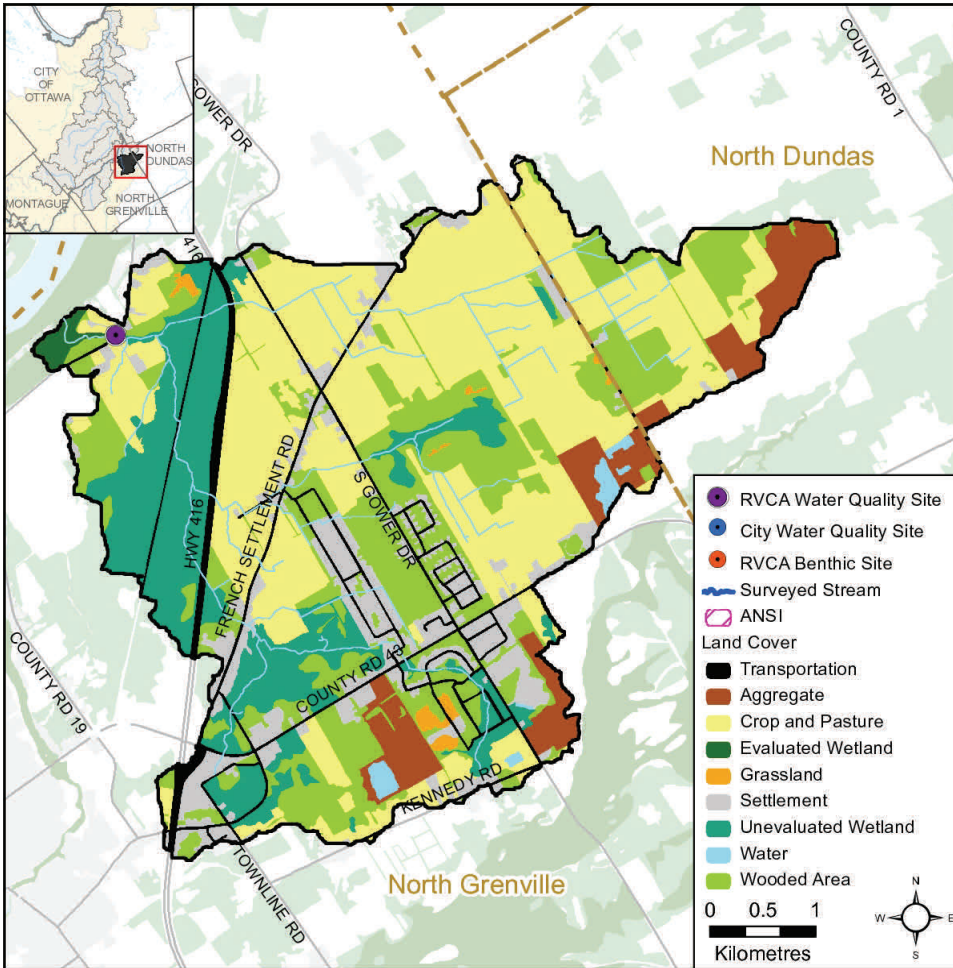


ARCAND DRAIN CATCHMENT

LOWER RIDEAU RIVER SUBWATERSHED REPORT 2012



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 Arcand 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

- 87% of the catchment falls within the Municipality of North Grenville and 13% within North Dundas Township
- Drains 27 sq. km of land or 3.5% of the Lower Rideau Subwatershed and 0.6% of the Rideau Valley Watershed
- Dominant land cover is crop and pastureland (46%), followed by woodland (27%), wetland (15%), settlement (5%), grassland (5%), roads (1%) and water (1%)
- Riparian buffer (30 m. wide along both sides of Arcand Drain and its tributaries) is comprised of crop and pastureland (46%), wetland (26%), woodland (15%), settlement (5%), aggregate sites (5%) and transportation (3%)
- Contains a warm/cool water baitfish fishery with 2 fish species
- Contains six municipal drains
- Water quality rating is poor along the Arcand Drain and has declined over a 12 year reporting period (2000-2005 vs. 2006-2011)
- Woodland cover has decreased by 8.6 percent (232 ha.) from 2002 to 2008
- Seven stewardship (landowner tree planting/clean water) projects have been completed
- No artificial water level control on Arcand Drain itself, but water levels throughout the catchment are affected by the managed water levels of the Rideau Waterway (as controlled at the dams in Manotick and flow releases from upstream reaches of the Waterway) as well as flood levels on the Rideau (with the dams at Manotick fully opened)
- Rideau River flooding affects large acreage at northwest end of catchment near confluence with Rideau (between Rideau R and Highway 416)
- RVCA development and site alteration regulation has been enforced within flood prone areas along the Rideau River since 1980 (Kars Bridge to Burritts Rapids)

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. Arcand Drain

Surface water quality conditions in Arcand Drain are monitored through the RVCA's Baseline Water Quality Program (at County Road 19 crossing, see Fig.1 for the location).

The water quality rating for Arcand Drain is "Fair" 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.

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

Arcand 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. Arcand Drain TP results are shown in Figures 2a and 2b. In addition to the TP guideline, the LRWS set the target for TP concentration of 0.030 mg/l (PWQO) at the 85th percentile for tributaries of the Rideau River, such as Arcand Drain. Percentile plots for this data are shown in Figures 3a and 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. Arcand Drain TKN results are shown in Figures 4a and 4b.

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

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

Total Phosphorus 2000-2005			
Site	Average (mg/l)	% Below	No. Samples
ARC-01	0.109	5	20
Total Phosphorus 2006-2011			
Site	Average (mg/l)	% Below	No. Samples
ARC-01	0.166	13	40

Arcand Drain Nutrients: Site ARC-01

The majority of samples were above the TP guideline for both time periods (Fig. 2a, 2000-2005 and 2b, 2006-

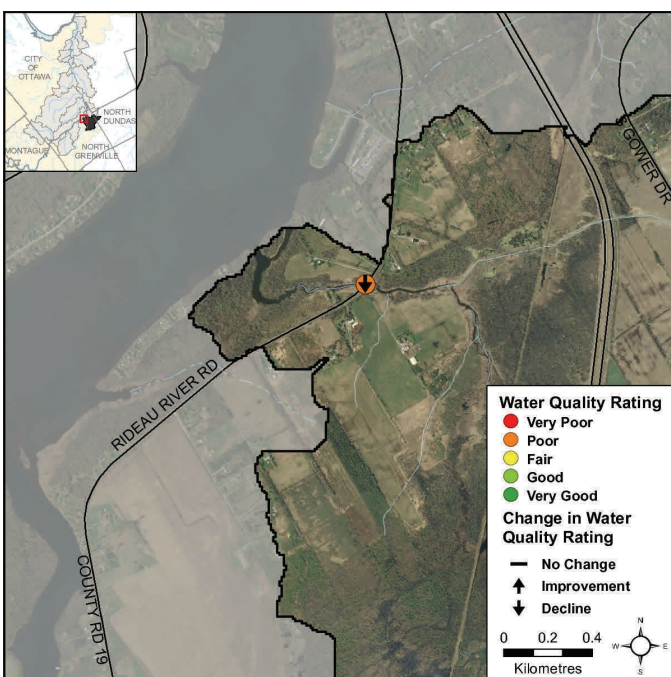


Figure 1. Sampling site in Arcand Drain

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

Total Kjeldahl Nitrogen 2000-2005			
Site	Average (mg/l)	% Below	No. Samples
ARC-01	0.863	5	20
Total Kjeldahl Nitrogen 2006-2011			
Site	Average (mg/l)	% Below	No. Samples
ARC-01	1.080	0	40

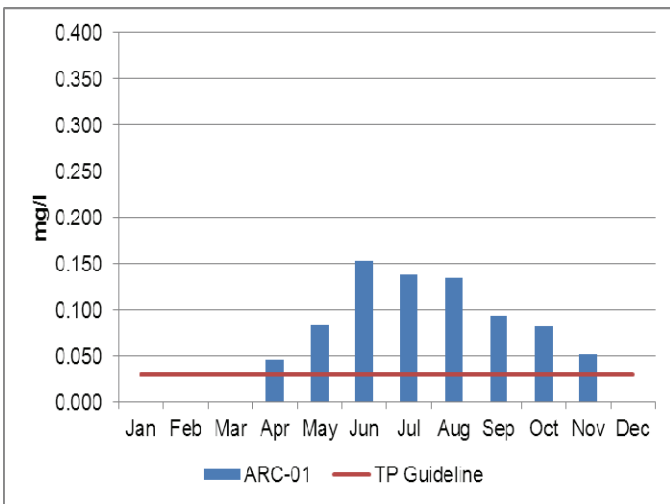


Figure 2a. Total phosphorous concentrations in Arcand Drain from 2000-2005

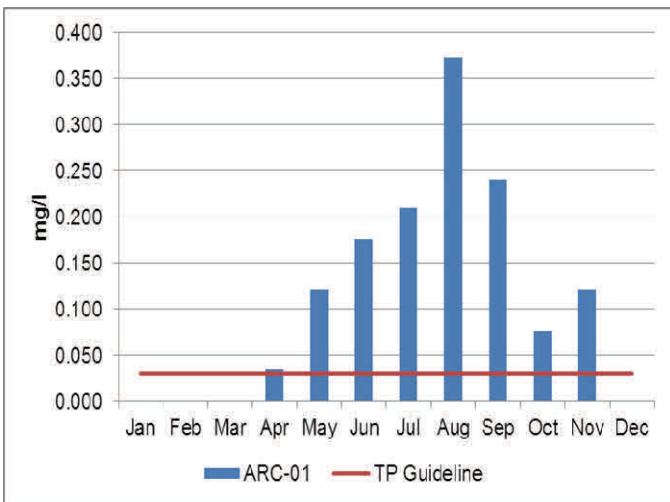


Figure 2b. Total phosphorous concentrations in Arcand Drain from 2006-2011

2011), and there has been an increase in average TP concentration from 0.109 mg/l (2000-2005) to 0.166 mg/l (2006-2011). The LRWS has not been achieved at this site. The concentration at the 85th percentile has increased from 0.192 mg/l (2000-2005, Fig. 3a) to 0.240 mg/l (2006-2011, Fig. 3b).

Table 3 shows that the majority of results exceeded the TKN guideline of 0.500 mg/l. The average concentration also increased from 0.863 mg/l (Fig. 4a) to 1.08 mg/l (Fig. 4b), far exceeding the guideline.

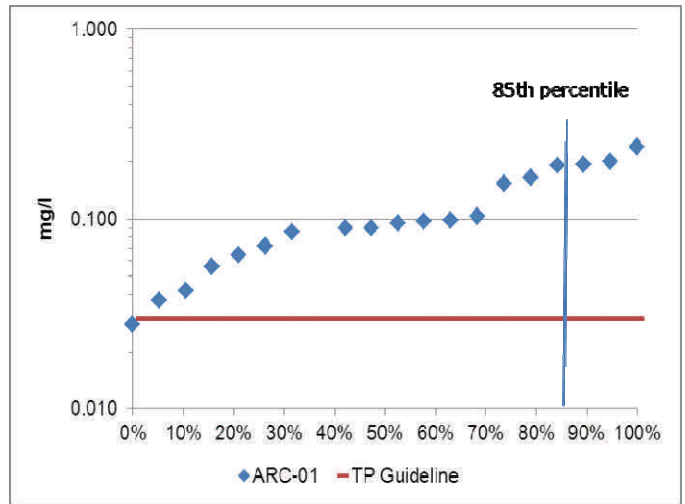


Figure 3a. Percentile plots of total phosphorous in Arcand Drain from 2000-2005

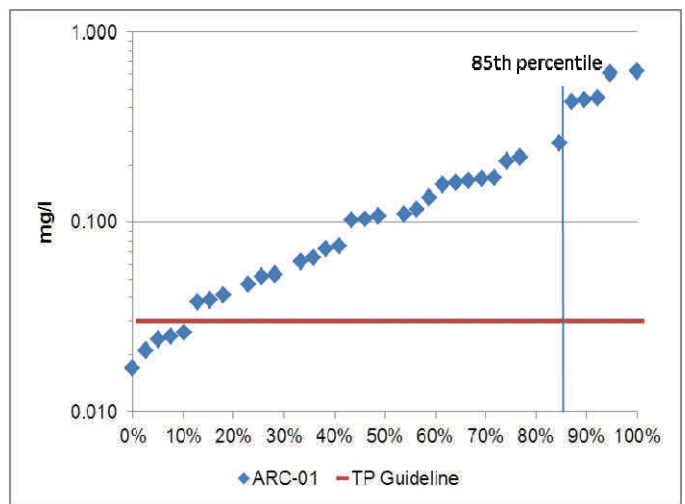


Figure 3b. Percentile plots of total phosphorous in Arcand Drain from 2006-2011

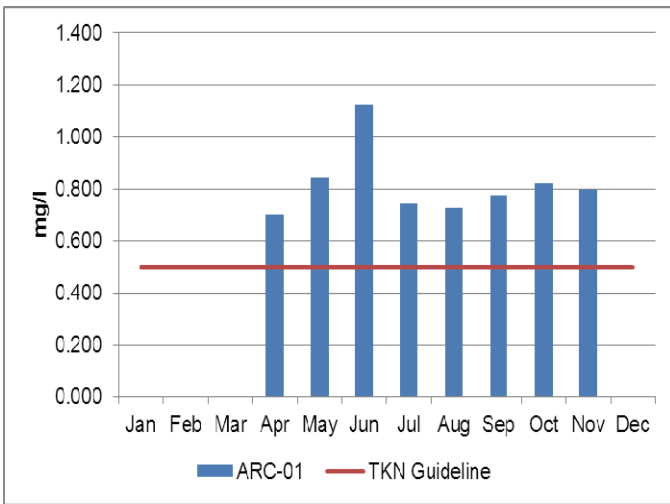


Figure 4a. Total Kjeldahl nitrogen concentrations in Arcand Drain from 2000-2005

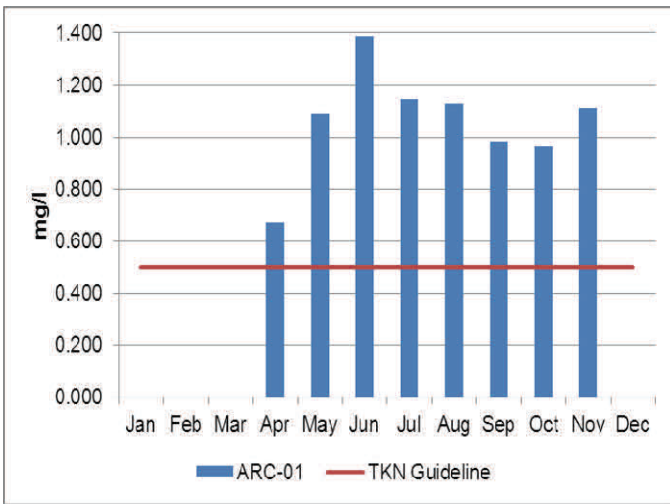


Figure 4b. Total Kjeldahl nitrogen concentrations in Arcand Drain from 2006-2011

Arcand Drain Nutrients Summary

Overall the data suggests that nutrient loading is a significant problem at this site; efforts should be made to reduce nutrient inputs to the creek.

Arcand 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) also set a target of E. coli counts at the 200 CFU/100ml for the 80th percentile and no counts that exceed 2000 CFU/100ml in tributaries of the watershed.

Table 4 summarizes the geometric mean at the monitored site on Arcand 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 (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 Arcand Drain

E. coli 2000-2005			
Site	Geometric Mean (CFU/100ml)	% Below Guideline	No. Samples
ARC-01	76.000	65	20
E. coli 2006-2011			
Site	Geometric Mean (CFU/100ml)	% Below Guideline	No. Samples
ARC-01	63.000	56	39

Arcand Drain E. coli: Site ARC-01

The proportion of samples below the E. coli guideline decreased from sixty-five percent (Fig.5a) to fifty-six percent (Fig. 5b), however the count at the geometric mean decreased from 76 CFU/100 ml to 63 CFU/100 ml. In comparing the two time periods, E. coli counts at the 80th percentile increased slightly from 171 CFU/100 ml (2000-2005, Fig. 6a) to 176 CFU/100 ml (2006-2011, Fig. 6b) but did remain below the target set by the LRWS.

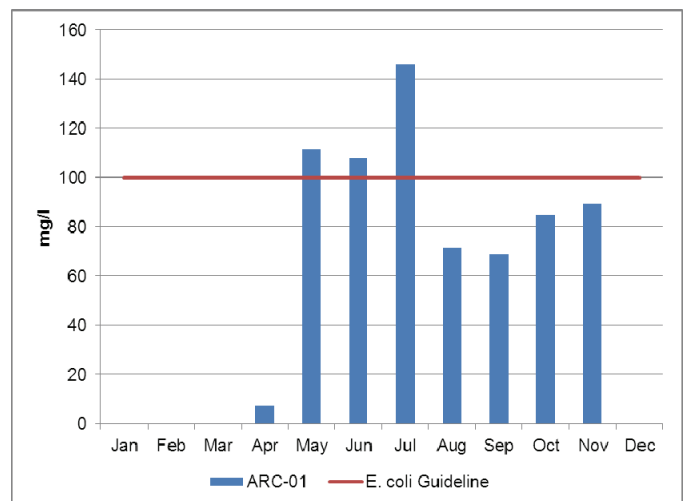


Figure 5a. E.coli counts in Arcand Drain from 2000-2005

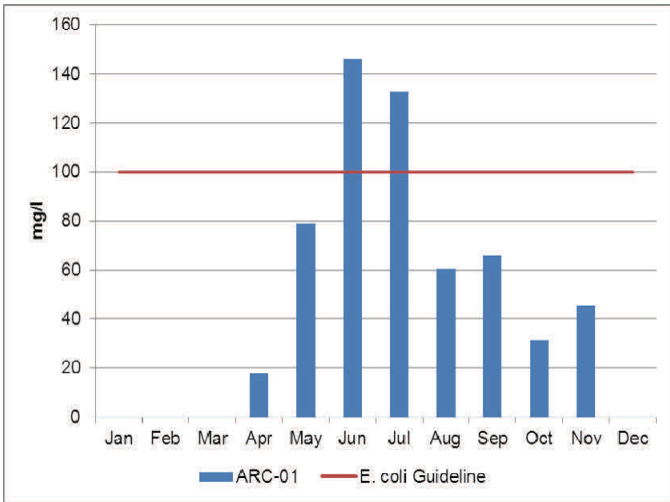


Figure 5b. E. coli counts in Arcand Drain from 2006-2011

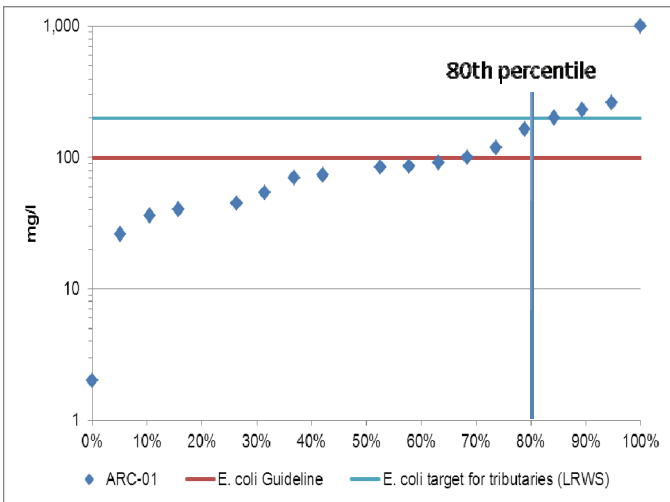


Figure 6a. Percentile plots of E. coli counts in Arcand Drain from 2000-2005

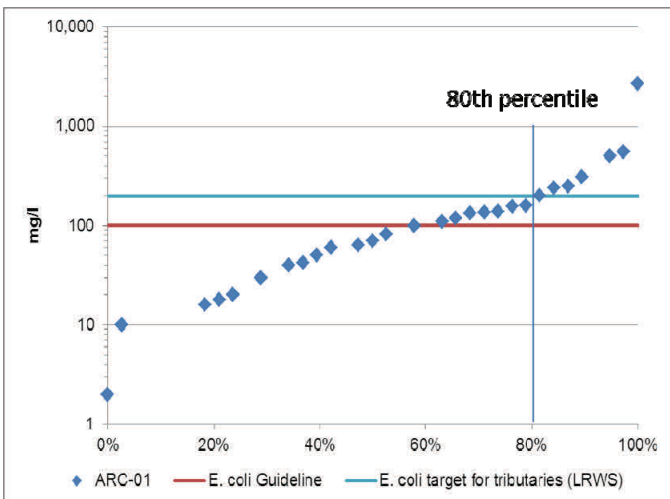


Figure 6b. Percentile plots of E. coli counts in Arcand Drain from 2006-2011

Arcand Drain E. coli Summary

These statistics indicate that overall E. coli counts have dropped but continue to exceed the guidelines, therefore efforts should be made to continue to reduce possible sources of bacterial contamination to the creek.

Arcand Drain Metals

Of the metals routinely monitored in Arcand Drain, iron (Fe) and copper (Cu) were metals that reported concentrations above their respected PWQO. Elevated metal concentrations are a concern as they may have cumulative toxic effect on aquatic species.

Table 5 summarizes average metal concentrations at monitored sites on Arcand Drain and shows the proportion of samples that meet guidelines. Highlighted values indicate average results that have exceeded the guidelines

Table 5. Summary of metal results for Arcand Drain.

Copper 2000-2005			
Site	Average (mg/l)	% Below Guideline	No. Samples
ARC-01	0.002	94	21
Copper 2006-2011			
Site	Average (mg/l)	% Below Guideline	No. Samples
ARC-01	0.004	60	18
Iron 2000-2005			
Site	Average (mg/l)	% Below Guideline	No. Samples
ARC-01	0.223	85	21
Iron 2006-2011			
Site	Average (mg/l)	% Below Guideline	No. Samples
ARC-01	0.419	67	18

Figures 7 and 8, show the results for site ARC-01 with respect to guidelines for the two periods 2000-2005 (figures 7a and 8a) and 2006-2011 (figures 7b and 8b). The guidelines for each metal as stated by the PWQO are Cu 0.005 mg/l and Fe 0.300 mg/l. The Lower Rideau Watershed Strategy (2005) also set a target for Cu concentration of 0.005 mg/l at the 80th percentile. Figure 9 shows percentile plots of the data for the two time periods of interest (Fig. 9a, 2000-2005) (Fig. 9b, 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

Arcand Drain Metals: Site ARC-01

Iron concentrations increased and often exceeded the guideline of 0.300 mg/l at this site, data from 2000-2005 (Fig.7a) show eighty-five percent of samples were below the guideline and this dropped to sixty-seven percent of samples in 2006-2011 (Fig.7b). Average Fe concentrations also increased in this same time period from 0.223 mg/l to 0.419 mg/l.

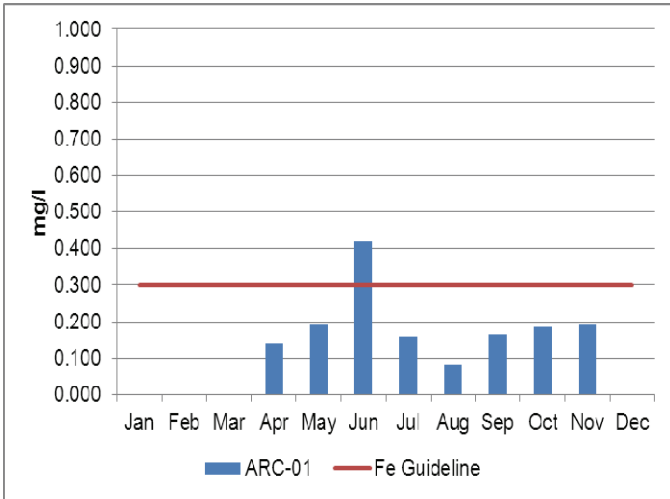


Figure 7a. Iron concentrations in Arcand Drain from 2000-2005

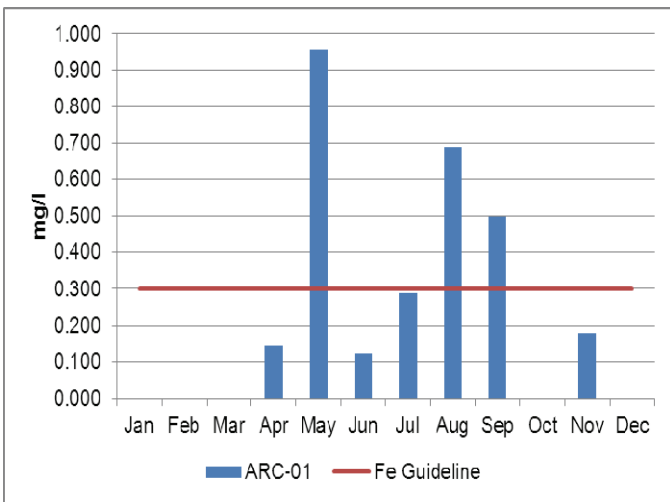


Figure 7b. Iron concentrations in Arcand Drain from 2006-2011

The proportion of Copper samples below the guideline decrease from ninety-four percent (Fig.8a) to sixty percent (Fig. 8b) between the two time periods. Similarly Cu concentrations had an overall increase from 0.002 mg/l to 0.004 mg/l. In comparing the two time periods Cu concentrations at the 80th percentile have increased from 0.003 mg/l (2000-2005, Fig.9a) to 0.007 mg/l (2006-2011, Fig.9b).

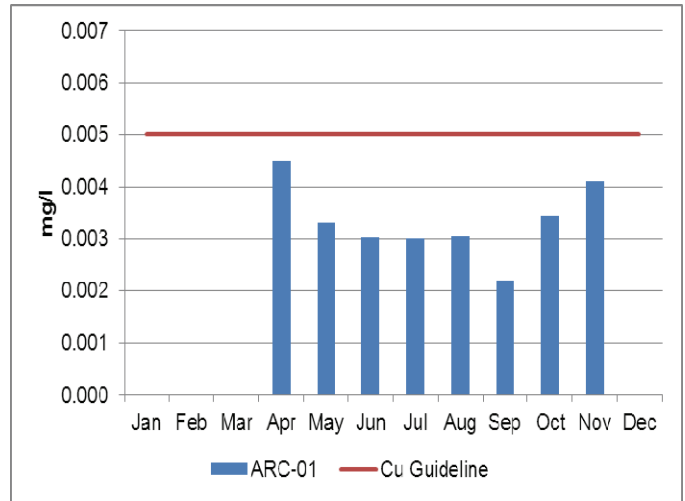


Figure 8a. Copper concentrations in Arcand Drain from 2006-2011

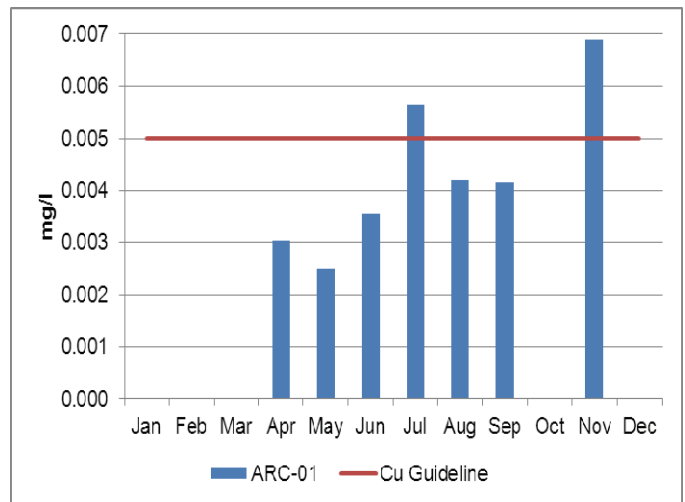


Figure 8b. Copper concentrations in Arcand Drain from 2000-2011

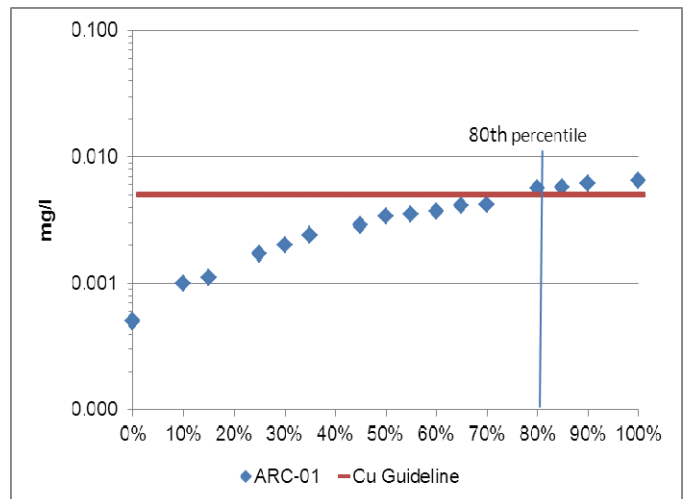


Figure 9a. Percentile plots of copper in Arcand Drain from 2000-2005

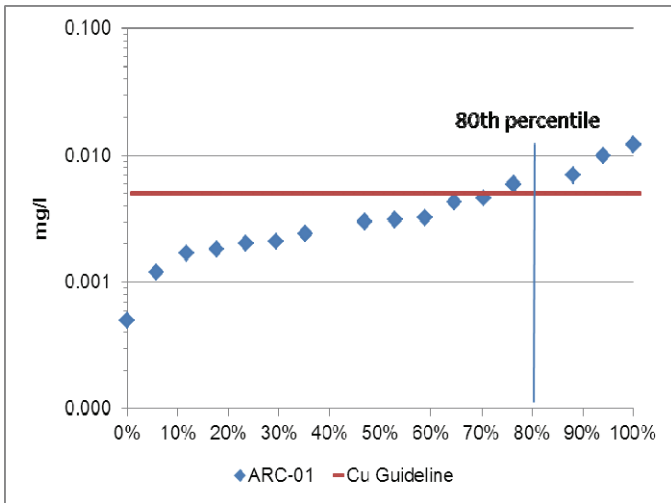


Figure 9b. Percentile plots of copper in Arcand Drain from 2006 -2011



Site photo of the Arcand Drain

Arcand Drain Summary

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



Using a YSI to collect water chemistry data



Collecting UTM co ordinates for site



Image of a bullfrog resting on a yellow lily pad

2) a. Overbank Zone

Riparian Buffer along Arcand 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 10 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 41 percent of streams and creeks are buffered with woodland and wetland; the remaining 59 percent of the riparian buffer is occupied by settlement, crop and pastureland, transportation and aggregate sites.

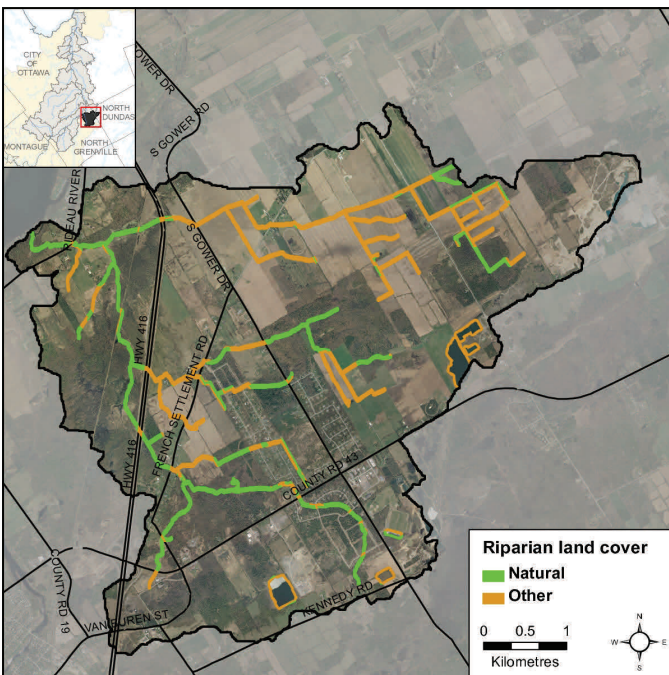


Figure 10. Catchment land cover in the riparian zone

Fish Sampling

Fish sampling sites located along the Arcand Drain are shown in Figure 11. The provincial fish codes shown on the following map are listed (in Table 5) beside the common name of those fish species identified in the Arcand Drain (Data source: RVCA and City of Ottawa).

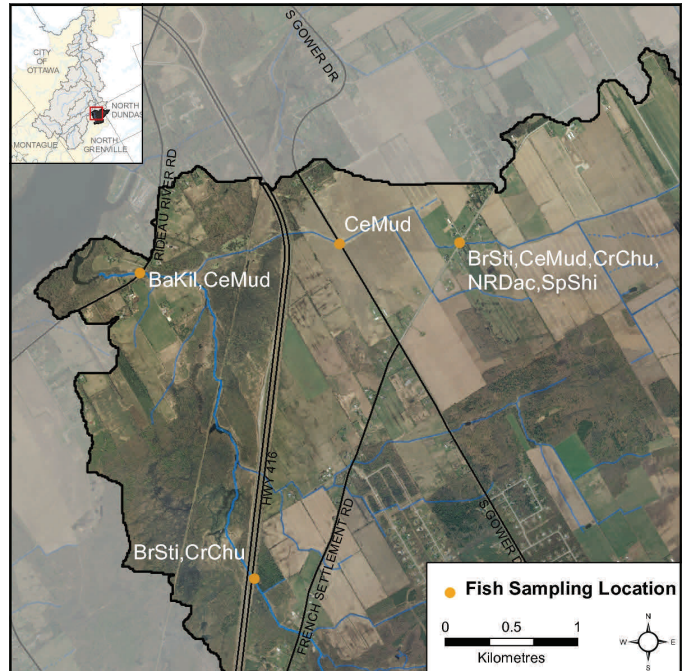


Figure 11. Fish species observed along Arcand Drain

Table 5. Fish species observed in Arcand Drain

BaKil banded killifish	CeMud central mudminnow	BrSti brook stickleback
CrChu creek chub	NRDac north- ern redbelly dace	SpShi spottail shiner



Image of a northern redbelly dace with spawning colours

3) Land Cover

Crop and pastureland is the dominant land cover type in the catchment as shown in Table 6 and displayed in the land cover map on the front cover of the report.

Table 6. Catchment land cover type

Cover Type	Area (ha)	Area (% of Cover)
Crop & Pasture	1059	39
Woodland	591	22
Wetland	432	16
Settlement	277	10
Aggregate Site	169	6
Transportation	132	5
Water	20	1
Grassland	15	1

Woodland Cover

The Arcand Drain catchment contains 591 hectares of woodland (Fig.12) that occupies 22 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 forest cover declines below 30 percent, forest birds tend to disappear as breeders across the landscape.

Thirty (31%) of the 96 woodland patches in the catchment are very small, being less than one hectare in size. Another 59 (61%) 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 seven (7%) of woodland patches range between 22 and 111 hectares. Six (6%) 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, one (1%) of the 96 woodland patches in the drainage area exceeds the 100 plus hectare size needed to support most forest dependent, area sensitive birds and is large enough to support approximately 60 percent of edge-intolerant 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 69 woodlands contain 17 forest interior patches (Fig.12) that occupy three percent (76 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.

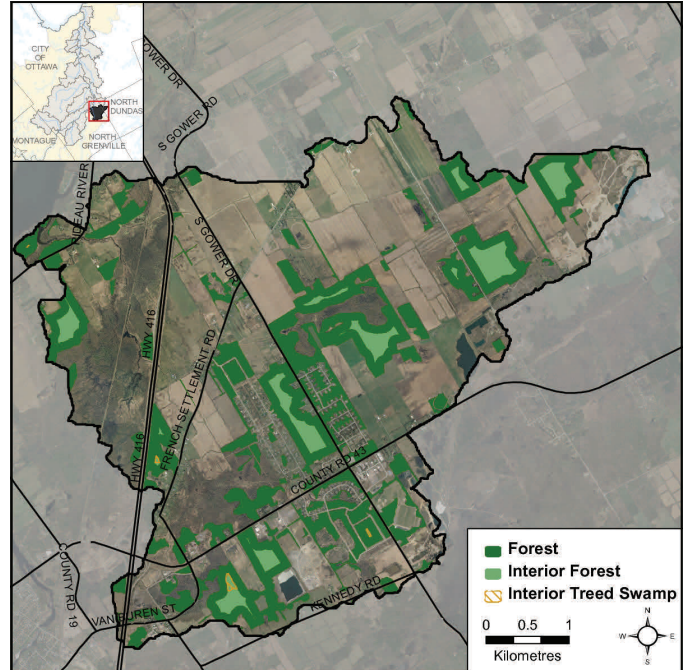


Figure 12. Catchment woodland cover and forest interior

Most patches (14) have less than 10 hectares of interior forest, eight of which have small areas of interior forest habitat less than one hectare in size. Conversely, three patches have greater than 10 hectares of interior forest, containing 10, 14 and 16 hectares of interior forest habitat respectively.

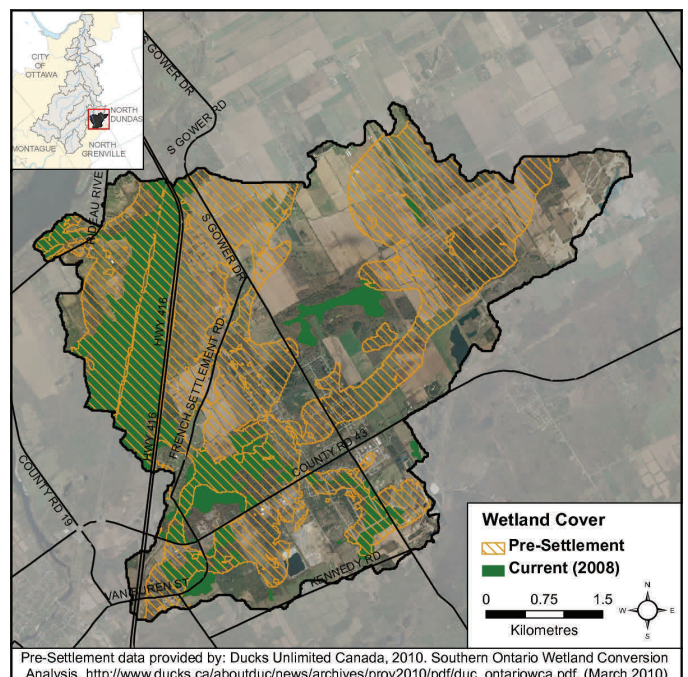


Figure 13. Pre-settlement and present day wetland cover

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)

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 14 shows the location of all Rural Clean Water Projects in the Arcand drainage area. From 2006 to 2011, landowners completed 3 projects including 1 septic system repair/replacement and 2 well upgrades. In total, RVCA contributed \$3,000 in grant dollars to projects valued at \$12,569.

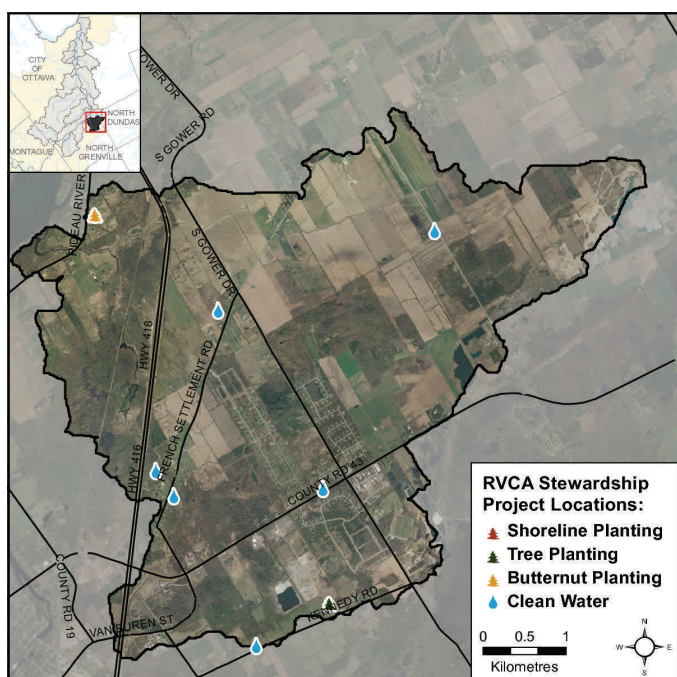


Figure 14. RVCA stewardship program project locations

Prior to 2006, the Rural Clean Water Program completed 3 projects in the area consisting of 1 septic repairs/replacement and 2 well upgrades. In total, RVCA contributed \$2,000 in grant dollars to projects valued at \$10,442.

Tree Planting Projects

The location of all tree planting and shoreline projects is also shown in Figure 14. From 2006 to 2011, no tree planting projects were completed.

Before that, from 1984 to 2006, landowners helped plant 500 trees, valued at \$570, on 1 project site, using the RVCA Tree Planting Program, on 0.2 hectares of private land.

Valley, Stream, Wetland and Hazard Land Regulation

Two square kilometres or seven percent of the catchment drainage area is within the regulation limit of Ontario Regulation 174/06 (Fig.15), giving protection to wetland areas and river or stream valleys that are affected by flooding and erosion hazards.

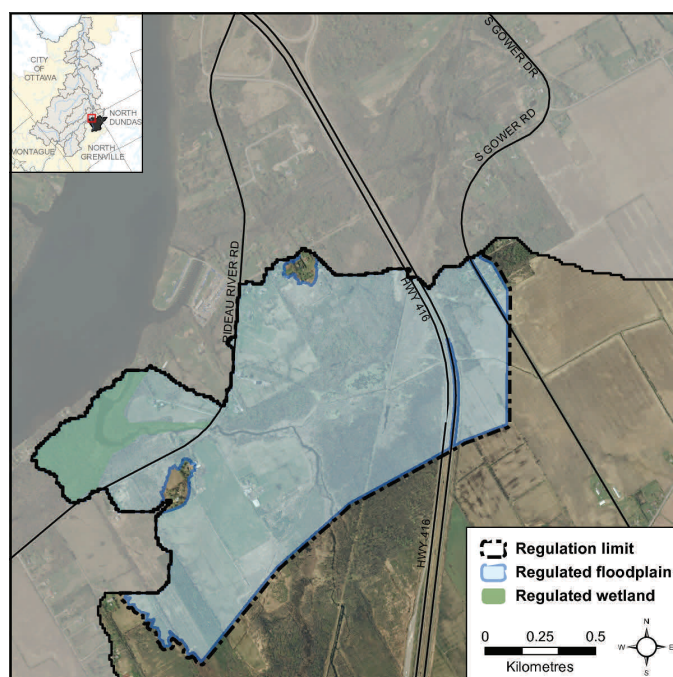


Figure 15. RVCA regulation limits

Natural features within the regulation limit include 3.9 kilometres of streams (representing 11 percent of all streams in the catchment).

Plotting of the regulation limit on the remaining 33.2 km (or 89 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*

- Loss and channelization of headwater tributaries due to rural drainage practices
- Removal of natural vegetation along watercourses
- Nutrient, E.coli and metal exceedances observed in water samples taken
- Altered hydrology from drainage practices causing in-stream erosion and impacts to aquatic habitat
- Reduced biodiversity
- Loss of wetland and forest habitat
- Erosion or slope stability issues have not been identified
- Flood plain mapping has not been extended along the Arcand Drain, east of Highway 416, but additional low lying lands adjacent to the creek are expected to be flood prone; flood plain delineation would be required prior to designating the area for urban expansion
- Portions of the travelled surfaces of local roads serving numerous residences in the South Gower sector of the Municipality of North Grenville, including River Road and Highway 416, are expected to be inundated under extreme flood events on the Rideau, giving rise to public safety issues to be addressed through effective emergency response plans

6) *Opportunities for Action*

- Work with landowners to implement agricultural best management practices and pursue improvements to the riparian corridor along Arcand 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