

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, surface water quality conditions are reported for Murphy Drain along with a summary of environmental conditions for 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.

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Catchment Facts	
<ul style="list-style-type: none"> • A mostly rural, agricultural watershed with some rural residential development • 100% of the catchment falls within the Municipality of North Grenville • Drains 43 sq. km of land or 5.6% of the Lower Rideau Subwatershed and 1.0% of the Rideau Valley Watershed • Dominant land cover is crop and pastureland (45%), followed by woodland (39%), wetland (6%), settlement (5%), grassland (3%) and 	<ul style="list-style-type: none"> transportation (2%) • Riparian buffer (30 m. wide along both sides of Murphy Drain and its tributaries) is comprised of crop and pastureland (51%), woodland (29%), wetland (15%), settlement (2%), transportation (2%), and grassland (1%) • Water quality rating is fair along Murphy Drain, with no change in water quality ratings observed over a 12 year reporting period (2000-2005 vs. 2006-2011) • Woodland cover has increased marginally (9 ha.) from 2002 to 2008
	<ul style="list-style-type: none"> • Contains a warm/cool water baitfish fishery with 2 fish species • Contains ten municipal drains • Eighteen stewardship (landowner tree planting/clean water) projects have been completed • Flood plain mapping completed on lower 1.5 km of the watercourse (in connection with Rideau River flood plain mapping) to its confluence with the Rideau River; flood levels associated with Rideau River 1:100 year event are contained in a well-defined valley within the mapped area

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. Murphy Drain

Surface water quality conditions in Murphy Drain are monitored through the RVCA's Surface Water Quality Program (at County Road 22 crossing, see Fig.1 for the location).

The water quality rating for Murphy Drain 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. Table 1 outlines the WQI scores and their corresponding ratings. For more information on the CCME WQI please see the Lower Rideau Subwatershed Report.

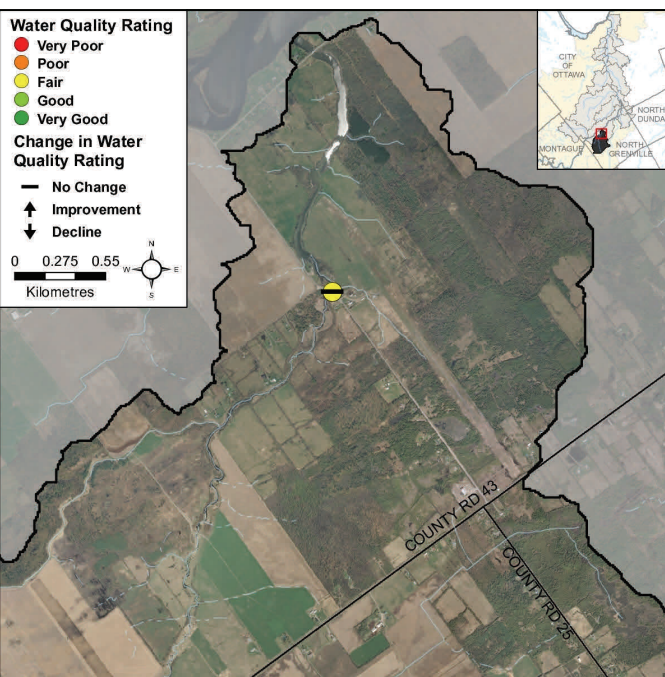


Figure 1. Sampling site in Murphy Drain

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

Murphy Drain 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. Murphy Drain TP results are shown in Figures 2a and 2b. In addition to the TP guideline, the Lower Rideau Watershed Strategy (2005) set a target for TP concentration of 0.030 mg/l at the 85th percentile for tributaries of the Rideau River, such as Murphy Drain. Percentile plots of TP data at site MUR-01 are shown for the 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. Murphy Drain TKN results are shown in Figures 4a and 4b.

Tables 2 and 3 summarize average nutrient concentrations at monitored sites on Murphy Drain and shows the proportion of samples that meet guidelines. Highlighted values indicate average value exceeds the guideline.

Table 2. Summary of total phosphorous results for Murphy Drain from 2000-2005 and 2006-2011

TP 2000-2005			
Site	Average (mg/l)	% Below Guideline	No. Samples
MUR-01	0.047	36	22
TP 2006-2011			
Site	Average (mg/l)	% Below Guideline	No. Samples
MUR-01	0.053	55	40

Table 3. Summary of total Kjeldahl nitrogen results for Murphy Drain from 2000-2005 and 2006-2011

TKN 2000-2005			
Site	Average (mg/l)	% Below Guideline	No. Samples
MUR-01	0.713	0	22
TKN 2006-2011			
Site	Average (mg/l)	% Below Guideline	No. Samples
MUR-01	0.745	20	40

Murphy Drain Nutrients: Site MUR-01

The proportion of samples below the TP guideline increased from thirty six percent to fifty five percent (Fig. 2a, 2000-2005 and 2b, 2006-2011). There was minimal change in the average TP concentration, a slight increase in average TP concentration was observed

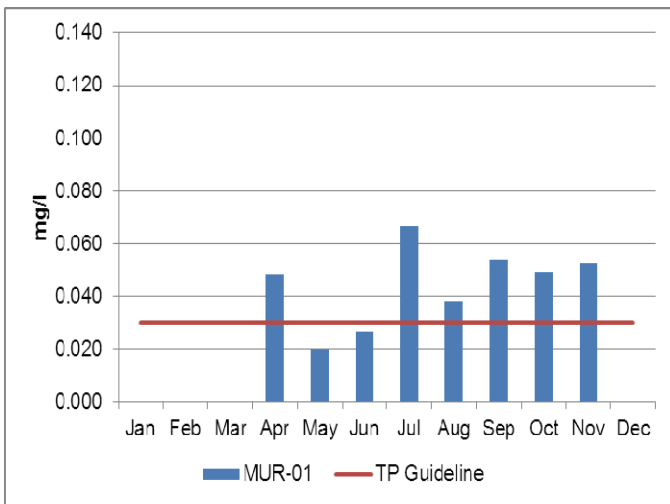


Figure 2a. Total phosphorous concentrations in Murphy Drain from 2000-2005

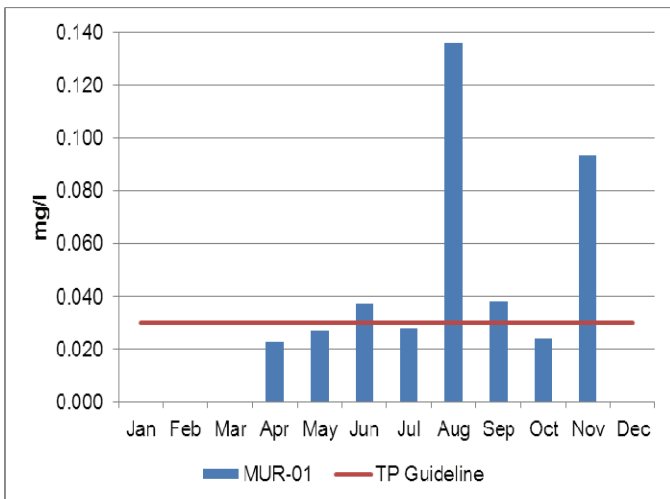


Figure 2b. Total phosphorous concentrations in Murphy Drain from 2006-2011

from 0.047 mg/l (2000-2005) to 0.053 (2006-2011). The target of a TP concentration of 0.030 mg/l at the 85th percentile is not achieved at this site. Though the target is not achieved there has been a decrease in the concentration at the 85th percentile from 0.072 mg/l (2000-2005, Fig. 3a) to 0.052 mg/l (2006-2011, Fig. 3b).

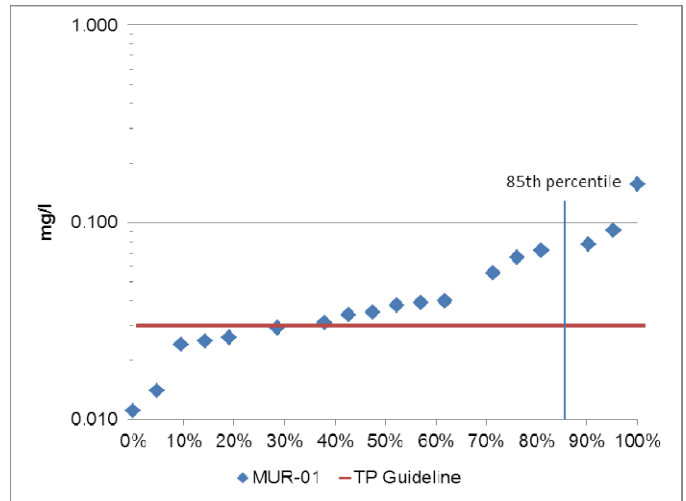


Figure 3a. Percentile plots of Total phosphorous in Murphy Drain from 2000-2005

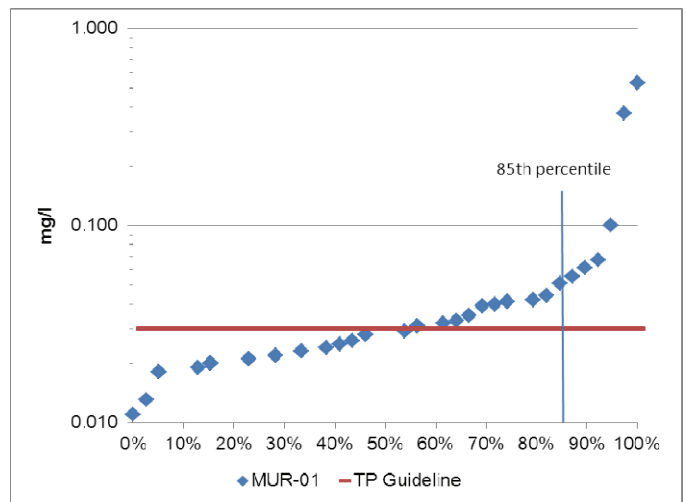


Figure 3b. Percentile plots of Total phosphorous in Murphy Drain from 2006-2011

TKN results remained fairly consistent. Exceedances above the guideline of 0.500 mg/l were common; the proportion of samples below the guideline increased from no samples to twenty percent. The mean concentration however increased slightly from 0.713 mg/l (Fig. 4a, 2000-2005) to 0.745 mg/l (Fig. 4b, 2006-2011), and just exceeded the guideline.

Murphy Drain Nutrients Summary

Overall the data suggests that nutrient loading does occur at this site and effort should be made to reduce any sources of excessive nutrient inputs..

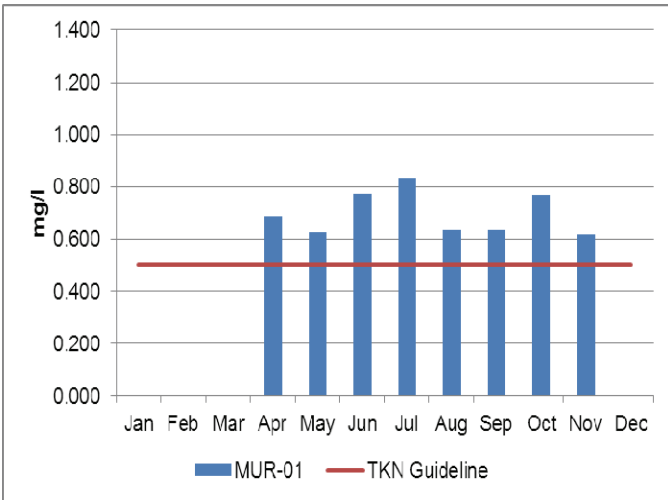


Figure 4a. Total Kjeldahl nitrogen concentrations in Murphy Drain from 2000-2005

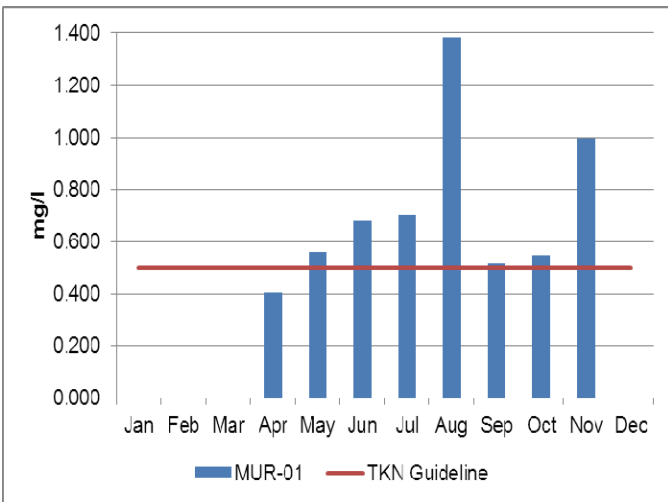


Figure 4b. Total Kjeldahl nitrogen concentrations in Murphy Drain from 2006-2011

Murphy Drain 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 (2005) set a target for E. coli counts of 200 colony forming units (CFU) per 100ml at the 80th percentile for tributaries of the Rideau River, such as Murphy's Drain.

Table 4 summarizes the geometric mean at the monitored site on Murphy Drain and shows the proportion of samples that meet the E. coli guideline of 100 CFU/100ml.

Figure 5 shows the results of the geometric mean with respect to the guideline for the two periods 2000-2005

Table 4. Summary of E. coli results for Murphy Drain

E. coli 2000-2005			
Site	Geometric Mean (CFU/100ml)	% Below Guideline	No. Samples
MUR-01	93	45	22
E. coli 2006-2011			
Site	Geometric Mean (CFU/100ml)	% Below Guideline	No. Samples
MUR-01	52	78	40

(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

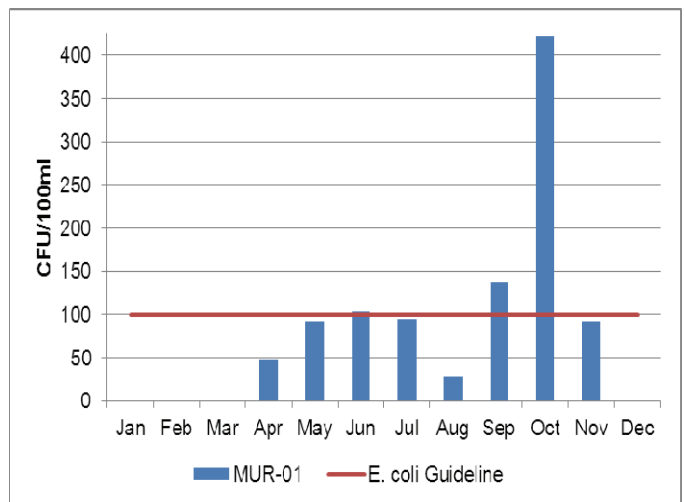


Figure 5a. E. coli concentrations in Murphy Drain from 2000-2005

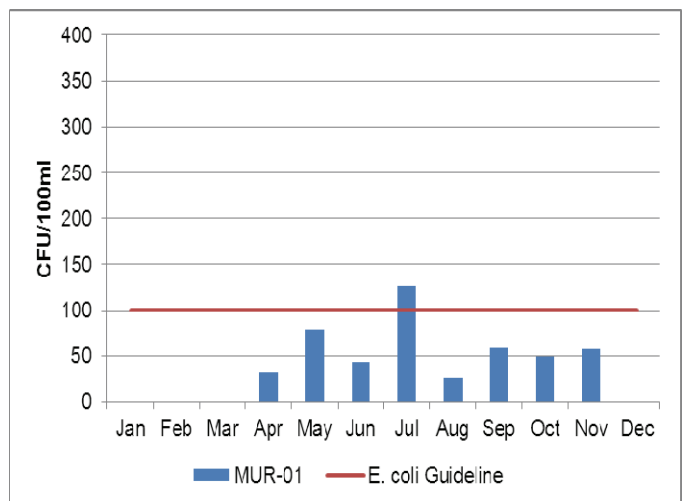


Figure 5b. E. coli concentrations in Murphy Drain from 2006-2011

Murphy Drain E. coli: Site MUR-01

The proportion of samples below the guideline also increased from only forty-five percent to seventy-eight percent and the geometric mean decreased from 93 CFU/100 ml to 52 CFU/100 ml. In comparing the two time periods E. coli counts at the 80th percentile have decreased from 200 CFU/100 ml (2000-2005, Fig. 6a) to 100 CFU/100 ml (2006-2011, Fig. 6b), to meet the target.

Murphy Drain E. coli Summary

These statistics indicated that bacterial counts have decreased at this site and have met the target set by the LRWS. Continued efforts should be made to reduce any possible sources of contamination to the creek to ensure there is no future deterioration in water quality.

Murphy Drain Metals

Of the metals routinely monitored in Murphy Drain, copper (Cu) reported concentrations above the respective PWQO. In elevated concentrations metals can have toxic effects on sensitive aquatic species.

Table 5 summarizes average metal concentrations at monitored sites on Murphy Drain and shows the proportion of samples that meet guidelines.

Figures 7a and b, show the results for each month with respect to guidelines for the two periods 2000-2005 (Fig.7a) and 2006-2011 (Fig.7b). The guideline for Cu as stated by the PWQO is 0.005 mg/l. The Lower Rideau Watershed Strategy (2005) also set a target for Cu concentration of 0.005mg/l at the 80th percentile. Figure 8 shows percentile plots of the data for the two time periods of interest (Fig. 8a, 2000-2005 and Fig. 8b, 2006-2011). 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 5. Summary of Copper results for Murphy Drain

Copper 2000-2005			
Site	Average (mg/l)	% Below Guideline	No. Samples
MUR-01	0.003	82	22
Copper 2006-2011			
Site	Average (mg/l)	% Below Guideline	No. Samples
MUR-01	0.004	65	17

Murphy Drain Metals: Site MUR-01

The proportion of samples below the guideline decreased from eighty-two percent (Fig.7a) to sixty-five percent (Fig.7b) and the average concentration increased slightly from 0.003 mg/l to 0.004 mg/l.

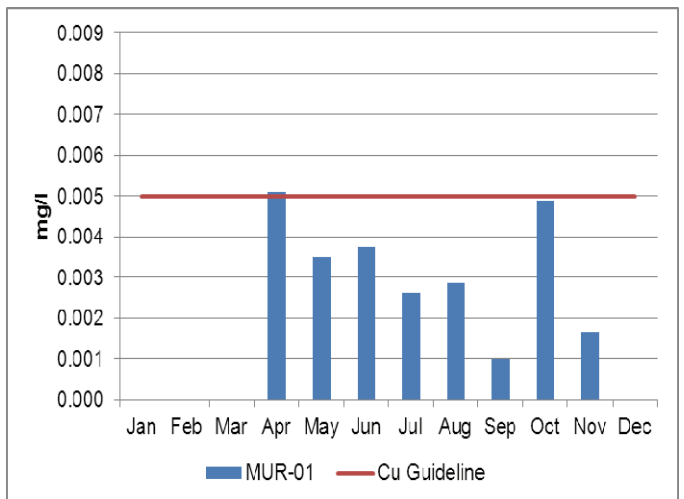


Figure 7a. Copper concentrations in Murphy Drain from 2000-2005

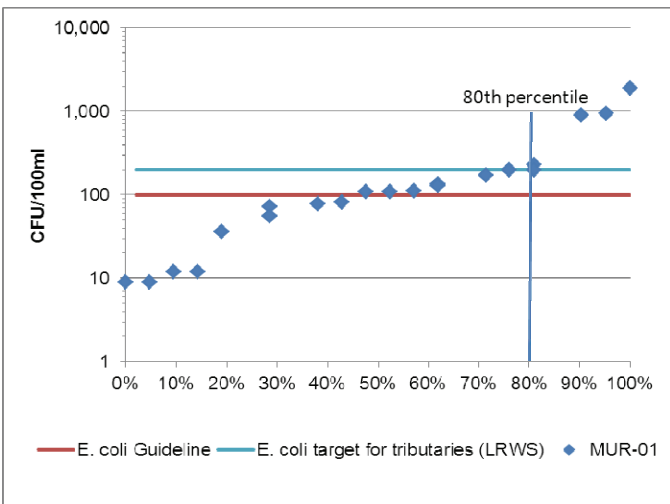


Figure 6a. E. coli concentrations in Murphy Drain from 2000-2005

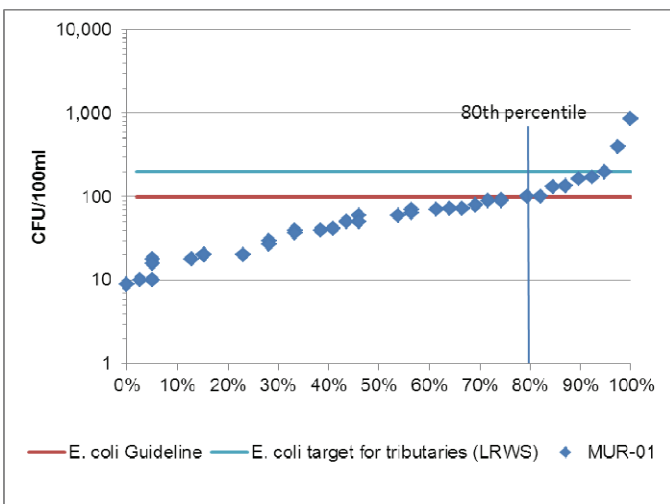


Figure 6b. E. coli concentrations in Murphy Drain from 2006-2011

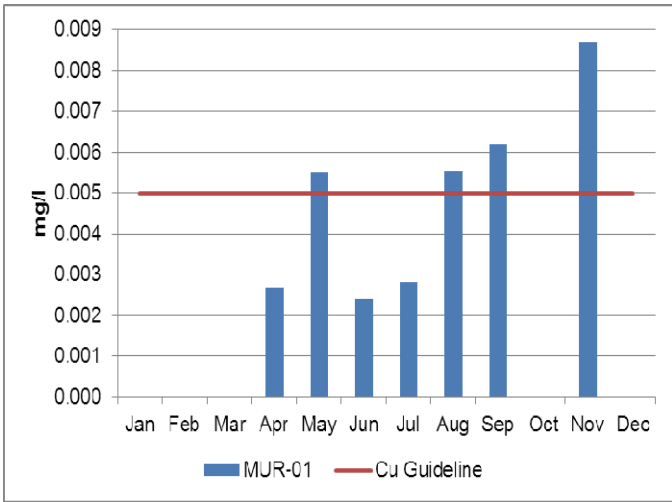


Figure 7b. Copper concentrations in Murphy Drain from 2006-2011

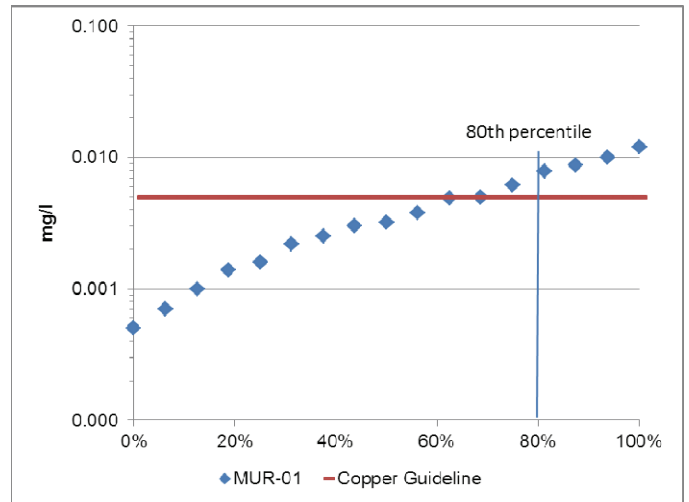


Figure 8b. Percentile plots of copper in Murphy Drain from 2006-2011

Of the three metals, copper (Cu) was the only metal that reported concentrations that exceeded the target of 0.005 mg/l at the 80th percentile. Figures 8a and 8b show that at the 80th percentile Cu concentrations have increased from 0.003 mg/l (Fig. 8a, 2000-2005) to exceed the target at 0.008 mg/l (Fig. 8b, 2006-2011).

Murphy Drain Metals Summary

Overall this data indicates that copper concentrations at this site have slightly increased over the monitoring period; efforts should be made to reduce pollution sources wherever possible and improve overall water quality.

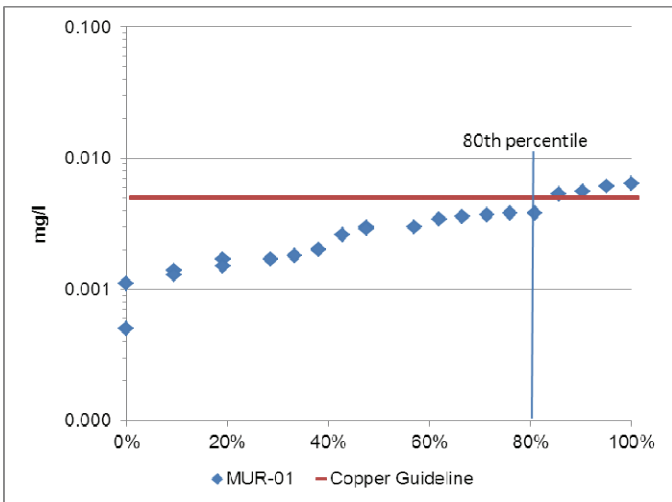


Figure 8a. Percentile plots of copper concentrations in Murphy Drain from 2000-2005



Image of Murphy Drain

2) a. Overbank Zone

Riparian Buffer along Murphy Drain and Tributaries

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 9 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 45 percent of streams, creeks and lakes are buffered with woodland, wetland and grassland; the remaining 55 percent of the riparian buffer is occupied by crop and pastureland, transportation and settlement.

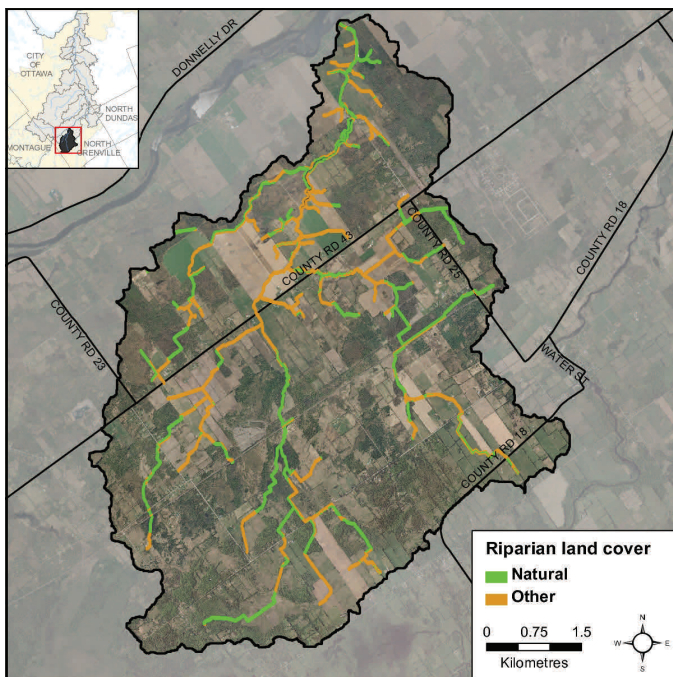


Figure 9. Catchment land cover in the riparian zone

Fish Sampling

Fish sampling sites located along Murphy Drain are shown in Figure 10. The provincial fish codes shown on the following map are listed (in Table 6) beside the common name of those fish species identified in Murphy Drain (Data source: RVCA and City of Ottawa).

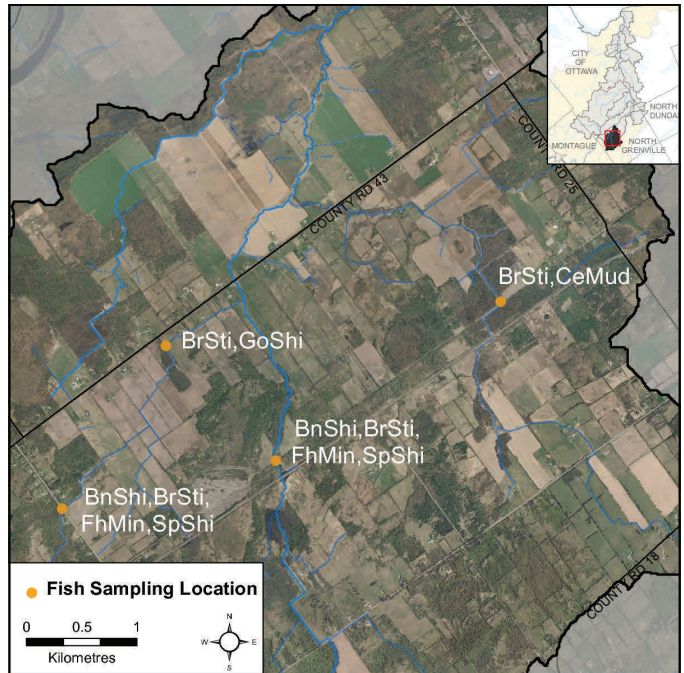


Figure 10. Fish species observed along Murphy Drain

Table 6. Fish species observed in Murphy Drain

BrSti brook stickleback	CeMin central mudminnow	GoShi golden shiner
BnShi blacknose shiner	FhMin fathead minnow	SpShi spottail shiner



Electrofishing is a method used for fish community sampling

3) Land Cover

Crop and pastureland is the dominant land cover type in the catchment as shown in Table 7 and displayed in the land cover map on the front cover of the report.

Table 7. Catchment land cover type

Cover Type	Area (ha)	Area (% of Cover)
Crop & Pasture	1929	45
Woodland	1673	39
Wetland	250	6
Settlement	231	5
Grassland	129	3
Transportation	94	2

Woodland Cover

The Murphy Drain catchment contains 1673 hectares of woodland (Fig.11) that occupies 39 percent of the drainage area. This figure is greater than the 30 percent of woodland area required to sustain forest birds, according to Environment Canada’s Guideline: “How much habitat is enough?” When forest cover declines below 30 percent, forest birds tend to disappear as breeders across the landscape.

Forty-three (38%) of the 114 woodland patches in the catchment are very small, being less than one hectare in size. Another 54 (47%) 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 17 (15% of) woodland patches range between 25 and 258 hectares. Thirteen of these patches contain woodland between 20 and 100 hectares and may support a few area-sensitive species and some edge intolerant species, but will be dominated by edge tolerant species.

Conversely, four (4%) of the 114 woodland patches in the drainage area exceed the 100 plus hectare size needed to support most forest dependent, area sensitive birds and are large enough to support approximately 60 percent of edge-intolerant species. One of these patches 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 114 woodlands contain 60 forest interior patches (Fig.11) that occupy seven percent (298 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.

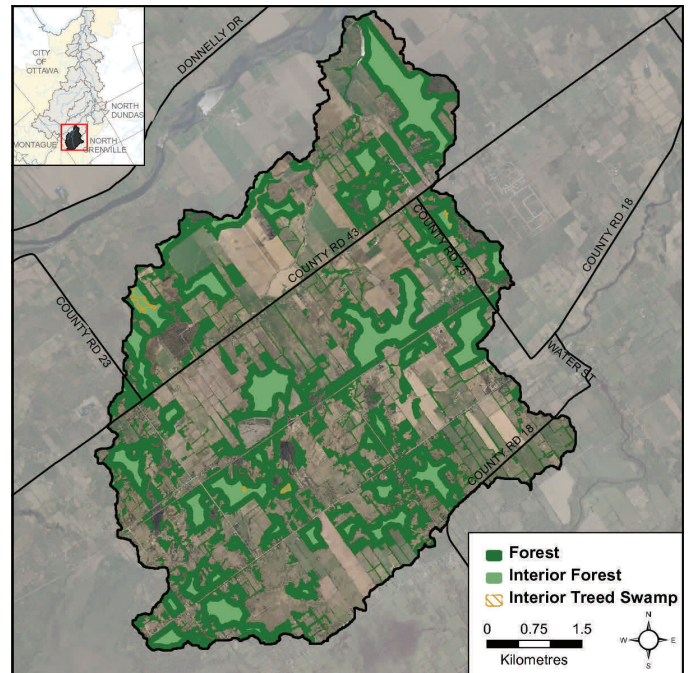
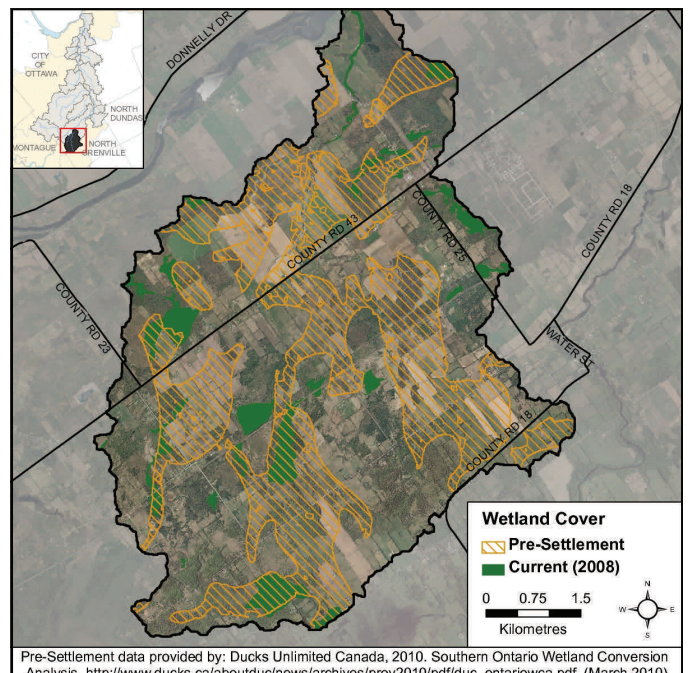


Figure 11. Catchment woodland cover and forest interior

Most patches (52) have less than 10 hectares of interior forest, 27 of which have small areas of interior forest habitat less than one hectare in size. Conversely, eight patches have greater than 10 hectares of interior forest, the largest of which contains more than 50 hectares of interior forest (at 63 ha.).



Pre-Settlement data provided by: Ducks Unlimited Canada, 2010. Southern Ontario Wetland Conversion Analysis. http://www.ducks.ca/aboutduc/news/archives/prov2010/pdf/duc_ontariowca.pdf. (March 2010)

Figure 12. Pre-settlement and present day wetland cover

4) Stewardship and Protection

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

Rural Clean Water Projects

Figure 13 shows the location of all Rural Clean Water Projects in the Murphy Drain area. From 2006 to 2011, landowners completed 4 projects including 2 septic system repair/replacements, 1 well upgrade and 1 well decommissioning. In total, RVCA contributed \$4,500 in grant dollars to projects valued at \$22,661.

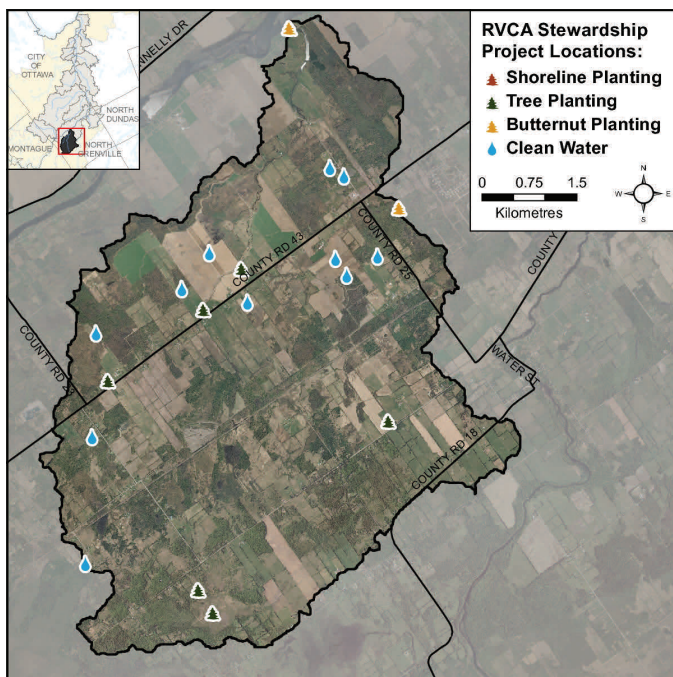


Figure 13. RVCA stewardship program project locations

Prior to 2006, the RVCA completed 8 projects in the area consisting of 3 chemical/fuel storage and handling, 2 fencing, 1 surface wastewater disposal, 1 manure storage treatment and 1 precision farming. In total, RVCA contributed \$22,568 in grant dollars to projects valued at \$42,883.

Tree Planting Projects

The location of all tree planting and shoreline projects is also shown in Figure 13. From 2006 to 2011, 11,800 trees, valued at \$22,840, were planted on 3 sites through the RVCA Tree Planting Program.

Before that, from 1984 to 2006, landowners helped plant 2,700 trees, valued at \$4,450, on 3 project sites, using the RVCA Tree Planting Program, on 1.4 hectares of private land; fundraising dollars account for \$2,450 of that amount.

Valley, Stream, Wetland and Hazard Land Regulation

One square kilometre or one percent of the catchment drainage area is within the regulation limit of Ontario Regulation 174/06 (Fig.14), giving protection to wetland areas and river or stream valleys that are affected by flooding and erosion hazards.

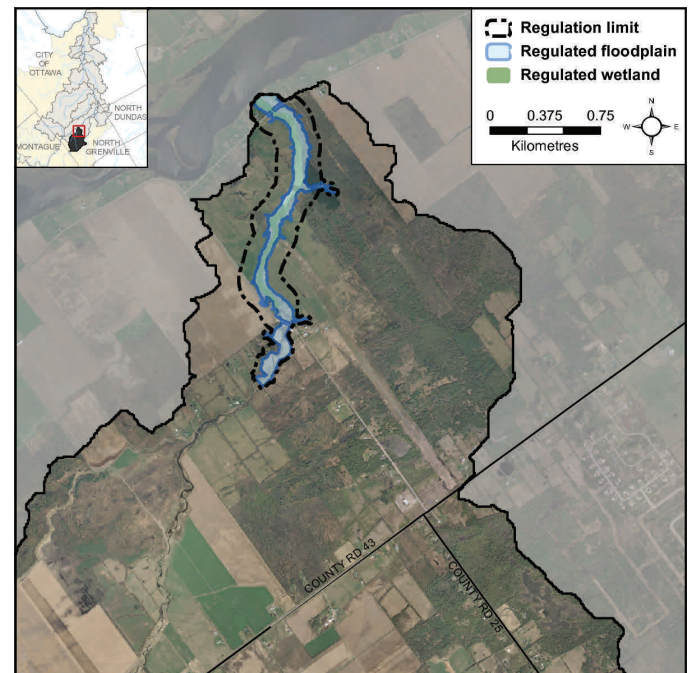


Figure 14. RVCA regulation limits

Natural features within the regulation limit include 4.3 kilometres of streams (representing seven percent of all streams in the catchment).

Plotting of the regulation limit on the remaining 56.7 km (or 93 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.

5) *Issues*

- Erosion or slope stability issues have not been assessed in this catchment
- Loss and channelization of headwater tributaries due to rural drainage practices
- Removal of natural riparian vegetation
- Reduced biodiversity
- Loss of wetland and forest habitat
- Nutrient and metal exceedances observed in water samples taken

6) *Opportunities for Action*

- Work with landowners to implement agricultural best management practices and pursue improvements to the riparian corridor along Murphy Drain and tributaries (by increasing buffers through reforestation/riparian plantings and invasive species removal)
- Add an Ontario Benthos Biomonitoring Network site to monitor stream health from a biological perspective