Ottawa West Tributaries 2017 Catchment Report

Watershed Features	
Area	7.3 Square kilometres 0.2% of the Rideau Valley watershed
Land Use	19.67% agriculture 26.06% urban 2.12% rural 31.05% forest 8.56% meadow 2.09% waterbody 10.45% wetland
Surficial Geology	31.68% clay 6.27% diamicton 5.19% organic deposits 54.69% Paleozoic bedrock 0.87% Precambrian bedrock 1.31% sand
Invasive Species	Nine invasive species were identified in 2017: bull thistle, common buckthorn, dog strangling vine, Eurasian milfoil, European Frogbit, flowering rush, garlic mustard, non-native honey suckle, and purple loosestrife.

Wetland Catchment Cover
10.45% unevaluated wetland

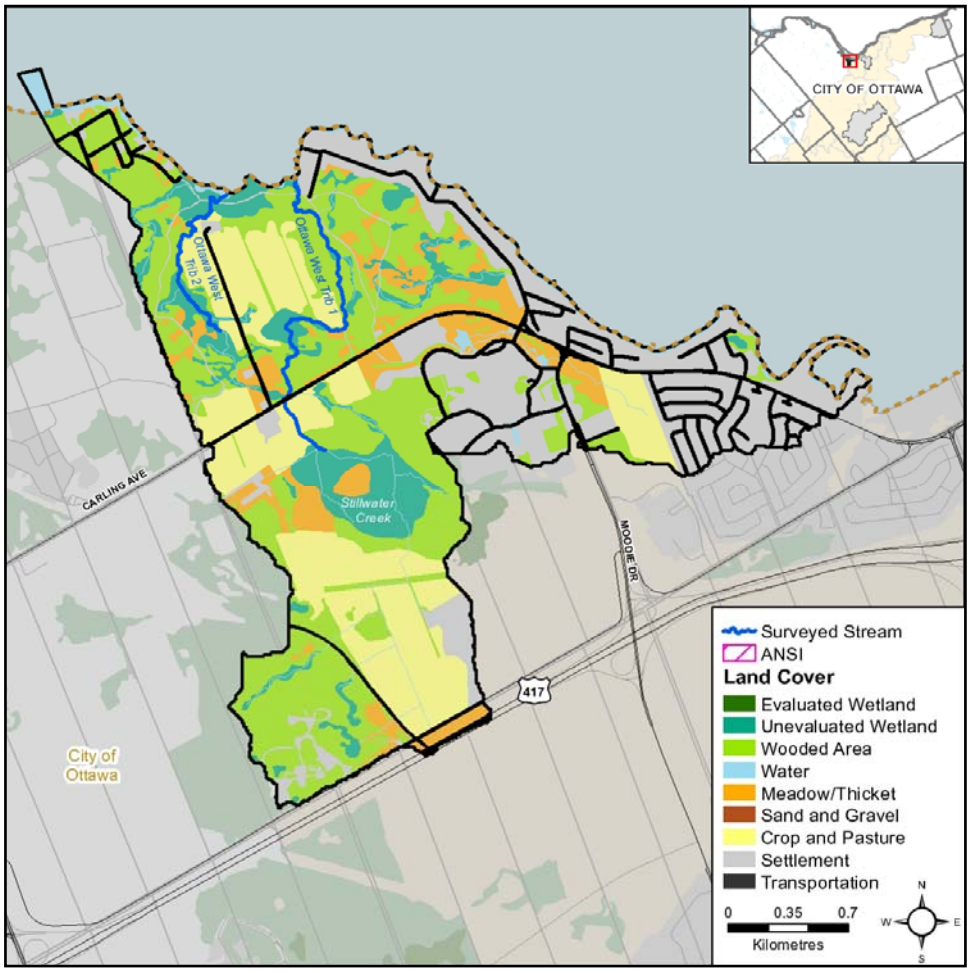

Figure 1 Land cover in the Ottawa West Tributaries catchment

Ottawa West Tributary 1 near the confluence with Ottawa River

Upstream view from a beaver dam along Ottawa West Tributary 2

The Rideau Valley Conservation Authority, in partnership with six other agencies in Ottawa: City of Ottawa, Ottawa Flyfishers Society, Ottawa Stewardship Council, Rideau Roundtable, Canadian Forces Fish and Game Club, and the National Capital Commission form the 2017 City Stream Watch Collaborative.

Flood Conditions - Rideau Valley Watershed

Flood Warning Conditions

Heavy rains throughout the summer and into the fall made 2017 the wettest year in Ottawa in recorded history. This year we observed prolonged and significant flooding in parts of the Ottawa river Watershed. RVCA monitors certain areas along the Ottawa River, by mid-April the first flood message was sent and by May 1st the message was upgraded to a Flood Warning.

The Ottawa River peaked on May 7th with a record flow of 5769 cubic meters per second, making it a 1:50 year flood event (RVCA, 2017). The confluence of the Ottawa West Tributaries is in the Ottawa River, it is situated in the West end of the City of Ottawa where flooding was experienced this spring affecting many homes in the area. This year was quite a contrast to 2016, when the city experienced moderate to severe drought conditions throughout most of the year.

Flooded road section in the Stevens Creek catchment near the Rideau River


Flooded section of Pinecrest Creek near the Ottawa River


Flooded agricultural field in the Becketts Creek catchment

Introduction

The Ottawa West Tributaries are unnamed creeks that flow from the headwaters of the Stillwater Creek wetland out towards the Ottawa River. They are located in the West end of the City of Ottawa, situated between Shirley's Bay and Crystal Bay. Tributary 1 is the larger system, on the East side of the catchment, that flows from the Stillwater Creek Wetland and it has a length of 2.4 kilometers; and Tributary 2 is the smaller system, on the West side of the catchment, with large marsh portions with a length of 1.3 kilometers.

The sub-watershed of the Ottawa West Tributaries drains 7.3 square kilometers of land, comprised of mainly forest, as well as agricultural urban and recreational land uses. The vegetation cover is comprised of 74.81 percent wooded areas and 25.19 percent wetland; of the woodlots in the catchment, 69 percent are less than one hectare in size, 28 percent are one to 30 hectares, and three percent have an area over 30 hectares. The majority of the headwaters of this catchment are influenced by agricultural land use. These tributaries are located within the Greenbelt, and are traversed by Greenbelt Trails managed by the National Capital Commission.

In 2017 the City Stream Watch program surveyed 37 sections (3.7 km) of the tributaries; 23 sections of Tributary 1 and 14 sections of Tributary 2. Areas that were not surveyed lacked defined channels, as some areas are part of wetland complexes. Sections surveyed on Tributary 1 were located from the confluence with the Ottawa river, upstream of Carling Avenue into Stillwater Creek Wetland. Tributary 2 was surveyed from the Ottawa River to its intersection with Davidson Side Road.

Ottawa West Tributaries 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 the surveyed sections of the Ottawa West Tributaries. Buffers greater than 30 meters were present along 83 percent of the left banks and 100 percent of the right banks. A 15 to 30 meter buffer was present along six percent of the left banks; and 5 to 15 meter buffers were observed along eleven percent of the left banks.

Buffer lengths along both tributaries meet the recommended guidelines. Buffers that were smaller, were affected by roadways and agricultural areas.

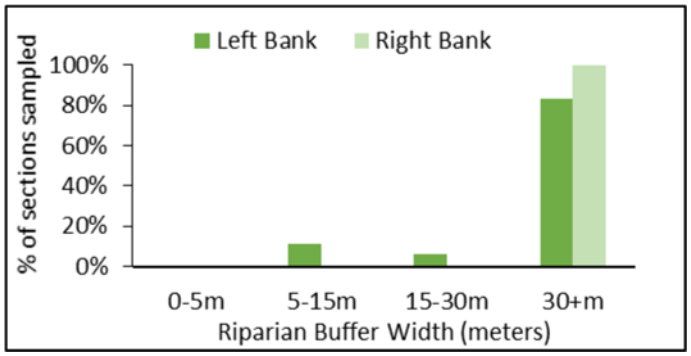

Figure 2 Vegetated buffer width along the Ottawa West Tributaries

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. The Ottawa West Tributary riparian zones are mostly natural vegetative communities, with alterations associated with municipal infrastructure, such as roadways, as well as recreational and agricultural land uses.

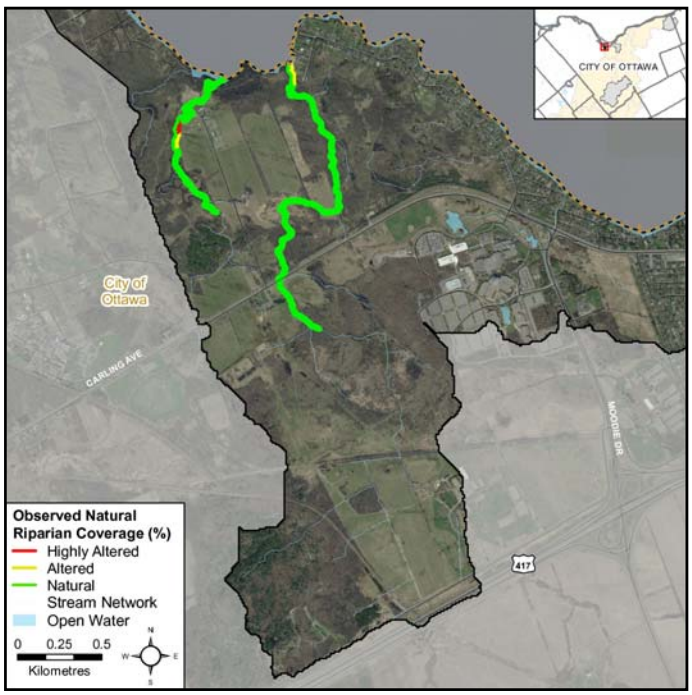

Figure 3 Riparian buffer alterations in the Ottawa West Tributaries

Adjacent Land Use

The surrounding land use is considered from the beginning to 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.

Forest and scrubland were present in 92 percent and 70 percent of the sections surveyed, being the most common land use found. Meadows were present in 54 percent of the surveyed areas, and wetlands were present in 41 percent of surveyed sections.

Aside from the natural areas, the most common land use in the catchment was agricultural, with 11 percent of the sections containing active agriculture and 19 percent of the sections had pasture land present. Other uses observed included recreational uses along five percent of the area, infrastructure (such as roads) in three percent, industrial or commercial was identified in three percent and residential was present in five percent of the adjacent land use.

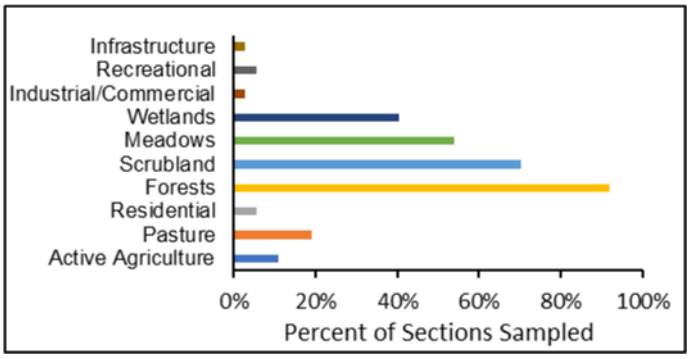

Figure 4 Adjacent land use 100 meters from each shoreline and percentage of presence along the Ottawa West Tributaries

Boardwalk bridge, part of the Greenbelt Trail that traverses through the Ottawa West Tributaries

Ottawa West Tributaries 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 the 37 sections surveyed in the Ottawa West Tributaries, with 62 percent remaining without any human alteration. Of the sections surveyed, 22 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 14 percent of surveyed areas, they may contain diverted or straightened sections and riparian buffers of five to fifteen meters. Shoreline alterations also include concrete. One or two storm water outlets could also be present. High alterations were found in three percent of sections. This category entails riparian buffers less than five meters, shoreline alterations found on most of the section, and portions of the stream may flow through culverts.

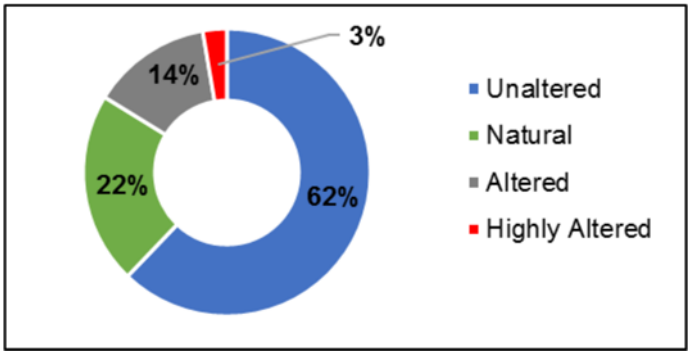

Figure 5 Anthropogenic alterations along the Ottawa West Tributaries

A highly altered stream section with a boxed concrete culvert where the Ottawa West Tributary 1 flows under Carling Avenue

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 Ottawa West Tributaries. Erosion was observed in few sections, and in levels below 40 percent. Erosion was observed in Ottawa River of Ottawa West Tributary 1 near the confluence with the Ottawa River, and in some upstream reaches North of Carling Avenue.

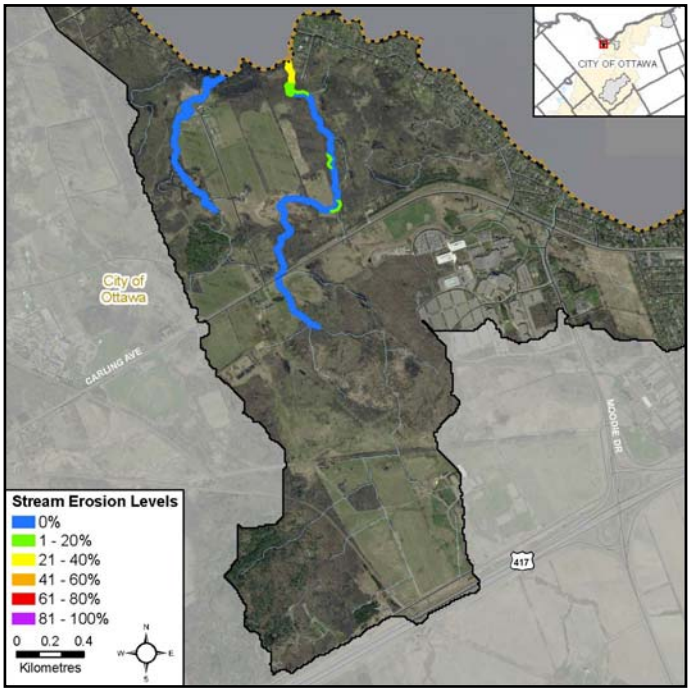

Figure 6 Erosion Levels along the Ottawa West Tributaries

Moderate levels of erosion along the banks of Ottawa West Tributary 1 near the confluence with the Ottawa River

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 overall extent of each surveyed section with overhanging bank cover present.

Figure 7 shows that undercut banks were not present in the Ottawa West Tributaries. This can be attributed to the wetland areas that are found through out the systems, which enables them to store water and mitigate flows.

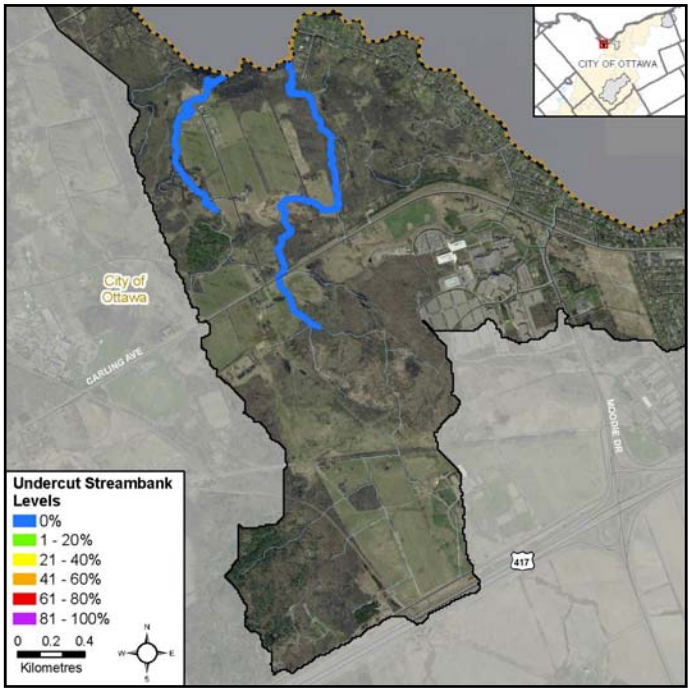

Figure 7 Undercut stream banks along the Ottawa West Tributaries

Wetland attributes throughout the Ottawa West Tributaries enables them to naturally mitigate flows and prevents undercutting downstream

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 stream shading. The majority of sections (38%) had a shade cover of 41 to 60 percent. The highest shading of 81 to 100 percent was observed in five percent of the sections. Cover of 21 to 40 percent was present in 19 percent of the sections and 16 percent of sections had levels of 61 percent to 80 percent shading. Minimal shading of one to 20 percent was observed in eight percent of sections and no cover was observed also in eight percent of the sections. Figure 9 shows the distribution of these shading levels along Ottawa West Tributaries.

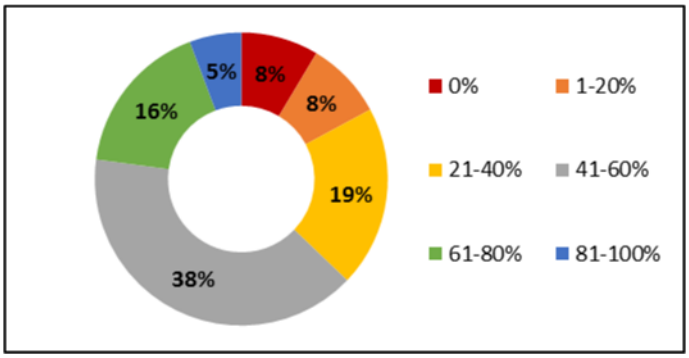

Figure 8 Stream shading along the Ottawa West Tributaries

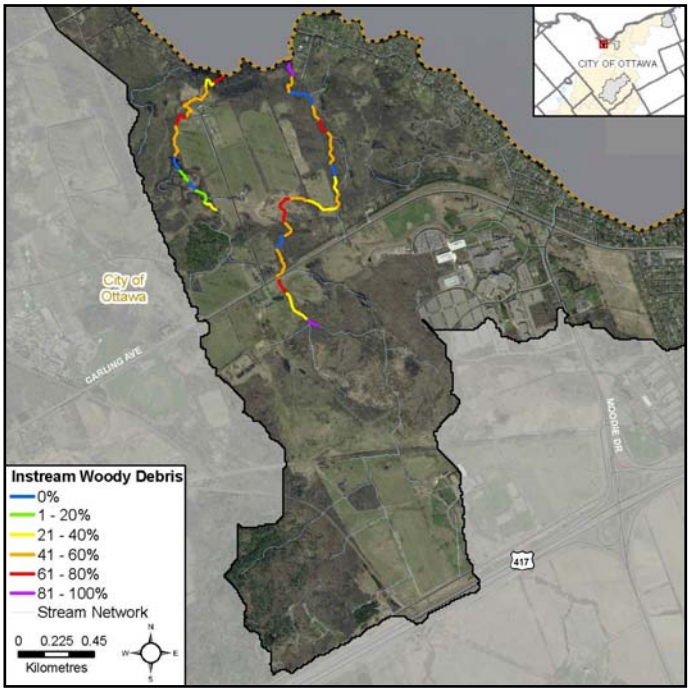

Figure 9 Stream shading along the Ottawa West Tributaries

A mix of trees and grasses comprised the majority of shading. Overhanging plants, mainly grasses were seen in 92 percent of the left and 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 of overhanging trees and branches that were observed along Ottawa West Tributaries. In the surveyed portions, 89 percent of the sections had overhanging trees and branches on the left banks and 78 percent of the right banks.

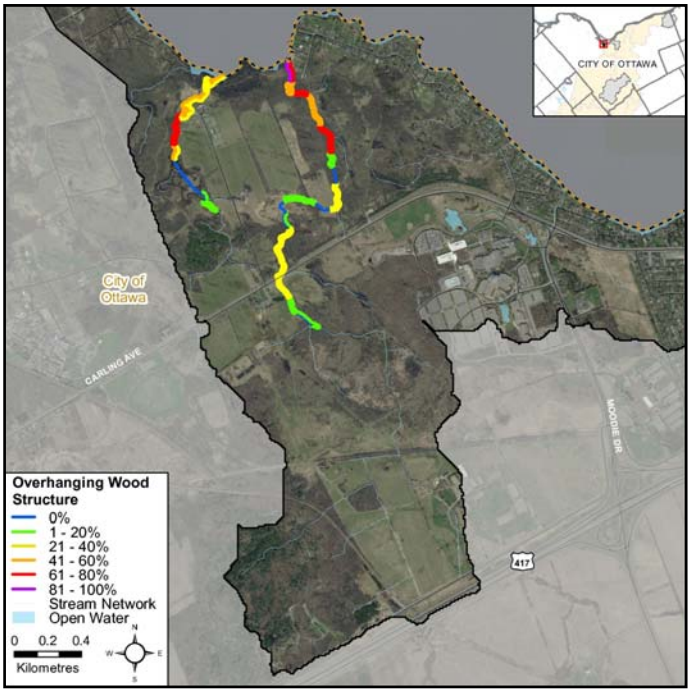

Figure 10 Overhanging trees and branches along the Ottawa West Tributaries

Overhanging branches along Ottawa West Tributary 1

Ottawa West Tributaries 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 woody material. A higher score shows greater complexity where a variety of species can be supported. Figure 11 shows habitat complexity of the sections surveyed: 14 percent had no complexity; 57 percent had a score of one; 11 percent scored two; 19 percent scored three; and 14 percent had the highest habitat diversity. Overall habitat complexity is of good quality in the Ottawa West Tributaries to support aquatic biota.

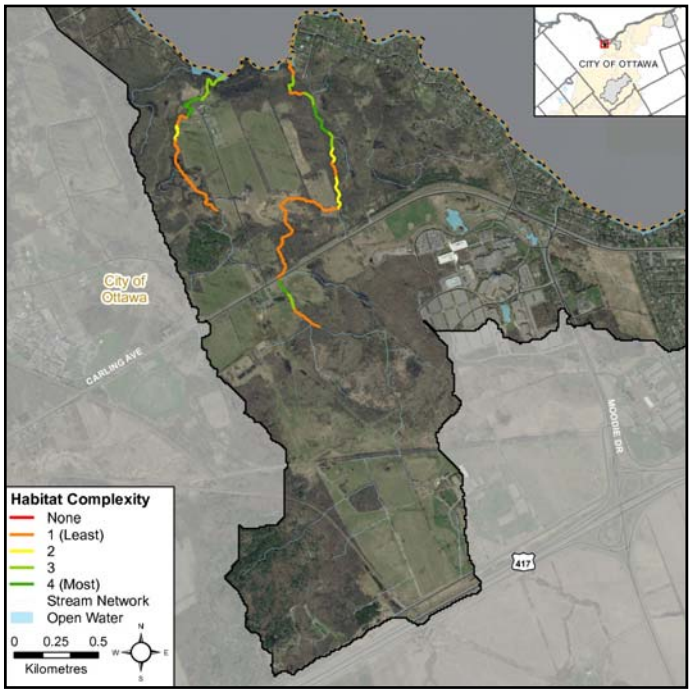

Figure 11 Instream habitat complexity along the Ottawa West Tributaries

Diverse habitat cover in Ottawa West Tributary 1

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 overall substrates present in the Ottawa West Tributaries.

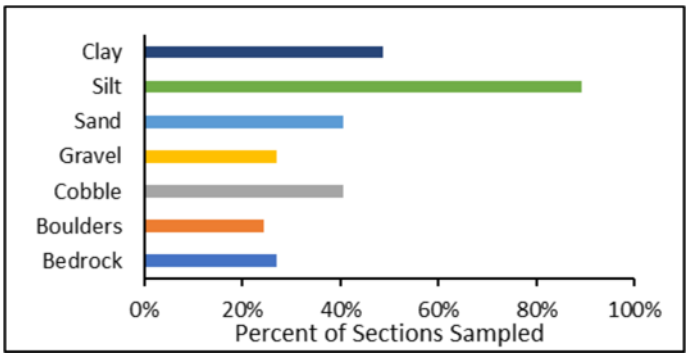

Figure 12 Instream substrate along the Ottawa West Tributaries

Figure 13 shows the dominant substrate of the Ottawa West Tributaries. Silt was the dominant substrate type in 70 percent of sections surveyed, attributed to the march conditions in the area. Bedrock was dominant in 22 percent of the areas observed and sand was dominant in eight percent.

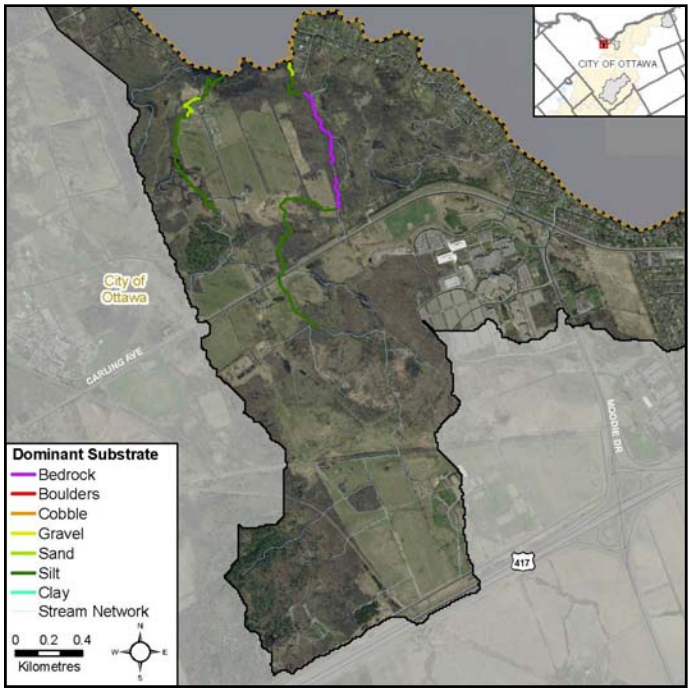

Figure 13 Dominant instream substrate along the Ottawa West Tributaries

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 Ottawa West Tributaries have a diversity of morphological conditions, suitable for a variety of aquatic species and life stages; 89 percent contained pools, 51 percent contained riffles and the majority, 95 percent, contained runs. Figure 15 shows the locations of riffle habitat along the Ottawa West Tributaries.

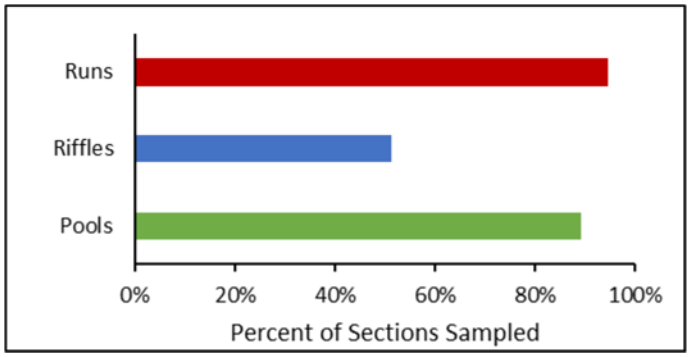

Figure 14 Instream morphology along Ottawa West Tributaries

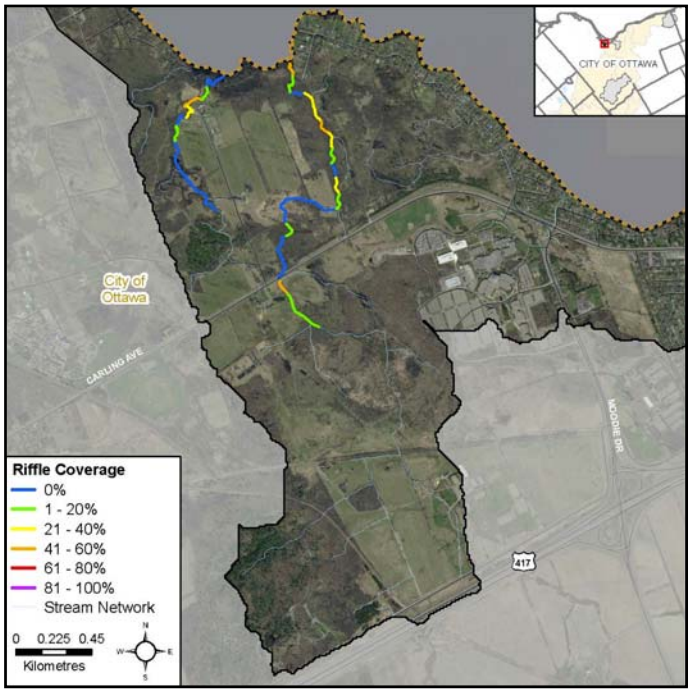

Figure 15 Riffle coverage along the Ottawa West Tributaries

Instream Wood Structure

Figure 16 shows that the majority of the Ottawa West Tributaries had low levels of instream wood material in the form of branches and trees. Some sections had elevated levels of wood structures associated with natural tree decay as well as beaver activity in the area. Instream wood material is important for fish and wildlife habitat, by providing refuge and feeding areas. Excessive amounts can create barriers.

Instream wood structures found along Ottawa West Tributary 1 (above) and Ottawa West Tributary 2 (below)

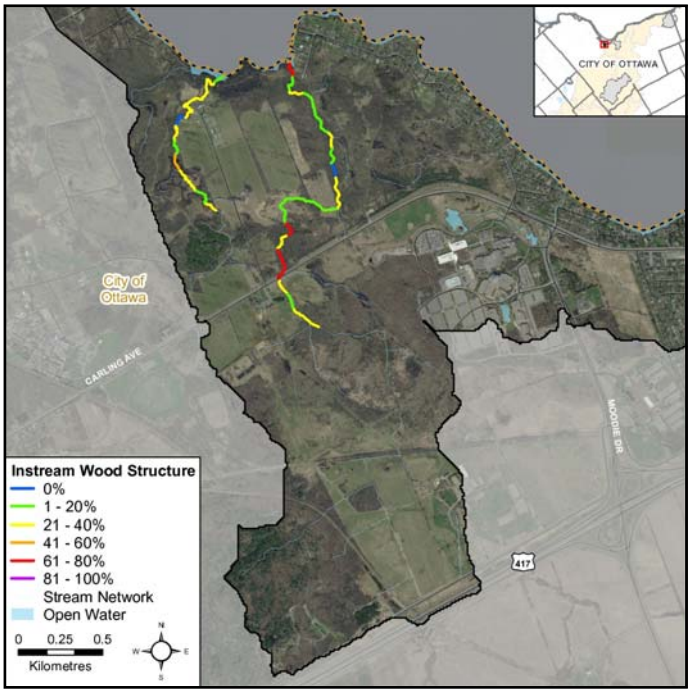

Figure 16 Instream wood material in the Ottawa West Tributaries

Instream 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. Narrowed-leaved vegetation is present in 81 percent of sections; broad leaved in 43 percent and robust emergent in 68 percent. Free floating were present in 41 percent of sections and rooted floating were observed in 24 percent. Submerged plants were found in 59 percent of sections; and algae was present in 62 percent of sections.

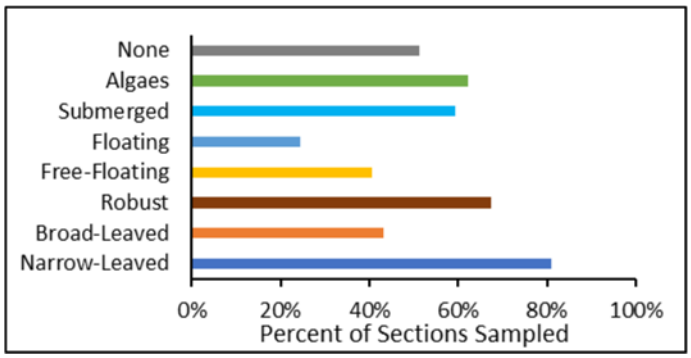

Figure 17 Instream vegetation presence along the Ottawa West Tributaries

The tributaries have a diverse community dominated by narrow-leaved/ robust emergent plants (Figure 18).

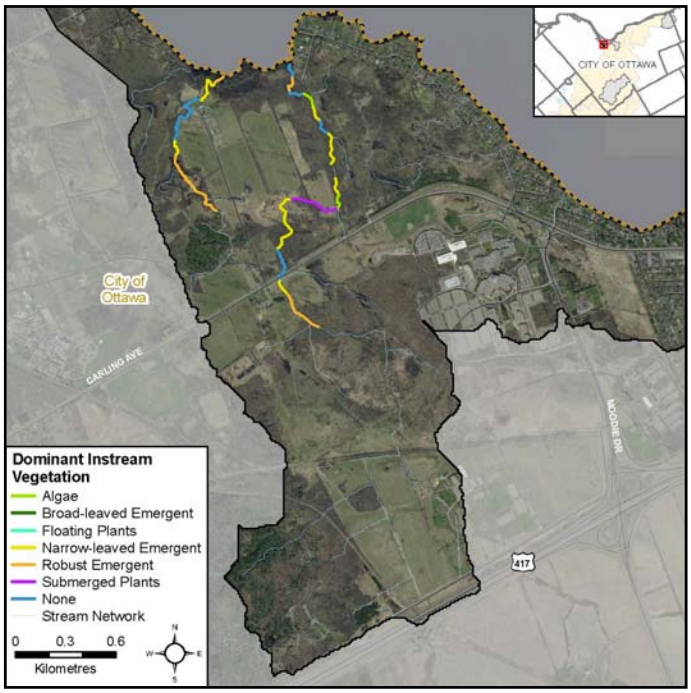

Figure 18 Dominant instream vegetation along the Ottawa West Tributaries

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, 54 percent of sections in the Ottawa West Tributaries had extensive levels of vegetation present; 57 percent had common levels. Normal levels of abundance were observed in 30 percent of sections; low levels were seen in 27 percent and rare levels were present in 19 percent of the streams. No vegetation has been observed in 35% of the sections surveyed.

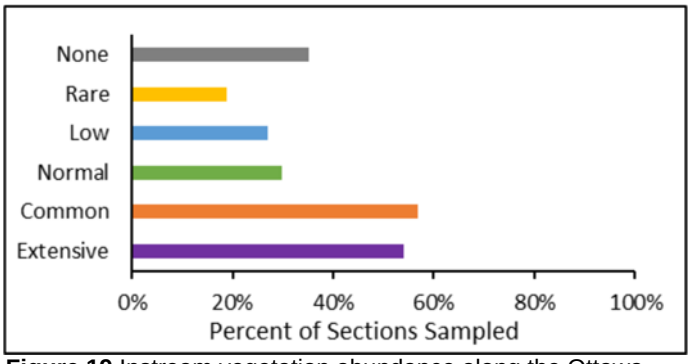

Figure 19 Instream vegetation abundance along the Ottawa West Tributaries

Water parsnip *Sium suave* (left) and cardinal flower *Lobelia cardinalis* (right) found along Ottawa West Tributary 1

Ottawa West Tributaries 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 standard monitoring and survey activities, and do not represent an extensive evaluation of species presence or absence.

A variety of odonates are found along the instream and shoreline vegetation of the Ottawa West Tributaries

Fresh eastern elliptio shells (above) found along Ottawa West Tributary 2

Large mammal tracks found along the banks of Ottawa West Tributary 1

Table 1 Wildlife observations along Ottawa West Tributaries in 2017

Wildlife Category	Observations
Birds	American crow, American robin, black-capped chickadee, barn swallow, cedar waxwing, finches, gray catbird, great blue heron, green heron, mallard, osprey, pileated woodpecker, red-winged blackbird, warblers, woodpeckers
Reptiles & Amphibians	American bullfrog, gray treefrog northern leopard frog, pickerel frog, tadpoles, wood frog
Mammals	American beaver, muskrat, white-tailed deer
Benthic Invertebrates	eastern elliptio, leeches, oligochaetes, snails, water boatman, water scorpion, water strider, whirligig beetle
Other	Butterflies, cicadas, crickets, cyprinids, damselflies, dragonflies, lady bug, red meadow-hawk, midges, mosquitoes, powdered darner

Wood frog (above) and a northern leopard frog (below) found along Ottawa West Tributary 2

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 manage or eradicate, however it is important to continue to research, monitor and manage them.

Figure 20 shows abundance of species observed per section. Nine invasive species present in 2017 were:

- bull thistle (*Chrisium vulgare*)
- common & glossy buckthorn (*Rhamnus cathartica & R. frangula*)
- dog strangling vine (*Cynanchum rossicum & C. louiseae)*
- Eurasian water-milfoil (*Myriophyllum spicatum*)
- European frog-bit (*Hydrocharis morsus-ranae*)
- flowering rush (*Butomus umbellatus*)
- garlic mustard (*Alliaria petiolata*)
- non-native honey suckle (*Lonicera sp.*)
- purple loosestrife (*Lythrum salicaria*)

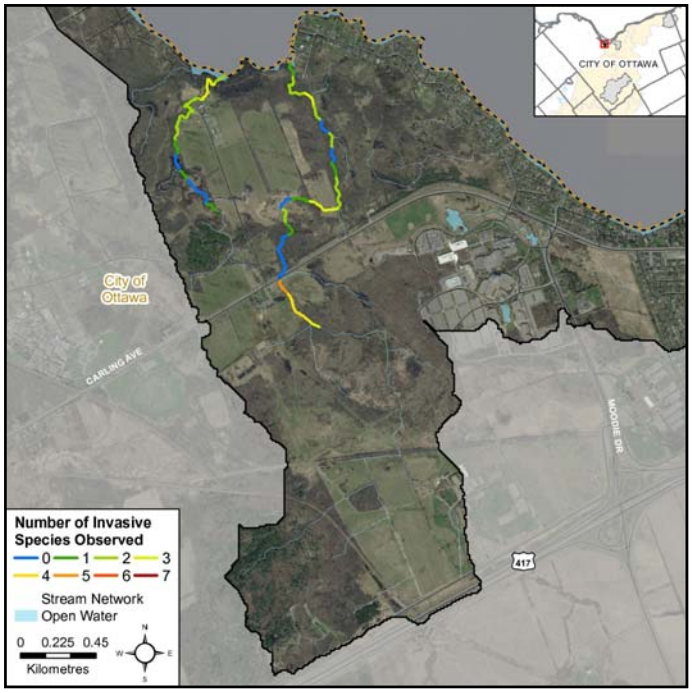

Figure 20 Invasive species abundance along the Ottawa West Tributaries

Invasive buckthorn found along the Ottawa West Tributaries

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 the Ottawa West Tributaries. The levels of garbage found in the streams were low, with 84 percent of sections surveyed containing no garbage. In the 16 percent of sections that were polluted, most garbage observed were packaged plastics, cans, shell casings, and an abandoned vehicle. This area receives small amounts of garbage from the surrounding land use including road ways, recreational trails and gun activity.

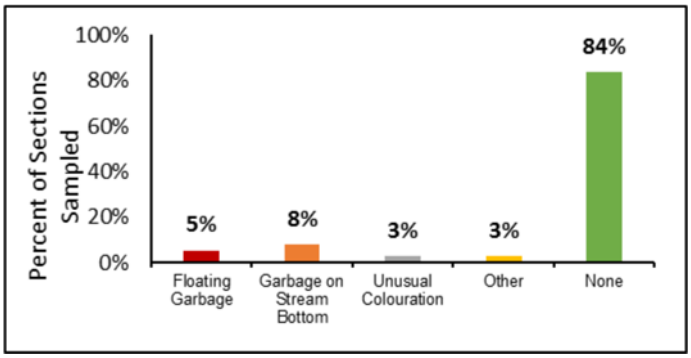

Figure 21 Pollution observed along the Ottawa West Tributaries

Shell casings found along Ottawa West Tributary 2

Ottawa West Tributaries 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.

Collecting water chemistry measurements with a YSI probe along the Ottawa West Tributary 1

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 along the Ottawa West Tributaries. The red dashed line depicts the Canadian water quality guideline for warm-water biota. Levels in the tributaries are below water quality guidelines for the protection of warm-water biota. Average levels across the system were 2.5 milligrams per liter. These levels are typical of wetland and marsh riverine areas, where there is high levels of nutrient loading and abundant macrophyte growth.

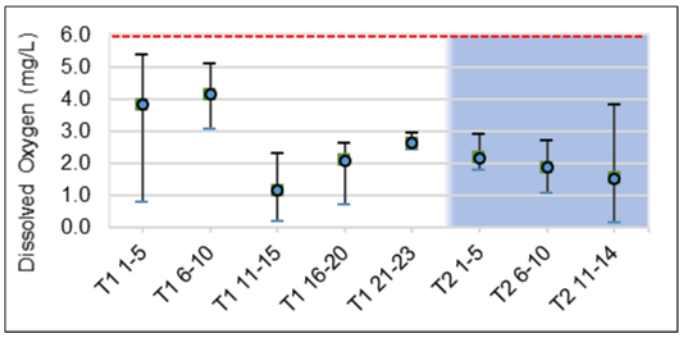

Figure 22 Dissolved oxygen ranges in the Ottawa West Tributaries: 1-23 Tributary 1 (T1), 1-14 Tributary 2 (T2) in blue

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 the Ottawa West Tributaries, the average level is depicted by the dashed line (485 µS/cm). Notable variability was observed in Tributary 1, (sec. T1 16-20) likely influenced by roadway input from Carling Avenue. Tributary 2 had more variability, likely resulting from the natural wetland conditions in the area.

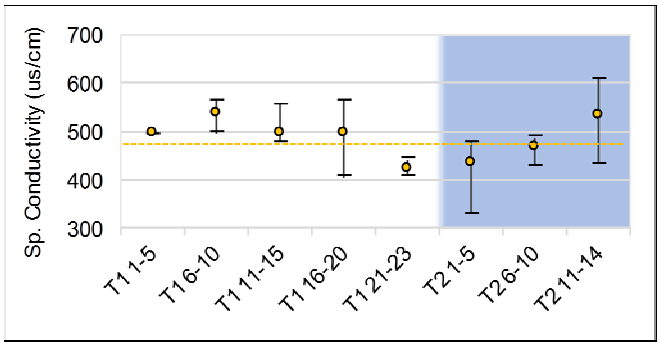

Figure 23 Conductivity ranges in the Ottawa West Tributaries: 1-23 Tributary 1 (T1), 1-14 Tributary 2 (T2) in blue

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 the Ottawa West Tributaries had mostly pH levels that meet the PWQO, depicted by the dashed lines. Average levels across both tributaries were pH 7.31. Tributary 2 had pH fluctuations in wetland reaches (Sec. T2 11-14).

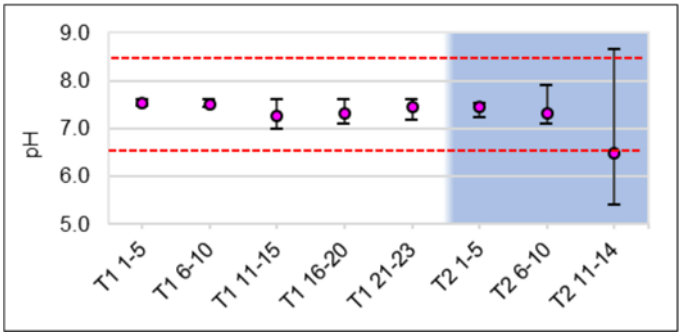

Figure 24 pH ranges in the Ottawa West Tributaries: 1-23 Tributary 1 (T1), 1-14 Tributary 2 (T2) in blue

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.

Site on Ottawa West Tributary 1 with aerating flows but **poor** oxygen conditions

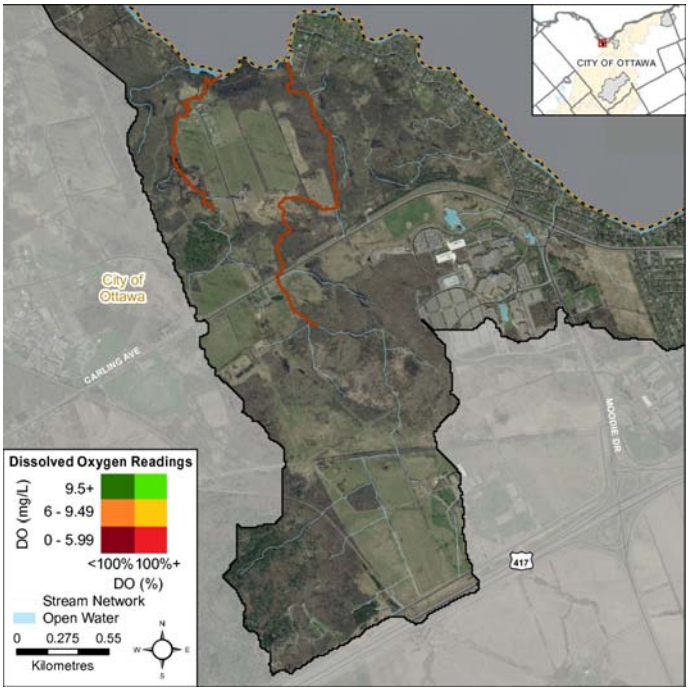

Figure 25 Bivariate assessment of dissolved oxygen concentration (mg/L) and saturation (%) in the Ottawa West Tributaries

Figure 25 shows the oxygen conditions across the areas that were surveyed in 2017. Overall dissolved oxygen conditions in the Ottawa West Tributaries are not sufficient to support aquatic life and may represent impairment.

Impairment of dissolved oxygen levels, shown in red in Figure 25, were observed in all areas. Natural low flow and low oxygen conditions are expected in wetland areas. There are reaches of Tributary 1 (sec. T1 1-10) that have flows that are conducive to aeriation, however limiting factors remain in that area. Tributary 2 has fewer sections with potential for improvement (sec. T2 5 -7), as it is dominated by wetland conditions.

Marsh type wetland site with low velocities on Ottawa West Tributary 2 with natural **poor** oxygen conditions

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 the Ottawa West Tributaries (485 µS/cm) are within guidelines (500 µS/cm) used for the Canadian Environmental Performance Index (Environment Canada 2011). Figure 26 shows relative specific conductivity levels along the Ottawa West Tributaries. Normal levels were maintained for most of the surveyed portions of both tributaries. Moderately elevated levels were observed on Tributary 1 near Carling Avenue and downstream from an online pond as well as downstream of a tributary that conveys flow from the area around Carling Avenue. On Tributary 2, moderately elevated levels were observed in the sections where small tributaries entered the system from adjacent lands. Highly elevated levels were observed in two sections of Tributary 2; Upstream in the wetland portion of the system, and near the confluence with the Ottawa River.

On-line pond with outlet to Ottawa West Tributary 1 upstream of Carling Avenue

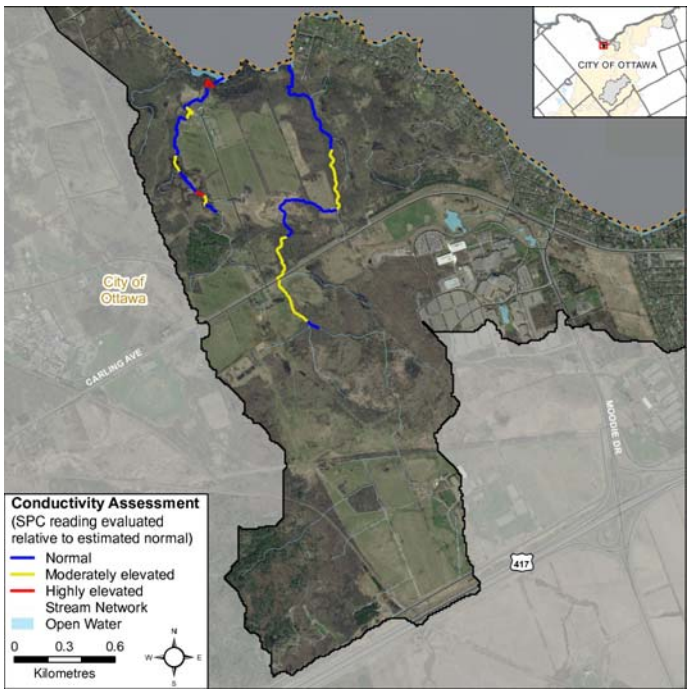

Figure 26 Relative specific conductivity levels along the Ottawa West Tributaries

Confluence of Ottawa West Tributary 2 with the Ottawa River

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 permanent or seasonal.

Ottawa West Tributary 1 had a series of bedrock grade barriers and one debris dam downstream of Carling Avenue (Figure 27).

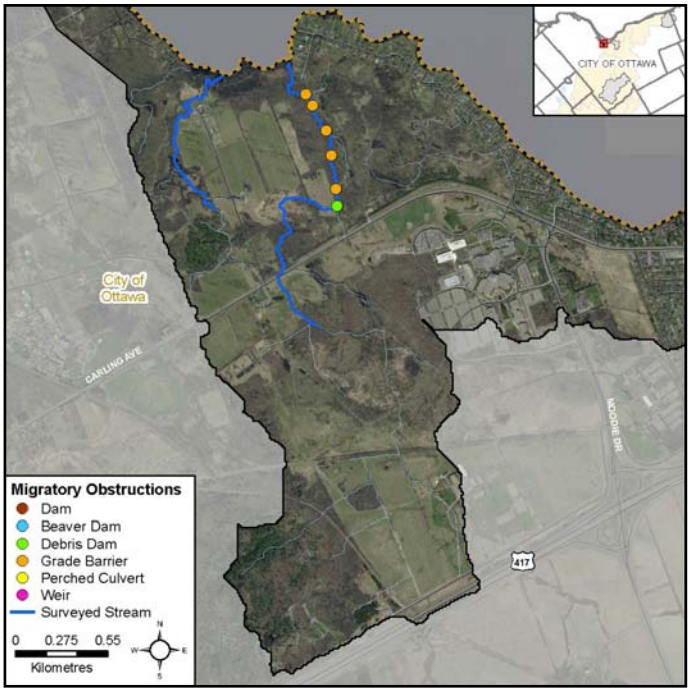

Figure 27 Migratory obstructions in the Ottawa West Tributaries

Small grade barrier along Ottawa West Tributary 1

Active beaver dam along Ottawa West Tributary 2

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 woody material used in the dams which removes excess nutrient and toxins. Beaver dams are also considered potential barriers to fish migration. In 2017, a total of two beaver dams were observed; their locations and condition are shown in Figure 28.

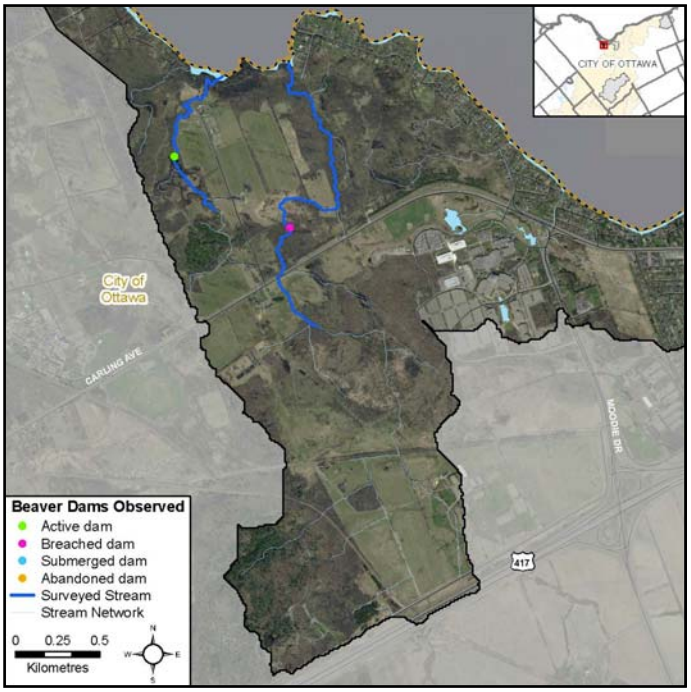

Figure 28 Beaver dam locations along the Ottawa West Tributaries

Breached beaver dam along Ottawa West Tributary 1

Monitoring and Restoration

Monitoring and Restoration Projects on Ottawa West Tributaries

Future monitoring activities will allow us to observe trends and changes overtime of the Ottawa West Tributaries as the area undergoes land use changes. Potential restoration opportunities are listed below.

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 29).

There are opportunities for invasive species control in both Tributaries near their confluence with the Ottawa River. In particular dog-strangling vine was observed in only two sections of Tributary 1 (TR1 sec.2-3), early intervention may prevent aggressive spreading of this plant. Along Tributary 2, few sections contained Flowering rush, Eurasian milfoil and European Frogbit, invading from the Ottawa River; they could be managed as this system will continue to receive backwater from the Ottawa River.

Although invasive buckthorn was observed in many sections of the Ottawa West Tributaries, its extensive range and high abundance makes this a non-ideal candidate for management as it could affect the overall riparian health of the streams.

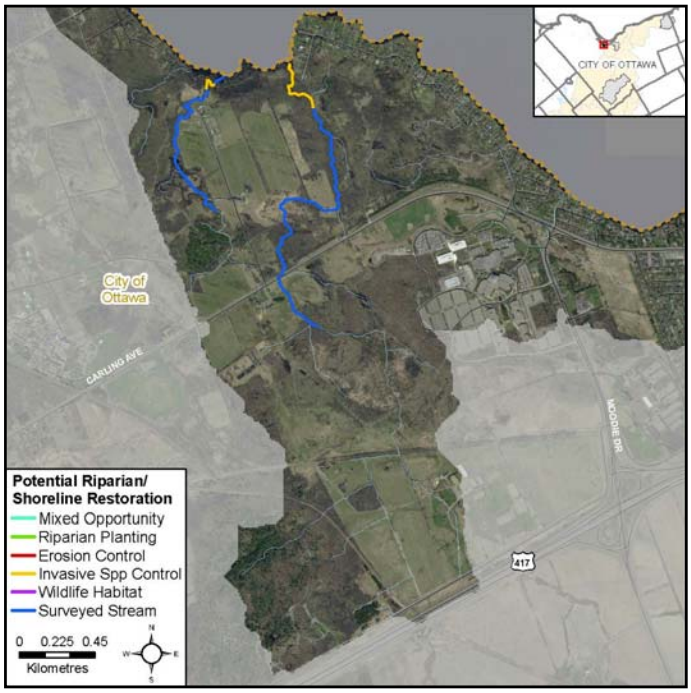

Figure 29 Potential riparian/shoreline restoration opportunities along the Ottawa West Tributaries

Potential Instream Restoration Opportunities

The Ottawa West Tributary 1 has an area identified for having potential for fish habitat enhancement (Figure 30). This area could benefit from increased heterogeneity in the stream by creation of riffles along that section. Riffle creation would also contribute to increase the oxygen levels which are currently impaired in that area.

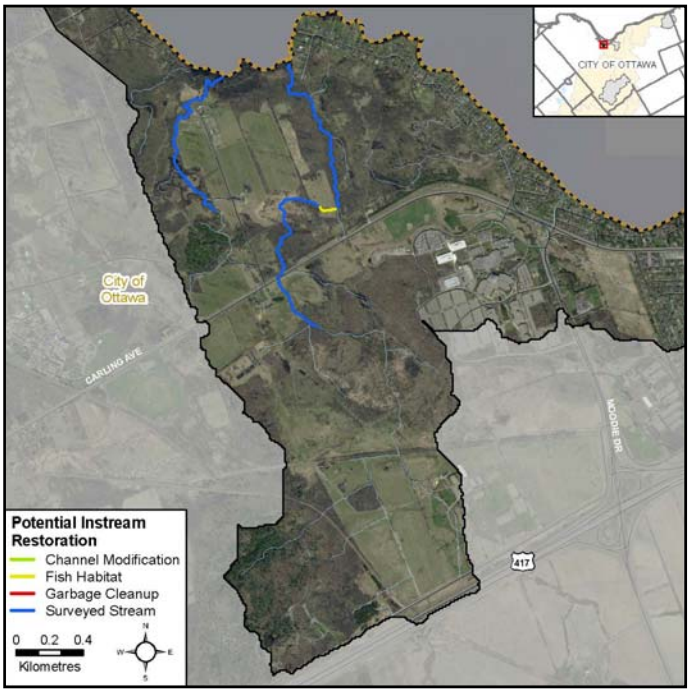

Figure 30 Potential instream restoration opportunities along the Ottawa West Tributaries

Section of Ottawa West Tributary 1 that would benefit from fish habitat enhancement.



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For more information on the overall 2017 City Stream Watch Program and the volunteer activities, please refer to the City Stream Watch 2017 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 **landowners and leasers** who gave us property access to portions of the stream; and to our **City Stream Watch Collaborative members**: City of Ottawa, Ottawa Flyfishers Society, Ottawa Stewardship Council, Rideau Roundtable, Canadian Forces Fish and Game Club, and the National Capital Commission