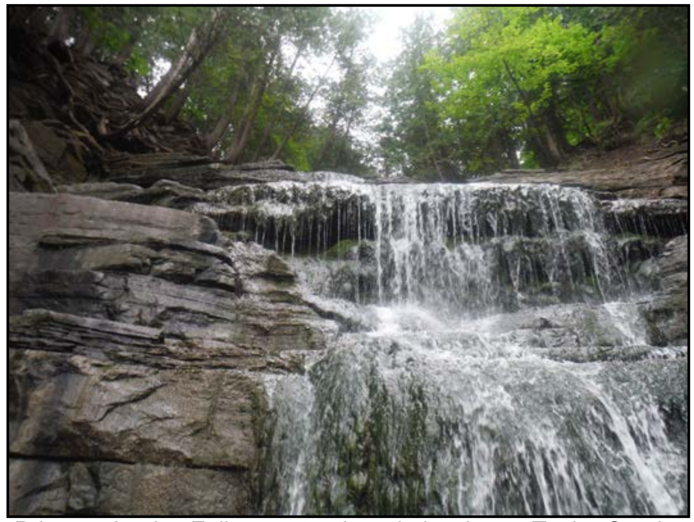


Figure 31 Locations of migratory obstructions along Taylor Creek

Natural grade barrier observed along Taylor Creek



Princess Louise Falls, a natural grade barrier on Taylor Creek

Stormwater outlet flow that passes through weir before flowing downstream towards the Princess Louise Falls

Beaver Dams

Overall, 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 are also considered potential barriers to fish migration.

No active dams were identified on the surveyed portions of Taylor Creek in 2018.

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, 2017):

- 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 are evaluated as per the Ontario Stream Assessment Protocol (OSAP, 2017). 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 2018 the City Stream Watch program assessed 5 HDF sites in the Taylor Creek Catchment (Figure 32).

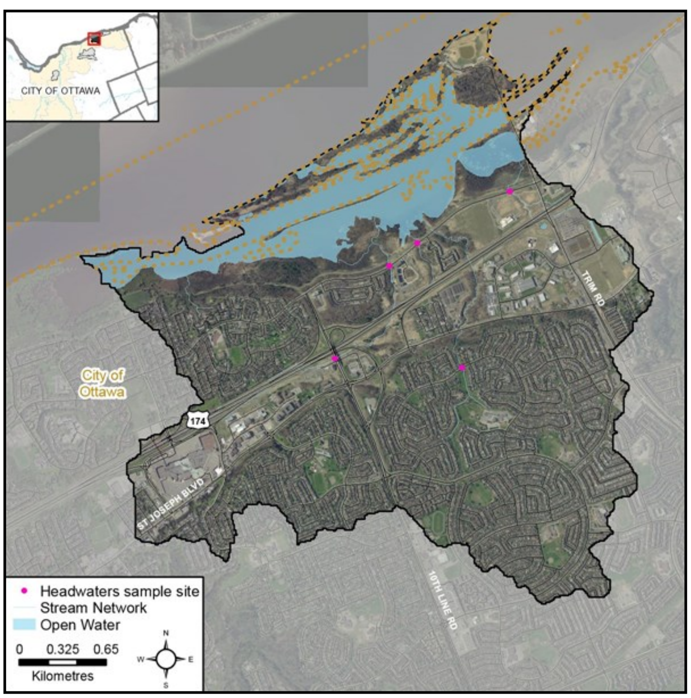


Figure 32 Location of HDF sampling sites in the Taylor Creek catchment

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 33 shows the feature type of the primary feature at the sampling locations. Out of the five sites, two were swales, one was natural, one was channelized and one was tiled.

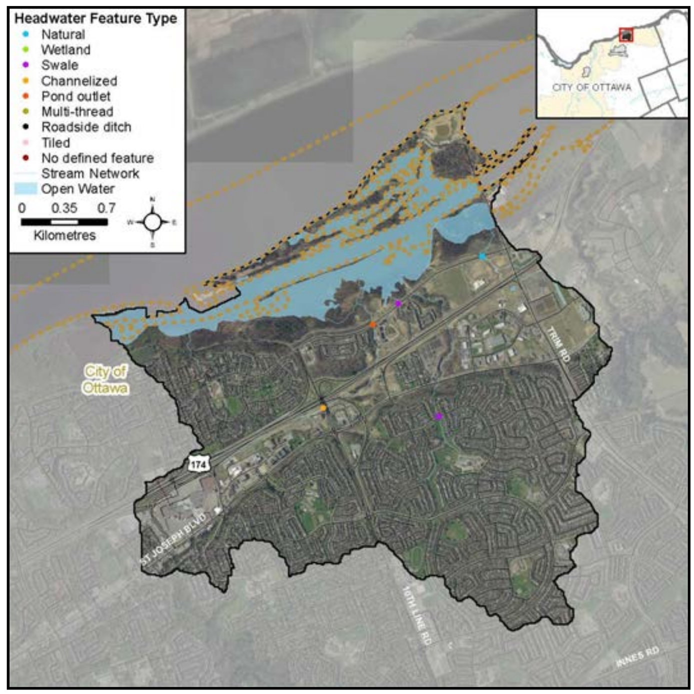


Figure 33 Map of Taylor Creek HDF feature types

Natural headwater drainage feature type on Jeanne D'Arc Boulevard

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.

Flow conditions in the Taylor Creek catchment area are shown in Figure 34.

Intermittent feature with spring and summer conditions on Jeanne D'Arc Boulevard

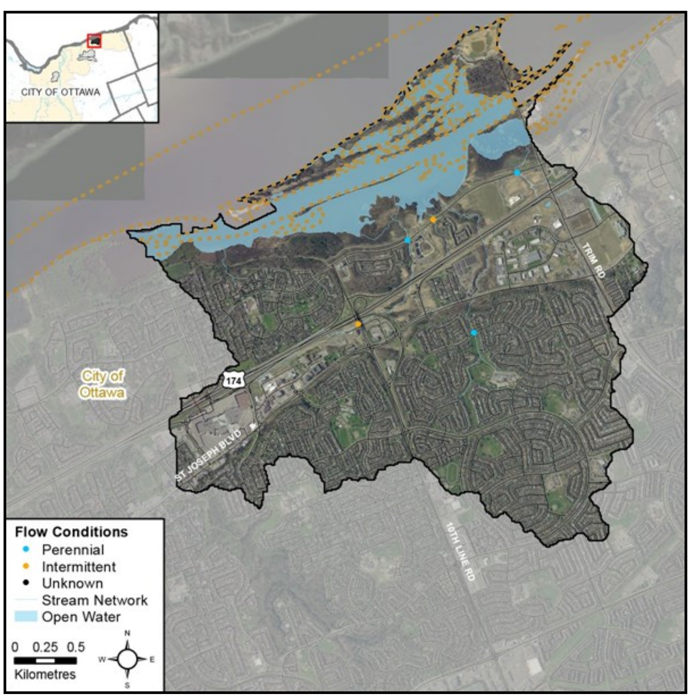


Figure 34 Headwater feature flow conditions in the Taylor Creek catchment

Feature Channel Modifications

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

Figure 35 shows channel modifications observed in Taylor Creek headwater drainage features. Most modifications in this catchment for headwater drainage features are mixed modifications. These features were mixed between dredging and hardening. In one case, this also included an upstream online stormwater pond.

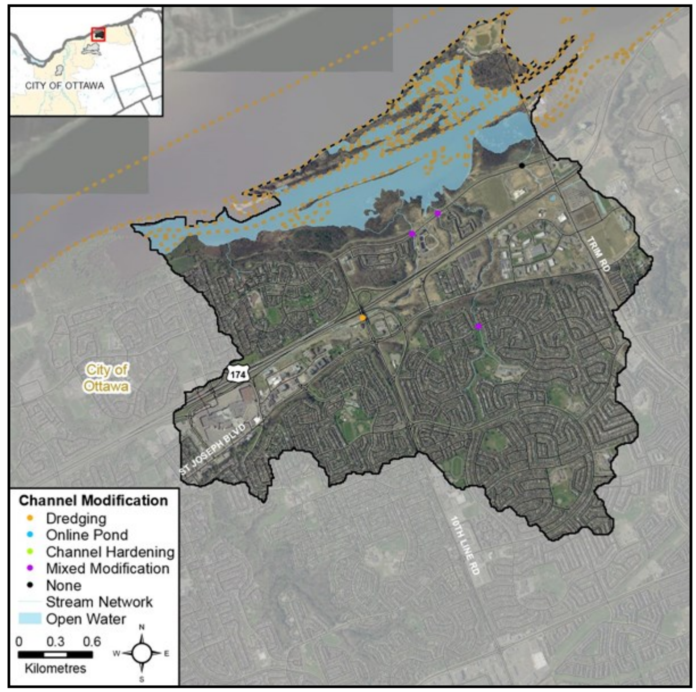


Figure 35 Headwater feature channel modifications in the Taylor Creek catchment

An example of mixed modifications: channel hardening and an online pond. Observed off of Jeanne D'Arc Boulevard

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 a very important role in flow, sediment movement and provides wildlife habitat. The following classifications are evaluated: no vegetation, lawn, wetland, meadow, scrubland and forest.

Figure 36 depicts the dominant vegetation observed at the sampled sites in the Taylor Creek catchment. Two sites had no vegetation, and one had meadow vegetation within the feature. In one site the feature vegetation could not be determined due to site access restrictions.

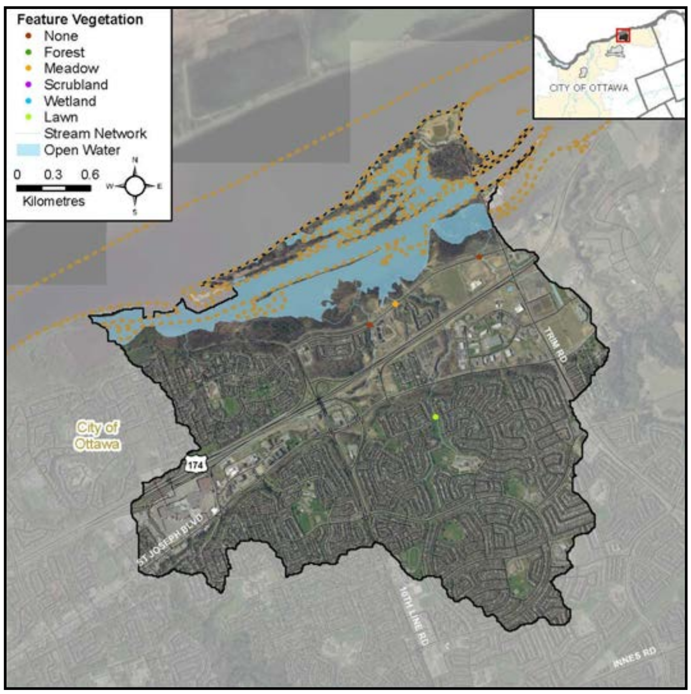


Figure 36 Headwater feature vegetation in the Taylor Creek catchment

Meadow feature vegetation in HDF on Jeanne D'Arc Boulevard

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 37 shows the type of riparian vegetation observed at the sampled headwater sites in the Taylor Creek catchment. Most sites had natural riparian vegetation with the exception of one which had mowed lawn. One site's vegetation could not be determined due to site access restrictions.

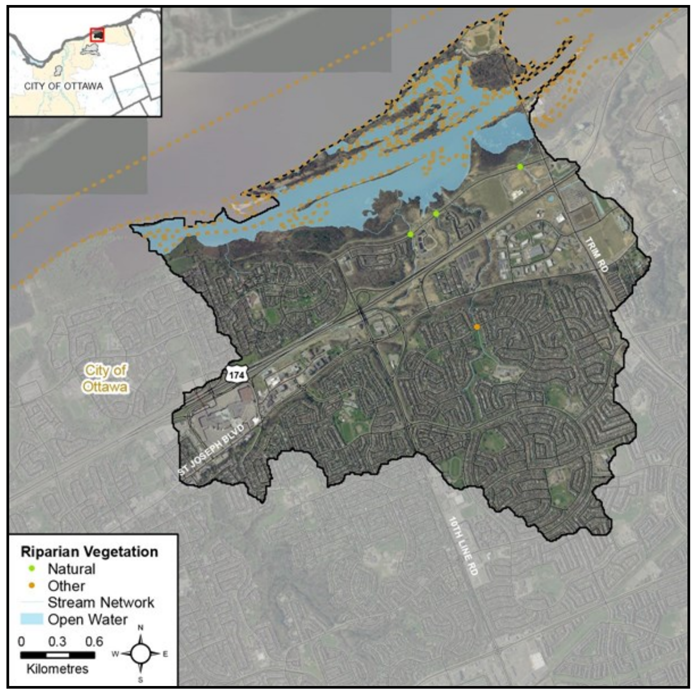


Figure 37 Riparian vegetation types along headwater features in the Taylor Creek catchment

HDF natural riparian vegetation on Jeanne D'Arc Boulevard

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, 2017). 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 upstream features assessed, sediment deposition ranged from minimal to substantial. One feature had evidence of minimal deposition and two had substantial levels. Two sites were not measured, one had site access restrictions. Figure 38 shows the levels of sediment deposition in the catchment.

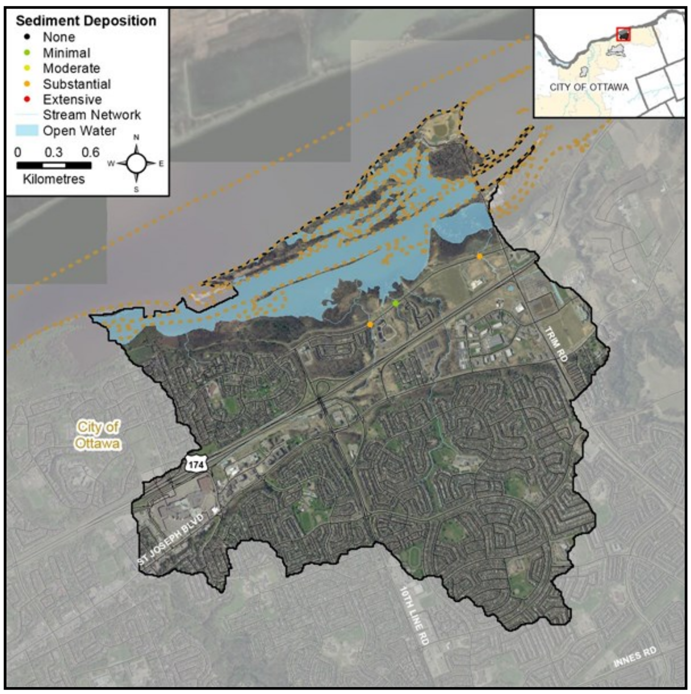


Figure 38 Headwater feature sediment deposition in the Taylor Creek catchment

Headwater drainage feature site with substantial level of sediment deposition off Jeanne D'Arc Boulevard

Headwater Feature Upstream Roughness

Feature roughness is a relative measure of the amount of material within the feature that diffuses flows (OSAP, 2017). 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 Taylor Creek catchment, two sites had minimal roughness, two had moderate, and one had high roughness. Figure 39 shows the various feature roughness across the area.

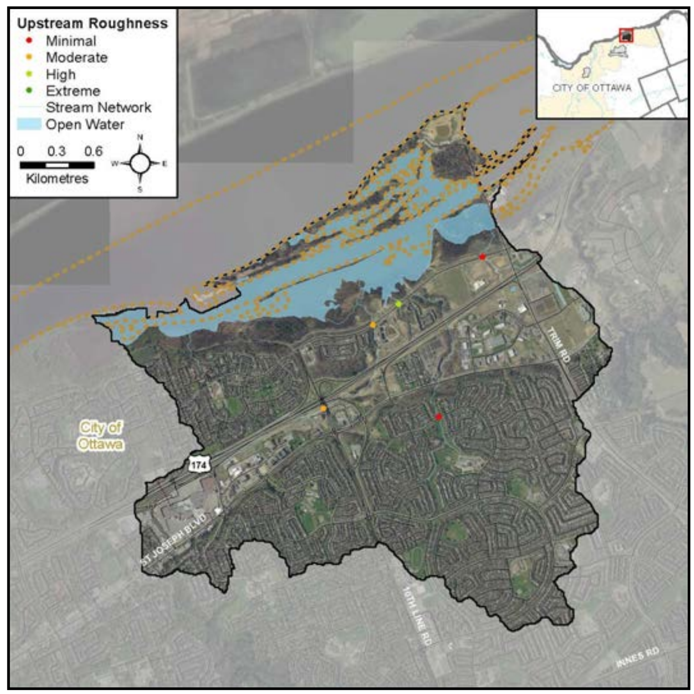


Figure 39 Headwater feature roughness in the Taylor Creek catchment

Headwater drainage feature site with high roughness at Jeanne D'Arc Boulevard

Stream Comparison Between 2007, 2012 and 2018

The following tables provide a comparison of observations on Taylor Creek between the 2007, 2012 and 2018 survey years (RVCA 2007, RVCA 2012). Monitoring protocols from 2007 were modified and enhanced, so data from that year cannot be compared to the later years (there are some exceptions). In order to accurately represent current and historical information, the site data was only compared for those sections which were surveyed in both reporting periods. This resulted in changes to our overall summary information, averages presented here differ from ones in this report. This information is therefore only a comparative evaluation and does not represent the entirety of our assessment.

Water Chemistry

Water chemistry parameters are collected throughout all sections surveyed in the stream. This criteria reflects the overall 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 parameters between 2012 and 2018. Average summer water temperatures range from cooler water in 2018 (17.7°C) to warmer values in 2012 (20.3C), with 2.6 degrees centigrade of variation. Aside from these general temperature observations, loggers provide a detailed summary of stream thermal conditions.

Standardizing stream temperature accounts for climatic factors including air temperatures and precipitation. With the data collected from temperature loggers, standardized stream temperatures are calculated and summarized in Table 3. These values decreased by 0.13°C for every degree of air temperature from 2012 to 2018.

Table 3 Water chemistry comparison (2012/2018)

Water Chemistry (2012—2018)				
YEAR	PARAMETER	UNIT	AVERAGE	STND ERROR
2012	pH	-	8.06	± 0.06
2018	pH	-	7.91	± 0.09
2012	Sp. Conductivity	us/cm	-	-
2018	Sp. Conductivity	us/cm	1546.5	± 322
2012	Dissolved Oxygen	mg/L	9.2	± 0.46
2018	Dissolved Oxygen	mg/L	9.0	± 0.45
2012	Water Temperature	ºC	20.3	± 0.67
2018	Water Temperature	ºC	17.7	± 0.67
2012	Standardized Stream Temperature[1]	ºC Water / 1ºC Air	0.76	± 0.44
2018	Standardized Stream Temperature[1]	ºC Water / 1ºC Air	0.63	± 0.43

[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 2 days preceding measurement
- Measurements to be taken between 4:00PM—6:00PM
- All temperatures points to be collected in July/August
- Logger must be deployed in flowing waters

Average dissolved oxygen levels were found to be decreasing by 0.2 milligrams per liter from 2012 to 2018. These changes can also be attributed to weather patterns and warmer temperatures which are conducive to the stream's ability to hold less oxygen.

Invasive Species

The overall percentage of sections surveyed where invasive species were observed had a reduction of 14 percent (Table 4). Purple loosestrife had a reduction of observations by 15 percent, this decline may be associated to management efforts (OMNR 2012). There were also many species that were observed in 2012 and not recorded in 2018 including Eurasian milfoil, European frogbit, garlic mustard and Japanese knotweed. Other invasive species have expanded their range, most notably Himalayan balsam. Yellow iris has also increased by one percent. Bull thistle and Manitoba maple are newly reported invasive species in 2018.

Table 4 Invasive species presence observed in 2012 and 2018 (NR are Not Reported species)

Invasive Species	2012	2018	+/-
bull thistle	NR	7%	▲
Eurasian milfoil	6%	NR	▼
European frogbit	18%	NR	▼
garlic mustard	6%	NR	▼
Himalayan balsam	41%	64%	▲
Manitoba maple	NR	57%	▲
Japanese knotweed	6%	NR	▼
purple loosestrife	94%	79%	▼
yellow iris	6%	7%	▲
Total	**100**	**86**	**▼**

Invasive Himalayan balsam plant on Taylor Creek

Pollution

Garbage accumulation on Taylor Creek was found to increase from 2007 to 2012. In 2018 floating garbage decreased, however garbage on the stream bottom was shown to increase. Table 5 shows the percentage of sections that contained garbage. This percentage increased from 87 to 100 percent from 2007 to 2012 and then again was recorded as 100 percent in 2018.

Table 5 Pollution levels (presence in % of sections)

Pollution/Garbage	2007	2012	2018	+/-
floating garbage	27%	88%	71%	▼
garbage on stream bottom	67%	88%	93%	▲
other	87%	88%	6%	▼
Total	**87%**	**100%**	**100%**	▲

Instream Aquatic Vegetation

Table 6 shows instream aquatic vegetation decrease from 2007-2018. This was also matched by an increase in the number of sections with no vegetation. Robust emergent plants (e.g. cattails), submerged plants (e.g. pondweed), free floating plants (e.g. duckweed) and broad leaved emergent plants (e.g. arrowhead) had lower observations in the number of sections surveyed between 2012 and 2018. Values were similar between 2007 and 2018. Narrow-leaved emergent plants (e.g. grasses) have been shown to increase with each year of survey.

Table 6 Instream aquatic vegetation (presence in % of sections)

Instream Vegetation	2007	2012	2018	+/-
narrow-leaved emergent plants	13%	35%	71%	▲
broad-leaved emergent plants	0%	12%	0%	▼
robust emergent plants	0%	18%	0%	▼
free-floating plants	0%	12%	0%	▼
floating plants	7%	18%	7%	▼
submerged plants	27%	18%	0%	▼
algae	47%	100%	57%	▼
none	47%	0%	86%	▲

Fish Community

Fish sampling was carried out by the City Stream Watch program in 2012 and 2018 to evaluate fish community composition in Taylor Creek (see Table 7). In total 8 species have been observed in Taylor Creek. Deep water levels from the spring freshet in 2018 limited the type and effort of sampling at some sites. The majority of species observed in 2018 were new captures. Only the white sucker was a reoccurring species.

Table 7 Comparison of fish species caught between 2012-2018

Species	2012	2018
banded killifish *Fundulus diaphanus*		X
brook stickleback *Culaea inconstans*	X	
central mudminnow *Umbra limi*	X	
creek chub *Semotilus atromaculatus*	X	
pumpkinseed *Lepomis gibbosus*	X	
rock bass *Ambloplites rupestris*		X
white sucker *Catostomus commersonii*	X	X
yellow perch *Perca flavescens*		X
Total Species 8	**5**	**4**

A white sucker (*Catostomus commersonii),* the only reoccurring species observed in 2018

Monitoring and Restoration

Monitoring and Restoration Projects on Taylor Creek

Table 8 highlights recent and past monitoring that has been done on Taylor Creek by the City Stream Watch program. Monitoring activities and efforts have changed over the years. Potential restoration opportunities are listed on the following page.

Table 8 City Stream Watch monitoring and restoration on Taylor Creek

Accomplishment	Year	Description
City Stream Watch Stream Monitoring	2007	1.5 km of stream was surveyed
	2012	1.7 km of stream was surveyed
	2018	1.4 km of stream was surveyed
City Stream Watch Fish Sampling	2012	Two sites were sampled using an electrofisher
	2018	Four sites were sampled; one using a seine net and three with an electrofisher
City Stream Watch Thermal Classification	2012	Two temperature loggers were deployed
	2018	Two temperature probes were deployed
City Stream Watch Headwater Drainage Feature Assessment	2018	5 headwater drainage feature sites were assessed in the Taylor Creek catchment
City Stream Watch Invasive Species Removals	2018	2 invasive species removals both targeting Himalayan balsam, clearing 1260m^2
City Stream Watch Stream Cleanups	2007	City Stream Watch staff joined forces with the Fallingbrook 4th Orleans Scouts to clean from St. Joseph Boulevard to the falls
	2012	City Stream Watch staff and 10 volunteers spent 28 volunteer hours cleaning the creek from Princess Louise Falls to just north of St. Joseph Boulevard
	2018	City Stream Watch held one cleanup upstream of St. Joseph Boulevard cleaning 750 m of shoreline

Volunteers participating in cleanup downstream of St. Joseph Boulevard

Volunteers at an invasive species removal for Himalayan balsam

Potential Riparian Restoration Opportunities

Riparian restoration opportunities were assessed in the field and include potential enhancement through riparian planting, erosion control, invasive species management and/or wildlife habitat creation (Figure 40).

Invasive Species Control

The majority of Taylor Creek can benefit from invasive species control. This is largely due to Himalayan balsam which dominates the shoreline of the creek.

Mixed Opportunities

These sections show potential for multiple restoration opportunities. This includes invasive species control, and erosion control directly downstream of the Princess Louise Falls.

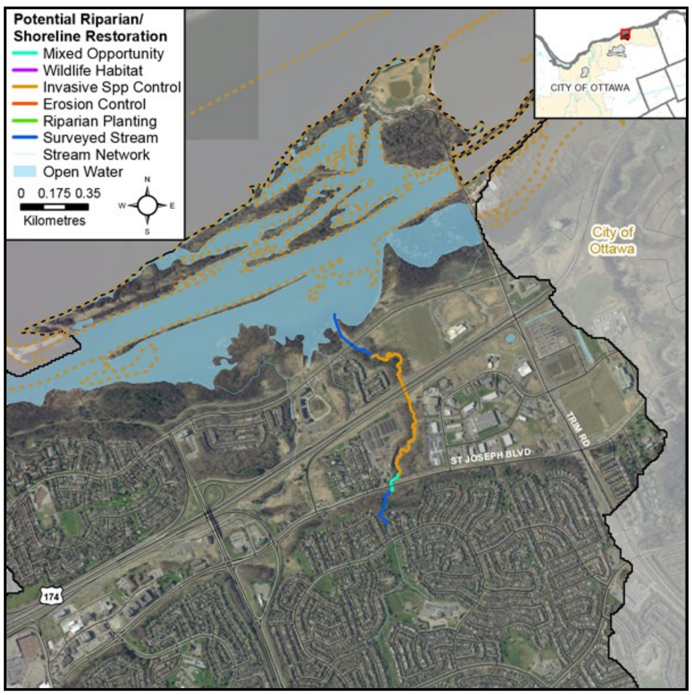


Figure 40 Potential riparian/shoreline restoration opportunities along Taylor Creek

Area dominated by Himalayan balsam that would benefit from invasive species control

Potential Instream Restoration Opportunities

Garbage clean up

Taylor Creek would benefit from a garbage clean up in the areas shown in Figure 41. Pollution is likely due to stormwater input upstream of the creek. The system can benefit from more frequent stream and shoreline cleanups along the highlighted areas in Figure 41.

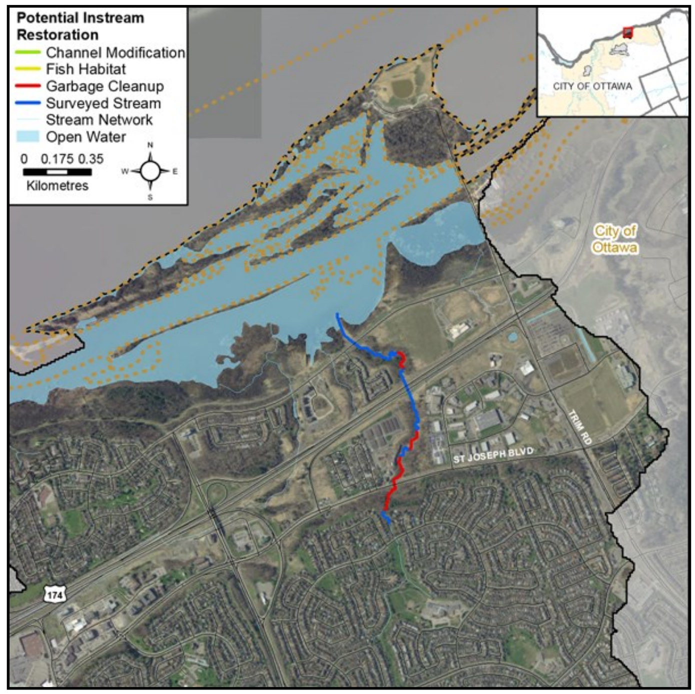


Figure 41 Potential instream restoration opportunities in Taylor

Area with garbage observed downstream of St. Joseph Boulevard that could benefit from a cleanup

References

1. Canadian Council of Ministers of the Environment (CCME), 1999. Canadian water quality guidelines for the protection of aquatic life: Dissolved oxygen (freshwater). In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg.
2. Environment Canada, 2011. Canada's Freshwater Quality in a Global Context Indicator. Data sources and methods. ISBN: 978-1-100-17978-0 . Available online: http://publications.gc.ca/collections/collection_2011/ec/En4-144-3-2011-eng.pdf
3. Environment Canada, 2013. *How Much Habitat is Enough? Third Edition*. Environment Canada, Toronto, Ontario. Accessed online: https://www.ec.gc.ca/nature/default.asp?lang=En&n=E33B007C-1.
4. Chu, C., Jones, N.E., Piggott, A.R. and Buttle, J.M., 2009. Evaluation of a simple method to classify the thermal characteristics of streams using a nomogram of daily maximum air and water temperatures. *North American Journal of Fisheries Management*, *29* (6), pp.1605-1619.
5. Coker, G.A., Portt, C.B. and Minns, C.K., 2001. *Morphological and ecological characteristics of Canadian freshwater fishes*. Burlington, Ontario: Fisheries and Oceans Canada.
6. Ministry of Environment and Energy (MOEE), 1994. Water management policies, guidelines, provincial water quality objectives of the Ministry of Environment and Energy. Copyright: Queens Printer for Ontario, 1994.
7. Ontario Ministry of Natural Resources (OMNR), 2012. Ontario Invasive Species Strategic Plan. Toronto: Queens Printer for Ontario. Accessed online: https://dr6j45jk9xcmk.cloudfront.net/documents/2679/stdprod-097634.pdf.
8. Scott, W.B. and E.J. Crossman. 1998. Freshwater Fishes of Canada. Galt House Publications Ltd, Oakville pp.1-966.
9. Stanfield, L. (editor) 2017. Ontario Stream Assessment Protocol (OSAP). Version 10.0. Fish and Wildlife Branch, Ontario Ministry of Natural Resources, Peterborough, Ontario.
10. Stoneman, C.L. and Jones, M.L., 1996. A simple method to classify stream thermal stability with single observations of daily maximum water and air temperatures. *North American Journal of Fisheries Management*, *16*(4), pp.728-737.
11. Stuart, V., Harker, D.B. and Clearwater, R.L., 2010. *Watershed Evaluation of Beneficial Management Practices (WEBs): Towards Enhanced Agricultural Landscape Planning-Four-Year Review (2004/5-2007/8)*. Agriculture and Agri-Food Canada, Ottawa, Ont.
12. Walker, H.J.W. and Walker, O., 1968. *Carleton Saga: By Harry and Olive Walker*. Carleton County Council.
13. Rideau Valley Conservation Authority (RVCA), 2018. Watershed Condition Statements. Manotick, ON. Available online:

    https://www.rvca.ca/watershed-conditions-statements

For more information on the overall 2018City Stream Watch Program and the volunteer activities, please refer to the City Stream Watch 2018 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**: South Nation Conservation Authority, Mississippi Valley Conservation Authority, City of Ottawa, Ottawa Flyfishers Society, Ottawa Stewardship Council, Rideau Roundtable, Canadian Forces Fish and Game Club, and the National Capital Commission