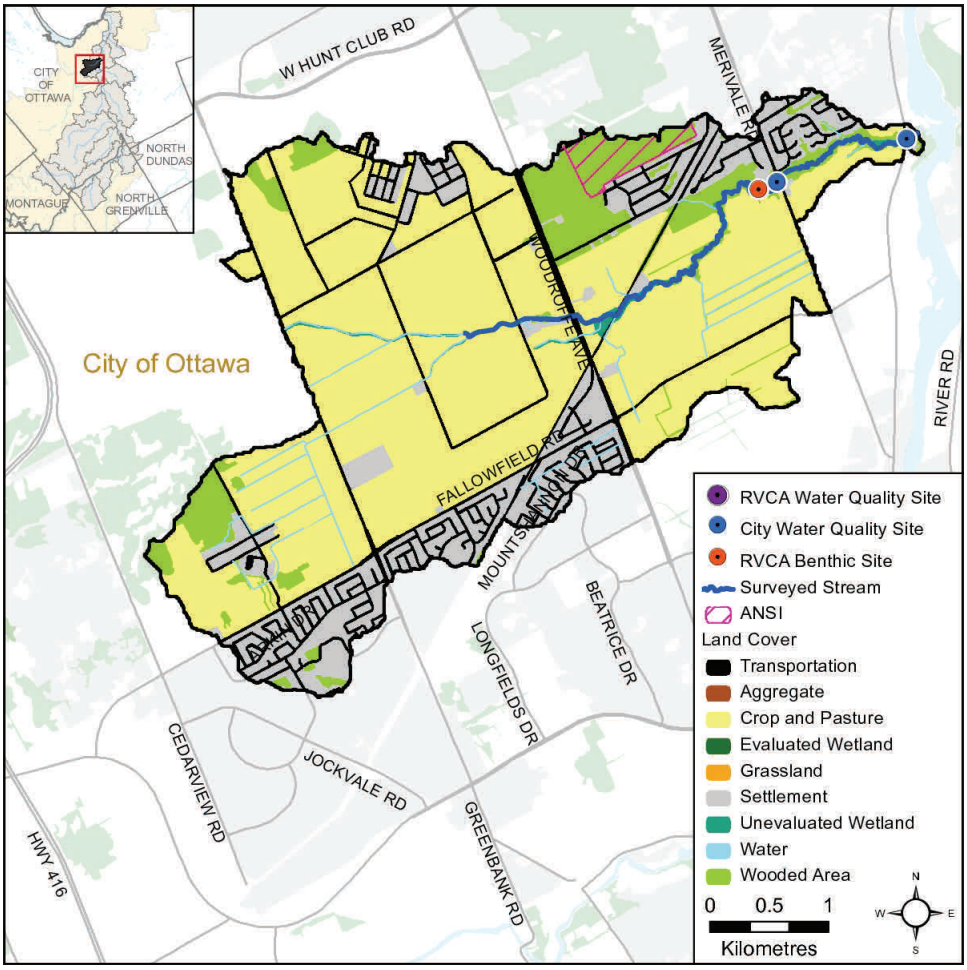
BLACKS RAPIDS CREEK CATCHMENT

LOWER RIDEAU RIVER SUBWATERSHED REPORT 2012

RIDEAU VALLEY CONSERVATION AUTHORITY



The RVCA produces individual reports for 16 catchments in the Lower Rideau subwatershed. Using data collected and analysed by the RVCA through its watershed monitoring and land cover classification programs, a summary of environmental conditions is reported for Blacks Rapids Creek and the surrounding countryside every six years.

This information is used to help better understand the effects of human activity on our water resources, allows us to better track environmental change over time and helps focus watershed management actions where they are needed the most.

The following pages of this report are a compilation of that work. For other Lower Rideau catchments and the Lower Rideau Subwatershed Report, please visit the RVCA website at www.rvca.ca.

Inside

Catchment Facts

- A mostly natural watercourse meandering within a well-defined valley system through Federally owned agricultural land in the National Capital Greenbelt
- Limited urban development in the catchment (Country Place) predates any requirements for stormwater management
- Geomorphologically stable and no flooding concerns
- Drains 16 sq. km of land or 2.1% of the Lower Rideau Subwatershed and 0.4% of the Rideau Valley Watershed
- Dominant land cover is crop and pastureland (63%), followed by settlement (16%), woodland (10%), transportation (10%) and wetland (1%)
- Riparian buffer (30 m. wide along both sides of Blacks Rapids Creek and its tributaries) is comprised of crop and pastureland (58%), wetland (19%), woodland (16%), transportation (4%) and settlement (3%)
- Contains a cool/warm water baitfish and recreational fishery with 19 fish species
- Water quality rating along Blacks Rapids Creek is poor at Merivale Road and poor at Prince of Wales Drive, with no change in the water quality rating observed over a 12 year reporting period (2000-2005 vs. 2006-2011)
- Woodland cover has increased by 0.7 percent (12 ha.) from 2002 to 2008
- Floodplain mapping is available along the Rideau River, at the outlet from Blacks Rapids Creek
- During 2003 and 2008 stream surveys were conducted from the mouth of the creek to the headwaters by volunteers.
- OBBN sampling for benthic invertebrates was conducted at Merivale Road in the spring and fall of 2003 and 2008 by RVCA staff.
- Three stewardship (tree planting/clean water/shoreline naturalization) projects have been completed
- During 2003 and 2008, RVCA staff and volunteers conducted fish sampling near the creek mouth and caught 24 species.
- RVCA staff placed three temperature probes at different locations on Black Rapids Creek in 2008 to give a representative sample of how temperature fluctuates and differs throughout the system.
- 2008 hands on seining demonstration for volunteers.
- 2008 Biothon/Check Your Watershed Day during which volunteers conducted fish and benthic invertebrate sampling at Merivale Road.

1) Surface Water Quality

Assessment of streams in the Lower Rideau is based on 24 parameters including nutrients (total phosphorus, total Kjeldahl nitrogen, nitrates), E. coli, metals (like aluminum and copper) and additional chemical/physical parameters (such as alkalinity, chlorides pH and total suspended solids). Each parameter is evaluated against established guidelines to determine water quality conditions. Those parameters that frequently exceed guidelines are presented below.

The assessment of water quality throughout the Lower Rideau Subwatershed also looks at water quality targets that are presented in the 2005 Lower Rideau Watershed Strategy (LRWS), to see if they are being met. The LRWS identifies improving water quality as a priority concern; specifically reducing the levels of nutrients, bacteria and contaminants in the Lower Rideau.

1)a. Black Rapids Creek

Surface water quality conditions in Black Rapids Creek are monitored through the City of Ottawa's Baseline Water Quality Program (Site CK13-01 at Prince of Wales road crossing and Site CK13-02 off of Merivale Road, see Fig.1 for their locations).

The water quality rating for Black Rapids Creek is "Poor"; as determined by the CCME Water Quality Index (CCME WQI); analysis of the data has been broken into two periods 2000-2005 and 2006-2011, to examine if conditions have changed in this timeframe. Please note that there is no data from 2000-2005 for site CK13-02. Table 1 outlines the WQI scores and their corresponding ratings. For more information on the CCME WQI please see the Lower Rideau Subwatershed Report.

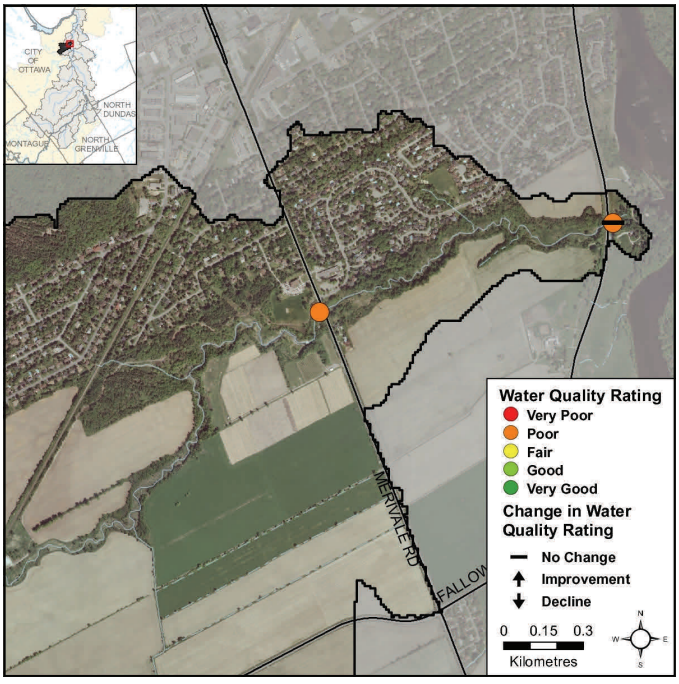


Figure 1. Sampling sites in Black Rapids Creek

Table 1. WQI Ratings and corresponding index scores (RVCA terminology, original WQI category names in brackets).

Rating	Index Score
Very good (Excellent)	95-100
Good	80-94
Fair	65-79
Poor (Marginal)	45-64
Very poor (Poor)	0-44

Black Rapids Creek Nutrients

Total phosphorus (TP) is used as a primary indicator of excessive nutrient loading and may contribute to abundant aquatic vegetation growth and depleted dissolved oxygen levels. The Provincial Water Quality Objectives (PWQO) of 0.030mg/l is used as the TP Guideline. Concentrations greater than 0.030 mg/l indicate an excessive amount of TP. Black Rapids Creek TP results are shown in Figures 2a and 2b. In addition to the TP guideline, the Lower Rideau Watershed Strategy set a target for TP concentration of 0.030 mg/l at the 85th percentile for tributaries of the Rideau River, such as Black Rapids Creek. Percentile plots of TP data are shown for two time periods 2000-2005 (Fig. 3a) and 2006-2011 (Fig. 3b). Any point to the left of the 85th percentile line (vertical) and above the guideline (horizontal line) have failed to reach the LRWS target.

Total Kjeldahl nitrogen (TKN) is used as a secondary indicator of nutrient loading; RVCA uses a guideline of 0.500 mg/l (TKN Guideline) to assess TKN concentrations. Black Rapids Creek TKN results are shown in Figures 4a and 4b.

Tables 2 and 3 summarize average nutrient concentrations at monitored sites on Black Rapids Creek and shows the proportion of samples that meet guidelines. Highlighted values indicate that the average value exceeded the guideline.

Table 2. Summary of total phosphorous results for Black Rapids Creek from 2000-2005 and 2006-2011

Total Phosphorus 2000-2005			
Site	Average (mg/l)	% Below Guideline	No. Samples
CK13-01	0.069	23	57
CK13-02			
Total Phosphorus 2006-2011			
Site	Average (mg/l)	% Below Guideline	No. Samples
CK13-01	0.059	16	50
CK13-02	0.058	20	10

Table 3. Summary of total Kjeldahl nitrogen results for Black Rapids Creek from 2000-2005 and 2006-2011

Total Kjeldahl Nitrogen 2000-2005			
Site	Average (mg/l)	% Below	No. Samples
CK13-01	0.702	23	57
CK13-02			
Total Kjeldahl Nitrogen 2006-2011			
Site	Average (mg/l)	% Below	No. Samples
CK13-01	0.509	54	50
CK13-02	0.568	30	10

Black Rapids Creek Nutrients: Site CK 13-01

The majority of samples at site CK13-01 were above the TP guideline of 0.030mg/l for both time periods (Fig. 2a, 2000-2005 and 2b, 2006-2011). Only twenty-three percent of samples were below the guideline in the 2000-2005 period, this declined to sixteen percent of samples in the 2006-2011 period. There was a slight decrease in average TP concentration from 0.069mg/l (2000-2005) to 0.059 mg/l (2006-2011).The LRWS target has not been achieved at site CK13-01, though the concentration at the 85th percentile did decrease from 0.124 mg/l (2000-2005, Fig. 3a) to 0.090 mg/l (2006-2011, Fig. 3b).

TKN is used as a secondary indicatory of nutrient enrichment. Figures 4a and 4b show that the majority of results exceeded the TKN guideline of 0.500 mg/l, twenty-three percent of samples were below the guideline in 2000-2005 (Fig. 4a) and this improved to fifty-four percent that were below the guideline in the 2006-2011 (Fig. 4b) period. The average concentration also increased slightly from 0.509 mg/l to 0.568 mg/l, exceeding the guideline.

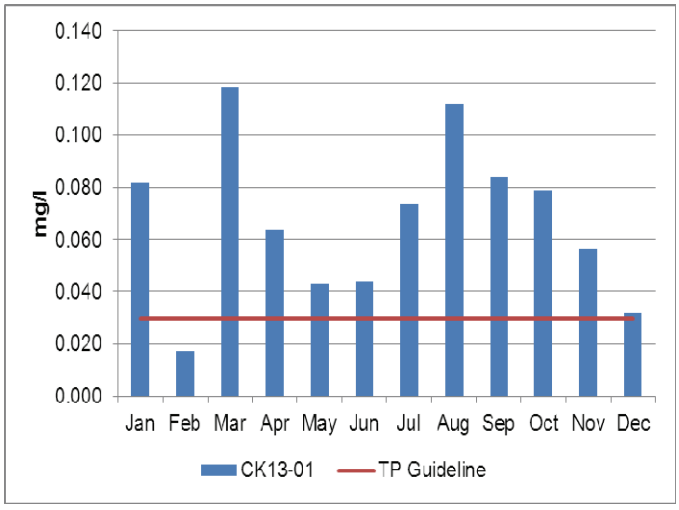


Figure 2a. Total phosphorus concentrations in Black Rapids Creek from 2000-2005

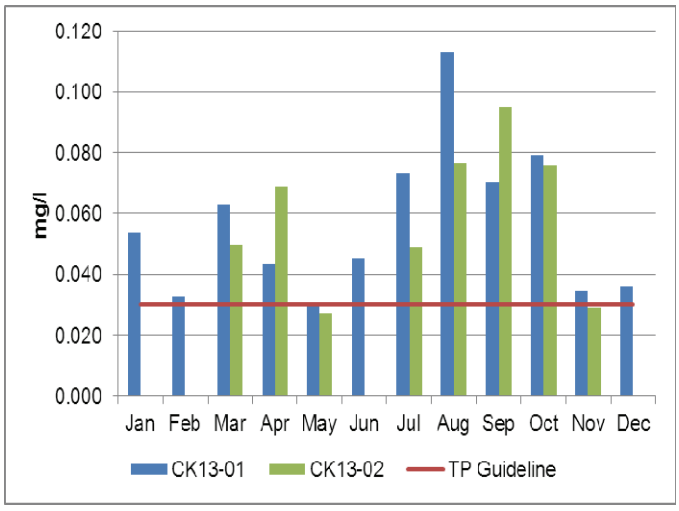


Figure 2b. Total phosphorus concentrations in Black Rapids Creek from 2006-2011

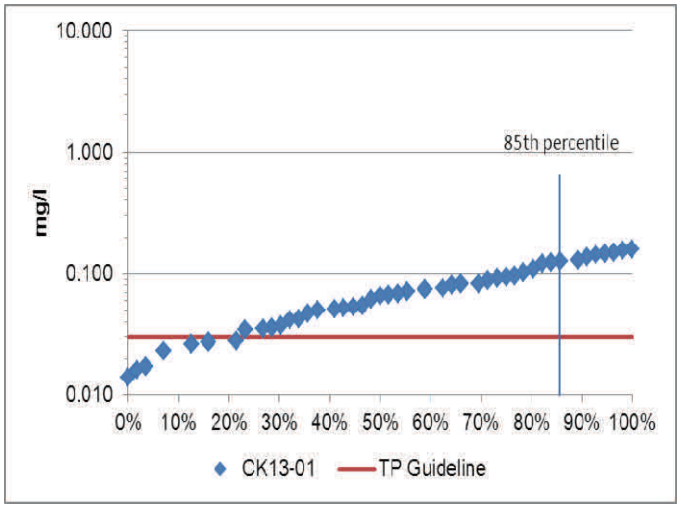


Figure 3a. Percentile plots of total phosphorous in Black Rapids Creek from 2000-2005

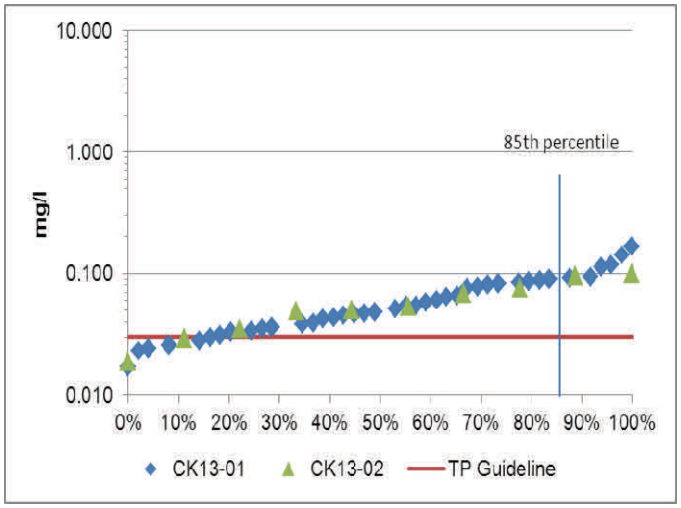


Figure 3b. Percentile plots of total phosphorous in Black Rapids Creek from 2006-2011

Black Rapids Creek Nutrients: Site CK13-02

Data for site CK13-02 is only available for a few dates in the 2006-2011 period; twenty percent of samples at this site were above the TP guideline of 0.030mg/l (Fig. 2b) and the average TP concentration was 0.058 mg/l (2006-2011). The percentile plots of TP data for site CK13-02 (Fig. 3b) show that the target set by the LRWS has not been achieved and the concentration at the 85th percentile exceeds the target at 0.088 mg/l.

TKN results show that the majority of results exceeded the TKN guideline of 0.500 mg/l (Fig. 4b) and the average concentration was 0.568 mg/l.

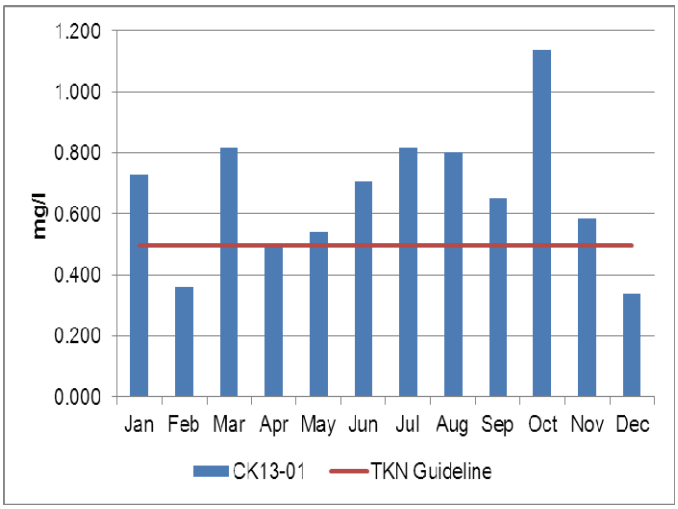


Figure 4a. Total Kjeldahl nitrogen concentrations in Black Rapids Creek from 2000-2005

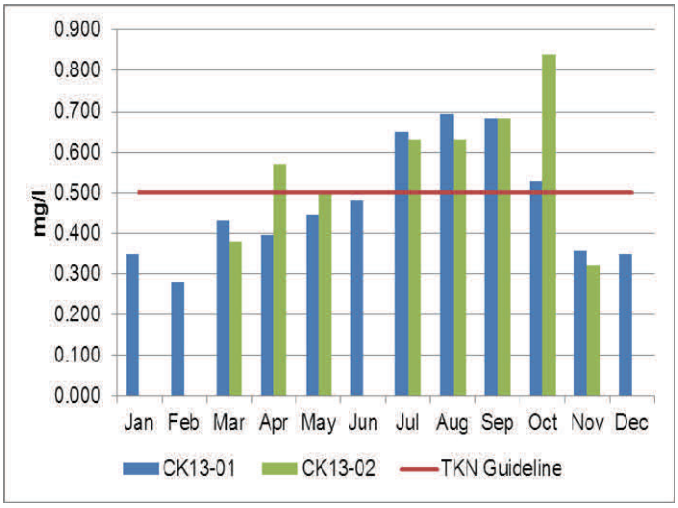


Figure 4b. Total Kjeldahl nitrogen concentrations in Black Rapids Creek from 2006-2011

Black Rapids Creek Nutrients Summary

Overall the data suggests that nutrient loading is a problem in Black Rapids Creek; efforts should be made to reduce nutrient inputs to the creek.

Black Rapids Creek *E. coli*

E. coli is used as an indicator of bacterial pollution from human or animal waste; in elevated concentrations it can pose a risk to human health. The PWQO of 100 colony forming units/100 millilitres is used, E. coli counts greater than this guideline indicate that bacterial contamination may be a problem within a waterbody. The Lower Rideau Watershed Strategy also set a target for E. coli counts of 200 CFU/100 ml at the 80th percentile for tributaries of the Rideau River, such as Black Rapids.

Table 4 summarizes the geometric mean at the monitored site on Black Rapids and shows the proportion of samples that meet the E. coli guideline of 100 CFU/100ml. Highlighted values indicate averages that exceed the guideline

Figure 5 shows the results of the geometric mean with respect to the guideline for the two periods 2000-2005 (Fig. 5a) and 2006-2011 (Fig 5b). Figures 6a and 6b show percentile plots of the data for the two time periods of interest 2000-2005 (Fig. 6a) and 2006-2011 (Fig. 6b). Any point to the left of the 80th percentile line (vertical) and above the guideline (horizontal line) have failed to reach the LRWS target.

Table 4. Summary of E. coli results for Black Rapids Creek.

E. coli 2000-2005			
Site	Geometric mean	% Below Guideline	No. Samples
CK13-01	88	53	57
CK13-02			
E. coli 2006-2011			
Site	Geometric mean	% Below Guideline	No. Samples
CK13-01	183	29	49
CK13-02	177	44	9

Black Rapids Creek E. coli: Site CK13-01

E. coli counts above the guideline of 100 colony forming units per 100 mL (CFU/100mL) were common at both water quality monitoring sites on Black Rapids Creek. In comparing the two time periods at site CK13-01 the proportion of samples below the guideline decreased from fifty-three percent (Fig. 5a) to twenty-nine percent (Fig. 5b), indicating higher counts occur more frequently. The count at the geometric mean increased from 88 CFU/100 ml to 183 CFU/100 ml. Percentile plots of E.coli data at site CK13-01 are shown for both periods. Figures 6a and 6b show that this target was exceeded in both time periods, the E. coli count at the 80th percentile increased from 386 CFU/100 ml to 548 CFU/100 ml.

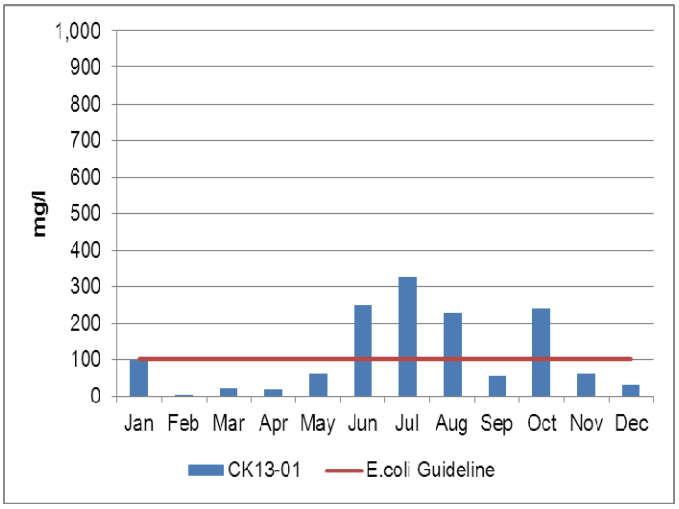


Figure 5a. E. coli counts in Black Rapids Creek from 2000-2005

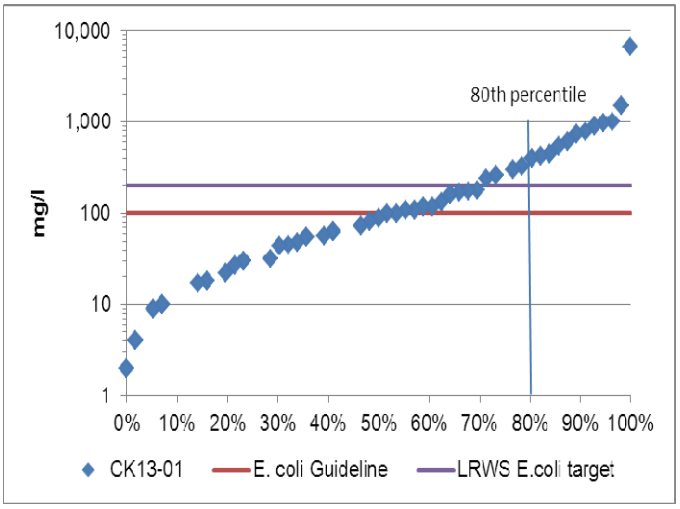


Figure 6a. Percentile plots of E. coli in Black Rapids Creek from 2000-2005

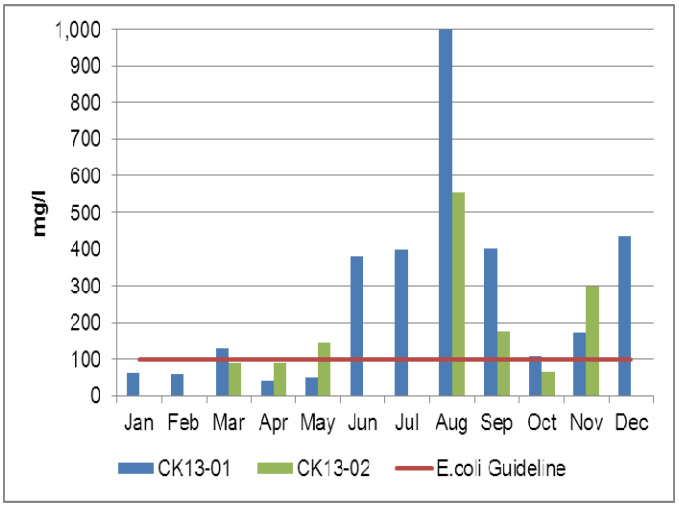


Figure 5b. E. coli concentrations in Black Rapids Creek from 2006-2011

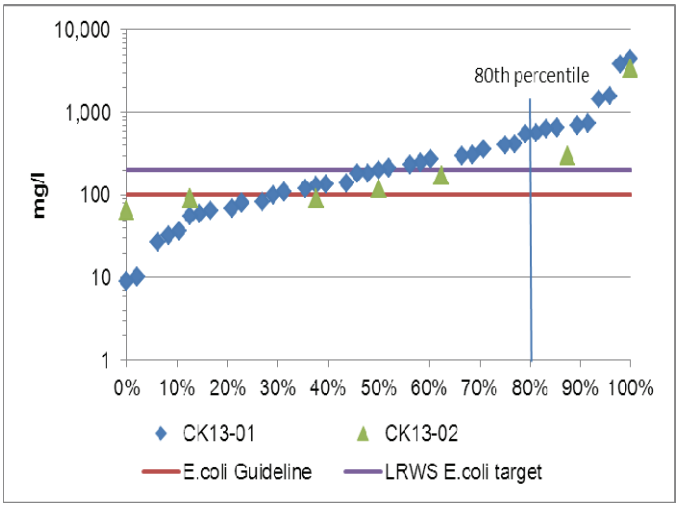


Figure 6b. Percentile plots of E. coli in Black Rapids Creek from 2006-2011

Black Rapids Creek E. coli: Site CK13-02

A second water quality monitoring site, CK13-02 is located upstream of CK13-01. The proportion of samples below the guideline at CK13-02 was forty-four percent (Fig. 5b) and the count at the geometric mean was 177 CFU/100ml. Figure 6b shows that the LRWS target for E. coli was exceeded at site CK13-02; as the E. coli count at the 80th percentile was 224 CFU/100 ml.

Black Rapids Creek E. coli Summary

These statistics indicated that bacterial counts have increased at site CK13-01 and efforts should be made to reduce any possible sources of contamination to the creek to protect overall water quality and aquatic life.

Bacterial counts are also high at site CK13-02, efforts should be continued to reduce any additional sources of contamination to the creek to protect overall water quality and aquatic life.

Black Rapids Creek Metals

Of the metals routinely monitored in Black Rapids Creek, aluminum (Al), copper (Cu) and iron (Fe) all reported concentrations above their respective PWQO. Elevated metals concentrations are a concern as they may have cumulative toxic effect on aquatic species.

Table 5 summarizes average metal concentrations at monitored sites on Black Rapids and shows the proportion of samples that meet guidelines. Highlighted values indicate averages that exceeded the guidelines

Figures 7, 8 and 9, show the results for each site with respect to guidelines for the two periods 2000-2005 (figures 7a, 8a and 9a) and 2006-2011 (figures 7b, 8b and 9b). The guidelines for each metal as stated by the PWQO are Al 0.075 mg/l, Cu 0.005 mg/l and Fe 0.300 mg/l. The Lower Rideau Watershed Strategy set a target for Cu concentration of 0.005 mg/l (Cu guideline) at the

Table 5. Summary of Metal concentrations in Black Rapids Creek.

Aluminum 2000-2005			
Site	Average (mg/l)	% Below Guideline	No. Samples
CK13-01	0.426	13	56
CK13-02			
Aluminum 2006-2011			
Site	Average (mg/l)	% Below Guideline	No. Samples
CK13-01	0.308	4	50
CK13-02	0.523	0	10
Iron 2000-2005			
Site	Average (mg/l)	% Below Guideline	No. Samples
CK13-01	0.524	36	56
CK13-02			
Iron 2006-2011			
Site	Average (mg/l)	% Below Guideline	No. Samples
CK13-01	0.386	48	50
CK13-02	0.531	30	10
Copper 2000-2005			
Site	Average (mg/l)	% Below Guideline	No. Samples
CK13-01	0.004	86	56
CK13-02			
Copper 2006-2011			
Site	Average (mg/l)	% Below Guideline	No. Samples
CK13-01	0.006	56	50
CK13-02	0.008	40	10

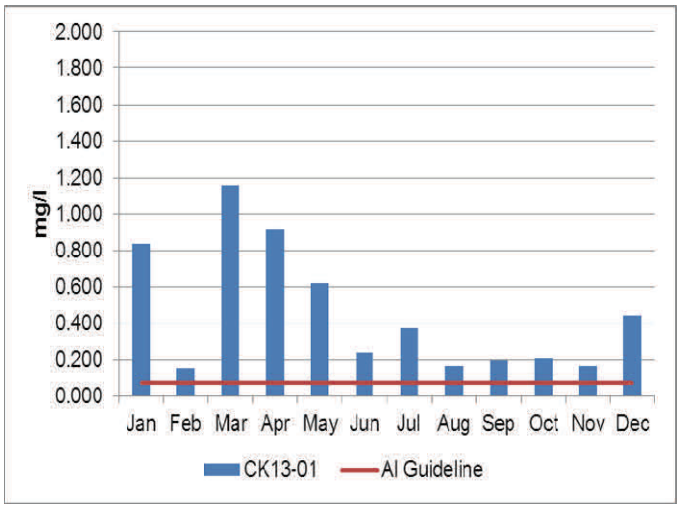


Figure 7a. Aluminum concentrations in Black Rapids Creek from 2000-2005

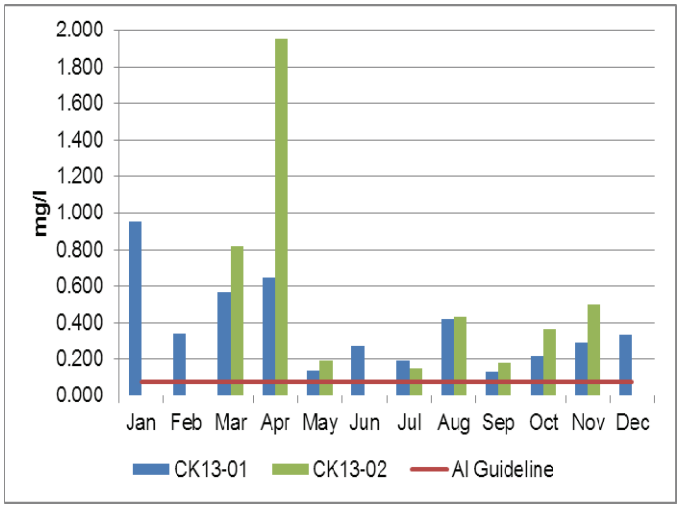


Figure 7b. Aluminum concentrations in Black Rapids Creek from 2006-2011

80th percentile for tributaries of the Rideau River, such as Black Rapids Creek. Percentile plots of Cu data are shown for the two time periods 2000-2005 (Fig. 10a) and 2006-2011 (Fig. 10b). Any point to the left of the 80th percentile line (vertical) and above the guideline (horizontal line) have failed to reach the LRWS target.

Black Rapids Creek Metals: Site CK13-01

The majority of metals monitored at site CK13-01 were below guidelines however results for aluminum (Al), iron (Fe) and copper (Cu) were occasionally elevated.

The Al guideline of 0.075 mg/l was generally exceeded in both time periods (Fig 7a, 2000-2005 and 7b, 2006-2011), only thirteen percent of samples were below the guideline in the 2000-2005 period, this decreased to four percent in the 2006-2011 period. There was a decrease in average Al concentration from 0.426 mg/l (2000-2005) to 0.308 mg/l (2006-2011).

Figures 8a and 8b show that the Fe results occasionally exceed the guideline of 0.300 mg/l and there was an overall increase in concentrations over the periods of interest. Thirty-six percent of samples were below the guideline in 2000-2005 and improved to forty-eight percent in the 2006-2011 period. The average concentration decreased from 0.524 mg/l to 0.386 mg/l, exceeding the guideline.

Results for Cu concentrations also exceeded the guideline of 0.005 mg/l. The proportion of samples below the guideline decreased slightly from eighty-six percent (Fig 9a, 2000-2005) to fifty-six percent (Fig 9b, 2006-2011), the average concentration increased from 0.004 mg/l to 0.006 mg/l. The target of a Cu concentration of

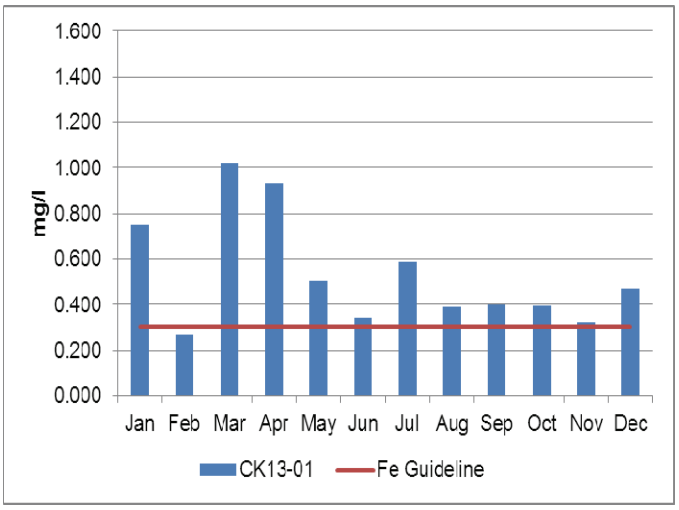


Figure 8a. Iron concentrations in Black Rapids Creek from 2000-2005

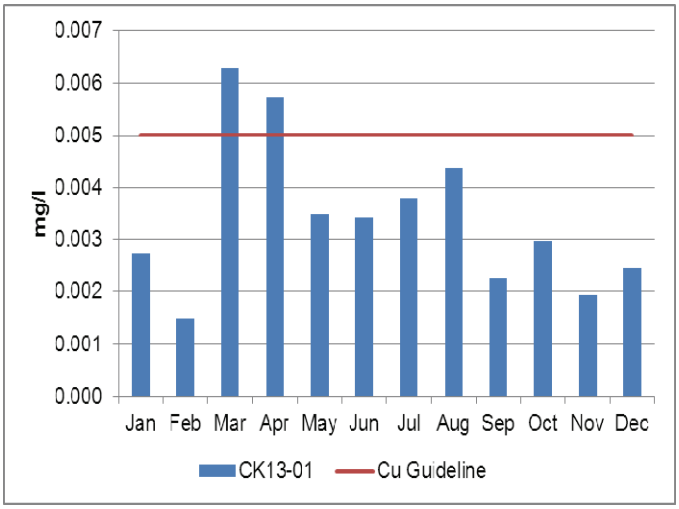


Figure 9a. Copper concentrations in Black Rapids Creek from 2000-2005

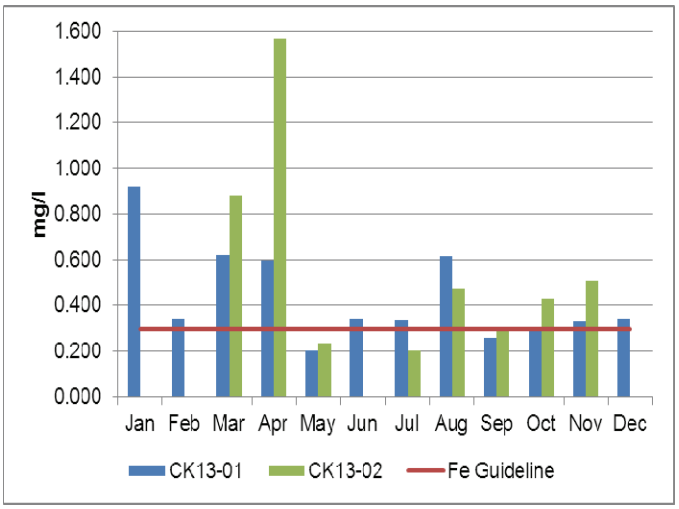


Figure 8b. Iron concentrations in Black Rapids Creek rom 2006 -2011

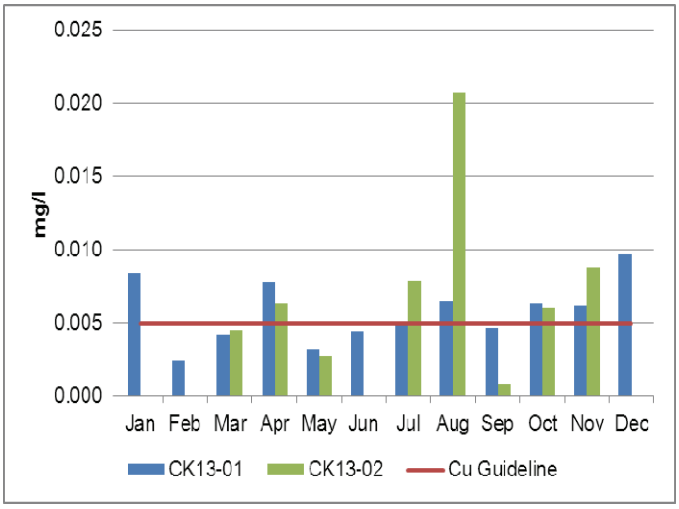


Figure 9b. Copper concentrations in Black Rapids Creek from 2006-2011

0.005 mg/l at the 80th percentile has not been achieved at site CK13-01; the concentration at the 80th percentile increased from 0.005 mg/l (2000-2005, Fig. 10a) to 0.008 mg/l (2006-2011, Fig. 10b).

Black Rapids Creek Metals: Site CK13-02

Results for Al generally exceeded the guideline at CK13-02 and there were no results below the guideline of 0.075 mg/l and the average Al concentration was 0.523 mg/l (2006-2011, Fig 7b)

Figure 8b shows that the Fe results often exceed the guideline of 0.300 mg/l; thirty percent of samples were below the guideline in the 2006-2011 period. The average concentration was 0.531 mg/l, exceeding the guideline.

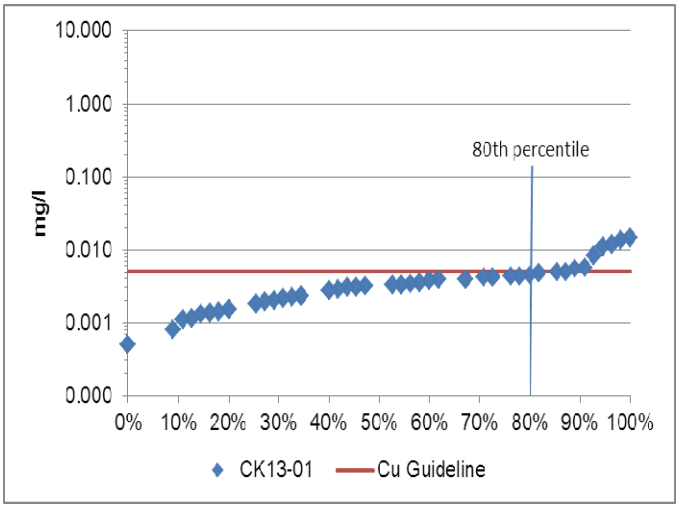


Figure 10a. Percentile plots of copper in Black Rapids Creek from 2000-2005

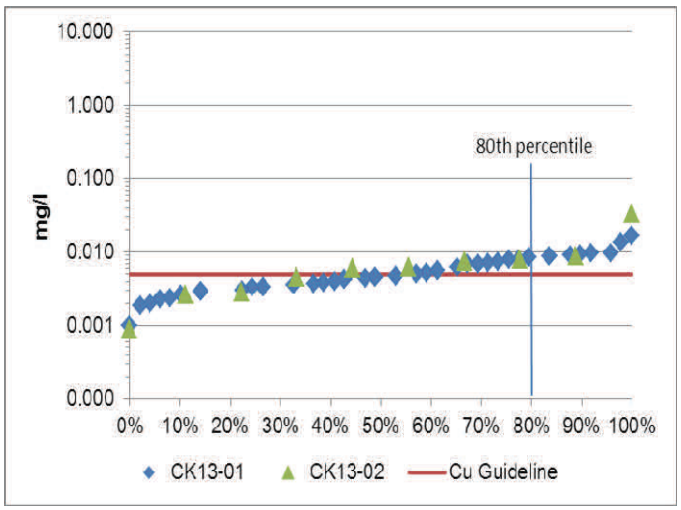


Figure 10b. Percentile plots of copper in Black Rapids Creek from 2006-2011

Results for Cu concentrations in site CK13-02 were also occasionally above the guideline of 0.005 mg/l. The target of a Cu concentration of 0.005 mg/l at the 80th percentile was 0.008 and therefore was not achieved.

Black Rapids Creek Metals Summary

Overall the data shows that metal pollution is a problem in the creek and efforts should be made to reduce concentrations wherever possible.

Black Rapids Creek Benthic Invertebrates

Freshwater benthic invertebrates are animals without backbones that live on the stream bottom and include crustaceans such as crayfish, molluscs and immature forms of aquatic insects. Benthos represent an extremely diverse group of aquatic animals and exhibit wide ranges of responses to stressors such as organic pollutants, sediments and toxicants, which allows scientists to use them as bioindicators.

Benthic sampling site replicate one on Black Rapids Creek at Merivale Rd in the city of Ottawa, this image was captured in the spring of 2008.

As part of the Ontario Benthic Biomonitoring Network (OBBN), the RVCA has been collecting benthic invertebrates at one location on Black Rapids Creek at Merivale Road since 2003. Monitoring data is analyzed and the results are presented using the Family Biotic Index, Family Richness and percent Ephemeroptera, Plecoptera and Trichoptera.

The Hilsenhoff Family Biotic Index (FBI) is an indicator of organic and nutrient pollution and provides an estimate of water quality conditions for each site using established pollution tolerance values for benthic invertebrates.

FBI results for Black Rapids Creek show that it has "Poor" water quality conditions for the period from 2006 to 2011 (Fig.11) and scores an overall "Poor" surface water quality rating using a grading scheme developed by Conservation Authorities in Ontario for benthic invertebrates.

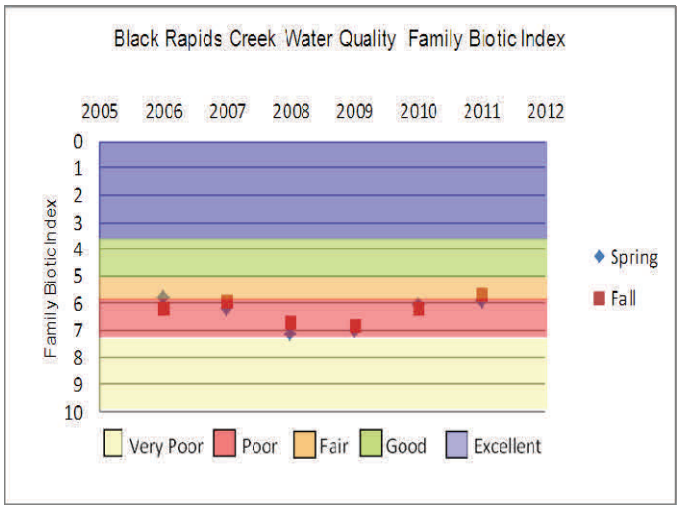


Figure 11. Surface water quality conditions in Black Rapids Creek based on the Family Biotic Index

Family Richness measures the health of the community through its diversity and increases with increasing habitat diversity suitability and healthy water quality conditions. Family Richness is equivalent to the total number of benthic invertebrate families found within a sample.

Using Family Richness as the indicator, Black Rapids Creek is reported to have "Fair" water quality (Fig.12).

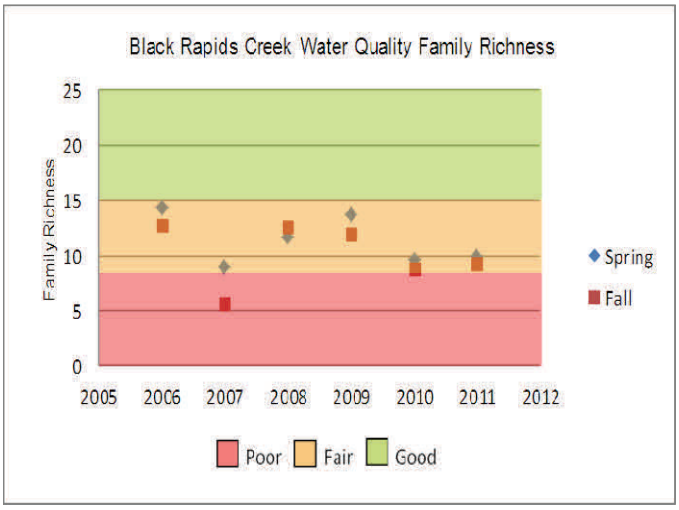


Figure 12. Surface water quality conditions in Black Rapids Creek based on Family Richness

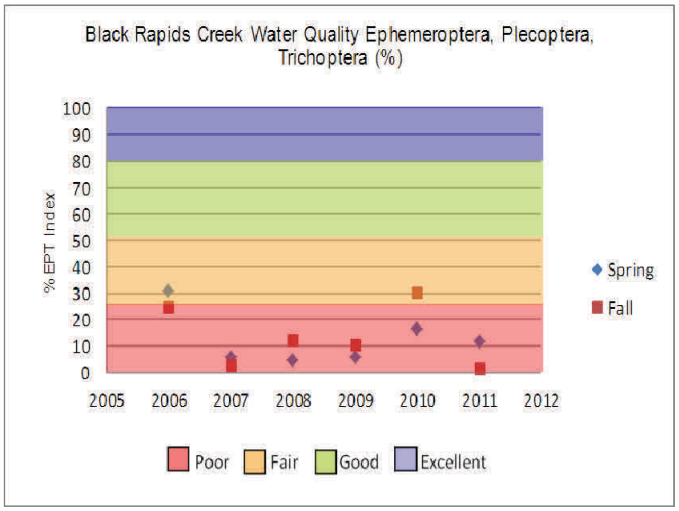


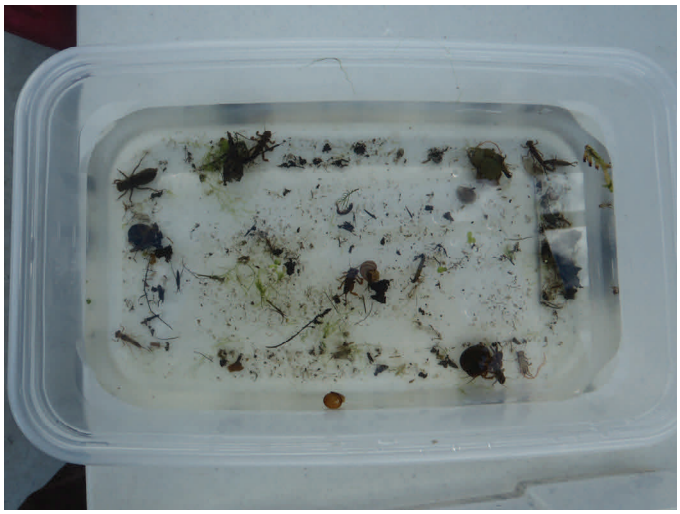
Figure 13. Surface water quality conditions in Black Rapids Creek using the EPT Index

Ephemeroptera (Mayflies), Plecoptera (Stoneflies), and Trichoptera (Caddisflies) are species considered to be very sensitive to poor water quality conditions. High abundance of these organisms is generally an indication of good water quality conditions at a sample location.

With the EPT indicator, Black Rapids Creek is reported to have water quality ranging from “Poor” to “Fair” (Fig.13) from 2006 to 2011.

Overall Black Rapids Creek has a water quality rating of “Poor” from 2006 to 2011.

The kick and sweep method to collect benthic invertebrates



Common benthic invertebrates you would find in Black Rapids Creek

2) a. Overbank Zone

Riparian Buffer along Black Rapids Creek and Tributaries

Figure 14 shows the extent of the naturally vegetated riparian zone in the catchment, 30 metres on either side of all waterbodies and watercourses. Results from the RVCA's Land Cover Classification Program show that 35 percent of streams, creeks and lakes are buffered with woodland, and wetland; the remaining 65 percent of the riparian buffer is occupied by settlement, transportation and crop and pastureland.

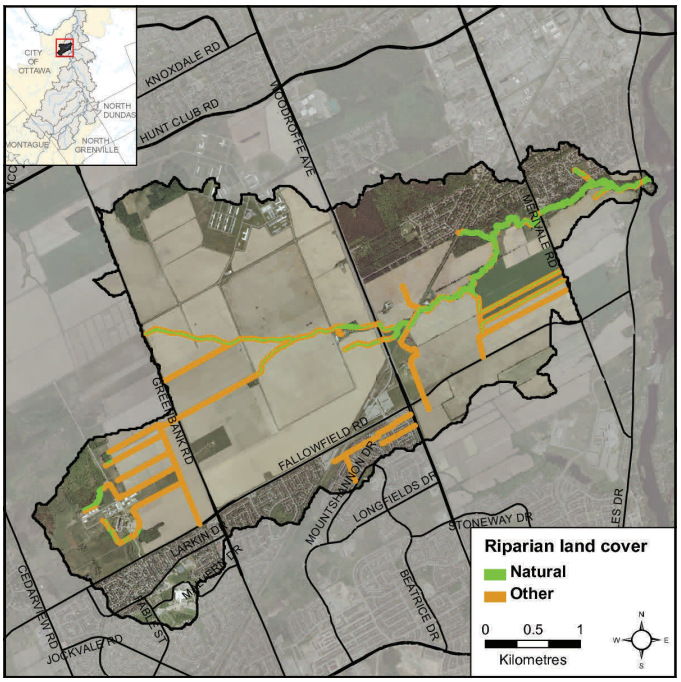


Figure 14. Catchment land cover in the riparian zone

Data from the RVCA's Macrostream Survey Program (Stream Characterization) is used in this section of the report and is generated from an assessment of 56 (100 metre long) sections along Black Rapids Creek in 2008.

Riparian Buffer along Black Rapids Creek

The riparian or shoreline zone is that special area where the land meets the water. Well-vegetated shorelines are critically important in protecting water quality and creating healthy aquatic habitats, lakes and rivers. Natural shorelines intercept sediments and contaminants that could impact water quality conditions and harm fish habitat in streams. Well established buffers protect the banks against erosion, improve habitat for fish by shading and cooling the water and provide protection for birds and other wildlife that feed and rear young near water.

A recommended target (from Environment Canada's Guideline: How Much Habitat is Enough?) is to maintain a minimum 30 metre wide vegetated buffer along at least 75 percent of the length of both sides of rivers, creeks and streams. Figure 15 demonstrates the buffer conditions of the left and right banks separately. Black Rapids Creek had a buffer of greater than 30 metres along 50 percent of the left bank and 51 percent of the right bank.

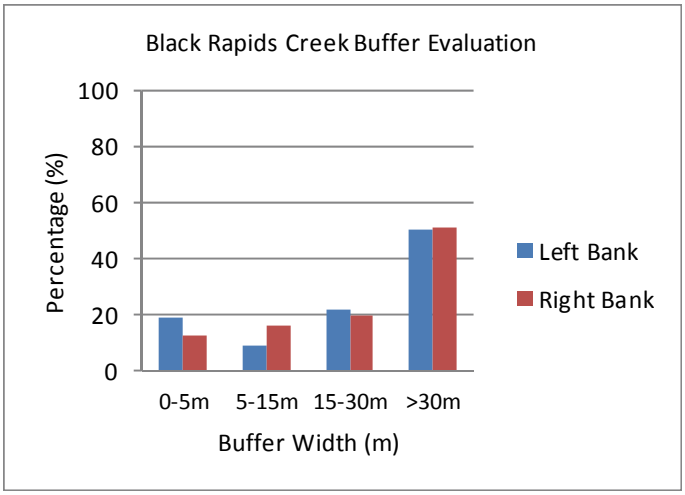


Figure 15. Vegetated buffer width along Black Rapids Creek

Land Use beside Black Rapids Creek

The RVCA's Macrostream Survey Program identifies ten different land uses beside Black Rapids Creek (Figure 16). Surrounding land use is considered from the beginning to end of the survey section (100m) and up to 100m on each side of the creek. Land use outside of this area is not considered for the surveys but is nonetheless part of the subwatershed and will influence the creek. Natural areas made up 60 percent of the stream, characterized by wetland, forest, scrubland and meadow. The remaining land use consisted of residential, pasture, active agriculture, abandoned agriculture, infrastructure, and recreational.

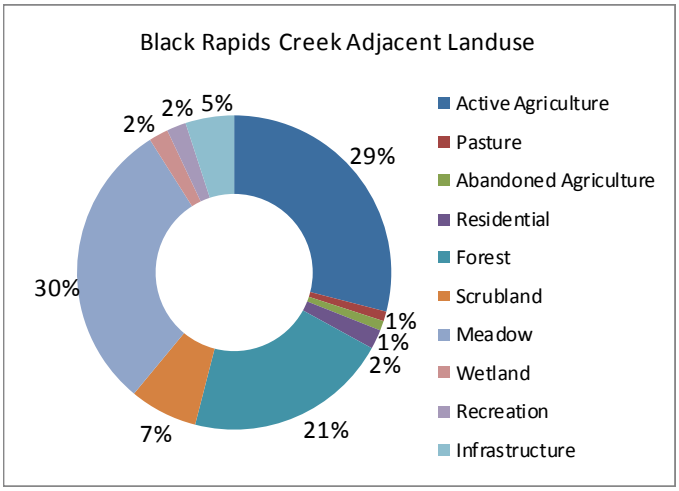


Figure 16. Land use alongside Black Rapids Creek

2) b. Shoreline Zone

Erosion

Erosion is a normal, important stream process and may not affect actual bank stability; however, excessive erosion and deposition of sediment within a stream can have a detrimental effect on important fish and wildlife habitat. Bank stability indicates how much soil has eroded from the bank into the stream. Poor bank stability can greatly contribute to the amount of sediment carried in a waterbody as well as loss of bank vegetation due to bank failure, resulting in trees falling into the stream and the potential to impact instream migration. Figure 17 shows the bank stability of the left and right bank along Black Rapids Creek.

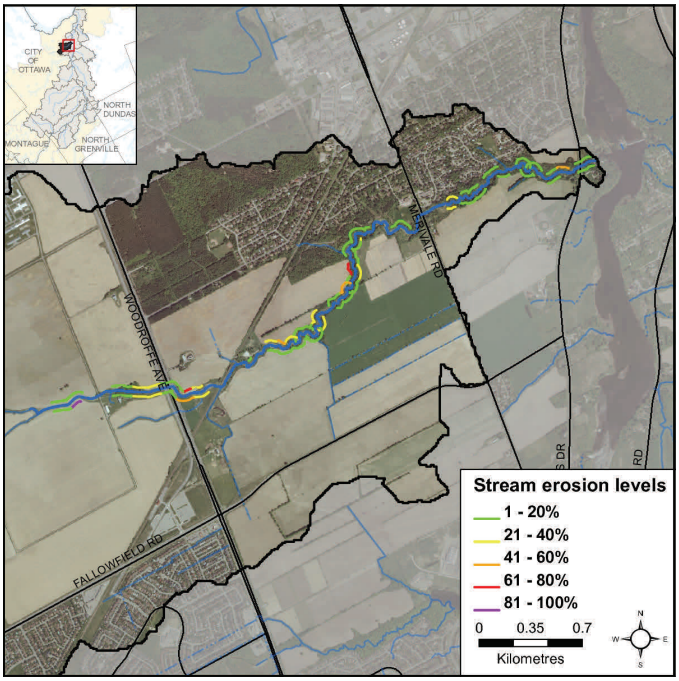


Figure 17. Erosion along Black Rapids Creek

Streambank Undercutting

Undercut banks are a normal and natural part of stream function and can provide excellent refuge areas for fish. Figure 18 shows that Black Rapids Creek had several locations with identified undercut banks.

Stream Shading

Grasses, shrubs and trees all contribute towards shading a stream. Shade is important in moderating stream temperature, contributing to food supply and helping with nutrient reduction within a stream. Figure 19 shows the stream shading locations along Black Rapids Creek.

Human Alterations

Figure 20 shows that 52 percent of Black Rapids Creek remains “unaltered.” Sections considered “natural” with some human changes accounted for 34 percent of sections. "Altered" sections accounted for nine percent of the stream, with the remaining five percent of sections sampled being considered “highly altered” (e.g., include road crossings, shoreline/ instream modifications and little or no buffer).

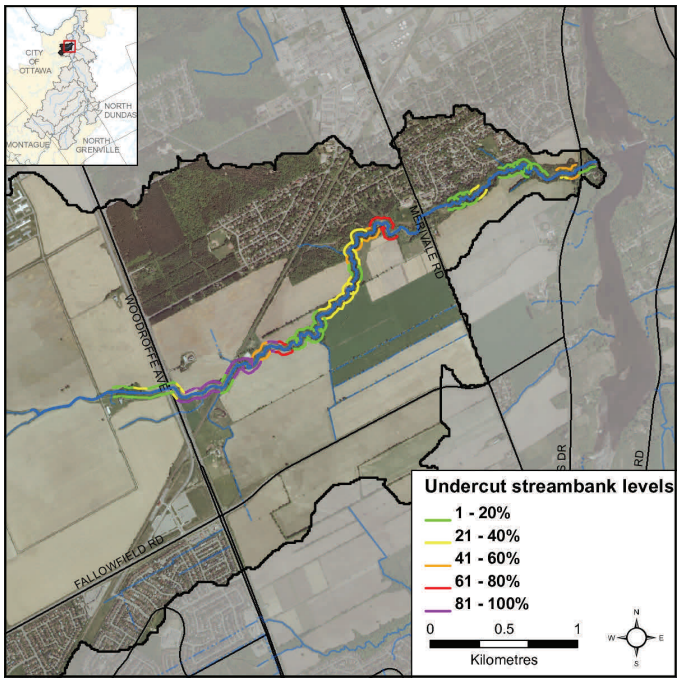


Figure 18. Undercut streambank along Black Rapids Creek

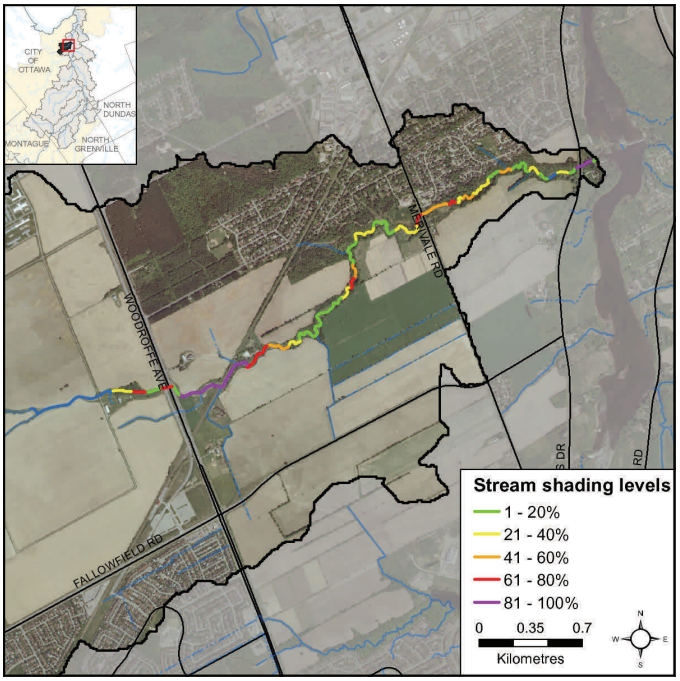


Figure 19. Stream shading along Black Rapids Creek

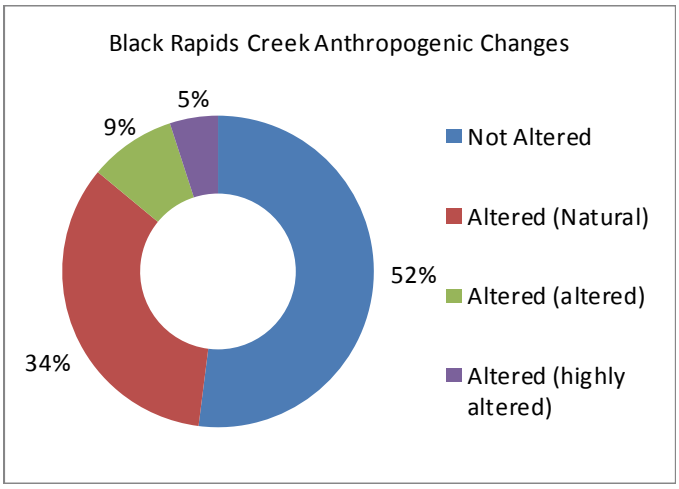


Figure 20. Alterations to Black Rapids Creek

Overhanging Trees and Branches

Figure 21 shows that the majority of Black Rapids Creek had varying levels of overhanging branches and trees. Overhanging branches and trees provide a food source, nutrients and shade which helps to moderate instream water temperatures.

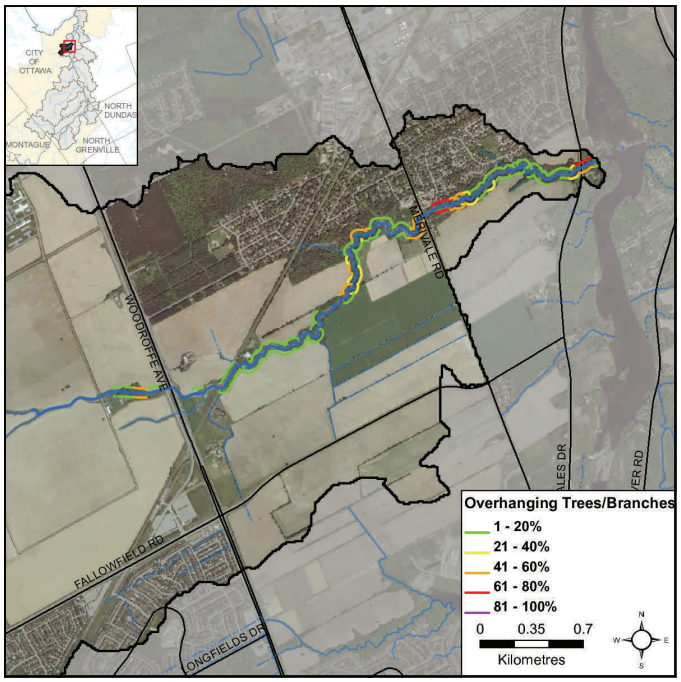


Figure 21. Overhanging trees and branches

Instream Woody Debris

Figure 22 shows that the majority of Black Rapids Creek had varying levels of instream woody debris in the form of branches and trees. Instream woody debris is important for fish and benthic habitat, by providing refuge and feeding areas.

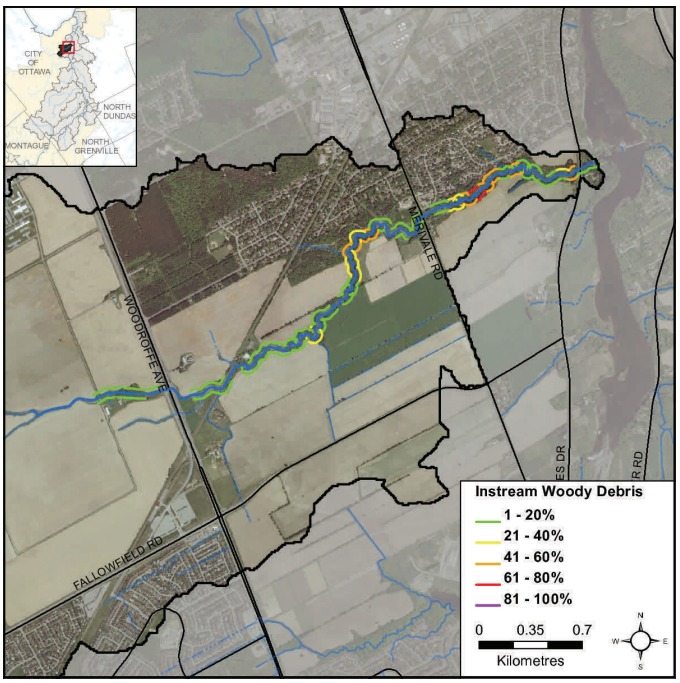


Figure 22. Instream woody debris

2c) Instream Aquatic Habitat

Habitat Complexity

Streams are naturally meandering systems and move over time; there are varying degrees of habitat complexity, depending on the creek. A high percentage of habitat complexity (heterogeneity) typically increases the biodiversity of aquatic organisms within a system. Forty-five percent of Black Rapids Creek was considered heterogeneous, as shown in Figure 23.

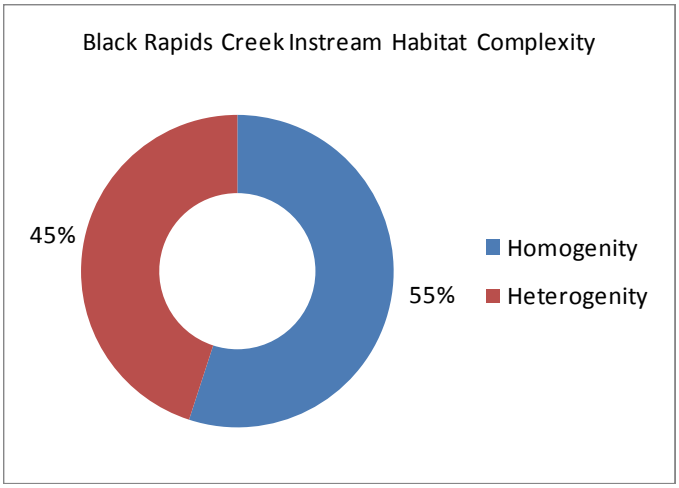


Figure 23. Instream habitat complexity in Black Rapids Creek.

Instream Substrate

Diverse substrate is important for fish and benthic invertebrate habitat because some species have

specific substrate requirements and for example will only reproduce on certain types of substrate. Figure 24 demonstrates the instream substrate diversity for Black Rapids Creek.

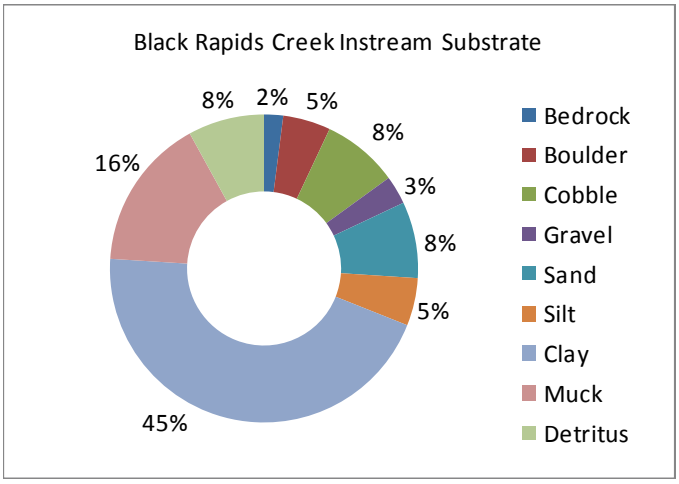


Figure 24. Instream substrate in Black Rapids Creek

Boulders create instream cover and back eddies for large fish to hide and/or rest out of the current. Cobble provides important over wintering and/or spawning habitat for small or juvenile fish. Cobble can also provide habitat conditions for benthic invertebrates that are a key food source for many fish and wildlife species. Figure 25 shows where cobble and boulder substrate is found in Black Rapids Creek.

Instream Morphology

Pools and riffles are important features for fish habitat. Riffles are areas of agitated water and they contribute higher dissolved oxygen to the stream and act as spawning substrate for some species of fish, such as walleye. Pools provide shelter for fish and can be refuge pools in the summer if water levels drop and water temperature in the creek increases. Pools also provide important over wintering areas for fish. Runs are usually moderately shallow, with unagitated surfaces of water and areas where the thalweg (deepest part of the channel) is in the center of the channel. Figure 26 shows that Black Rapids Creek was somewhat variable; 84 percent consisted of runs, 12 percent pools and four percent riffles.

Types of Instream Vegetation

Black Rapids Creek had fairly diverse types of instream vegetation. The dominant vegetation type recorded at thirty-two percent consisted of algae. A total of 25 percent of the sections recorded narrow emergent vegetation. Submerged vegetation was recorded at 23 percent. A total of eight percent of the sections recorded broad emergent vegetation. Free floating and floating vegetation made up nine percent of the vegetation types

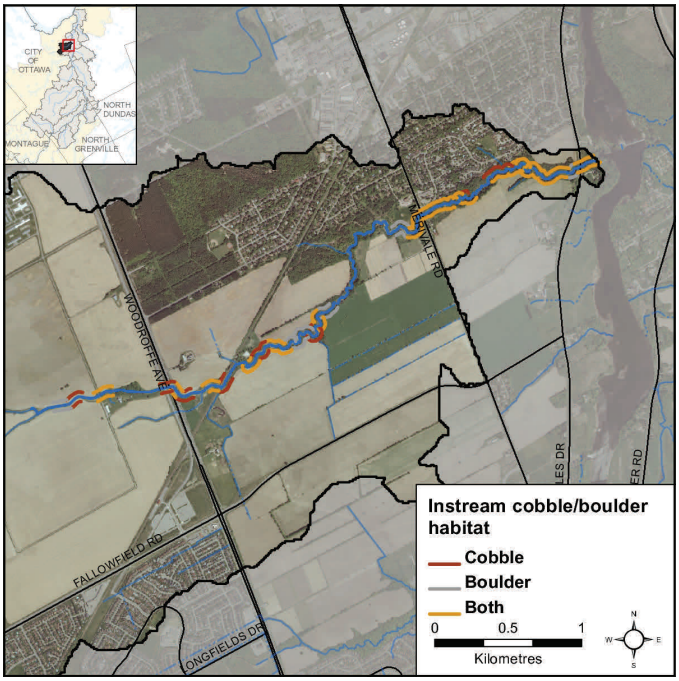


Figure 25. Instream cobble and boulder habitat along Black Rapids Creek

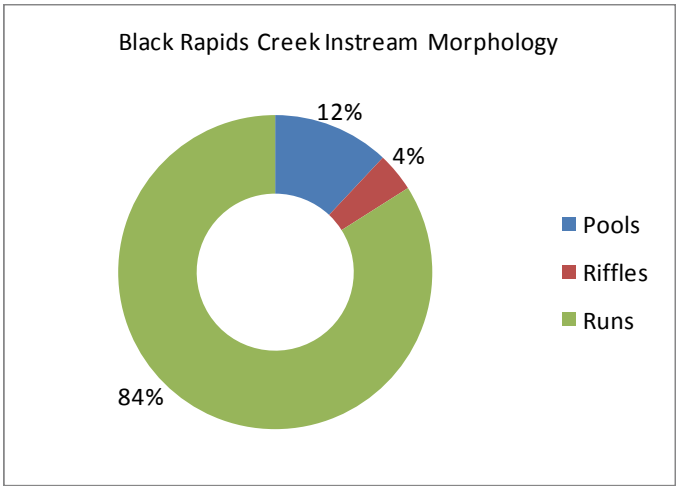


Figure 26. Instream morphology in Black Rapids Creek

recorded in the stream. Robust emergents were the remaining three percent of the vegetation community, as seen in figure 27.

Amount of Instream Vegetation

Instream vegetation is an important factor for a healthy stream ecosystem. Vegetation helps to remove contaminants from the water, contributes oxygen to the stream, and provides habitat for fish and wildlife. Too much vegetation can also be detrimental. Figure 28 demonstrates that Black Rapids Creek had a healthy variety of instream vegetation levels for most of its length.

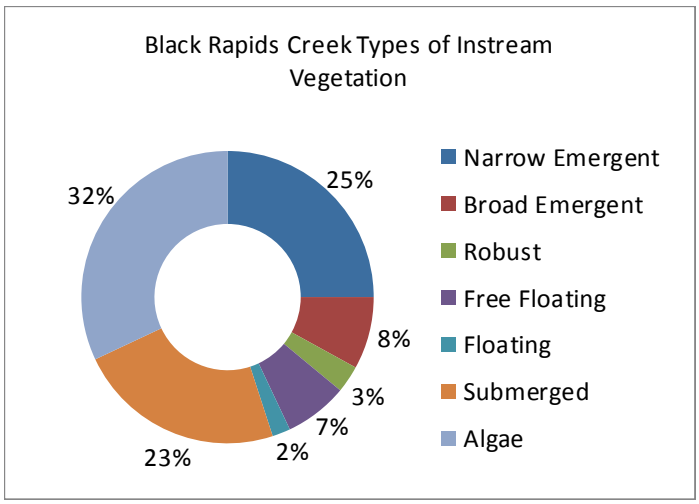


Figure 27. Instream vegetation types in Black Rapids Creek.

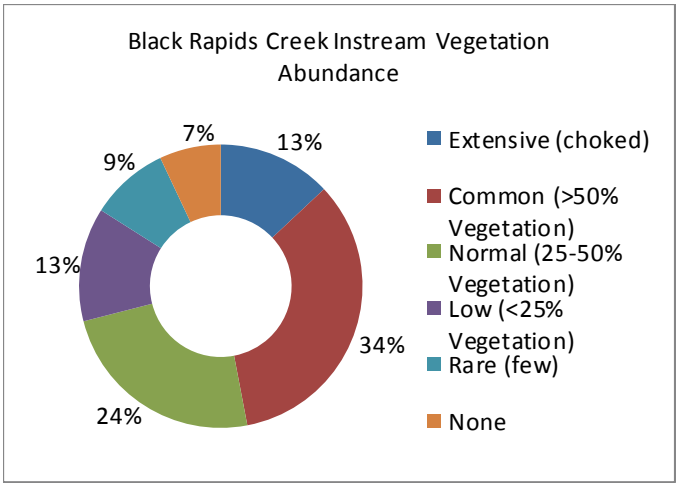


Figure 28. Vegetation abundance in Black Rapids Creek

Riparian Restoration

Figure 29 depicts the locations where various riparian restoration activities can be implemented as a result of observations made during the stream survey assessments.

Instream Restoration

Figure 30 depicts the locations where various instream restoration activities can be implemented as a result of observations made during the stream survey assessments.

Invasive Species

Invasive species can have major implications on streams and species diversity. Invasive species are one of the largest threats to ecosystems throughout Ontario and can outcompete native species, having negative effects on local wildlife, fish and plant populations. Seventy-seven of the sections surveyed along Black Rapids Creek had invasive species (Figure 31). The only invasive species observed in Black Rapids Creek was purple loosestrife.

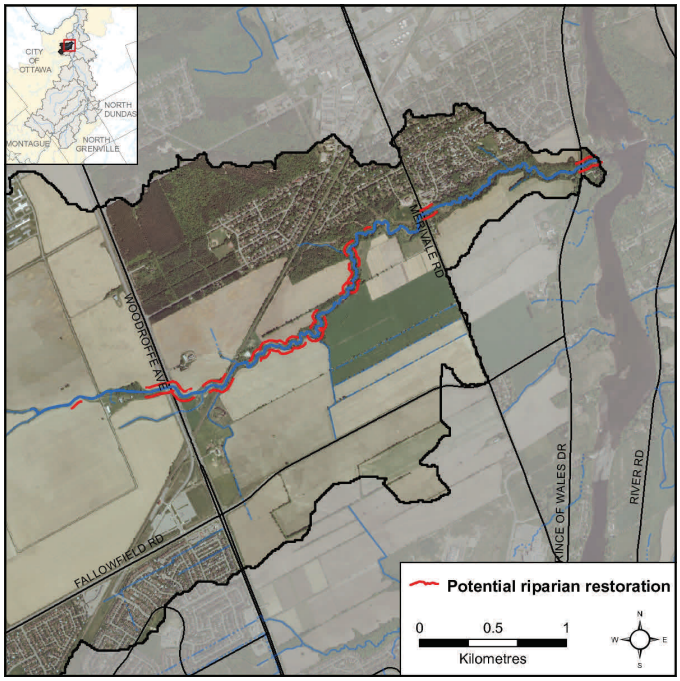


Figure 29 Riparian restoration opportunities (new map needed)

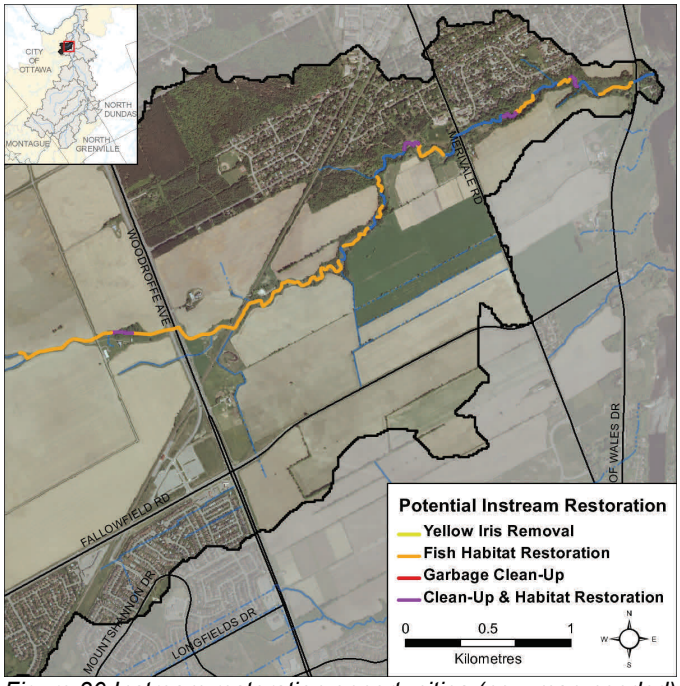


Figure 30 Instream restoration opportunities (new map needed)

Thermal Classification

Temperature is an important parametre in streams as it influences many aspects of physical, chemical and biological health. Three temperature dataloggers were deployed in Black Rapids Creek from April to late

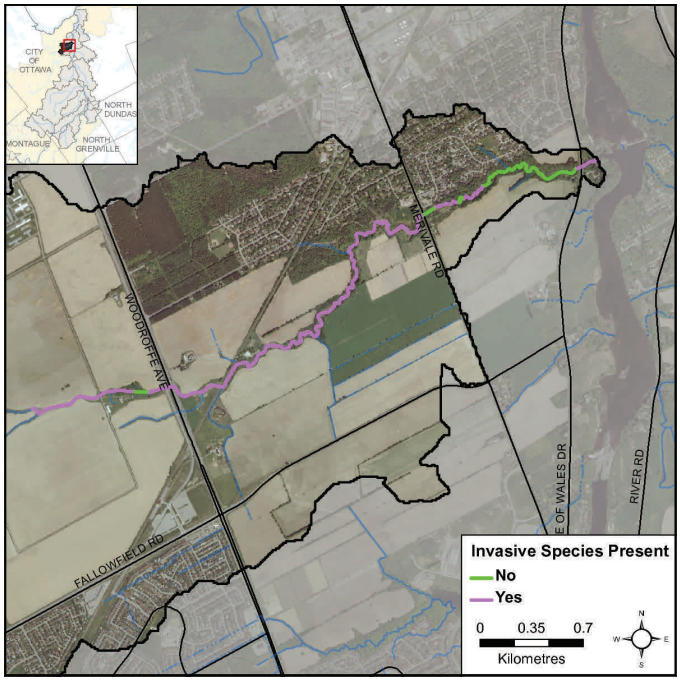


Figure 31. Invasive species along Black Rapids Creek

September 2008 (Figure 32) to give a representative sample of how water temperature fluctuates. Many factors can influence fluctuations in stream temperature, including springs, tributaries, precipitation runoff, discharge pipes and stream shading from riparian vegetation. Water temperature is used along with the maximum air temperature (using the Stoneman and Jones method) to classify a watercourse as either warmwater, coolwater or cold water. Analysis of the data collected indicates that Black Rapids Creek is a coolwater system.

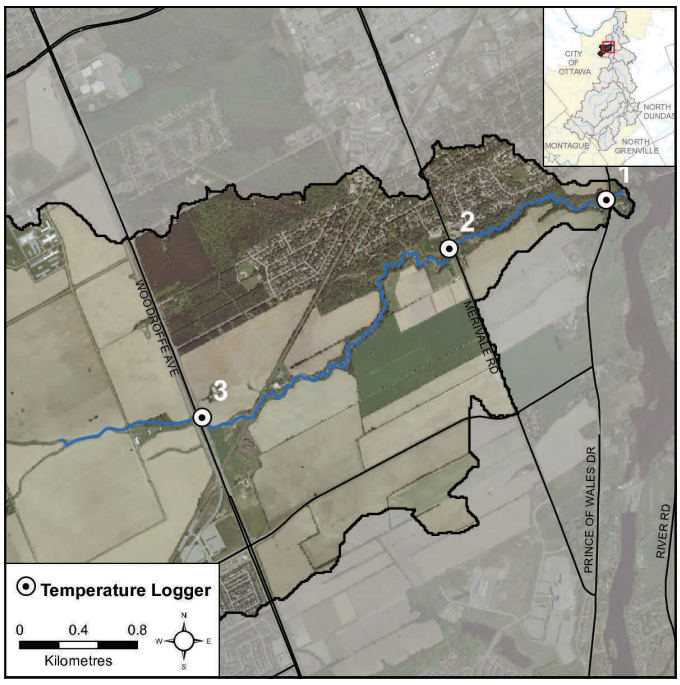


Figure 32. Temperature dataloggers along Black Rapids Creek

Fish Sampling

Fish sampling sites located along Black Rapids Creek are shown in Figure 33. The provincial fish codes shown on the preceding map are listed (in Table 6) beside the common name of those fish species identified in Black Rapids Creek (Data source: RVCA and City of Ottawa).

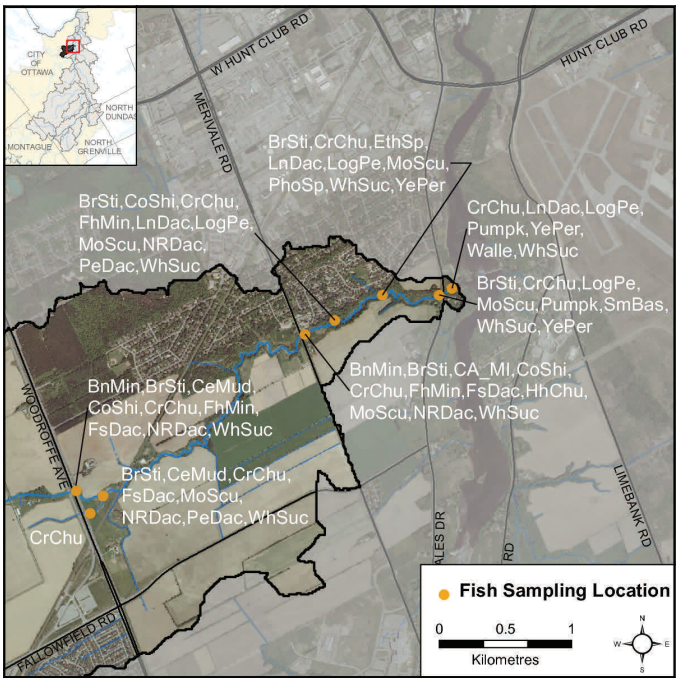


Figure 33. Fish species observed along Black Rapids Creek

Table 6. Fish species observed in Black Rapids

BnMin- bluntnose minnow	**BrSti-** brook stick-leback	**CeMud-** central mudminnow	**CoShi-** common shiner	**CrChu-** creek chub
FhMin- fathead minnow	**FsDac-** finescale dace	**HhChu-** hornyhead chub	**LoPer-** logperch	**LnDac-** longnose dace
MoScu- mottled sculpin	**NRDac-** northern redbelly dace	**PeDac-** pearl dace	**Pumk-** pumpkin-seed	**SmBas-** smallmouth bass
Walle- walleye	**WhSuc-** white sucker	**YePer-** yellow perch	**PhoSp** phoximus species	**CA_MA** carps and minnows
EthSp ehteostoma species				

Migratory Obstructions

It is important to know the locations of migratory obstructions because they can prevent fish from accessing important spawning and rearing habitat (Figure 34). Migratory obstructions can be natural or manmade, and they can be permanent or seasonal. There were three debris dams within the Black Rapids Creek catchment at the time of the survey.

Water Chemistry

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

- Dissolved Oxygen is a measure of the amount of oxygen dissolved in water. The lowest acceptable concentration of dissolved oxygen is 6.0 mg/L for early stages of warmwater fish and 9.5 mg/L for cold water fish (CCME, 1999). A saturation value (concentration of oxygen in water) of 90 percent or above is considered healthy

- Conductivity is the ability of a substance to transfer electricity. This measure is influenced by the presence of dissolved salts and other ions in the stream

- pH is a measure of relative acidity or alkalinity, ranging from 1 (most acidic) to 14 (most alkaline/ basic), with 7 occupying a neutral point.

2008 data for these three parameters is summarized in Table 7.

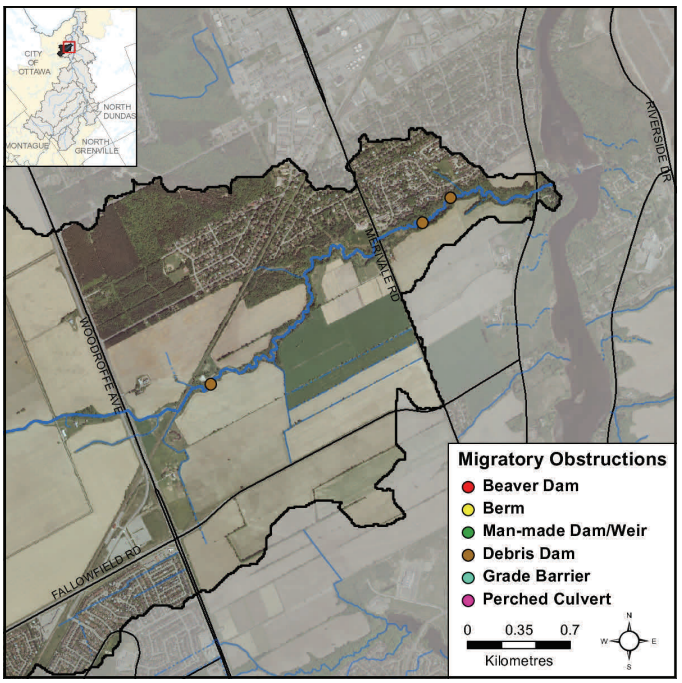


Figure 34. Migratory obstructions in Black Rapids Creek

Table 7. 2008 water chemistry collected along Black Rapids Creek

Month	Range	DO (mg/ L)	DO (%)	Conductivity (µs/cm)	pH
May-08	low	-	-	-	-
	high	-	-	-	-
Jun-08	low	7.48	68	439	7.7
	high	12.8	143	728	8.52
Jul-08	low	-	-	-	-
	high	-	-	-	-
Aug-08	low	3.32	34	416	7.5
	high	15.53	138	885	8.28

A migratory obstruction on Black Rapids Creek

Identifying fish on Black Rapids Creek

3) Land Cover

Crop and pastureland is the dominant land cover types in the catchment as shown in Table 8 and displayed on the front cover of the report.

Table 8. Catchment land cover type

Cover Type	Area (ha)	Area (% of Cover)
Crop & Pasture	1024	63
Settlement	258	16
Woodland	168	10
Transportation	161	10
Wetland	21	1

Woodland Cover

The Blacks Rapids Creek catchment contains 168 hectares of woodland (Fig.35) that occupies 10 percent of the drainage area. This figure is less than the 30 percent of woodland area required to sustain forest birds, according to Environment Canada's Guideline: "How much habitat is enough?" When woodland cover declines below 30 percent, forest birds tend to disappear as breeders across the landscape.

Twenty (49%) of the 41 woodland patches in the catchment are very small, being less than one hectare in size. Another 19 (46%) of the wooded patches ranging from one to less than 20 hectares in size tend to be dominated by edge-tolerant bird species. The remaining two (5% of) woodland patches are 21 and 69 hectares in size and may support a few area-sensitive species and some edge intolerant species, but will be dominated by edge tolerant species.

No patch tops 200 hectares, which according to the Environment Canada Guideline will support 80 percent of edge-intolerant forest bird species (including most area sensitive species) that prefer interior forest habitat conditions.

Forest Interior

The same 41 woodlands contain 3 forest interior patches (Fig.35) that occupy two percent (31 ha.) of the catchment land area. This is below the ten percent figure referred to in the Environment Canada Guideline that is considered to be the minimum threshold for supporting edge intolerant bird species and other forest dwelling species in the landscape.

Two of these patches have less than 10 hectares of interior (at one-quarter ha. and five ha.) and one has more than twenty hectares (at 31 ha.).

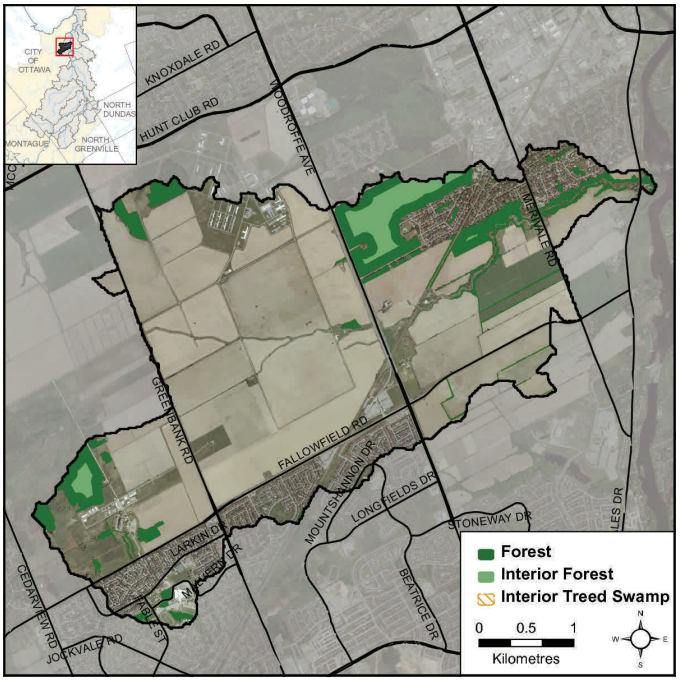


Figure 35. Catchment woodland cover and forest interior

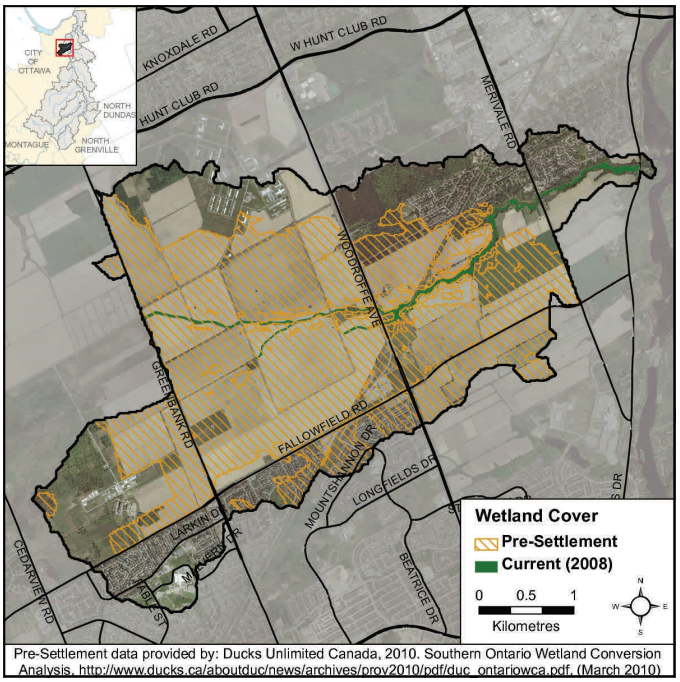


Figure 36. Pre-settlement and current wetland cover

4) Stewardship and Protection

The RVCA and its partners are working to protect and enhance environmental conditions in the Lower Rideau River Subwatershed.

Rural Clean Water Projects

Figure 37 shows the location of all Rural Clean Water Projects in the Black Rapids Creek drainage area. From 2006 to 2011, landowners completed 1 septic system repair/replacement project. In total, RVCA contributed $2,000 in grant dollars to projects valued at $18,717. Prior to 2006, no Rural Clean Water projects were completed.

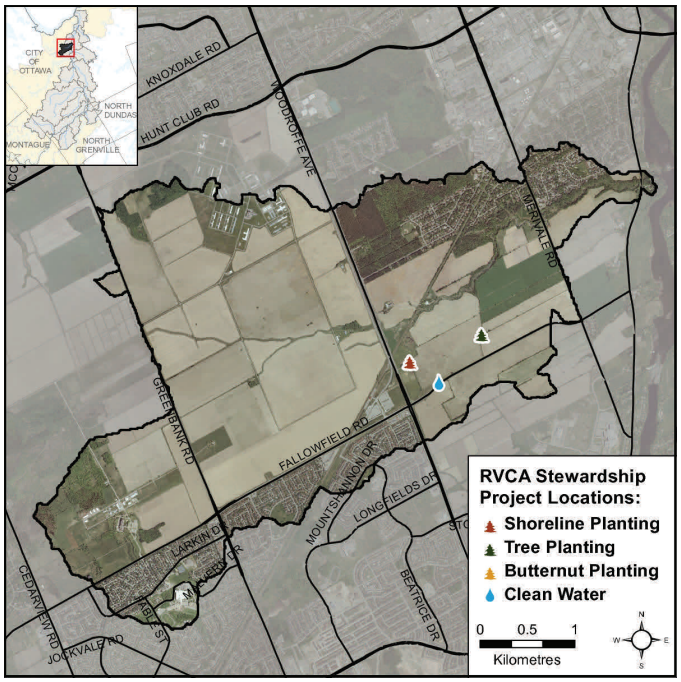


Figure 37. RVCA stewardship program project locations

Tree Planting Projects

The location of all tree planting and shoreline projects is also shown in Figure 37. From 2006 to 2011, no Tree Planting projects were completed.

Before that, from 1984 to 2006, landowners helped plant 1,590 trees, valued at $3,209, on 1 project site, using the RVCA Tree Planting Program, on 0.8 hectares of private land; fundraising dollars account for $1,838 of that amount.

Shoreline Naturalization Projects

In 2011, with assistance from the RVCA's Shoreline Naturalization Program, City Stream Watch Program, the National Capital Commission and 24 community volunteers, 460 trees and shrubs were planted along 280 metres of a tributary of Black Rapids Creek, at a total project value of $4,623.

Valley, Stream, Wetland and Hazard Land Regulation Limit and Source Water Protection Zones

Less than one percent of the catchment drainage area is within the regulation limit of Ontario Regulation 174/06 (Fig.38), giving protection to wetland areas and river or stream valleys that are affected by flooding and erosion hazards.

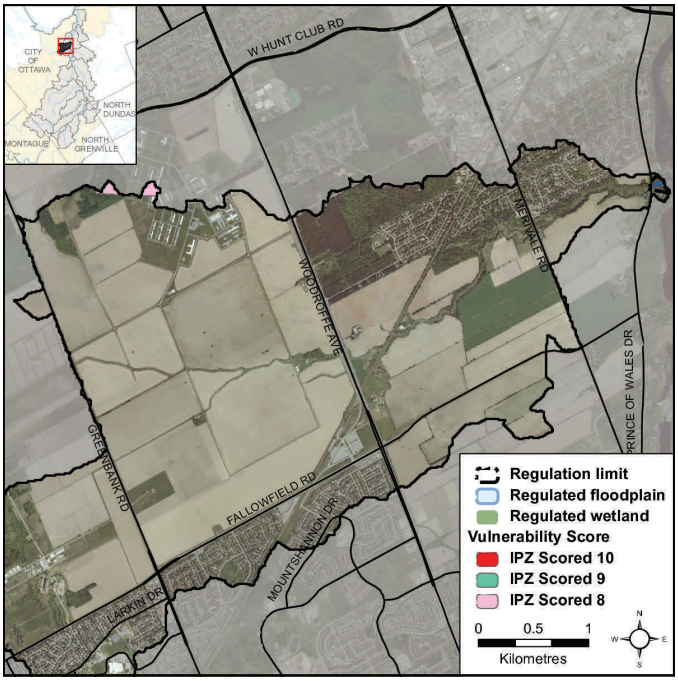


Figure 38. RVCA regulation limit and intake protection zones

Natural features within the regulation limit include 100 metres of streams (representing one percent of all streams in the catchment).

Plotting of the regulation limit on the remaining 169.1 km (or 99 percent) of streams requires identification of flood and erosion hazards and valley systems.

Within the regulation limit, "development" and "site alteration" require RVCA permission, as do any proposed works to alter a watercourse, which are subject to the "alteration to waterways" provision of Ontario Regulation 174/06.

Also within the catchment drainage area is the Intake Protection Zone for the Britannia Water Purification Plant. Zones where new policies will give protection to local municipal drinking water are shown in Figure 45 (zones scored eight to ten). Please refer to the Mississippi-Rideau Source Protection Plan at www.mrsourcewater.ca to see what activities are regulated in these areas.

5) Issues

- No subwatershed planning has been carried out for Blacks Rapids Creek
- Riparian cover is lacking in the reach between Greenbank Road and Woodroffe Avenue.
- Loss of headwater tributaries due to urban drainage practices.
- Removal of natural vegetation along watercourses
- Nutrient, E.coli and metal exceedances observed in water samples taken
- Altered hydrology causing in-stream erosion and loss of aquatic habitats
- Reduced biodiversity
- Increasing presence of invasive species

6) Opportunities for Action

- Work with the National Capital Commission (NCC) and other landowners to implement agricultural best management practices and pursue improvements to the riparian corridor along Blacks Rapids Creek (by increasing buffers through reforestation/riparian plantings and invasive species removal)
- Target riparian and instream restoration at sites identified in this report (as shown in Figures 29, 30 and 34) and explore other restoration and enhancement opportunities along the Blacks Rapids Creek riparian corridor