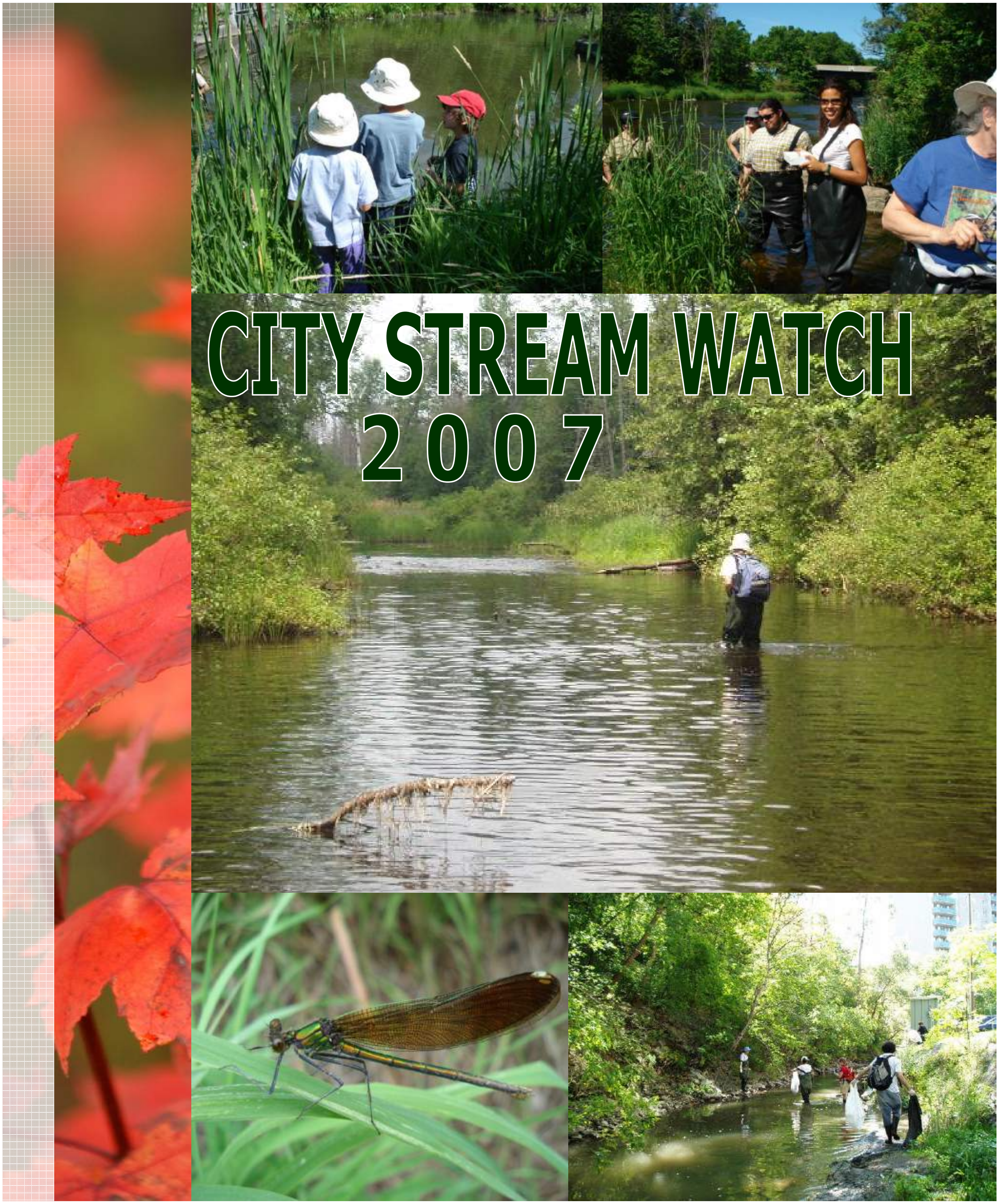
CITY STREAM WATCH 2007



City Stream Watch
2007 Annual Report

Prepared by:

Grant Nichol
City Stream Watch Coordinator
Rideau Valley Conservation Authority

City Stream Watch Collaborative:
(alphabetically)

Brian Bezaire, Water Quality Field Technician-Fisheries, City of Ottawa
Clayton Brockett, Director of Conservation, National Defence Headquarters Fish and Game Club
Bruce Clarke, Ottawa Flyfishers Society
Jennifer Lamoureux, Fish Habitat Biologist, Rideau Valley Conservation Authority
Dr. Francis Pick, Rideau River Roundtable
Donna Silver, Heron Park Community Association

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Executive Summary

This document summarizes the activities of the City Stream Watch program for the 2007 season. The program is headed by a partnership of six groups from the Ottawa area:

- *The Heron Park Community Association*
- *The Rideau Valley Conservation Authority*
- *The City of Ottawa*
- *The Ottawa Flyfishers Society*
- *The Rideau River Roundtable*
- *National Defence Headquarters Fish and Game Club*

Working together, these organizations help outline a program that fulfills many of the community's needs for environmental information and promotion of local streams within the municipality.

The goal of the program is to obtain, record, and manage valuable information on the physical and biological characteristics of streams in the City of Ottawa, while ensuring that they are respected and valued natural features of the communities through which they flow. To this end, the program relies on and encourages the interest and commitment of volunteers from the community, guided by an experienced coordinator, to learn and conduct macro stream assessments on local waterways over a five-year cycle. Volunteers also participate in sampling fish communities through seining and electrofishing, aquatic invertebrate sampling, assisting in stream clean-ups and habitat rehabilitation projects such as riparian planting.

The City Stream Watch program uses a macro stream assessment protocol originally developed by the Ontario Ministry of Natural Resources. To facilitate its use by community volunteers, the Rideau Valley Conservation Authority has since altered the protocol to make it less complicated. This was necessary as volunteer groups consist of people with a variety of backgrounds and experiences.

Seven streams were chosen for 2007, based on community interest as well as the need for current information. This year's focus was on Nepean Creek, Cranberry Creek, Taylor Creek and the major tributaries of Greens Creek: Black, Mud, Borthwick and Ramsay Creek.

A total of 121 volunteers from the community participated in the program throughout the summer and fall, contributing a total of 611 hours working on various projects. Approximately 30km of stream were surveyed in 2007. Volunteers also participated in intensive fish sampling, collecting fish data on 35 sites throughout the city. All information is housed in the Rideau Valley Conservation Authority's Watershed Information System and is available interactively on the Authority's website at *www.rideauvalley.on.ca*.

In 2007 four stream cleanups were completed. In May, City Stream Watch (CSW) assisted the Urban Rideau Conservationists with their Mother's Day Cleanup on the Rideau River. In September, as part of the nation-wide Great Canadian Shoreline Cleanup, 34 volunteers assisted in cleaning 3km of stream on Sawmill Creek. In October, CSW joined forces with two local boy scout troops: 7th Orleans Scout Troop cleaned Taylor Creek in the Orleans area, and the 19th Nepean Scout Troop cleaned Graham Creek in Ottawa's west end. In total, volunteers spent over 235 hours cleaning local streams.

In 2008, the original four streams sampled in 2003 will be re-surveyed. This will allow managers to observe positive/negative trends that may have occurred over the past five years. The data will complement work conducted by certain municipal and regional programs, most of which do not survey the smaller urban streams which are the focus of City Stream Watch. In addition, the intrinsic value of community-based environmental monitoring and stewardship through personal involvement will be further developed.

Program Funders and Program Support

Trinity Development Group Inc.

In 2007 Trinity Development Foundation donated $12,500 to the City Stream Watch program to help monitor the health and biological condition of Ottawa's urban creeks. The gift was earmarked for the hiring of two summer students to assist the coordinator with the implementation of the 2007 City Stream Watch program.

The gift from Trinity allowed for an increase in data collection and more flexible schedules for volunteers. Their leadership and commitment to the health of the Ottawa's natural environment is very much appreciated.

Fisheries and Oceans Canada

Fisheries and Oceans Canada supported the City Stream Watch program with a contribution of $10,000 for the 2006/2007 season.

Monterey Inn Resort and Conference Centre

Monterey Inn Resort and Conference Centre has been a long time supporter of the City Stream Watch program. Monterey staff kindly donates lunches, snacks and beverages for various projects to reward volunteers for their efforts. A huge thanks from the program and its volunteers goes out to Andrea Vinette and the staff at the Monterey Inn Resort for their generosity and continued support of the program.

Acknowledgements

Thank you to all the volunteers who helped out throughout the field season. The dedication and enthusiasm you conveyed to this project was incredible and very much appreciated.

Thank you to **Trinity Development Foundation** for their financial contribution to the program to hire two summer students to assist with the program.

Thank you to **Fisheries and Oceans Canada** for their financial contribution to the program in 2006/2007.

Thank you to Andrea Vinette of the **Monterey Inn Resort and Conference Centre** at 2259 Prince of Wales Drive for donating sandwiches and drinks for hungry volunteers during our community clean-up initiatives on Sawmill Creek.

Thank you to Ken Connolly, Area Manager with the **City of Ottawa Parks Department** and his staff for arranging dumpsters to be delivered and removed during the cleanup efforts on Sawmill, Taylor and Graham Creek

Thank you to Peter Stewart-Burton of the **National Defense Headquarters Fish and Game Club** for assisting in organizing the Great Canadian Shoreline Cleanup on Sawmill Creek.

Thank you to **Live 88.5FM** for inviting the program on the radio to promote the program and the Mothers Day Cleanup on the Rideau River.

Thank you to the **Kemptville MNR office** for the use of thier fish sampling equipment.

Thank you to the **City of Ottawa** for providing office space for the coordinator.

Thank you to Francois Trudel of the **4th Orleans Scouts** for helping to organize the cleanup on Taylor Creek.

Thank you to Austin Sweezy of the **19th Nepean-Briargreen Scouts** for helping to organize the cleanup on Graham Creek.

Thank you to Bob Laughton of **Bushtukah Great Outdoor Gear** for donating prizes for scouts at the Taylor Creek cleanup.

Thank you to Catherine Canning of the **Urban Rideau Conservationists** for all the organizational work for the Mothers Day Cleanup on the Rideau River.

Thank you to Sean Crossan of the **Cardinal Creek Community Association** for inviting us to speak at a community meeting as well as promoting the program within the community for the 2008 season.

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Appendices

1.0 Introduction

1.1 City Stream Watch – An Evolving Program

The health of Ontario's water resources is of paramount importance to its citizens. A dependable supply of clean freshwater is critical to a strong economy and high quality of life, and can only be achieved through proper management of all water supplies. Water resources are threatened by a myriad of stresses, including urbanization and development, pollution, and public apathy. The City Stream Watch program obtains, records and manages valuable information on the physical and biological characteristics of streams in the City of Ottawa. From this data, areas of concern are identified and remediation projects initiated, with the goal of ensuring that city streams remain respected and valued natural features of the communities through which they flow.

1.2 Partners of the City Stream Watch Program

The City Stream Watch program was initiated in 2003 through a partnership of seven groups from throughout the City of Ottawa. Without the help and dedication of these organizations the Stream Watch program would not have become the success it is today.

The Heron Park Community Association

The Heron Park Community Association, created in the mid 1980's, functions as a representative body in protecting community interests, supports programs that provide safety and information for community residents, and encourages social and recreational community activities. The Association was the lead organization of the City Stream Watch program and aids in training and recruiting volunteers and organizing conservation efforts on Sawmill Creek.

The Rideau Valley Conservation Authority

Conservation Authorities in Ontario ensure the protection and restoration of Ontario's water, land and natural habitats through responsible management by providing programs that balance human, environmental, and economic needs. In 1966, in response to the above needs as they relate to the Rideau River watershed, the Rideau Valley Conservation Authority (RVCA) was established. The RVCA delivers a wide range of watershed management services to the community, including:

- Flood plain management
- Aquatic environment monitoring and reporting
- Land use and development review
- Regulations administration and enforcement
- Watershed management planning
- Stewardship advice and incentives programs
- Conservation information

The RVCA provides technical management and supervision to the City Stream Watch program to ensure the environmental data is collected, managed, and stored to meet appropriate standards.

The City of Ottawa

The City of Ottawa is dedicated to monitoring and improving the natural environment, including water resources, of the municipality. The city's evolving environmental strategy works to ensure that environmental management is an integral part of its practices and policies. The City of Ottawa helps to coordinate, provide technical assistance, and recruit volunteers for the City Stream Watch program.

The Ottawa Flyfishers Society

The Ottawa Flyfishers Society is dedicated to promoting flyfishing as well as fish habitat conservation. The Society helps to recruit volunteers for the City Stream Watch program and concentrates its efforts on monitoring, maintaining and improving the natural beauty and health of Greens Creek.

The Rideau River Roundtable

The Rideau River Roundtable consists of representatives from community groups, municipalities, government agencies and private businesses. The Roundtable is dedicated to conducting research and coordinating projects to protect and improve the Rideau River watershed.

National Defence Headquarters Fish and Game Club (NDHQ)

The NDHQ Fish and Game Club is dedicated to observe and practice sound conservation of all wildlife and its habitat; to respect the property rights of others; to assist the authorities with implementing conservation measures for the benefit of the community; and to oppose activities such as poaching or pollution that are prejudicial to sound conservation of wildlife and its natural habitat, so as to provide a continuing source of enjoyment for all its present and future members. The NDHQ works closely with the City Stream Watch program to help maintain the health of Sawmill Creek, South of Walkley Road.

1.3 Stream Selection in 2007

In 2007 seven streams were chosen to be sampled based on community interest as well as need for current information. Nepean Creek, Cranberry Creek, Taylor Creek and four important tributaries, which make up Greens Creek: Black, Mud, Borthwick and Ramsay Creek were selected. Figure 1 shows the locations of the 2007 sample streams as well as all streams sampled from 2003 to 2006.

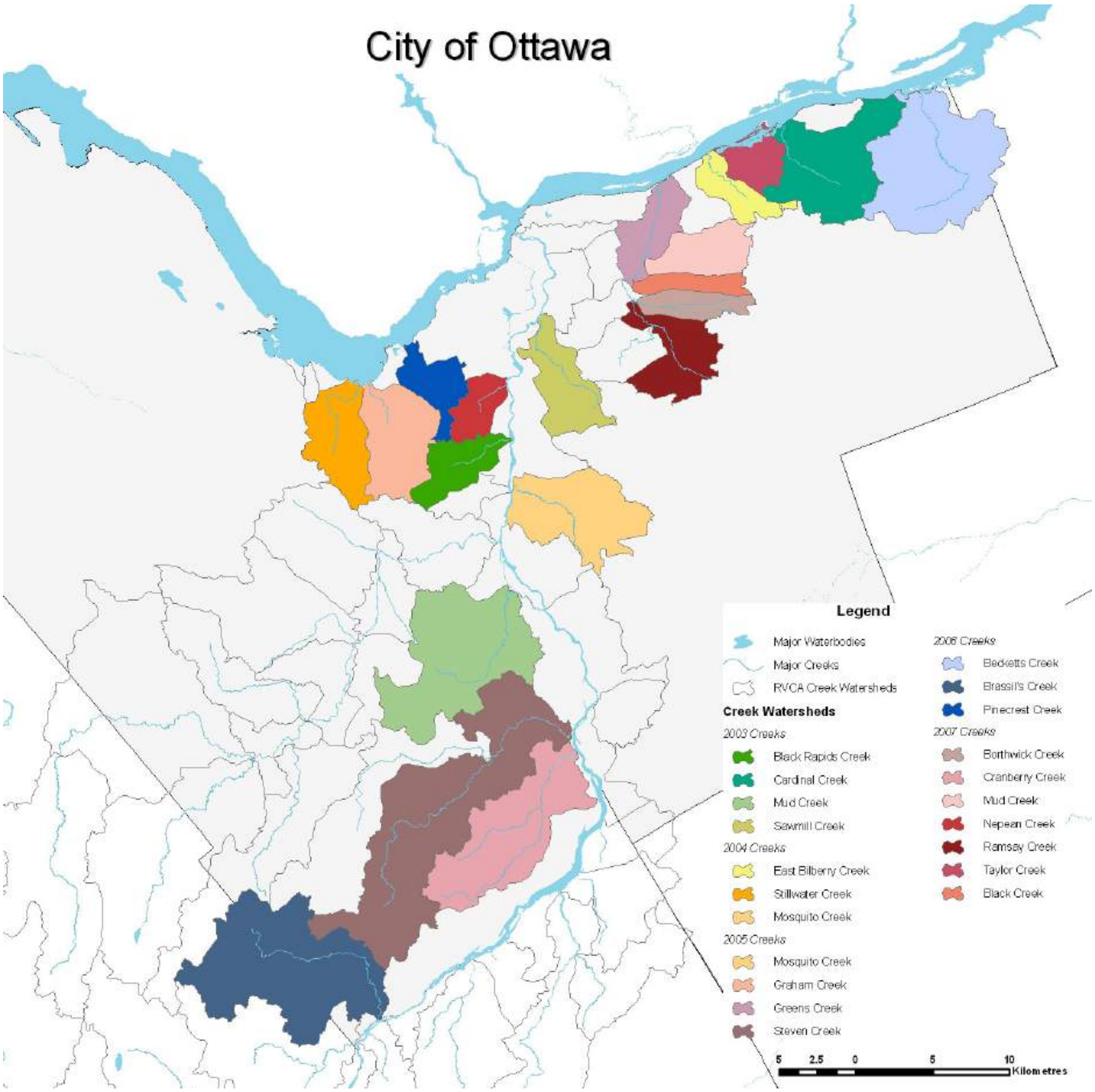

Figure 1. Locations of Streams and Their Watersheds Sampled From 2003 to 2007.

2.0 Methodology

2.1 The Stream Watchers – The Heart of City Stream Watch

The City Stream Watch program relies on and encourages the interest and commitment of volunteers from the community in order to fulfill its goal. Two formal training sessions for interested volunteers were advertised and conducted in May of 2007. As well, informal training sessions for individuals or small groups were conducted throughout the field season to ensure that everyone had an opportunity to participate in the program. Volunteers were introduced to representatives from the various partners and the coordinator of the program. Volunteers completed an interest form (Appendix A) and were then guided through the stream assessment protocol used for monitoring the streams (Appendix B). Volunteers were given a summary and definitions handout for future reference (Appendix C), shown the equipment used in sampling (Appendix D) and given a brief demonstration on how to use some of the more technical instruments. Representatives from RVCA then demonstrated the entire process for sampling one section of stream.

2.2 The Macro Stream Assessment Protocol

The City Stream Watch program utilizes a macro stream assessment protocol. The protocol was originally used by the Ontario Ministry of Natural Resources, but has been modified by RVCA so that community volunteers can easily apply it. Changes to the original protocol were essential as volunteers have a variety of educational backgrounds and experiences.

Streams are sampled in 100-meter sections. At the start of each section, the date, time, and section number are recorded. GPS coordinates are taken using a handheld GPS handheld, pre-programmed for the NAD 83 Datum and displaying Universal Transverse Mercator (UTM) coordinates. These parameters were chosen to facilitate analysis and display of City Stream Watch data with other spatial information already digitally recorded in the RVCA's existing spatial database. Overhead cloud cover is estimated and recorded as a percent, air temperature in ºC is recorded, and a photo upstream is taken. Water temperature is recorded to the nearest ºC. Stream width is measured to the nearest tenth of a metre using a 60-meter tape at right angles to the banks at water level. Stream depth is measured using the metre stick, at the deepest point across the width of the stream. Where stream depth is greater than one metre and can be accessed safely by the volunteers, stream depth is estimated to the nearest tenth of a metre.

After all necessary measurements are recorded for the start of the section, one volunteer remains at the start of the section and holds on to one end of the tape while the others begin walking upstream holding the other end. Volunteers walking upstream are asked to remember observations on land use, anthropogenic alterations of the stream, substrate characteristics and instream vegetation, bank characteristics and vegetation on the banks, tributaries, agricultural impacts, presence of wildlife and habitat, pollution and other characteristics as outlined in the macro stream assessment form. When the tape hits 50 metres, the volunteer left behind joins the others at the 50-metre mark, observing the stream characteristics while walking up.

Water temperature, stream width, and stream depth are again recorded at the mid-way point of the section. The procedure used for observing the first 50 metres of the section is repeated for the second 50 metres, thereby completing a 100 metre section. Water temperature, stream width, and stream depth are recorded at the end of the section. The UTM coordinates are recorded for the end of the section and a photo is taken downstream. The volunteers then discuss what they observed, and the macro stream assessment form is filled out for the section. The entire procedure is repeated for each 100m section of stream.

2.3 Fish Sampling through Seine Netting, Electrofishing and Hoopnetting

This year's City Stream Watch program intensified the fish sampling regime to get more in-depth fish community data on the small tributaries and their headwater areas. Sampling was done through seine netting, electrofishing, and hoopnetting. Hoopnetting is a fish capture method, which involves a large enclosed mesh net which is set in deep water and left for a 24 hour period. Fish are captured and then processed and released. Appropriate seining sites were chosen and volunteers assisted in pulling the net through the water column, processing, and identifying the catch. The different species of fish were sorted and counted. Minnow species were counted and a bulk weight (weight of all the individuals of a particular species) was measured. Game species were counted, a round weight was taken, and individual fish were measured for total length (from tip of the nose to the end of the caudal fin). Volunteers gained valuable insight into fish sampling methodology as well as experience in identifying different fish species. Electrofishing was done by RVCA certified technicians and only volunteers with certification were able to participate due to safety requirements.

2.4 Stream Clean-Ups

In 2007, four stream cleanups were held on various systems throughout the city. Cleanups were completed on the Rideau River, Sawmill Creek, Taylor Creek and Graham Creek. Volunteers were guided in the safe and appropriate removal of garbage from the creek bed and riparian areas. Only human-made (unnatural) materials were removed and protocols were followed for the safe removal of hazardous objects (broken glass, hypodermic needles, etc.). Natural debris (i.e. sticks, logs, vegetation) was not removed or disturbed as it provides valuable habitat for fish and stream dwelling organisms.

2.5 Riparian Planting//Fish and Wildlife Habitat Rehab

In 2007 two riparian planting initiatives were successfully carried out on streams in the city of Ottawa. Mosquito and Graham Creek were planted in the spring of 2007 as part of the phase II initiative to help reduce erosion and siltation as well as to promote growth of natural plant species along the banks. Additional planting opportunities have been identified for 2008 and will commence in the spring.

2.6 Data Management

All data collected, as well as photos taken as part of the City Stream Watch program, have been entered and are maintained in a spatial database by the RVCA. Data on human alterations, instream vegetation, fish habitat, instream pollution or garbage, bank characteristics, and invasive species is available for each section of the stream that was surveyed. Information on each stream is made available to the public through the Watershed Information System on the RVCA website www.rideauvalley.on.ca.

Data collected is valuable and is used on a variety of levels. Various organizations and community groups throughout the City of Ottawa use City Stream Watch data for:

- Identifying potential rehabilitation projects (riparian and fish habitat)
- Identifying stream cleanup opportunities
- Sub Watershed Plans (RVCA/City of Ottawa)
- RVCA Plan and Review
- NCC rehabilitaion projects (Pinecrest Creek Rehabilitation Project)
- Long term monitoring of urban streams

3.0 Results

3.1 The Community Response

A total of 121 volunteers from the community participated in the 2007 City Stream Watch program, consisting of people from a variety of backgrounds and experiences. Each volunteer approached the work in a slightly different way, contributing their own unique qualities to enhance the program as well as the experience of their fellow volunteers. The most significant quality they brought with them was their concern for the environment in which they live. As a result, over 611 volunteer hours were given to learning about, sampling and rehabilitating urban and rural streams in the City of Ottawa. Table 1 summarizes volunteer activities for the 2007 season.

	Black Creek	Borthwick Creek	Cranberry Creek	Mud Creek	Nepean Creek	Ramsay Creek	Taylor Creek	Becketts Creek	Rideau River	Graham Creek	Sawmill Creek	Mosquito Creek	TOTAL
# of Sections Surveyed	33	32	61	62	18	74	15	NA	NA	NA	NA	NA	**295**
# of Seining/ Electrofishing/ Hoopnetting Events	1	1	16	0	9	2	0	6	0	0	0	0	**35**
# of Species Caught	11	9	20	0	14	11	0	11	0	0	0	0	**NA***
# of Cleanup Outings	0	0	0	0	0	0	1	0	1	1	1	0	**4**
# of kilometres (km) Cleaned	0	0	0	0	0	0	0.5 km	0	2.5km	1 km	3 km	0	**7 km**
# of Riparian Plantings	0	0	0	0	0	0	0	0	0	1	0	1	**2**
# of Temperature Probe Readings	2	2	3	2	2	2	2	0	0	0	0	0	**15**
# of Volunteers	--	--	--	--	--	--	--	--	--	--	--	--	**121**
# of Volunteer Hours	32	30.5	37	58	49	69	60	21	30	27	136	7.5	**611****

Table 1. City Stream Watch Accomplishments of 2007.

* This number represents the total number of species caught in all systems. Many species were found in more than one stream.

** An aquatic invertebrate Sampling/ID session was held at the Jock River landing in which eighteen volunteers attended, contributing 54 hours to the volunteer total.

3.2 Environmental Monitoring

3.2.1 Nepean Creek

Nepean Creek is approximately 1.8 kilometers long (excluding the stormwater ponds) and flows from Colonnade Park, just east of Merivale Road and empties into the Rideau River east of the intersection of Prince of Wales and Fisher Ave. The stream flows through a highly developed residential area, which is still in the process of construction, however there is a natural buffer zone between the development and the stream. Nepean Creek has an online stormwater pond installed in its upper reaches. A second offline stormwater-settling pond is located closer to the Rideau River. The stormwater ponds were not sampled as part of the stream survey as they fall outside the guidelines of the protocol.

Figure 2 shows an air photo taken of the Nepean Creek area.

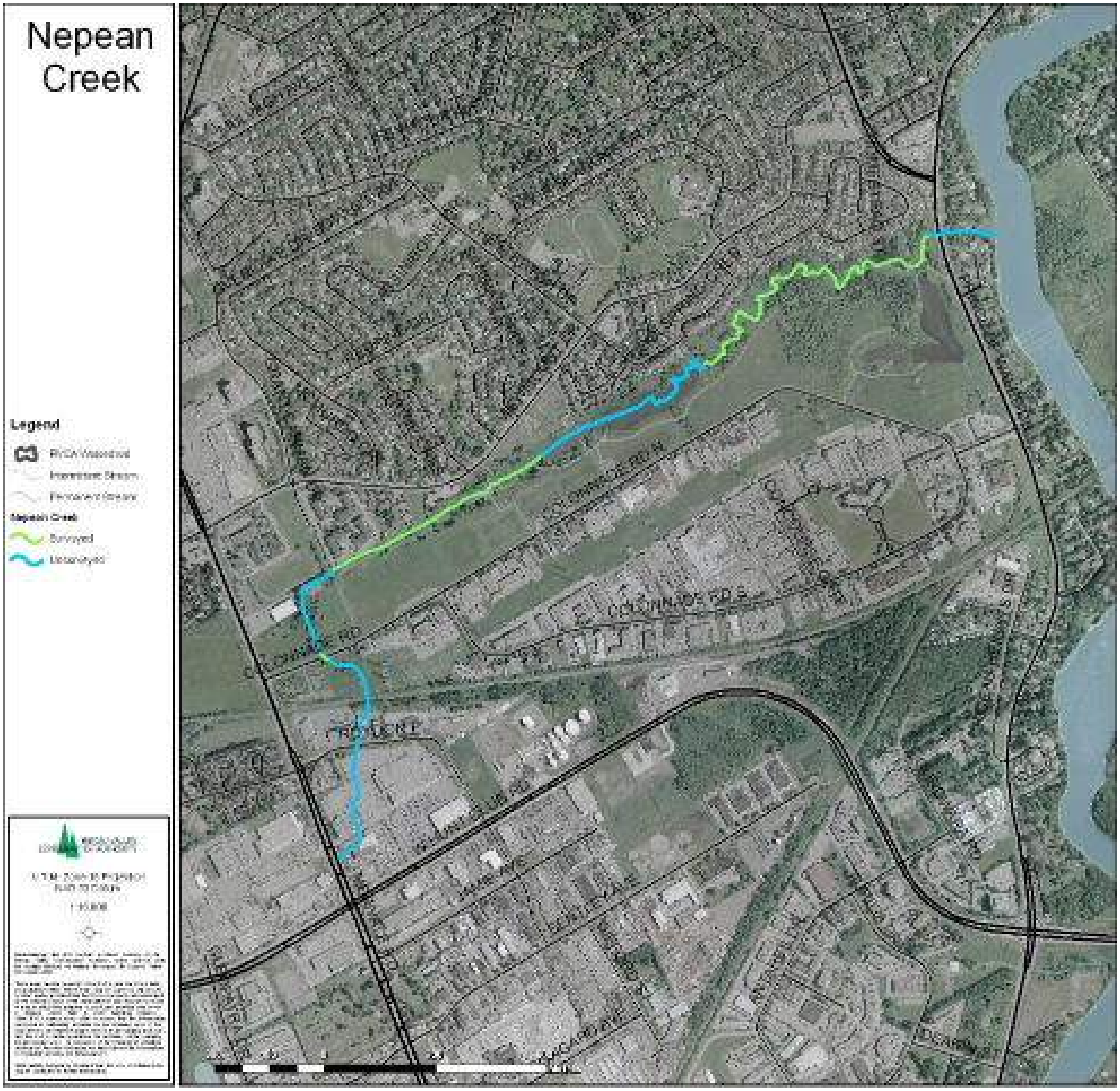

Figure 2. Air Photo of Nepean Creek and Surrounding Area.

A total of 1.8 kilometres of Nepean Creek was sampled during the 2007 season. The following is a summary of the 18 macro-stream assessment forms completed by technicians and volunteers. Observations concerning anthropogenic alterations, land use, in-stream vegetation, bank stability, wildlife and pollution are discussed.

1. Observations of Anthropogenic Alterations and Land Use

Figure 3 illustrates the classes of anthropogenic alterations observed by volunteers along Nepean Creek. Of the 18 sections of stream sampled, there were no sections of stream that were without human alterations of some kind. Sections that remained in a natural condition with some man-made alterations made up 56% of the stream. Stretches considered altered made up the remaining 44% of stream. These altered areas coincided with low to rare aquatic vegetation and were associated with man-made structures. Three altered sections were found in the lower reaches of Nepean Creek where it meets the Rideau River. This area had alterations which included stormwater pond control structures and a concrete bridge under Prince of Wales Dr. Seven sections in the upper reaches of stream were altered due to a residential development and a parking area on its north bank which had no buffer between it and the stream.

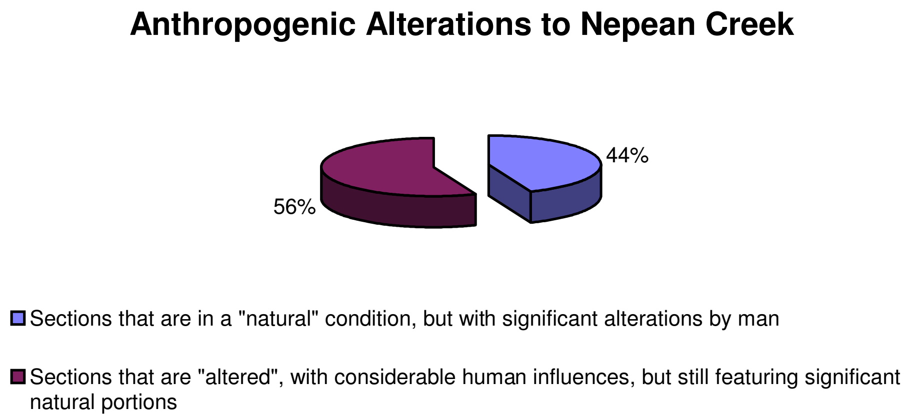

Figure 3. Classes of Anthropogenic Alterations Occurring Along Nepean Creek.

Figure 4 demonstrates the four different land uses identified by volunteers occurring along the banks adjacent to Nepean Creek. Natural areas make up the majority of the stream with 66% of the land being classed as untouched. As mentioned previously, a buffer zone of natural vegetation has been left along the banks of Nepean Creek, protecting the stream from runoff and the pressures of upland urban development.

Recreational parks and pathways make up 14% of land use for Nepean Creek. The majority of cleared fields and pathways exist along the south bank in the upper reaches of the creek. These areas are well back from the stream bank and fields are used primarily for sporting activities. Residential areas account for 17% of land use along the banks of the stream. Most residential housing is set back from the creek although in the upper reaches, a housing complex runs along the north bank, immediately above the creek. This development accounts for the percentage of residential land use. A small percentage of land use is classified as roadway/construction. Roadways consisted of a concrete bridge at Prince of Wales Dr. Currently some of the area surrounding Nepean Creek is under construction to make a new residential development. The construction is temporary and will be replaced by residential land use following completion.

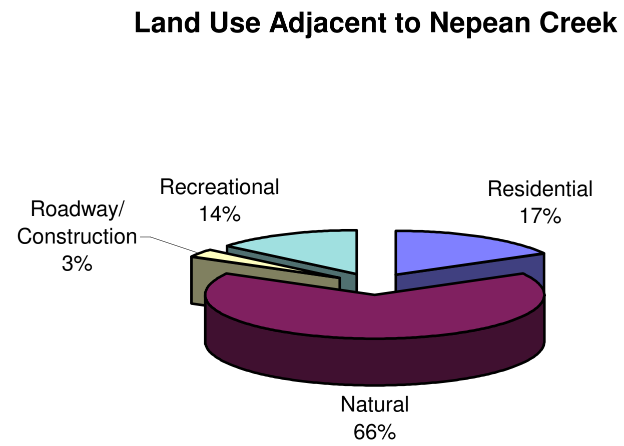

Figure 4. Land Use Identified by Volunteers Along Nepean Creek.

2. Observations 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. Figure 5 demonstrates the frequency of instream vegetation in Nepean Creek.

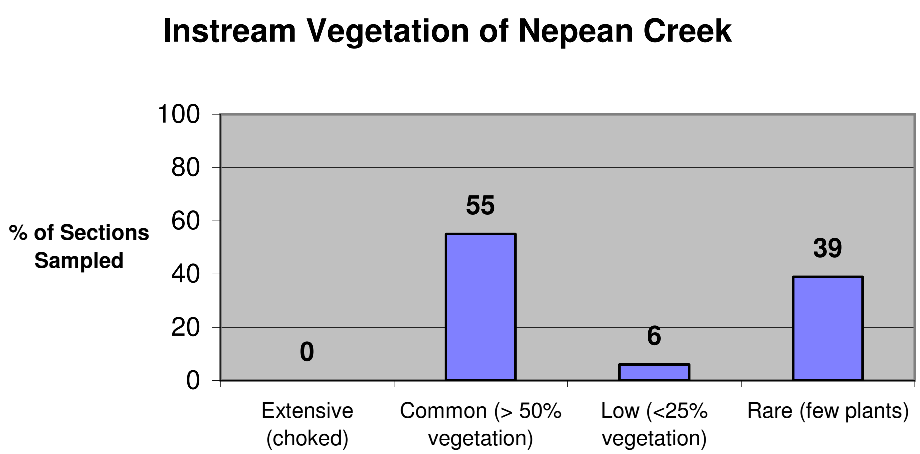

Figure 5. Frequency of Instream Vegetation in Nepean Creek.

The instream vegetation in Nepean Creek varied by location throughout the stream. In 55% of sections sampled vegetation was found to be common and this coincided with areas that are in a "natural" condition. The remaining sections (45%) were classified as low or rare. Areas in an "altered" state coincided with areas of little to no instream vegetation.

Nepean Creek was surveyed in early June therefore vegetation was not in full bloom. Fish sampling was carried out in July, and by that time the vegetation had become thick and extensive in some areas in the lower reaches of the stream. Areas choked with vegetation can negatively affect the stream due to increased biological oxygen demand (BOD) when the plants die off. Extensive vegetation can also restrict the mobility of aquatic organisms.

3. Observations of Bank Stability

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 removal of aquatic macrophytes, which provide habitat. Excessive erosion and deposition of sediment within a stream can also have detrimental effects to important fish and wildlife habitat.

Figure 6 shows the overall bank stability of Nepean Creek. In 87% of sections sampled by volunteers, the stream banks were identified as being stable. The stability of the banks can be attributed to a healthy buffer of trees and vegetation between the residential development and the stream. Eroded sections were identified in 13% of surveyed sections. Erosion along this stream was moderate and does not pose a risk to overall stream health. A small amount of undercutting was observed but appeared to result from a woody debris jam. This unnatuaral deflector caused the water to change its natural course, eroding a small section of bank downstream of the debris jam. It is not known how long this debris has been in the stream although at the time of sampling it appeared to be the cause.

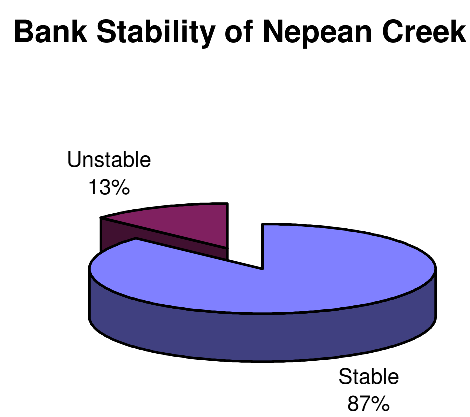

Figure 6. Bank Stability of Nepean Creek.

Areas of erosion have been identified on an aerial photo of Nepean Creek and are detailed in Appendix G.

4. Observations of Wildlife

The diversity of fish and wildlife populations can be an indicator of water quality and overall stream health. Table 2 is a summary of all wildlife observed during stream surveys.

Wildlife	Observed While Sampling
Birds	red-winged blackbird, goldfinch, crow, grackle, robin, sparrows, flicker
Mammals	mink, skunk, chimpmunk
Reptiles/Amphibians	green frog, bull frog, painted turtle, american toad, tadpoles
Aquatic Insects	water striders, snails, damselflies, crayfish, dragonfly, caddisfly, midge, whirligig beetles, mollusks
Other	butterflies, various arthropods

Table 2. Wildlife Observed on Nepean Creek During Stream Surveys

5. Observations of Pollution

Figure 7 demonstrates the incidence of pollution in Nepean Creek. Pollution in the stream is assessed visually and noted for each section where it is observed. At least one piece of garbage (floating or on the stream bottom) was found in each of the 18 sections surveyed. Garbage did not occur in large quantities or accumulate in large amounts, but there was scattered debris in all sections surveyed.

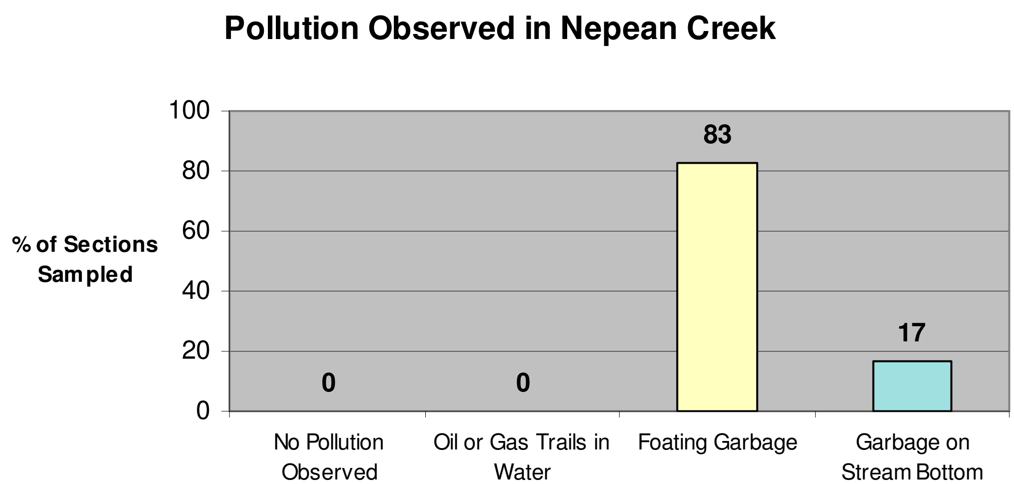

Figure 7. Frequency of Pollution Occurring in Nepean Creek.

Pollution observed includes garbage in the stream and along its banks. Much of it likely results in trash blowing in from the sports fields, recreational pathways, neighbouring residential areas and the construction sites.

Floating garbage found in the stream consisted of plastic bags, styrofoam and pop bottles. Garbage found on the stream bottom included scrap metal, plastic (fencing), glass bottles, cans, PVC piping, shopping carts, bicycle parts and tires. A community cleanup was held in 2007 by a Boy Scout troop as part of the Great Canadian Shoreline Cleanup. Nepean Creek would benefit from annual cleanups where members from the community walk the stream and remove all un-natural debris from the stream channel and banks.

6. Fish Community Sampling

Seine Netting

Seine netting is an effective way to sample fish communities in streams, rivers and lakes. Seine nets are dragged through the water column to collect fish in the near shore area. This data is used in conjunction with electrofishing to determine fish communities and distributions. Volunteers contributed 32 hours to assisting with seine netting activities along Nepean Creek. Volunteers were introduced to fish sampling methods as well as taught how to identify and process seine net catches.

Five seine netting sites were completed along Nepean Creek on July 3, 2007. Figure 8 shows the locations of the sampling sites, and Table 4 is a summary of the fish caught.

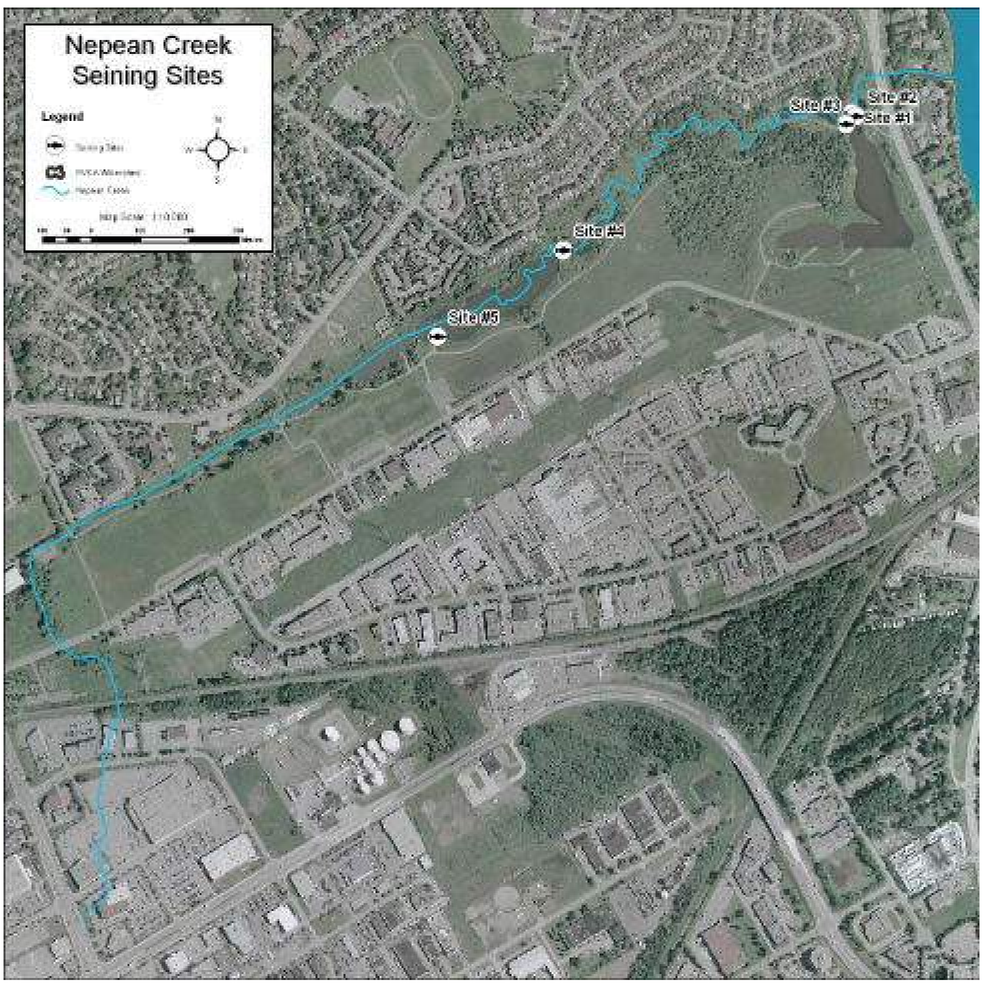

Figure 8. Air photo of Nepean Creek Showing Seining Sites.

Water chemistry data was taken prior to seine netting using a YSI probe. This instrument measures water temperature, dissolved oxygen (DO), pH, and conductivity. Water temperature of a stream is classified into warm, cool and cold water systems. Temperature has a major influence on the biota found in a stream system. Dissolved oxygen is what stream-dwelling species such as fish and invertebrates use to breathe. Fast flowing, cold water will have higher dissolved oxygen content than slow moving warm water. This is because cold water has the ability to hold more oxygen as does water that is constantly churning, thereby incorporating air from the atmosphere into the water. Conductivity is a measure of the water's ability to pass an electrical current. It is primarily affected by the geology of the area in which the stream flows. Streams with clay soils tend to have a higher conductivity because of ionized materials in the water. The pH of water is a scale used to evaluate the alkalinity or acidity of water and is ranked on a scale of 1 to 14. Acidity increases, as pH gets lower (7 being neutral). The pH determines the solubility and availability of nutrients and heavy metals to stream dwelling organisms.

Table 3 summarizes water chemistry data for each seining site. No conductivity values were obtained as the YSI unit had a contaminated cell and therefore required service and calibration.

Location	Seine #	Date (mm/dd/yy)	Air Temp (C)	Water Temp (C)	DO (mg/L)	pH	Conductivity (uS/cm)	Substrate	Instream Vegetation
Nepean Creek	1	03/07/2007	23	20.3	5.62	8.4	NA	clay, muck, rip rap along shore and near shore area	algae, waterweed, cattails in riparian
Nepean Creek	2	03/07/2007	23	20.3	5.62	8.4	NA	clay, muck, rip rap along shore and near shore area	algae, waterweed, cattails in riparian
Nepean Creek	3	03/07/2007	23	20.3	5.62	8.4	NA	clay, muck, rip rap along shore and near shore area	algae, waterweed, cattails in riparian
Nepean Creek	4	02/07/2007	28	21.4	7.62	8	NA	clay, muck, large rocks along shore (man made)	algae, sago pondweed
Nepean Creek	5	03/07/2007	28	21	12.1	8.1	NA	gravel, muck	pondweed, broad-leaved arrowhead

Table 3. Water Chemistry Results for Seining Sites Along Nepean Creek.

Table 4 summarizes the biological data obtained from each seine netting event on Nepean Creek. A total of twelve different fish species were collected. Top predators within the stream ecosystem are highlighted by italics and bold.

Seine #	Species	Number	Total Length (mm)	Weight (g)	Comments
1	Rock Bass	2	NA	16.4	
	Brown Bullhead	1	195	97.5	
2	**Smallmouth Bass**	**1**	**154**	**32.2**	
	Pumpkinseed	1	145	43.4	
	Pumpkinseed	1	114	31.6	
	Pumpkinseed	1	85	12.9	
	Pumpkinseed	1	82	10.1	
3	**Largemouth Bass**	**1**	**284**	**342.5**	
	Smallmouth Bass	**1**	**178**	**73.7**	
	White Sucker	1	194	70.9	
	Bluegill	1	96	13.5	
	Brook Stickleback	1	NA	3.1	
	Rock Bass	1	NA	3.4	

	Sunfish	7	NA	12.6	
	Central Mudminnow	5	NA	5.7	
	Banded Killifish	1	NA	0.9	
4-1	Pumpkinseed	6	NA	115.7	
	Brook Stickleback	11	NA	7.9	
	Creek Chub	11	NA	69.7	
	Unknown Cyrpinid	6	NA	8.6	
4-2	Pumpkinseed	1	NA	41.1	
	Brook Stickleback	118	NA	80.9	
	Cyrpinid	67	NA	85.7	
5-1	Fathead Minnow	1	NA	NA	not processed
	Brook Stickleback	>100	NA	NA	not processed
	Brook Stickleback	>100	NA	NA	not processed
5-2	Brook Stickleback	>100	NA	NA	not processed

Table 4. Fish Community Results for Seining Sites along Nepean Creek

Electrofishing

Electrofishing is one of the key tools used to effectively sample fish communities. Basically, electricity is passed through the water using a backpack electrofisher which causes a muscle response reaction in fish, temporarily stunning them while the netters scoop them from the stream and place them in a recovery bucket. Electrofishing very seldom kills fish if the correct voltages are used. This makes it the most effective way to sample fish from a variety of habitats in otherwise hard to access areas of stream. Once the data is recorded the fish are returned to the area of stream from where they were collected.

RVCA staff electrofished two sites along Nepean Creek on July 5, 2007. A total of eight different species were identified. Some cyprinid (minnow) species could not be identified.

Figure 9 shows the locations of the electrofishing sites.

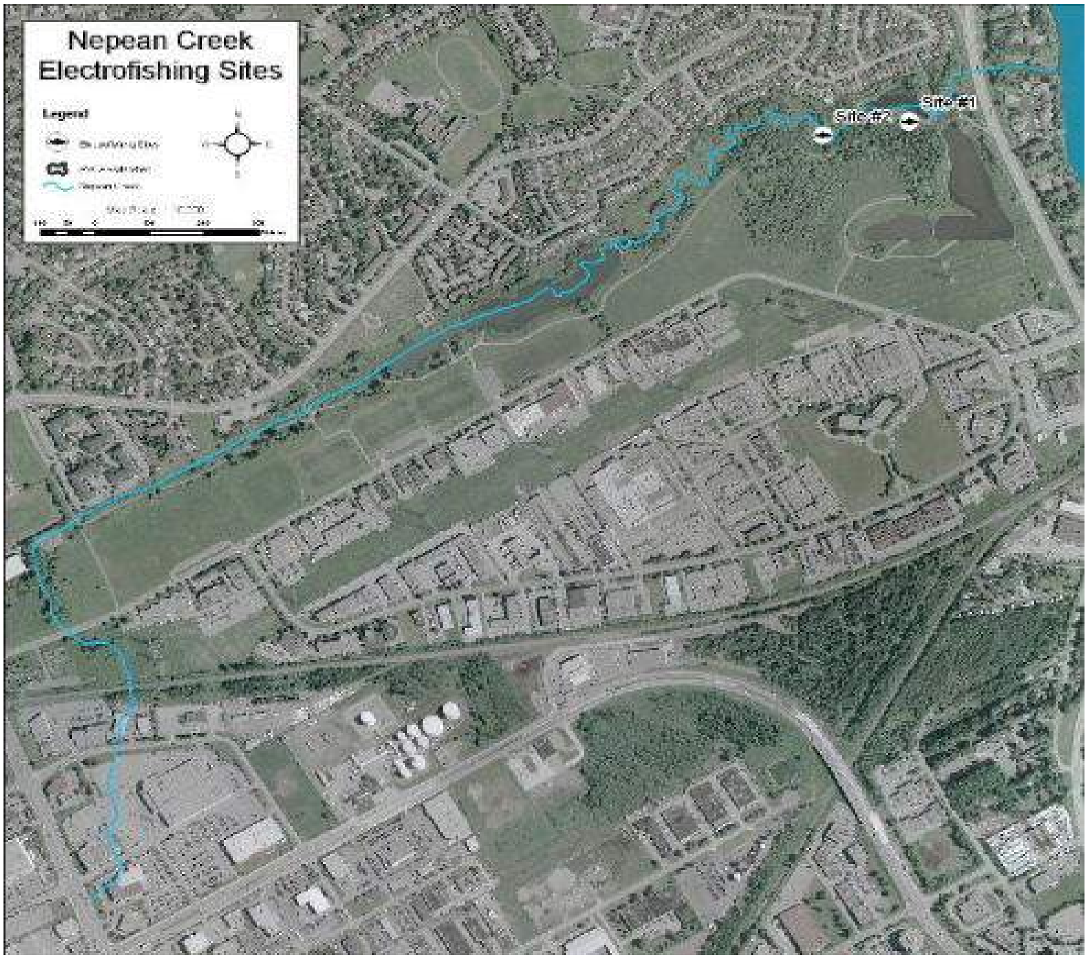

Figure 9. Air photo of Nepean Creek Showing Electrofishing Sites.

Table 5 illustrates the water chemistry values obtained at the time of electrofishing. No detailed water chemistry data was recorded for Site 1 and 2, as the YSI probe was damaged and in the process of being repaired.

Location	E-fish #	Date (mm/dd/yy)	Air Temp (C)	Water Temp (C)	DO (mg/L)	pH	Conductivity (uS/cm)	Substrate	Vegetation
Nepean Creek	1	05/07/2007	22	NA	NA	NA	NA	boulder, silt, clay, sand	thick waterweed, algae, arrowheads in riparian
Nepean Creek	2	05/07/2007	22	NA	NA	NA	NA	clay, muck, silt	waterweed, algae, waterlilly, grasses

Table 5. Water Chemistry Results for Electrofishing Sites Along Nepean Creek.

Table 6 summarizes the biological data obtained from each electrofishing event along Nepean Creek.

E-fish #	Species	Number	Total Length (mm)	Weight (g)	Comments
1	Pumpkinseed	7	NA	31.1	
	Brook Stickleback	12	NA	9	
	Fathead Minnow	20	NA	26.5	
	Creek Chub	6	NA	124.3	
	Cyrpinids	14	NA	106.7	could not ID
2	Brook Stickleback	17	NA		
	Creek Chub	23	NA		
	Brown Bullhead	1	196		
	Brown Bullhead	11	211		
	Common White Sucker	1	190		
	Common White Sucker	1	223		
	Common White Sucker	1	206		
	Common White Sucker	1	230		
	Common White Sucker	1	116		
	Common White Sucker	1	191		
	Common White Sucker	1	129		
	Common White Sucker	1	215		
	Common White Sucker	1	213		
	Banded Killifish	2	2.8		
	Northern Redbelly Dace	2	4.5		
	Cyprinids	55	84.8		could not ID

Table 6. Fish Community Results for Electrofishing Sites Along Nepean Creek

Fish Species Status, Trophic, and Reproductive Guilds - Nepean Creek

Table 7 was generated by taking the fish community structure of Nepean Creek and classifying the recreational, commercial, or bait fishery importance, the Species at Risk status, reproductive guild (spawning habitat requirements), thermal classification, and trophic guild (feeding preference). The majority of the species within Nepean Creek are either significant to the recreational or baitfish fisheries. The fish community structure consists of a mix of warm and cool water species. The spawning habitat requirements for the fish community of Nepean Creek is extremely diverse and demonstrated in Table 7.

MNR Code	Common Name	Scientific Name	Recreational Fishery	Commercial Fishery	Bait Fishery	Status	Reproductive Guild	Thermal Classification	Trophic Guild
163	White Sucker	Catostomus commersoni				None	(non guarder) Lithophils	cool	Insectivore/ Omnivore
182	Northern redbelly dace	Phoxinus eos			X	None	(non guarder) Phytophils	cool/warm	Herbivore
141	Central mudminnow	Umbra limi			X	None	(non guarder) Phytophils	cool/warm	Insectivore/ Omnivore
281	Brook stickleback	Culaea inconstans			X	None	(guarders) Ariadnophils	cool	Insectivore
212	Creek chub	Semotilus atromaculatus	X		X	None	(brood hiders) Lithopils	cool	Insectivore/ Generalist
261	Banded killifish	Fundulus diaphanus			X	None	(non guarder) Phytophils	cool	Insectivore

314	Bluegill	Lepomis macrochirus	X			None	(nest spawners) Lithophils	cool/warm	Insectivore
313	Pumpkinsee d	Lepomis gibbosus	X			None	(nest spawners) Polyphils	cool/warm	Insectivore
311	Rock bass	Ambloplites rupestris	X			None	(nest spawners) Lithophils	warm	Insectivore
317	Largemouth bass	Micropterus salmoides	X	past		None	(nest spawners) Phytophils	warm	Insectivore/ Piscivore
316	Smallmouth bass	Micropterus dolomieu	X	past		None	(nest spawners) Lithophils	cool	Insectivore/ Piscivore
209	Fathead minnow	Pimephales promelas			X	None	(guarder) Speleophils	warm	Omnivore
233	Brown bullhead	Ameiurus nebulosus	X	limited	X	None	(guarder) Speleophils	warm	Insectivore

Table 7. Fish Species Status, Trophic, and Reproductive Guilds for Nepean Creek
(Source: MTO Environmental Guide to Fish and Fish Habitat, 2006)

Table 8 summarizes the fish community structure found in Nepean Creek and their sensitivity to sediment and turbidity for reproduction, feeding, and respiration. The composition of the fish community in Nepean Creek ranges from species that are fairly tolerant to those that are intolerant to sediment and turbidity. However, the majority of the species would be classified in the moderately tolerant range for reproduction and feeding. Fish species such as bass that are sensitive to sediment and turbidity for feeding were caught close to the Rideau River where food could be found elsewhere if ideal conditions did not exist.

Fish Species Sensitivity to Sediment/Turbidity for Nepean Creek

MNR Code	Common Name	Scientific Name	Reproduction	Feeding	Respiration
163	White Sucker	Catostomus commersoni	M	L	H
182	Northern redbelly dace	Phoxinus eos	M	L	L
141	Central mudminnow	Umbra limi	M	M	L
281	Brook stickleback	Culaea inconstans	L	M	unknown
212	Creek chub	Semotilus atromaculatus	M	H	H
261	Banded killifish	Fundulus diaphanus	M	M	L
314	Bluegill	Lepomis macrochirus	L	M	unknown
313	Pumpkinseed	Lepomis gibbosus	L	M	unknown
311	Rock bass	Ambloplites rupestris	L	H	unknown
317	Largemouth bass	Micropterus salmoides	L	H	H
316	Smallmouth bass	Micropterus dolomieu	M	H	unknown
209	Fathead minnow	Pimephales promelas	L	L	unknown
233	Brown bullhead	Ameiurus nebulosus	L	L	L

Table 8. Fish Species Sensitivity to Sediment/Turbidity (High, Moderate, Low, unknown) for Nepean Creek
(Source: MTO Environmental Guide to Fish and Fish Habitat, 2006)

7. Temperature Profiling

Temperature is an important parameter in streams as it influences many aspects of physical, chemical and biological health. The temperature of a stream can vary considerably between the seasons as well as fluctuate between night and day. Many factors can influence fluctuations in stream temperature such as springs, tributaries, rain runoff and discharge pipes. The greatest factor of fluctuating temperature is solar radiation and runoff from developed areas. Streams with large amounts of riparian canopy cover will yield lower temperatures while areas with no trees will be warmer. The thermal classifications for cold, cool and warm water are as follows:

Status	Water Temperature
Cold	<19 Degrees Celsius
Cool	19-25 Degrees Celsius
Warm	>25 Degrees Celsius

Table 9. Water Temperature Classifications (Minns et al. 2001)

Two temperature dataloggers were set in Nepean Creek for a 100-day period. Readings began on June 13 and the dataloggers were removed September 20, 2007. Figure 10 shows the locations of dataloggers in Nepean Creek.

Figure 10. Datalogger Locations Along Nepean Creek.

Dataloggers were set in two different locations along the stream to give a representative sample of how temperature fluctuates and differs throughout the course of the stream. One was set in the lower reaches, 200 meters upstream of where the stream enters the Rideau River and the other was set approximately 50m downstream of the stormwater pond.

Figure 11 shows the results from the two dataloggers relative to one another.

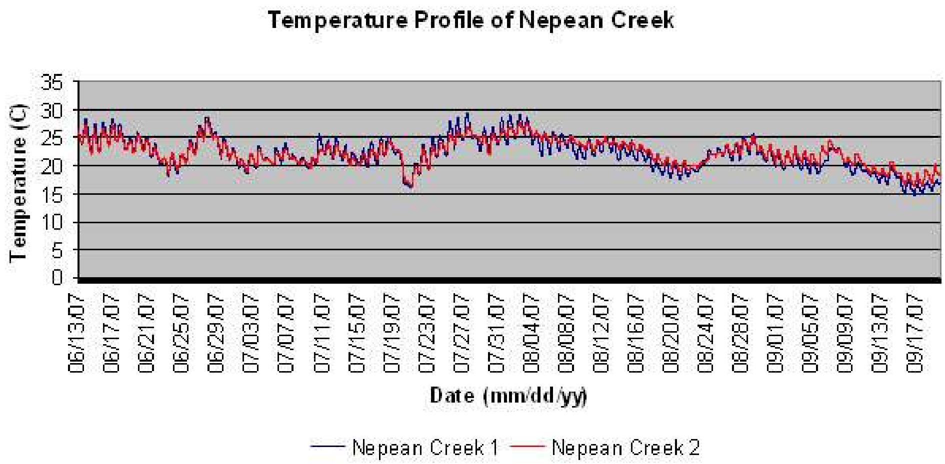

Figure 11. Temperature Profile for Nepean Creek.

Figure 11 has a consistent trend of fluctuating temperatures throughout the stream. Over the 100-day period this stream reached a maximum temperature of 29.5°C and a minimum of 14.7°C.

In comparison, the two dataloggers show little variation and the temperature patterns are very similar which is typical for this type of stream. Temperature highs and lows can differ from section to section as factors such as overhead cover, water depth, flow, and stream morphology play a large role in determining temperature trends.

Based on the fish community structure and temperature data collected, Nepean Creek can be classified as a warm water system with cool water reaches. Through evaluation of the temperature data, Nepean Creek's waters warm well above 25 degrees in late July and early August reaching a maximum temperature of 29.5°C, thus classifying it as warm water system. However, cool water areas do exist along the system as indicated by the presence of fish such as smallmouth bass.

3.2.2 Cranberry Creek

Cranberry Creek is approximately 19 kilometres long, flowing through natural areas and some agricultural land. The watershed supports a provincially significant wetland called Cranberry Creek wetland, which spans 1716 ha (White, 1997). The wetland area is made up of swamp and marsh areas. Most is in fair to good condition and there is representation of good quality mixed swamp and deciduous swamp. (White, 1997)

The stream begins just west of Malakoff Road and empties into the Rideau River just south of Kars. Figure 12 shows an air photo taken of the Cranberry Creek area with the provincially significant wetland in green.

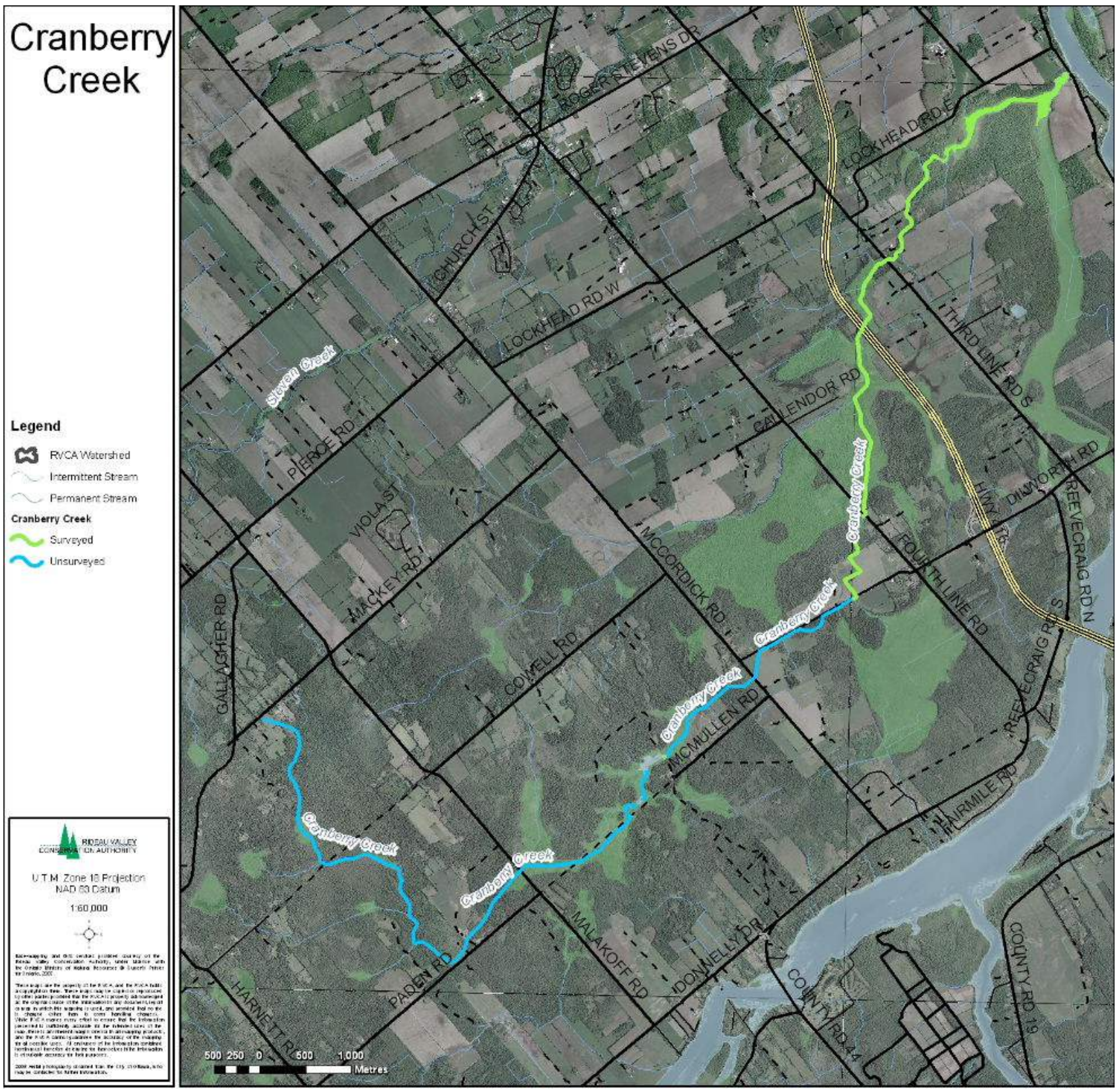

Figure 12. Air Photo of Cranberry Creek and Surrounding Area.

A total of 6.1 kilometres of Cranberry Creek was surveyed during the 2007 season. The headwaters and upper reaches of Cranberry Creek, west of McCordick Road, were not sampled due to lack of water in the stream channel, making stream habitat assessment impossible. Drought conditions were observed across the watershed in 2007 so many streams dried up, especially in the headwater areas. The remaining sections of Cranberry Creek with be surveyed in 2008 and results will be published in the 2008 report.

It also must be noted that there were a few instances where the stream channel turned into a wetland area. These areas were not surveyed. The area bypassed was approximately 1.5 kilometres. Wetland areas do not fall under the macro stream survey since there is no defined channel; however, future wetland studies of these areas would provide valuable data on the system.

Stream data below only consists of the stream sections sampled and should not be representative for the entire stream. The following is a summary of the 61 macro stream assessment forms filled out by volunteers.

1. Observations of Anthropogenic Alterations and Land Use

Figure 13 illustrates the classes of anthropogenic alterations observed by volunteers along Cranberry Creek. Of the 61 sections of stream surveyed, volunteers identified 39 sections that displayed no human alterations or disturbances. Much of Cranberry Creek's land use is made up of natural wetland areas and is isolated from developmental pressures. Of the remaining sections, 15 were considered natural with some human alteration. These minor alterations to land use included active and abandoned agricultural fields and cleared powerline areas. The remaining 7 sections were considered altered and this was due to culverts and bridges for roadways such as Highway 416 and other road crossings. Some active agriculture along the banks was classed as altered as well. There were no areas considered highly altered along the sections sampled.

Anthropogenic Alterations to Cranberry Creek

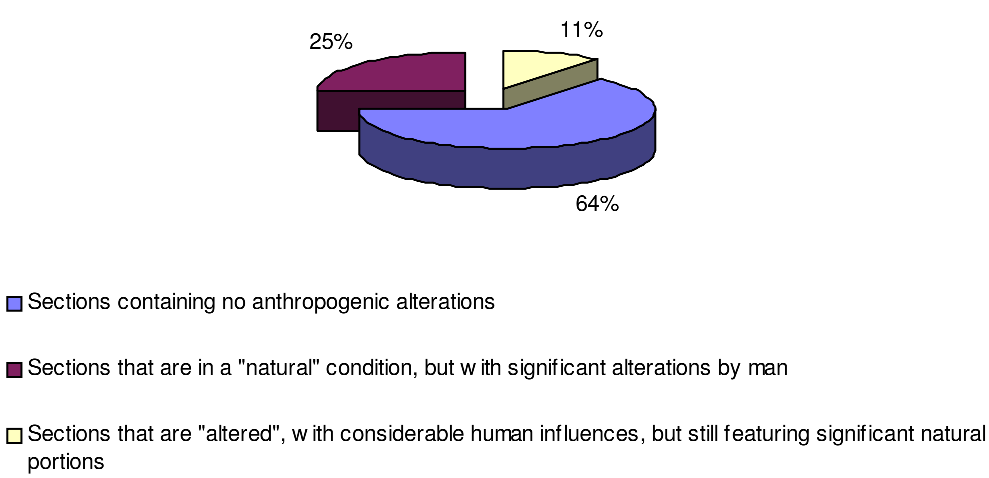

Figure 13. Classes of Anthropogenic Alterations Occurring Along Cranberry Creek.

Figure 14 demonstrates the seven different land uses adjacent to Cranberry Creek observed by volunteers. Natural areas exist along 76% of the creek, while active agriculture made 10% of the stream. Agricultural impacts were minimal for most of the stream as grazing pasture made up 3% of sampled sections and abandoned agricultural fields made up 6%. Cattle access to the stream was not observed and the only disturbances observed to the stream were agricultural drains. Roadways and bridges where the stream passes under major road crossings such as Highway 416, Rideau Valley Drive and McCordick Road made up 3% of land use along Cranberry Creek. Recreational and residential land use occurred along 2% of the stream, where the stream emptied into the Rideau River. It should also be noted that parts of the Cranberry Creek system are classified as a municipal drain.

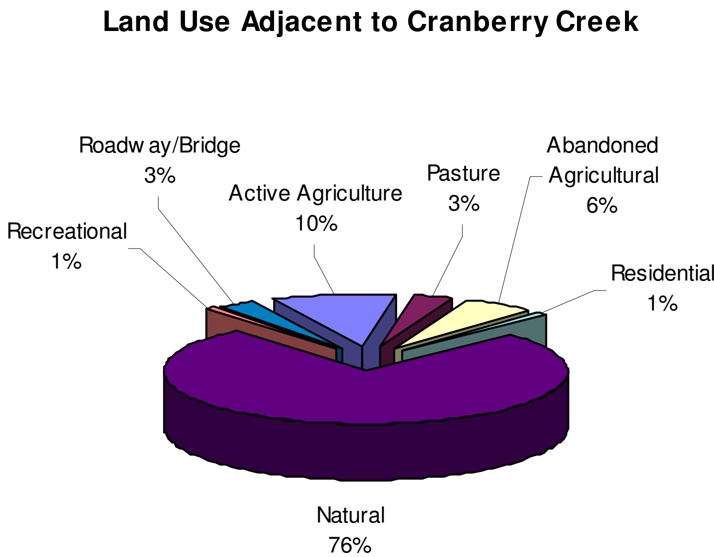

Figure 14. Land Use Identified by Volunteers Along Cranberry Creek.

2. Observations of Instream Vegetation

Figure 15 demonstrates the incidence of instream vegetation in Cranberry Creek. Instream vegetation was categorized as being common to normal for 23% of the stream. Low vegetation made up 7% of sampled sections and very little or rare vegetation was found in 5%. Extensive vegetation was found to be quite high in Cranberry Creek. In areas such as the wetlands which exist along the stream it is common for there to be thick growth of macrophytes although extensive growth was found throughout the stream. Extensive vegetation can have negative affects on the stream such as biological oxygen demand (BOD), which reduces the amount of dissolved oxygen in the system. Choked vegetation also can impact the mobility and migration of aquatic organisms as well as affects the feeding patterns of fish.

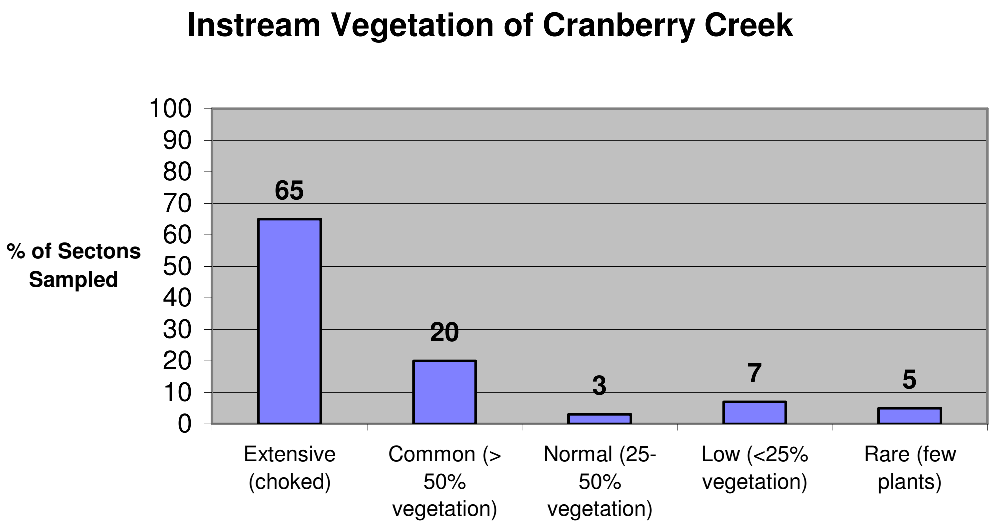

Figure 15. Frequency of Instream Vegetation in Cranberry Creek.

Exotic plants are species that are not native to an area and often cause specific harm to an ecosystem. Species such as purple loosestrife, European frogbit, eurasion milfoil, and flowering rush are examples of invasive plant species. These exotics degrade ecosystems which they occupy as they out-compete native species, especially the rare or endangered, and eliminate fish and wildlife habitat.

The frequency of invasive species was high in Cranberry Creek. Purple loosestrife and European frogbit were identified in every section. Frogbit was found in all sections of stream and was thick matted in some areas. This shows that frogbit is out competing native species and negatively affecting the plant communities. See Appendix H for a map of distribution and frequency.

3. Observations of Bank Stability

Figure 16 demonstrates the overall bank stability of Cranberry Creek. Evidence of erosion from the bank was observed in only 2% of the shoreline. These areas of bank instability were found in altered sections, downstream of man-made structures such as culverts for driveways and road crossings.

Cranberry Creek is a rural stream that is isolated from development and other urban pressures. Most often, urban streams exhibit excessive erosion due to the removal of buffer zones, accelerated runoff from developed areas, and channel modification. The banks of Cranberry Creek support a healthy vegetative community of hardwood forests and wetland areas. For this reason very little erosion was observed along this stream.

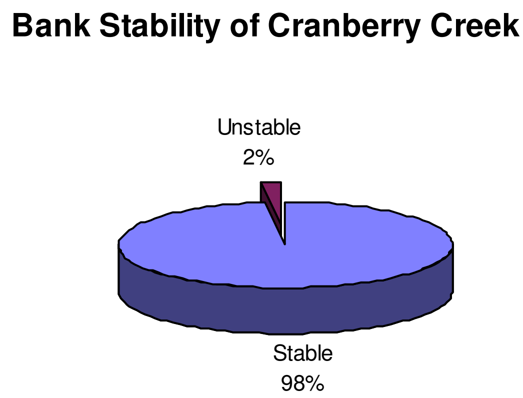

Figure 16. Bank Stability of Cranberry Creek.

Areas of erosion have been identified on an aerial photo of Cranberry Creek and can be found in Appendix G.

4. Observations of Wildlife

Volunteers recorded the presence of many types of wildlife in and around Cranberry Creek. Table 10 is a summary of wildlife observed.

Wildlife	Observed While Sampling
Birds	green heron, great blue heron, mallard ducks, mallards with ducklings, common moorhen, American bittern, red-winged blackbird, grey catbird, herring gull, robin, crow, blue jay, eastern kingbird, sparrows, goldfinch, song sparrow, downy woodpeckers, common yellowthroat, starlings, hawk, chickadees, mourning dove
Mammals	muskrat, squirrel, chipmunk, white-tailed deer, racoon, beaver, coyote (tracks)
Reptiles/Amphibians	green frogs, bullfrogs, leopard frog, pickerel frog
Aquatic Insects	water strider, whirligig beetle, dragonfly, caddisfly, stonefly, giant water bug, leeches, water scorpion, mayfly, damselfly
Other	various arthropods

Table 10. Wildlife Observed on Cranberry Creek During Stream Surveys.

5. Observations of Pollution

Figure 17 demonstrates the incidence of pollution along Cranberry Creek. Pollution was observed in 38% of sampled sections. Of the 61 sections sampled, no pollution was found in 38 sections making up 62% of the stream.

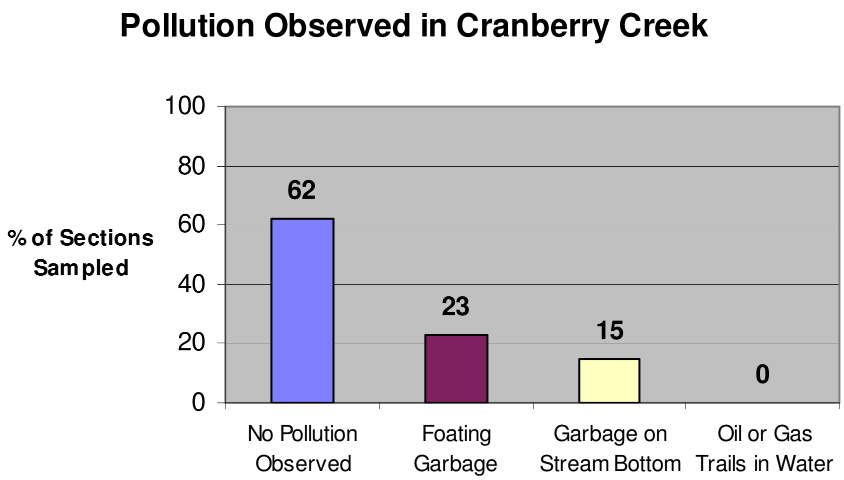

Figure 17. Frequency of Pollution Occurring in Cranberry Creek.

Cranberry Creek is a rural stream and therefore the frequency of pollution is low. Though pollution was found in 38% of sections sampled, very few items were found within each of those sections. Streams that flow through rural land generally lack human access which tends to result in decreased pollution in the stream. Accordingly, much of the pollution was observed around agricultural areas and downstream of road crossings. Pollution included tires, beverage cans, plastic bags, glass bottles and some PVC piping. Overall Cranberry creek has little pollution in comparison to most streams primarily because it is a rural system. Many of the items identified were removed at the time of sampling.

6. Fish Community Sampling

Seine Netting

Seine netting was completed at five sites along Cranberry Creek on July 4 and 5, 2007. Two volunteers assisted in seining and processing the catch. Figure 18 shows the locations of the sampling sites

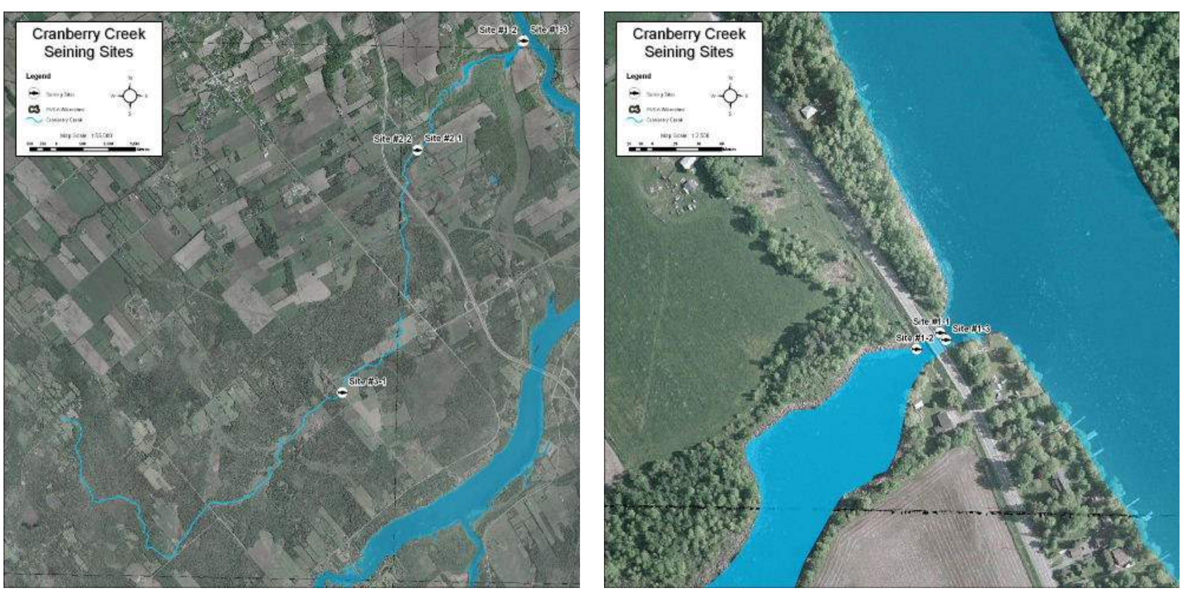

Figure 18. Air photo of Cranberry Creek Showing Seining Sites

Table 11 illustrates the water chemistry values obtained from each site at the time of seining. No conductivity values were obtained as the YSI unit had a contaminated cell and therefore required service and calibration.

Location	Seine #	Date (mm/dd/yy)	Air Temp (C)	Water Temp (C)	DO (mg/L)	pH	Conductivity (uS/cm)	Substrate	Instream Vegetation
Cranberry Creek	1	07/05/2007	NA	21.73	7.32	8.3	NA	gravel, boulder, muck in some areas with weeds present	algae, duckweed, pondweed, burreed, cattail, lilly, European frogbit
Cranberry Creek	2	07/05/2007	NA	21.73	7.32	8.3	NA	gravel, boulder, muck in some areas with weeds present	algae, duckweed, pondweed, burreed, cattail, lilly, European frogbit
Cranberry Creek	3	07/05/2007	NA	21.73	7.32	8.3	NA	gravel, boulder, muck in some areas with weeds present	algae, duckweed, pondweed, burreed, cattail, lilly, European frogbit
Cranberry Creek	4	07/04/2007	NA	17.2	1.7	7.7	NA	boulders around bridge, mucky in all other areas, hard substrate in areas	cattails, burreed, duckweed, grasses, pondweed
Cranberry Creek	5	07/04/2007	NA	17.2	1.7	7.7	NA	boulders around bridge, mucky in all other areas, hard substrate in areas	cattails, burreed, duckweed, grasses, pondweed
Cranberry Creek	6	07/04/2007	NA	17.7	2.52	7.7	NA	clay with rubble and gravel, a few boulders	grasses, algae, frogbit, cattails

Table 11. Water Chemistry Results for Seining Sites Along Cranberry Creek

Table 12 summarizes the biological data obtained from each seine netting event along Cranberry Creek. A total of thirteen different fish species were collected throughout the sites, most notably young largemouth bass and northern pike. Top predators within the stream ecosystem are highlighted in bold.

Seine #	Species	Number Caught	Total Length (mm)	Weight (g)	Comments
1	**Yellow Perch**	1	129	21.6	fish has black spots
	Largemouth Bass	1	42	1.2	
2	**Largemouth Bass**	8	NA	131.6	too small to measure length
	Pumpkinseed	1	100	23.1	
	Pumpkinseed	1	93	15.7	
	Pumpkinseed	1	84	11	
	Rock Bass	1	68	5.7	
	Banded Killifish	1	NA	3.4	
	Johnny Darter	1	NA	0.4	
	Brown Bullhead	16	NA	15.3	mostly YOY
3	Pumpkinseed	1	NA	4.8	
4	Central Mudminnow	24	NA	44.9	various sizes (some YOY, some large adults)
	Brook Stickleback	5	NA	3.2	
5	Central Mudminnow	36	NA	93	
	Brook Stickleback	3	NA	3.1	

6	**Northern Pike**	**1**	**183**	**39**	
	Northern Pike	**1**	**191**	**45.9**	
	Northern Pike	**1**	**166**	**26.4**	
	Northern Pike	**1**	**186**	**39.9**	
	Northern Pike	**1**	**165**	**28**	
	Northern Pike	**1**	**165**	**30.6**	
	Northern Pike	**1**	**167**	**28.7**	
	Northern Pike	**1**	**152**	**20.7**	
	Northern Pike	**1**	**145**	**18.2**	black spots on body
	Northern Pike	**1**	**149**	**18.6**	black spots on body
	Northern Pike	**1**	**141**	**15.8**	
	Brown Bullhead	13	2063	881.4	
	Common White Sucker	64	NA	1825	
	Brook Stickleback	19	NA	21.6	
	Central Mudminnow	24	NA	235.6	
	Golden Shiner	3	NA	24.9	
	Creek Chub	1	216	100.6	
	Common Shiner	10	NA	79.5	

Table 12. Fish Community Results for Seining Sites along Cranberry Creek.

Electrofishing

Cranberry Creek was electrofished by RVCA staff on July 12, 2007. A total of three sites, each made up of approximatley 50m, were sampled. A total of seven different species were identified. (See discussion at 3.2.1 for a description of electrofishing).

Figure 19 shows the locations of the electrofishing sites along Cranberry Creek.

Figure 19. Air photo of Cranberry Creek Showing Electrofishing Sites.

Table 13 illustrates the water chemistry values obtained at the time of electrofishing. No detailed water chemistry data was recorded for the electrofishing sites, as the YSI probe was damaged and was in the process of being repaired at the time of sampling.

Location	E-fish #	Date (mm/dd/yy)	Air Temp (C)	Water Temp (C)	DO (mg/L)	pH	Conductivity (uS/cm)	Substrate	Vegetation
Cranberry Creek	1	07/12/2007	20	20	NA	NA	NA	muck with clay bottom	sago pondweed, duckweed, frogbit, milfoil, waterweed
Cranberry Creek	2	07/12/2007	22	20	NA	NA	NA	muck with clay	sago pondweed, duckweed, algae, grasses, frogbit
Cranberry Creek	3	07/12/2007	26	22	NA	NA	NA	clay with a little muck	grasses, cattails, sago pondweed

Table 13. Water Chemistry Results for Electrofishing Sites Along Cranberry Creek

Table 14 summarizes the biological data obtained from each electrofishing event on Cranberry Creek. The top predators are highlighted in bold.

E-fish #	Species	Number	Total Length (mm)	Weight (g)	Comments
1	Central Mudminnow	75	NA	352.2	
	Pumpkinseed	9	NA	62.9	
	Northern Pike	**1**	**164**	**25.6**	
	Northern Pike	**1**	**164**	**24.5**	
	Northern Pike	**1**	**174**	**32.8**	
	Rock Bass	1	136	56.1	
	Common White Sucker	5	NA	272	
	Brook Stickleback	6	NA	1.9	
2	Central Mudminnow	79	NA	275.4	
	Brook Stickleback	1	NA	NA	YOY
3	Northern Redbelly Dace	5	NA	3.2	
	Brook Stickleback	5	NA	1.8	
	Central Mudminnow	12	NA	8.2	

Table 14. Fish Community Results for Electrofishing Sites Along Cranberry Creek

Hoopnetting

Hoopnetting is a fish capture method which involves a large enclosed mesh net which fish swim into and cannot get out. This method allows for sampling in deep open water areas consistent with wetlands. Hooponetting was used on Cranberry Creek for this reason. Hoopnetting is relatively harmless to fish and is a preferred method to gill netting. Occasionally aggressive fish such as northern pike thrash around once caught in the net, resulting in wounds on the body, though mortalities are low.

Two hoopnets were set in the wetland areas, upstream of the Rideau River to determine what kind of fish are migrating up and living in the lower reaches of Cranberry Creek. Hoopnets were set for approximately 24 hours for a one-week period. Nets were checked each morning and re-set and left until the next day.

Figure 20 shows the two hoopnetting locations on Cranberry Creek.

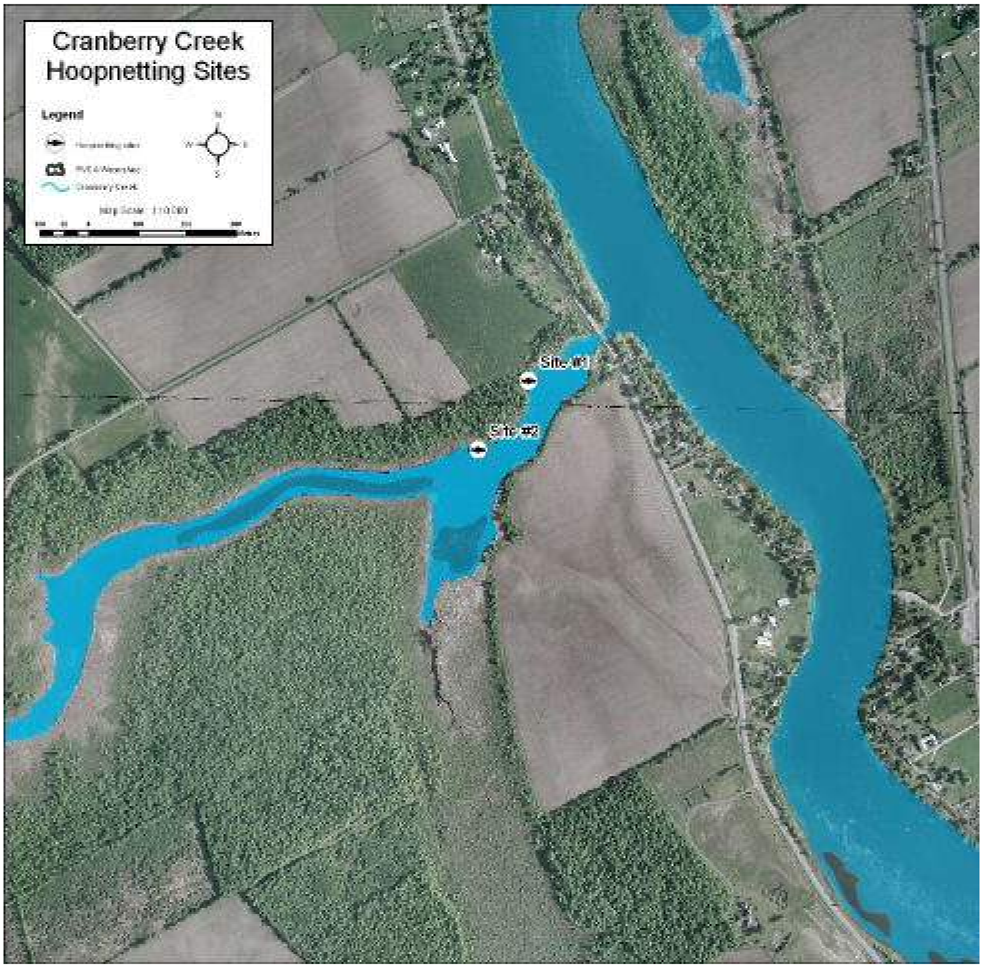

Figure 20. Air photo of Cranberry Creek Showing Hoopnetting Sites.

Table 15 summarizes the biological data obtained from each hoopnetting site on Cranberry Creek. Hoopnets used on Cranberry Creek targeted only larger fish. Species such as cyprinids (minnows) and other smaller fish were not captured as they could swim in and out of the net. Many game fish were captured including northern pike, walleye, largemouth bass, perch and bluegill. Top predators are highlighted in bold.

Hoopnet #	Species	Number	Total Length (mm)	Weight (g)	Comments
1	*No Catch*	*NA*	*NA*	*NA*	*No Catch*
2	**Northern Pike**	1	680	NA	
	Northern Pike	1	710	NA	
	Largemouth Bass	1	270	302.5	
	Largemouth Bass	1	335	609	
	Largemouth Bass	1	166	61.9	
	Largemouth Bass	1	157	50.3	
	Largemouth Bass	1	170	67.1	
	Largemouth Bass	1	156	58	
	Bluegill	9	NA	548.1	
	Yellow Perch	1	180	69.4	
	Yellow Perch	1	186	88.4	
	Yellow Perch	1	194	89.4	
	Yellow Perch	1	181	69.9	
	Yellow Perch	1	203	106.3	
	Yellow Perch	1	185	85.9	
	Yellow Perch	1	165	57.3	
	Yellow Perch	1	190	79.9	
	Yellow Perch	1	195	81.7	
	Pumpkinseed	25	NA	1803.9	
3	Common Carp	1	700	NA	approx 12.5kg
	Pumpkinseed	3	NA	306.2	
	Bluegill	4	NA	309.5	
4	**Walleye**	1	350	348.3	
	Northern Pike	1	660	approx. 3.8kg	right side lesions from hoopnet
	Northern Pike	1	600	approx. 2.5kg	left side lesions from hoopnet
	Brown Bullhead	1	260	227.5	
	Bluegill	14	NA	944.7	
	Yellow Perch	1	186	71.7	
	Yellow Perch	1	184	61	white tumors on caudal fin
	Yellow Perch	1	200	92.6	
	Yellow Perch	1	180	65.5	
	Yellow Perch	1	186	77.7	
	Pumpkinseed	22	NA	1115.2	
5	**Largemouth Bass**	1	150	NA	
	Yellow Perch	1	160	NA	
	Black Crappie	1	230	NA	
	Black Crappie	1	250	NA	
	Pumpkinseed	11	NA	NA	
	Bluegill	4	NA	NA	
6	Pumpkinseed	4	NA	463	

7	**Northern Pike**	1	558	NA	deceased, trapped in net and was pecked at
	Largemouth Bass	1	211	130.9	
	Largemouth Bass	1	261	242.2	
	Yellow Perch	1	166	53.8	
	Yellow Perch	1	185	66.7	
	Yellow Perch	1	211	117.6	
	Yellow Perch	1	180	68.4	
	Yellow Perch	1	193	92.3	
	Yellow Perch	1	158	57.7	
	Yellow Perch	1	200	96.6	
	Yellow Perch	1	173	63.6	
	Brown Bullhead	1	213	108.8	
	Brown Bullhead	1	234	164.8	
	Brown Bullhead	1	254	195.3	
	Brown Bullhead	1	233	149	
	Brown Bullhead	1	218	127.8	
	Black Crappie	1	255	289.7	
	Black Crappie	1	248	243.4	
	Bluegill	22	NA	1578.5	
	Pumpkinseed	121	NA	8149.4	

Table 15. Fish Community Results for Hoopnetting Sites along Cranberry Creek.

Fish Species Status, Trophic, and Reproductive Guilds - Cranberry Creek

The following table was generated by taking the fish community structure of Cranberry Creek and classifying the recreational, commercial, or bait fishery importance, the Species at Risk status, reproductive guild (spawning habitat requirements), thermal classification, and trophic guild (feeding preference).

The fish community in Cranberry Creek is made up of both cool and warm water species. Spawning habitat requirements within Cranberry are diverse and can been seen in the table below. There is a good mix of fish from the recreational and bait fishery in Cranberry Creek. Fish such as walleye, northern pike, largemouth bass, and black crappie were found in the lower reaches and are fish commonly targeted by sportsfishermen.

MNR Code	Common Name	Scientific Name	Recreational Fishery	Commercial Fishery	Bait Fishery	Status	Reproductive Guild	Thermal Classification	Trophic Guild
163	White Sucker	Catostomus commersoni				None	(non guarder) Lithophils	cool	Insectivore/ Omnivore
182	Northern redbelly dace	Phoxinus eos			X	None	(non guarder) Phytophils	cool/warm	Herbivore
141	Central mudminnow	Umbra limi			X	None	(non guarder) Phytophils	cool/warm	Insectivore/ Omnivore
281	Brook stickleback	Culaea inconstans			X	None	(guarders) Ariadnophils	cool	Insectivore
212	Creek chub	Semotilus atromaculatus	X		X	None	(brood hiders) Lithopils	cool	Insectivore/ Generalist
261	Banded killifish	Fundulus diaphanus			X	None	(non guarder) Phytophils	cool	Insectivore
314	Bluegill	Lepomis	X			None	(nest	Cool/warm	Insectivore

		macrochirus					spawners) Lithophils		
313	Pumpkinseed	Lepomis gibbosus	X			None	(nest spawners) Polyphils	cool/warm	Insectivore
311	Rock bass	Ambloplites rupestris	X			None	(nest spawners) Lithophils	warm	Insectivore
317	Largemouth bass	Micropterus salmoides	X	past		None	(nest spawners)	warm	Insectivore/ Piscivore
194	Golden shiner	Notemigonus crysoleucas			X	None	(non guarder) Phytophils	cool/warm	Omnivore
331	Yellow perch	Perca flavescens	X	X		None	(non guarder) Phyto-lithophils	cool	Insectivore/ Piscivore
233	Brown bullhead	Ameiurus nebulosus	X	limited	X	None	(guarder) Speleophils	warm	Insectivore
198	Common shiner	Luxilus cornutus			X	None	(guarders) Lithopils	cool	Insectivore
341	Johnny darter	Etheostoma nigrum			X	None	(guarder) Speleophils	cool	Insectivore
334	Walleye	Stizostedion vitreum viteum	X	X		None	(non guarder) Lithophils	cool	Piscivore
131	Northern pike	Esox lucius	X			None	(non guarder) Phytophils	cool	Piscivore
186	Carp	Cyprinus carpio	X			None	N.A.	warm	Omnivore
319	Black Crappie	Pomoxis nigromaculatus	X			None	(nestspawners) Phytophils	cool	Insectivore/ Piscivore

Table 16. Fish Species Status, Trophic, and Reproductive Guilds for Cranberry Creek
(Source: MTO Environmental Guide to Fish and Fish Habitat, 2006)

The following table summarizes the fish community structure found in Cranberry Creek and their sensitivity to sediment and turbidity for reproduction, feeding, and respiration. The composition of the fish community in Cranberry Creek ranges from species that are fairly tolerant, to species to are intolerant to sediment and turbidity, though the majority of the species are classified in the moderately tolerant range. Fish that rely heavily on sight to feed (walleye, largemouth bass, northern pike) are extremely sensitive to increased sediment and turbidity.

Fish Species Sensitivity to Sediment/Turbidity for Cranberry Creek

MNR Code	Common Name	Scientific Name	Reproduction	Feeding	Respiration
163	White Sucker	Catostomus commersoni	M	L	H
182	Northern redbelly dace	Phoxinus eos	M	L	L
141	Central mudminnow	Umbra limi	M	M	L
281	Brook stickleback	Culaea inconstans	L	M	unknown
212	Creek chub	Semotilus atromaculatus	M	H	H
261	Banded killifish	Fundulus diaphanus	M	M	L
314	Bluegill	Lepomis macrochirus	L	M	unknown
313	Pumpkinseed	Lepomis gibbosus	L	M	unknown
311	Rock bass	Ambloplites rupestris	L	H	unknown
317	Largemouth bass	Micropterus salmoides	L	H	H

331	Yellow perch	Perca flavescens	M	H	unknown
194	Golden shiner	Notemigonus crysoleucas	M	M	L
233	Brown bullhead	Ameiurus nebulosus	L	L	L
198	Common shiner	Luxilus cornutus	M	M	unknown
341	Johnny darter	Etheostoma nigrum	M	M	unknown
131	Northern pike	Esox lucius	M	H	L
186	Carp	Cyprinus carpio	M	L	unknown
334	Walleye	Stizostedion vitreum viteum	M	H	H
319	Black Crappie	Pomoxis nigromaculatus	L	H	unknown

Table 17. Fish Species Sensitivity to Sediment/Turbidity (High, Moderate, Low, unknown) for Cranberry Creek (Source: MTO Environmental Guide to Fish and Fish Habitat, 2006)

It should be noted that carp are an invasive fish species although they are thought by some to be a native species as they have been around for so long. Carp can degrade shallow water systems through their feeding which increases turbidity and can lead to declines in native fish populations.

7. Temperature Profiles

Three temperature dataloggers were set in Cranberry Creek for a 90-day period beginning on June 12 and removed on September 9, 2006. Datalogger 1 was not recovered therefore temperature data is only available for sites 2 and 3. Figure 21 shows the locations of dataloggers in Cranberry Creek.

Figure 21. Datalogger Locations Along Cranberry Creek

Dataloggers were set in three different locations along the stream to give a representative sample of how temperature fluctuates and differs throughout the course of the stream. Sites begin at the furthest downstream site and were placed in order upstream. Datalogger 1 was set just downstream of Third Line Drive South. This logger was damaged and the data could not be retrieved. Datalogger 2 was set close to midway through the system, just downstream of McCordick Road. Datalogger 3 was set downstream of Malakoff Road.

Datalogger 3 was set differently than the other two and recorded temperature every four minutes instead of every five minutes. For this reason the two temperature profiles cannot be compared on the same graph. Figure 22 and 23 show the results from datalogger 2 and 3.

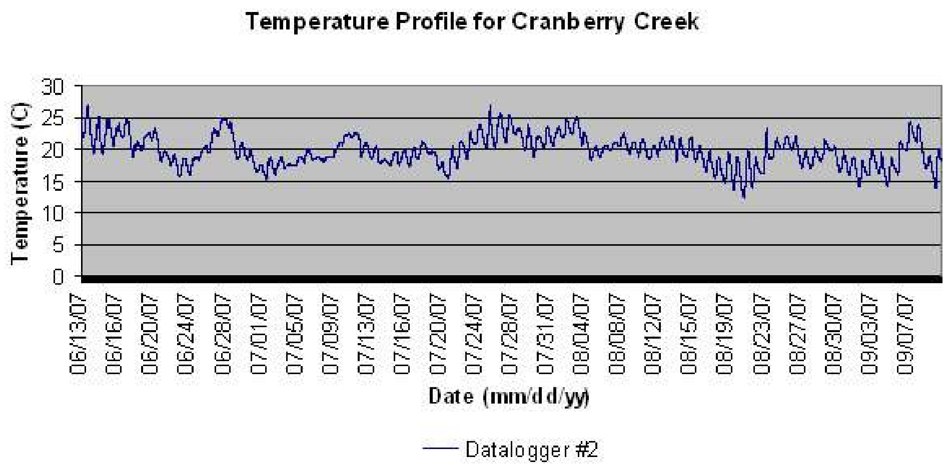

Figure 22. Temperature Profile for Datlogger 2 in Cranberry Creek.

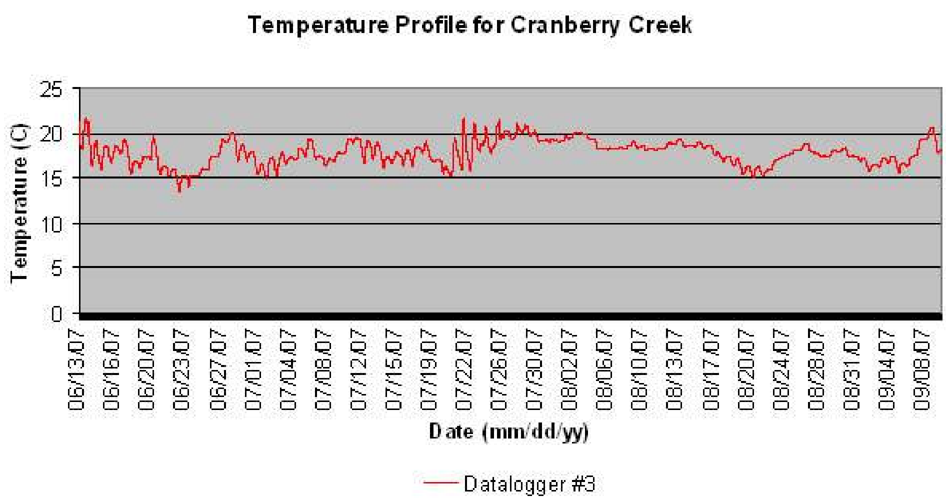

Figure 23. Temperature Profile for Datlogger 3 in Cranberry Creek.

The thermal classifications for cold, cool and warm water are as follows:

Status	Water Temperature
Cold	<19 Degrees Celsius
Cool	19-25 Degrees Celsius
Warm	>25 Degrees Celsius

Table 9. Water temperature classifications (Minns et al. 2001)

Cranberry Creek can be classified as a coolwater stream with warmwater wetland areas. The maximum stream temperature in the months of July and August at datalogger 2 was 26.96°C and at datalogger 3 it was 21.67°C. Two very different temperature profiles were observed along Cranberry Creek as seen in Figure 23 and 23. Irregular temperature fluctuations between the two sites can be due to the many wetland areas which exist along the stream, stretches of stream with little canopy cover and lack of water due to drought conditions.

Much of the fish community was made up of cool water fish species although some warm water species such as carp and largemouth bass were captured through hoopnetting in the wetland areas near the mouth.

3.2.3 Taylor Creek

Taylor Creek is approximately 1.5 kilometres long and flows from the Fallingbrook Community, just east of 10th Line Road and empties into the Ottawa River at Petrie Island. The upper reaches of Taylor Creek, south of Princess Louise Drive, is entombed (flows underground) and therefore could not be surveyed. Surveyed sections only account for open stream areas. Figure 24 shows an air photo taken of the Taylor Creek area.

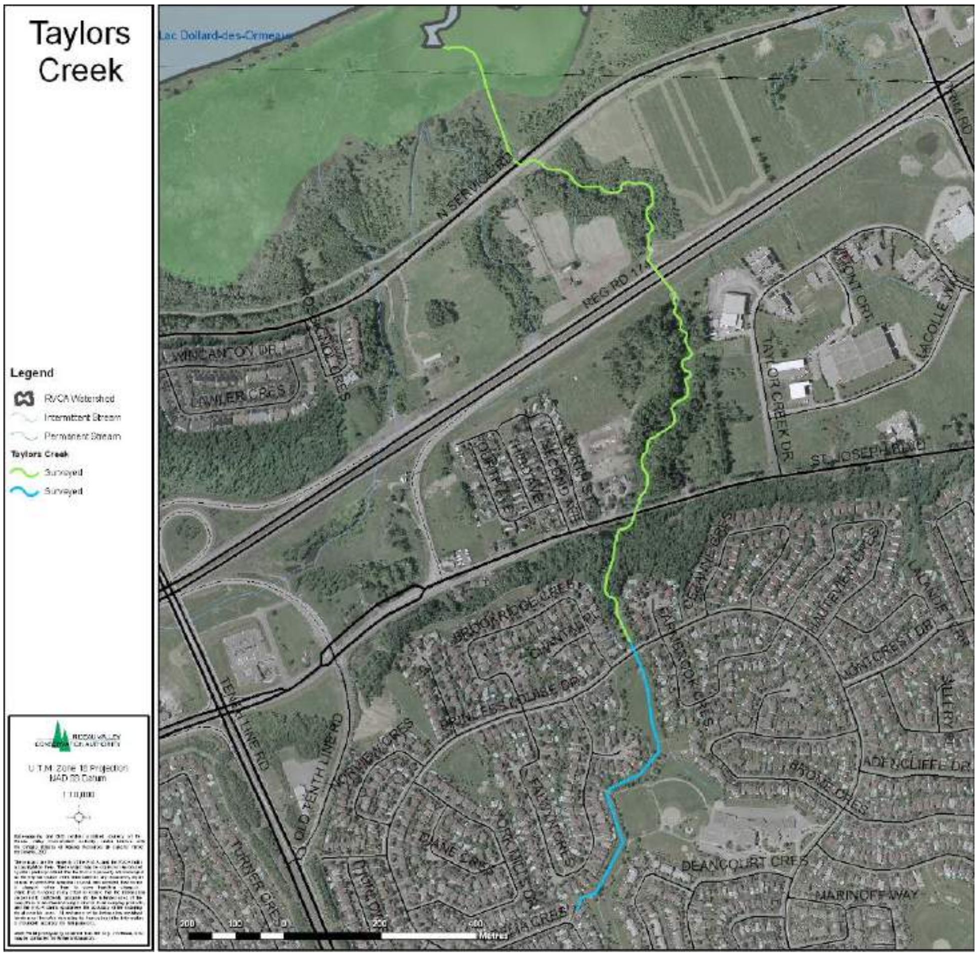

Figure 24. Air Photo of Taylor Creek and Surrounding Area.

A total of 1.5 kilometres of Taylor Creek was sampled during the 2007 season. The following is a summary of the 15 macro-stream assessment forms filled out by volunteers.

1. Observations of Anthropogenic Alterations and Land Use

Figure 25 illustrates the classes of anthropogenic alterations that volunteers observed along Taylor Creek. In the lower reaches, where Taylor Creek meets the Ottawa River, natural wetland areas still exist and are untouched by development. This area represents the 33% (5 sites) of the stream, and contains no anthropogenic alterations. Altered sections still in a natural condition existed and made up approximately 27% of the sampled stream. Sections that were considered altered made up 40% (6 sites) of the stream. Altered sections were due to roadways crossing over the stream at North Service Road, Highway 174, and St. Joseph Blvd.

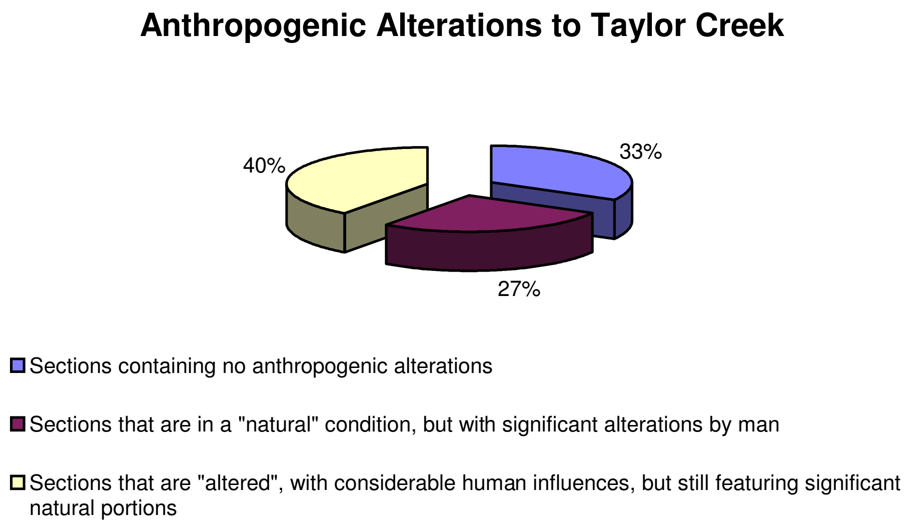

Figure 25. Classes of Anthropogenic Alterations Occurring Along Taylor Creek.

Figure 26 demonstrates the five different land uses identified by volunteers occurring along the banks adjacent to Taylor Creek. Natural areas make up the primary land use for the stream, representing 70%. These areas remain natural, as buffers have been left between developed areas and the stream. Road crossings and culverts account for 10% of land use. The stream crosses three major roadways, including North Service Road, Highway 174, and St. Joseph Blvd. Industrial areas make up a small percentage of land use, mainly concentrated around the Taylor Creek business park. Residential areas were only found in one site at the beginning of the stream. The developed residential areas above Taylor Creek exist only where the stream becomes entombed for approximately one kilometre and therefore cannot be assessed. Water quality and stream data could not be recorded as the stream is not accessible. Princess Louise falls and the surrounding area was classed as recreational as many residents from the nearby communities use this area to walk, hike, and access the falls.

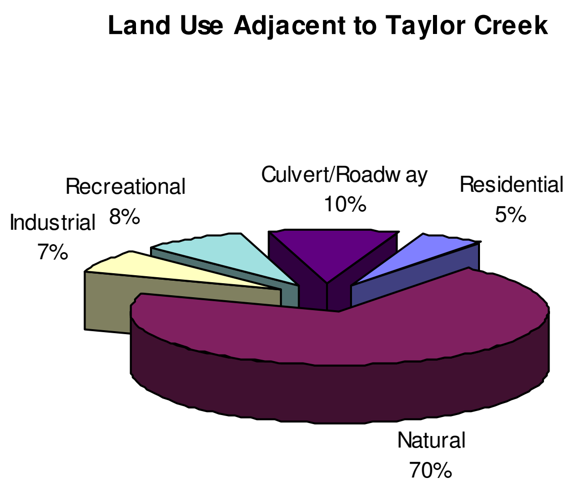

Figure 26. Land Use Identified by Volunteers Along Taylor Creek.

2. Observations of Instream Vegetation

Volunteers found Taylor Creek contained very little instream vegetation. In the sections surveyed, vegetation was found to be low or rare in 87% of the stream. Instream vegetation was found to be normal in the reaches close to the Ottawa River and quickly became sparse to rare as crews moved upstream.

Figure 27 demonstrates the frequency of instream vegetation in Taylor Creek.

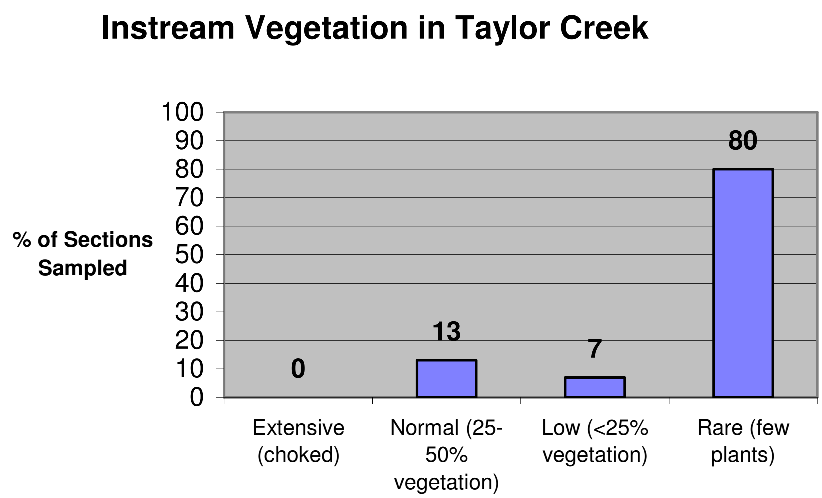

Figure 27. Frequency of Instream Vegetation in Taylor Creek.

A lack of instream vegetation can greatly increase bank erosion and sediment pollution, which was a problem, observed in certain areas along the stream. Instream vegetation also provides habitat for fish and wildlife, aids in removing contaminants from the water, and contributes oxygen to the stream. Areas with little to no vegetation can negatively impact aquatic organisms by resulting in reduced refuge and cover areas.

Invasive species observed along Taylor Creek included purple loosestrife and european frogbit. Purple loosestrife was found in 53% of sections sampled and european frogbit was observed in one section. For more information on exotics and their distribution in Taylor Creek see Appendix H

3. Observations of Bank Stability

Figure 28 shows the overall bank stability of Taylor Creek. In 55% of sections sampled by volunteers, the stream banks along Taylor Creek were identified as being unstable or undercut. These areas of erosion occurred throughout the stream in isolated areas. Stable banks were observed in 45% of sections. Some areas identified as being stable were due to artificial features. These included concrete bridge structures and entombed sections, which offer no habitat or refuge for wildlife. Areas of undercut banks were observed in approximately 20% of sections surveyed. Undercut banks can have both positive and negative impacts depending on the vegetation present. Undercutting which still has rooted vegetation can provide valuable habitat as nursing, rearing and feeding areas for fish.

Gabion cage structures were also recorded in two sections. Though gabion cages secure the bank structure, they have a tendency to fail and require repair. Gabion structures also create a steep vertical interface between the terrestrial and aquatic ecosystems along a stream which can negatively impact fish and wildlife. Natural shoreline bioengineering projects such as brush bundles, fascines, live cribwalls and live cuttings are now the preferred options as they require little maintenance and promote the regeneration of vegetation to further stabilize the bank. The City of Ottawa will be undertaking a major stabilization project on Taylor Creek in 2008 using the natural methods listed above. Results will be interesting when Taylor Creek is re-assessed in 5 years to observe how erosion has been influenced by the rehabilitation efforts by the City of Ottawa.

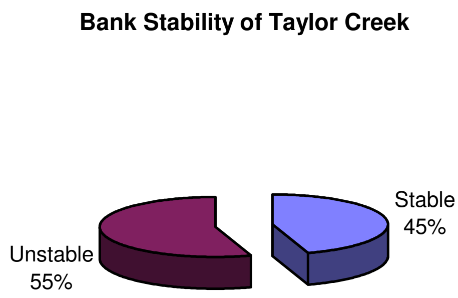

Figure 28. Bank Stability of Taylor Creek.

Areas of erosion have been identified on an aerial photo of Taylor Creek and can be found in Appendix G.

4. Observations of Wildlife

The presence or absence of diverse fish and wildlife populations can be an indicator of water quality and overall stream health. Table 18 is a summary of all wildlife observed while surveying Taylor Creek.

Wildlife	Observed While Sampling
Birds	marsh wren, red-wing blackbird, herring gull, black tern, robin, grey catbird, sparrow, crow, hawk, tree swallow, goldfinch, common yellow throat
Mammals	muskrat, skunk (tracks), racoon (tracks)
Reptiles/Amphibians	bull frog, leopard frog, pickerel frog, green frog
Aquatic Insects	water striders, sowbugs, caddisfly, leeches, damselfly, snails, dragonfly
Other	butterflies, spiders, various arthropods

Table 18. Wildlife Observed on Taylor Creek During Stream Surveys.

5. Observations of Pollution

Figure 29 demonstrates the incidence of pollution in Taylor Creek. Pollution in the stream was assessed visually and noted for each section where observed. At least one piece of garbage (floating or on the stream bottom) was found in 87% of the 15 sections surveyed. Garbage did not occur in large quantities or accumulate in large amounts, but there was scattered debris in the majority of sections.

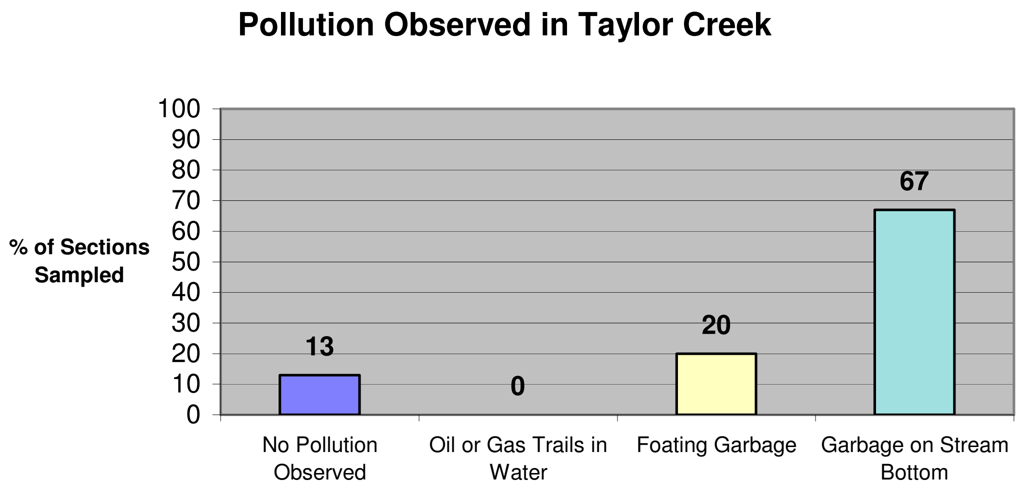

Figure 29. Frequency of Pollution Occurring in Taylor Creek.

The majority of garbage found in the stream likely enters the stream by blowing in from the busy roadways and flowing down from the upstream residential areas through runoff. Items found floating in the stream included tennis balls, food wrappers, plastic, stytrofoam, plastic bags, and plastic bottles. Pollution found on the stream bottom included pop cans, tires, bicycles, scrap metal, scrap lumber, cell phones, and baby carriages.

A stream cleanup was completed in October by City Stream Watch and a local Scouts Canada troop. The scouts removed all unnatural debris from the stream below Princess Louise Falls to St. Joseph Blvd. For more information on the cleanup see page 93. Taylor Creek would benefit from annual cleanups where members from the community walk the stream and remove all human debris from its stream channel.

6. Temperature Profiling

No dataloggers were placed in Taylor Creek as it was decided to survey the stream after the temperature loggers were put in place. However, temperature data was obtained at the time of stream sampling from July 11 to July 24; the stream had temperatures ranging from 15°C to 22°C.

Greens Creek Tributaries

The tributaries of Greens Creek play a major role in the health of the stream as well as the Ottawa River. The tributaries of Greens Creek include Black, Borthwick, Ramsay and Mud Creek. All of these streams originate from the provincially significant wetland known as Mer Bleue.

The Mer Bleue Bog is one of the largest bogs in southern Ontario and arguably the most important natural area in the Greenbelt. Ecologically, Mer Bleue is an especially valuable example of a northern ecosystem, more typical of the Arctic than the Ottawa Valley, and it has been designated an internationally significant wetland under the United Nations' Ramsar Convention. The key to the bog's character is a small moss called Sphagnum. Other plants include the sundew, pitcher plant, rare orchids, bog rosemary, Labrador tea, several species of cotton grass, and a variety of low heath shrubs. This habitat is also home for a variety of exceptional animals including the nationally rare spotted turtle, and Fletcher's dragonfly, an insect known from only a handful of sites worldwide. (NCC, 2006)

3.2.4 Black Creek

Black Creek is approximately four kilometres long, flowing from the provincially significant Mer Bleue wetland west through NCC land before entering Greens Creek just west of Cyrville Road. Black Creek is one of four major tributaries of Greens Creek and is very important to the overall health of the system. Over the course of the 2007 season, all major tributaries of Greens Creek were surveyed to learn more about how they influence Greens Creek and, in turn, the Ottawa River.

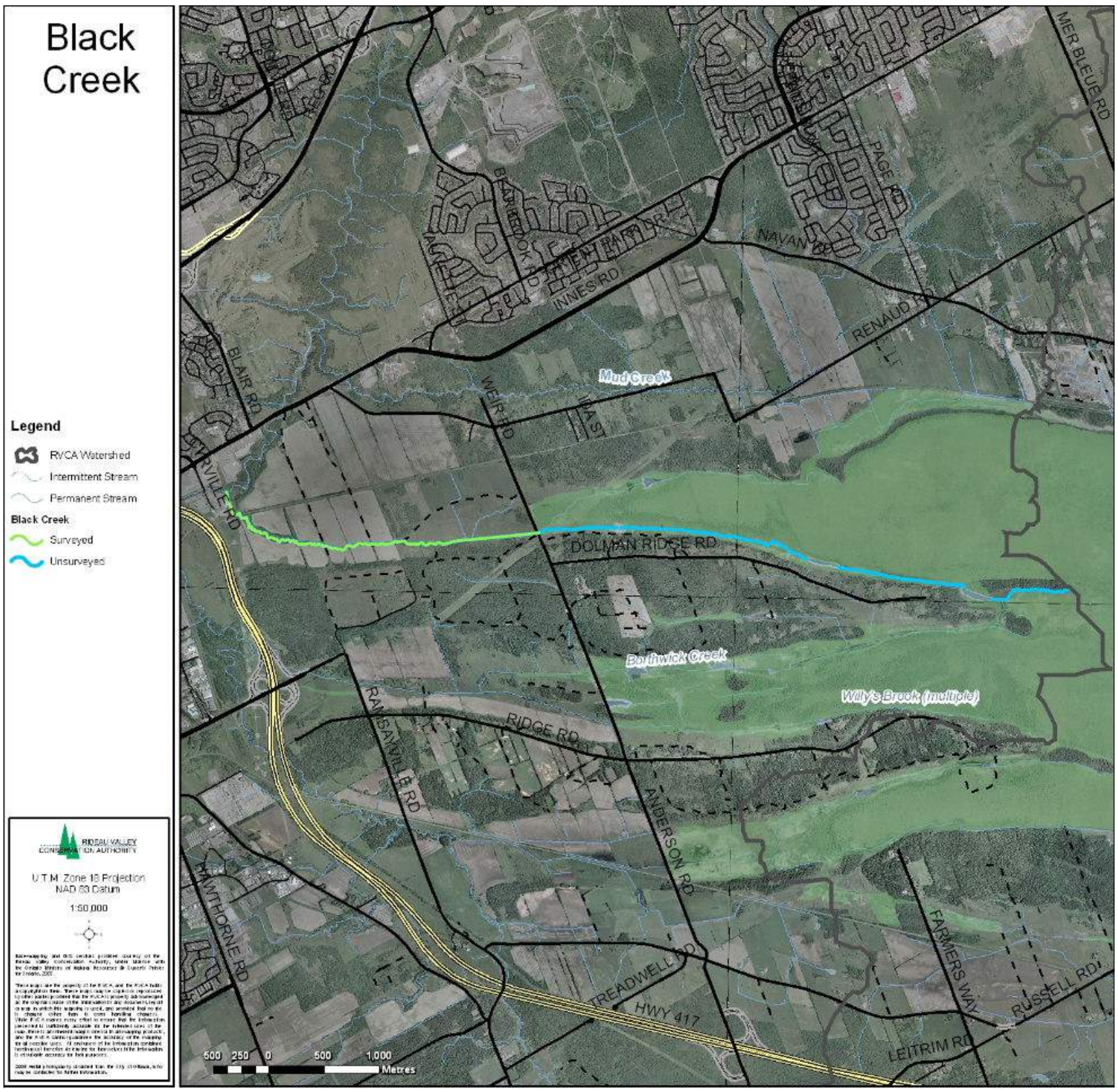

Figure 30. Air Photo of Black Creek and Surrounding Area.

A total of 3.3 kilometres of Black Creek was sampled in 2007. West of Anderson Rd., stream morphology changes to a wetland for the remaining 0.7 km of stream. As wetland environments have no defined channel, this area could not be surveyed using the macro stream assessment protocol.

The following is a summary of the 33 macro stream assessment forms filled out by volunteers. Observations concerning anthropogenic alterations, land use, instream vegetation, bank stability, wildlife, and pollution are discussed.

1. **Observations of Anthropogenic Alterations and Land Use**

Figure 31 illustrates the classes of anthropogenic alterations that volunteers observed along Black Creek. Of the 33 sections of stream surveyed, volunteers identified thirteen sections (40%) that displayed no human alterations. Nine sections, making up 27% of the stream, were considered to be in a natural condition with some alterations by man. The remaining 33% of the stream was classified as having considerable human alterations. Flowing through natural, protected land, urban development was not an issue, although alterations that were recorded were due to culverts being installed, roadways, cleared powerline areas and active agricultural activities.

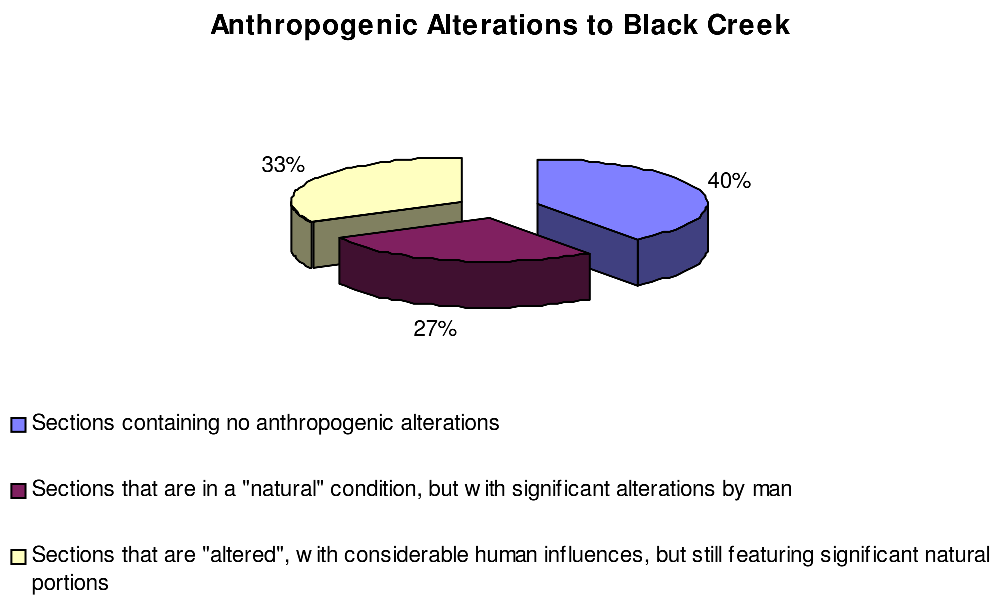

Figure 31. Classes of Anthropogenic Alterations Occurring Along Black Creek.

Volunteers observed four different land uses occurring adjacent to Black Creek. Natural areas with no human alteration exist along 56% of portions surveyed, while active agriculture made up 35%. Where Black Creek empties into Greens Creek, a cleared powerline area, with a small buffer, is found on the east bank. On the west bank, an industrial site with a salt dome facility. Together, these make up the remaining 9% of land use. With the exception of the industrial facility there is no urban development long the stream.

NCC ownership and protection, along with no public access, account for the large percentage of natural areas. Figure 32 demonstrates the different land uses identified adjacent to Black Creek.

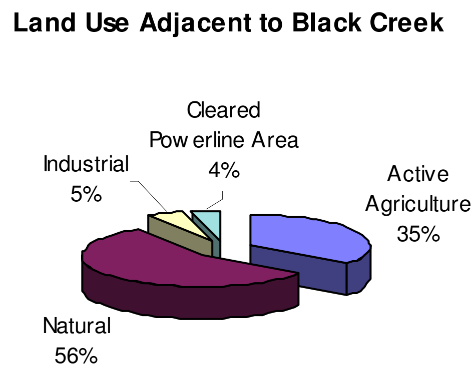

Figure 32. Land Use Identified by Volunteers Along Black Creek.

Overall, land use on this system does not appear to be a major stressor on the stream. Most areas were observed as being natural although some potential impacts were identified. Possible pollution sources coming from the industrial facility via drainage were identified and are currently under investigation. Agriculture exists along much of Black Creek but does not seem to be a major issue to the overall health of the stream. Some areas could benefit from tree planting, as no upland riparian buffer is present for a one-kilometer stretch of stream. A natural grass and shrub buffer is present along all sections of this stream.

2. Observations of Instream Vegetation

Figure 33 demonstrates the incidence of instream vegetation in Black Creek. Instream vegetation was categorized as either low or rare in abundance in only 9% of the sections surveyed. The substrate in these areas differed from the rest of the stream as it was made up of rubble, sand, and silt which is not well suited to instream vegetation growth. Twenty-three sections were recorded as having either common to normal instream vegetation. Extensive vegetation was observed along twenty-one sections and the plant community was made up of pondweed, duckweed and waterweed. The extensive vegetation growth was present as the stream began to transition into the Mer Bleue wetland. Much of the extensive growth was European frogbit, which is an invasive species that out-competes native plant species. The thick matting of frogbit also limits the feeding and migration of aquatic organisms.

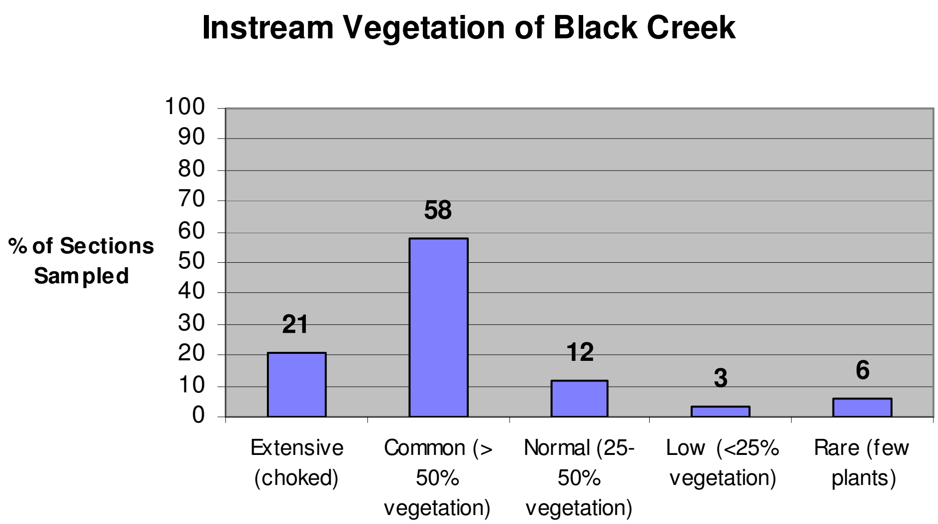

Figure 33. Frequency of Instream Vegetation in Black Creek.

Purple loosestrife and European Frogbit were found in many sections of Black Creek. European Frogbit was found in 85% of sections sampled, being thick matted in some areas. Maps of invasive species have been identified on aerial photographs for Black Creek in Appendix H.

3. Observations of Bank Stability

Figure 34 demonstrates the overall bank stability of Black Creek. Evidence of erosion from the stream bank was observed along 17% of the shoreline, coinciding with areas of little or no vegetation. No excessive erosion locations were identified and erosion only occurred in small frequencies along the system. Areas of erosion often existed below man made structures such as bridges, railroad tracks (bridge) and where disturbances such as agriculture with no buffer zone and industrial facilities were found along the bank.

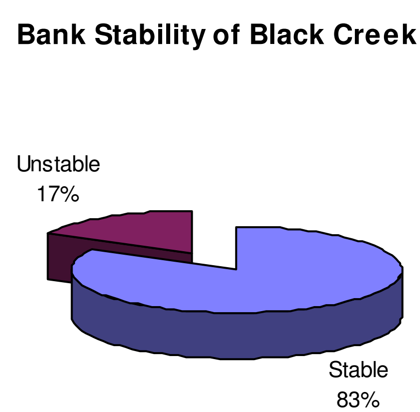

Figure 34. Bank stability of Black Creek.

Areas of erosion have been identified on an aerial photo of Black Creek and can be found in Appendix G.

4. Observations of Wildlife

Volunteers recorded the presence of many types of wildlife in and around Black Creek. Table 19 is a summary of wildlife observed.

Wildlife	Observed While Sampling
Birds	mallard ducks, swallows, red-winged blackbird, robin, goldfinch, eastern kingbird, american bittern, veery, common yellowthroat, barn swallow, black capped chickadee, red-tailed hawk, killdeer, crow
Mammals	muskrat, beaver, white-tailed deer, racoon (tracks)
Reptiles/Amphibians	bullfrog, painted turtle, green frog, leopard frog, wood frog, snapping turtle
Aquatic Insects	water strider, whirligig beetle, damselfly, dragonfly,leeches, cranefly, mollusk, water boatman, aquatic sowbugs, caddisfly
Other	various arthropods

Table 19. Wildlife Observed on Black Creek During Stream Surveys.

5. Observations of Pollution

Figure 35 illustrates the incidence of pollution in Black Creek. A healthy 73% of stream was surveyed without observing unnatural debris. Pollution was observed in 27% (9 sections) of surveyed sections. Of the 33 sections surveyed, garbage on the stream bottom was observed in 15% (5 sections), while floating garbage was observed in 9% (3 sections). Oil or gas trails were observed in only one section of stream, and seemed to be coming from a drainage pipe. This is currently under investigation. Much of the unnatural pollution in Black Creek has been there for some time and probably remains from historical work done in the area. Items such as old pop cans/bottles, scrap metal and a tire were found. Some items were removed at the time of sampling while other items were imbedded in the substrate and removing them would cause more damage than leaving them. The frequency of debris in each section was low and only a few items were found in each stretch sampled. Overall, unnatural debris is not a major problem along Black Creek.

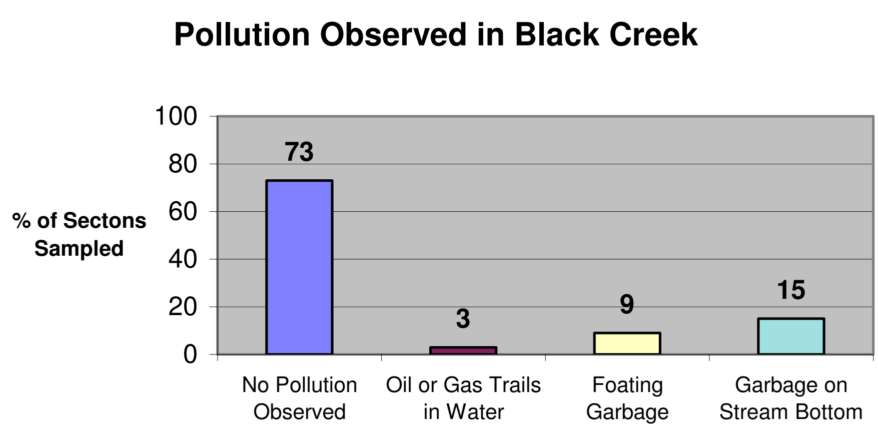

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Figure 35. Frequency of Pollution Occurring in Black Creek.

6. Fish Community Sampling

Eletrofishing

RVCA staff electrofished only one site along Black Creek on July 6, 2007. A total of eight different species were identified. Some cyprinid (minnow) species could not be identified and were sent away for verification. Figure 36 shows the locations of the electrofishing sites along Black Creek.

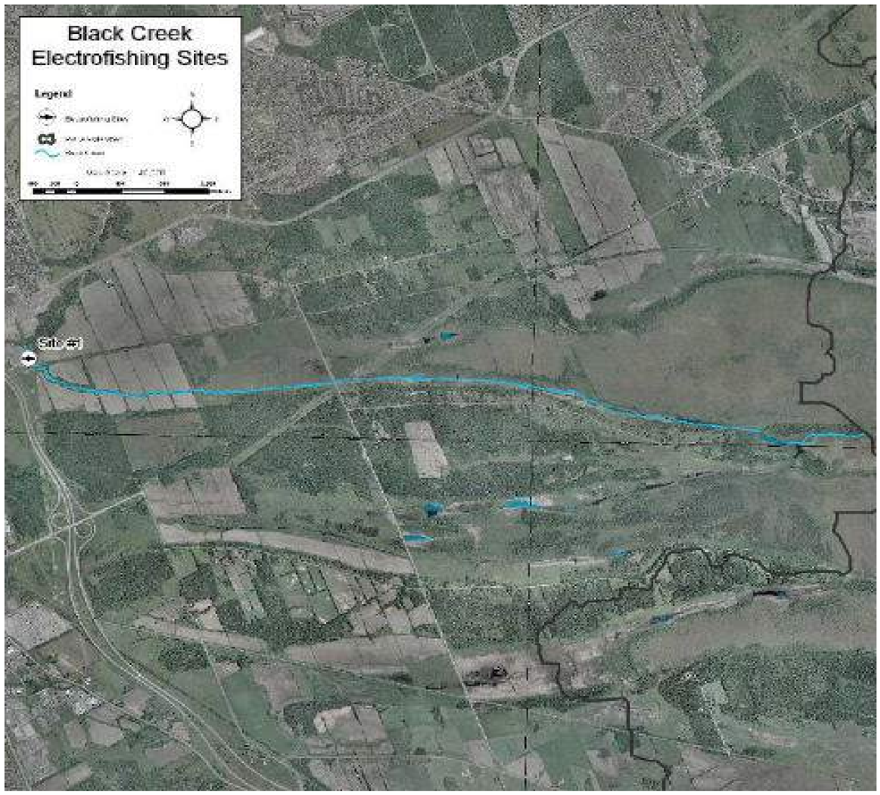

Figure 36. Air photo of Black Creek Showing Electrofishing Sites.

Table 20 illustrates the water chemistry values obtained at the time of electrofishing. No detailed water chemistry data was recorded for Site 1, as the YSI probe broken and unavailable at the time of sampling.

Location	E-fish #	Date (mm/dd/yy)	Air Temp (C)	Water Temp (C)	DO (mg/L)	pH	Conductivity (uS/cm)	Substrate	Vegetation
Black Creek	1	06/07/2007	NA	NA	NA	NA	NA	clay	pondweed, grasses

Table 20. Water Chemistry Results for Electrofishing Sites Along Black Creek.

Table 21 summarizes the biological data obtained from electrofishing on Black Creek.

E-fish #	Species	Number	Total Length (mm)	Weight (g)	Comments
1	Central Mudminnow	3	NA	12.5	
	Common Shiner	25	NA	24.2	

	Johnny Darter	10	NA	9.9	
	Common White Sucker	22	NA	363.8	
	Creek Chub	82	NA	829.5	
	Northern Redbelly Dace	23	NA	35.5	
	Brook Stickleback	8	NA	6.2	
	Longnose Dace	1	NA	4.6	
	Unknown Bronze	14	NA	31.8	Could not identify
	Unknown (1)	15	NA	25.1	Could not identify
	Unknown (2)	30	NA	49.6	Could not identify

Table 21. Fish Community Results for Electrofishing Sites along Black Creek

Fish Species Status, Trophic, and Reproductive Guilds - Black Creek

The following table was generated by taking the fish community structure of Black Creek and classifying the recreational, commercial, or bait fishery importance, the Species at Risk status, reproductive guild (spawning habitat requirements), thermal classification, and trophic guild (feeding preference).

Mainly cool water fish species were found in Black Creek although species such as Northern Redbelly Dace and Central Mudminnow are tolerant of both temperature ranges. Black Creek primarily contains bait fish, although species existing in the headwater areas are not know as fish sampling was only completed at one site.

MNR Code	Common Name	Scientific Name	Recreational Fishery	Commercial Fishery	Bait Fishery	Status	Reproductive Guild	Thermal Classification	Trophic Guild
163	White Sucker	Catostomus commersoni				None	(non guarder) Lithophils	cool	Insectivore/ Omnivore
182	Northern redbelly dace	Phoxinus eos			X	None	(non guarder) Phytophils	cool/warm	Herbivore
141	Central mudminnow	Umbra limi			X	None	(non guarder) Phytophils	cool/warm	Insectivore/ Omnivore
281	Brook stickleback	Culaea inconstans			X	None	(guarders) Ariadnophils	cool	Insectivore
212	Creek chub	Semotilus atromaculatus	X		X	None	(brood hiders) Lithopils	cool	Insectivore/ Generalist
211	Longnose dace	Rhinichthys cataractae			X	None	(non guarder) Lithophils	cool	Insectivore
198	Common shiner	Luxilus cornutus			X	None	(guarders) Lithopils	cool	Insectivore
341	Johnny darter	Etheostoma nigrum			X	None	(guarder) Speleophils	cool	Insectivore

Table 22. Fish Species Status, Trophic, and Reproductive Guilds for Black Creek
(Source: MTO Environmental Guide to Fish and Fish Habitat, 2006)

The following table summarizes the fish community structure found in Black Creek and their sensitivity to sediment and turbidity for reproduction, feeding, and respiration. The composition of the fish community in Black Creek ranges from species that are fairly tolerant, to species that are intolerant to sediment and turbidity. However, the majority of the species would be classified in the moderately tolerant range for reproduction and feeding.

Fish Species Sensitivity to Sediment/Turbidity for Black Creek

MNR Code	Common Name	Scientific Name	Reproduction	Feeding	Respiration

163	White Sucker	Catostomus commersoni	M	L	H
182	Northern redbelly dace	Phoxinus eos	M	L	L
141	Central mudminnow	Umbra limi	M	M	L
281	Brook stickleback	Culaea inconstans	L	M	unknown
212	Creek chub	Semotilus atromaculatus	M	H	H
211	Longnose dace	Rhinichthys cataractae	M	M	H
198	Common shiner	Luxilus cornutus	M	M	unknown
341	Johnny darter	Etheostoma nigrum	M	M	unknown

Table 23. Fish Species Sensitivity to Sediment/Turbidity (High, Moderate, Low, unknown) for Black Creek (Source: MTO Environmental Guide to Fish and Fish Habitat, 2006)

7. Temperature Profiling

Two temperature dataloggers were set in Black Creek for a 100-day period. Readings began on June 13 and the dataloggers were removed September 20, 2007. Figure 36 shows the locations of dataloggers in Black Creek. It can be noted that Black Creek ends at Anderson Road (first road east of site 2) that can be seen in the image below.

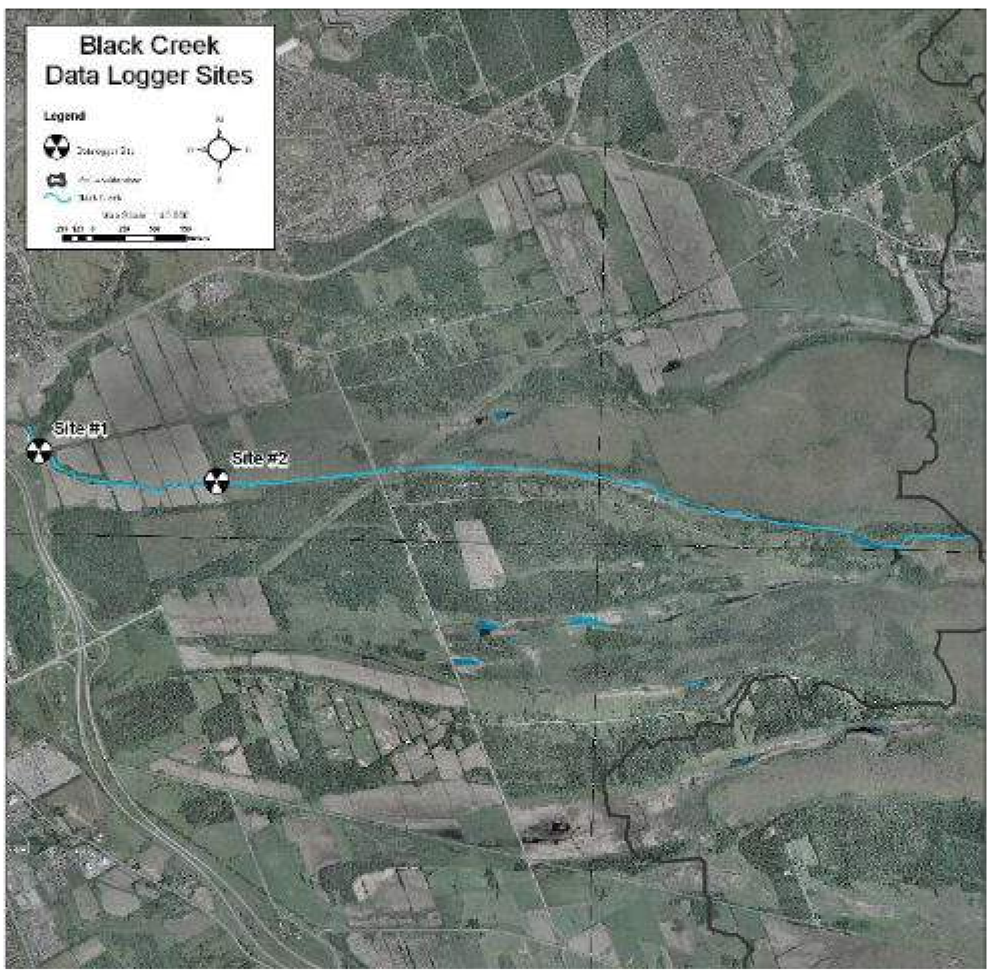

Figure 36. Datalogger Locations Along Black Creek

Dataloggers were set in two different locations along the stream to give a representative sample of how temperature fluctuates and differs throughout the course of the stream. One was set approximately 200 meters upstream of where the stream joins Greens Creek and the other was set approximately 1km downstream of the headwater area of Black Creek at Mer Bleue wetland (Anderson Road).

Figure 37 shows the results from the two dataloggers relative to one another.

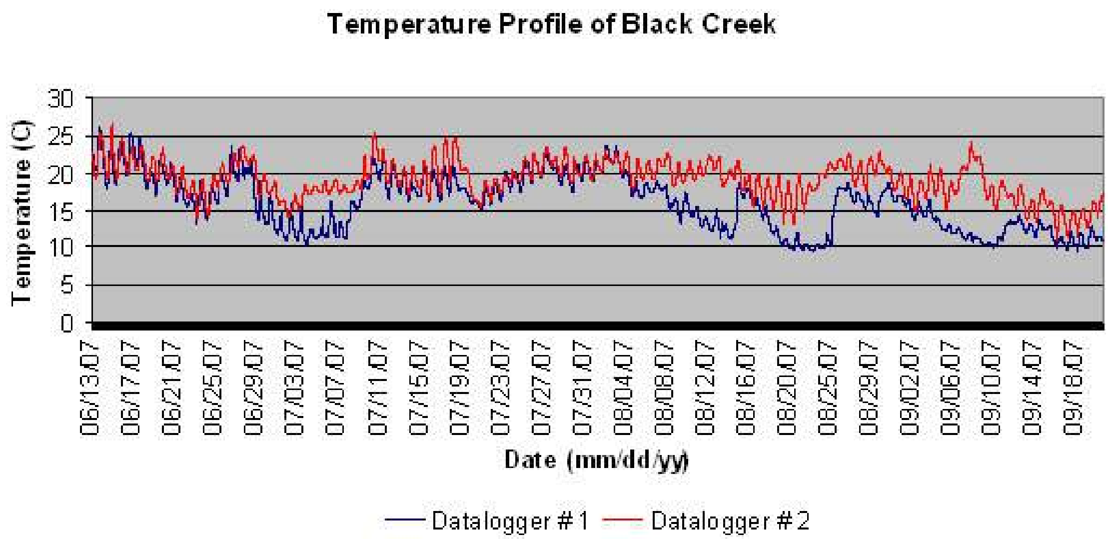

Figure 37. Temperature Profile for Black Creek.

The thermal classifications for cold, cool and warm water are as follows:

Status	Water Temperature
Cold	<19 Degrees Celsius
Cool	19-25 Degrees Celsius
Warm	>25 Degrees Celsius

Table 9. Water temperature classifications (Minns et al. 2001)

Black Creek can be classified as a coolwater stream with cold water inputs. The maximum temperature of the stream throughout the summer (July/August) was 25°C. Readings at datalogger 1 were much colder than datalogger 2 and it is possible that cold water springs exist along the stream. Volunteers and technicians did not observe any springs while sampling, but it is likely as stream temperatures at datalogger 1 reached a low of 9.5°C in late August. Black creek was found to also support a fish community made up of primarily cool water fish species.

3.2.5 Mud Creek

Mud Creek is approximately six kilometres long, flowing from Mer Bleue wetland, south of Renaud Rd, through NCC land before entering Greens Creek just north of Innes Road. Mud Creek is one of four major tributaries of Greens Creek and is very important to the overall health of the system. Figure 38 shows a more detailed look at the creek.

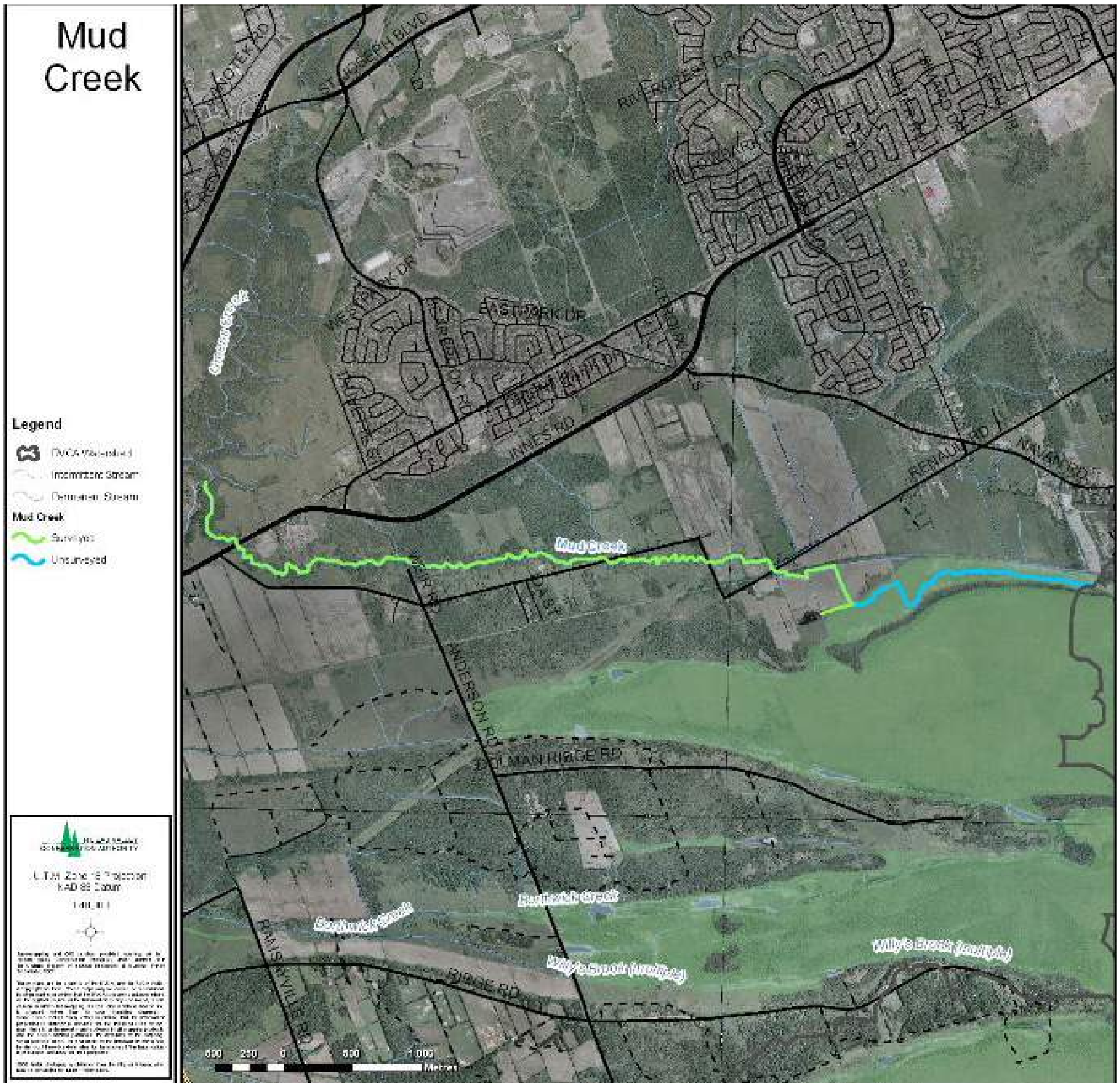

Figure 38. Air Photo of Mud Creek and Surrounding Area.

A total of 6.2 kilometres of Mud Creek was sampled throughout the 2007 season. The following is a summary of the 62 macro stream assessment forms filled out by volunteers.

1. **Observations of Anthropogenic Alterations and Land Use**

Figure 39 illustrates the classes of anthropogenic alterations that volunteers observed along Mud Creek. Much of Mud Creek has limited access and no developmental pressures as it runs through NCC land. Volunteers recorded 72% (45 sections) of the stream remains untouched and in a natural condition. In eleven sections (18%), natural conditions still existed although there were some man-made alterations. No highly altered sections were observed, although altered sections made up 10% (6 sections) of the stream. Altered sections were represented major road crossings with bridges, some active agricultural areas and culverts.

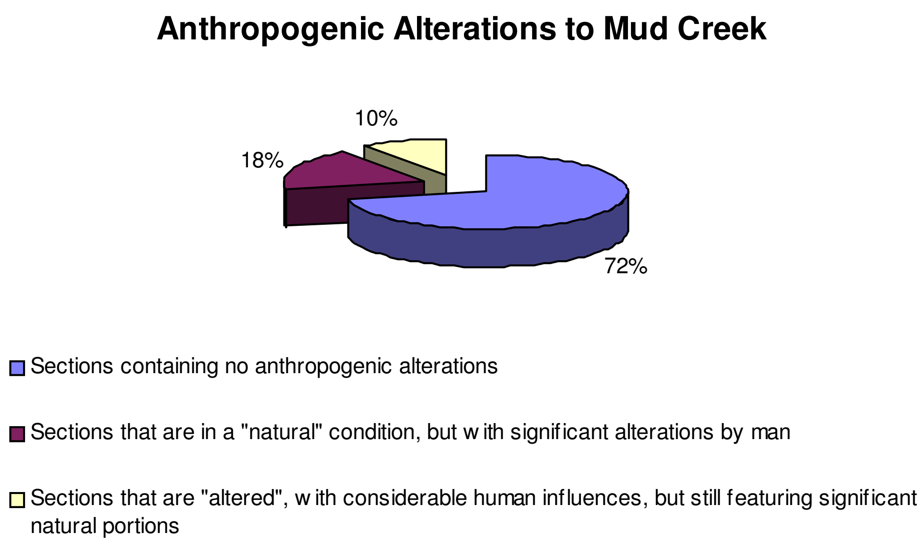

Figure 39. Classes of Anthropogenic Alterations Occurring Along Mud Creek.

Volunteers observed three different land uses occurring adjacent to Mud Creek. Natural areas exist along 82% of sampled creek, while active agriculture makes up 16%. Active agricultural areas were only found in the headwater areas of the stream. Major road crossings, including Innes Rd., Renaud Rd., and Kemp Rd. account for the 2% of culvert/roadway.

Figure 40 demonstrates the different land uses identified adjacent to Mud Creek.

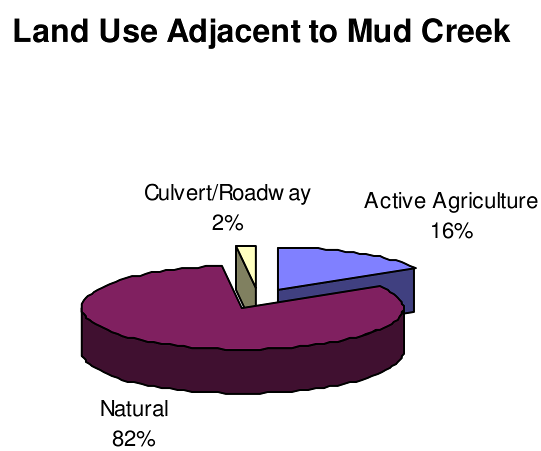

Figure 40. Land Use Identified by Volunteers Along Mud Creek.

A church and penitentiary are located along the banks of Mud Creek although they are located well back from the stream with a large natural buffer. NCC ownership and protection along with difficult access, account for the large percentage of natural areas.

2. Observations of Instream Vegetation

Figure 41 demonstrates the incidence of instream vegetation in Mud Creek. Instream vegetation was categorized as being rare in 71%, and low in 22% of sections surveyed. Decreased vegetation was due in part by slick clay substrate and cloudy water which does not allow sunlight to penetrate to stream bottom. Rare and low vegetation growth negatively affects aquatic systems by limiting instream cover and food sources. Mud Creek also is prone to excessive erosion which could be a contributing factor to the lack of vegetation as well.

Normal, common and excessive vegetation combined to make up 6% of the stream. Sections where instream vegetation was found were in the headwater area where the stream begins at Mer Bleue wetland. Stream morphology in this area was slow, sometimes with water being backed up from beaver dams, making wetland areas where conditions for vegetation growth are more suitable.

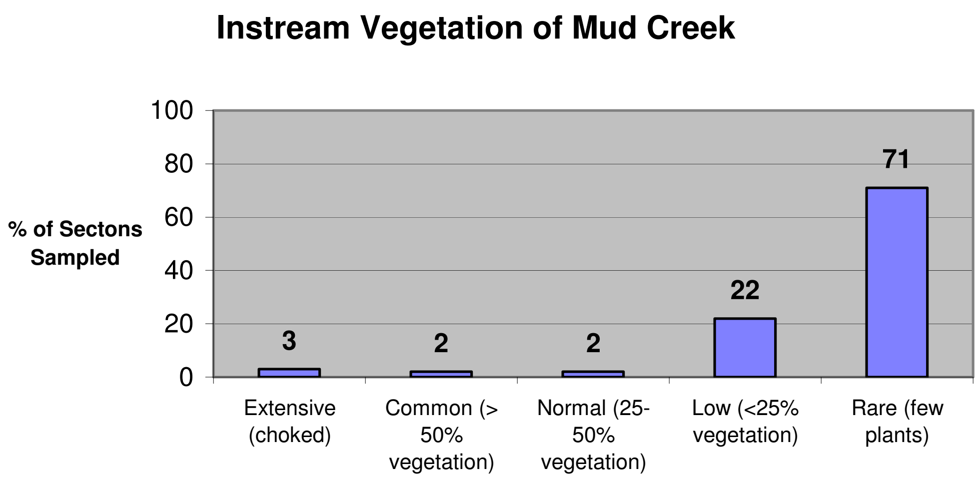

Figure 41. Frequency of Instream Vegetation in Mud Creek.

Purple loosestrife was found in 76% of sections throughout Mud Creek. European frogbit was found in the wetlands in the headwater areas. Maps of invasive species for Mud Creek have been identified on aerial photographs in Appendix H.

3. Observations of Bank Stability

Figure 42 demonstrates the overall bank stability of Mud Creek. Evidence of erosion from the stream bank was observed along 67% of the shoreline, coinciding with areas of little or no vegetation. Many undercut sections and failed banks, where trees have fallen into the stream, were observed. Areas of undercut banks were observed in approximately 12% of sections sampled. Undercut banks can have both positive and negative impacts depending on the vegetation present. Undercutting which still has rooted vegetation can provide valuable habitat as nursery and feeding areas for fish, although if little vegetation is present it can cause the bank to fail and fall into the stream, increasing sediment and turbidity.

The banks and substrate of Mud Creek are made up of clay and silt. Clay banks usually comprise weakly consolidated material, which are sometimes prone to weathering and erosion.

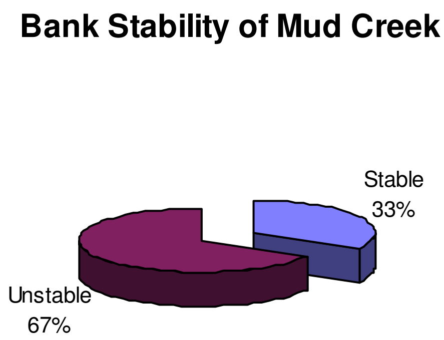

Figure 42. Bank Stability of Mud Creek.

Mud Creek is a natural flowing stream, with little urban/commercial disturbance, so it is likely that most of this erosion is natural, though maybe accelerated by human alterations. High spring flows, rain events, woody debris jams, and varying soil conditions are all possible causes of the erosion along Mud Creek.

Mud Creek would benefit from some rehabilitation work such as riparian plantings and debris jam thinning. Once banks fail debris jams often block the stream channel, forcing the stream to find an alternate route, usually resulting in erosion.

Areas of erosion have been identified on an aerial photo of Mud Creek and can be found in Appendix G.

4. Observations of Wildlife

Volunteers recorded the presence of many types of wildlife in and around Mud Creek. Table 24 is a summary of wildlife observed during stream surveys.

Wildlife	Observed While Sampling
Birds	great blue heron, goldfinch, song sparrow, grey catbird, killdeer, cedar waxwing, mourning dove, cardinal, warbler, woodpecker, red-winged blackbird, oriole, tree swallow, hawk, nuthatch, chickadee, sandpiper, crows
Mammals	white-tailed Deer, racoon, fox (tracks), muskrat, beaver, coyote(tracks), red squirrel
Reptiles/Amphibians	leopard frog, snapping turtle, american toad, green frog
Aquatic Insects	water strider, damselfly, dragonfly, aquatic sowbugs, gastropods, caddisfly, cranefly, whirligig beetles, water boatman
Other	various arthropods

Table 24. Wildlife Observed on Mud Creek During Stream Surveys.

5. Observations of Pollution

Figure 43 demonstrates the incidence of pollution in Mud Creek. Pollution was observed in 92% of sampled sections. This high abundance of pollution can be attributed to debris being blown and washed into the stream by littering from roadways and flowing downstream. Many items have been in the stream for some time and can be a result of historical work done in and around the stream.

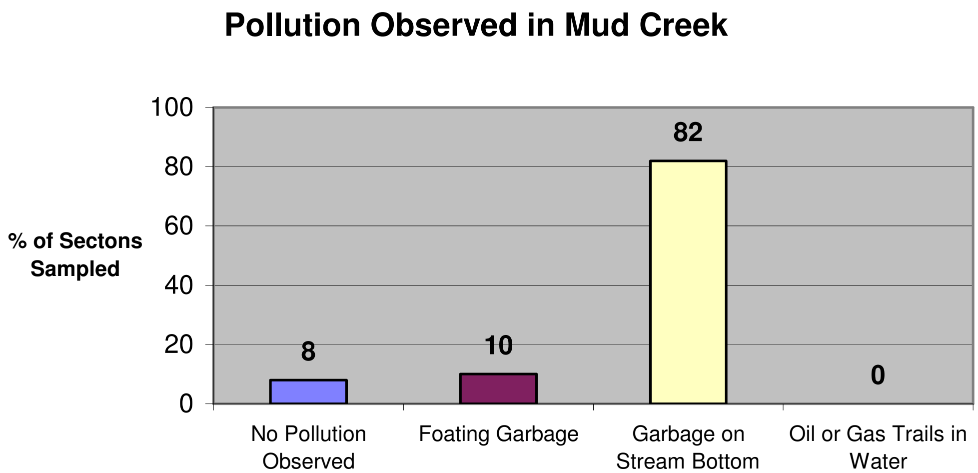

Figure 43. Frequency of Pollution Occurring in Mud Creek.

Of the 62 sections sampled, garbage on the stream bottom was observed in 82%, while floating garbage was observed in 10%. Some debris found included tires, lumber, scrap metal, plastic bags, food wrappers, Styrofoam, construction equipment, bottles and cans. The frequency of unnatural debris in each section was moderate. Mud Creek would benefit from a cleanup where community volunteers walk a reach of stream ridding it of the pollution problems identified. The program will be organizing a cleanup on Mud Creek in 2008.

6. Temperature Profiling

Two temperature dataloggers were set in Mud Creek for a 100-day period. Readings began on June 13 and the dataloggers were removed September 20, 2007. Figure 44 shows the locations of dataloggers in Mud Creek. It can be noted that Mud Creek turns into wetland habitat (Mer Bleue) after the road crossing after Site #2.

Figure 44. Datalogger Locations Along Mud Creek.

Dataloggers were set in two different locations along the stream to give a representative sample of how temperature fluctuates and differs throughout the course of the stream. One was set approximately 500 meters upstream of where the stream joins Greens Creek and the other was set approximately 1km downstream of the headwater area at Mer Bleue wetland.

Figure 45 shows the results from the two dataloggers relative to one another.

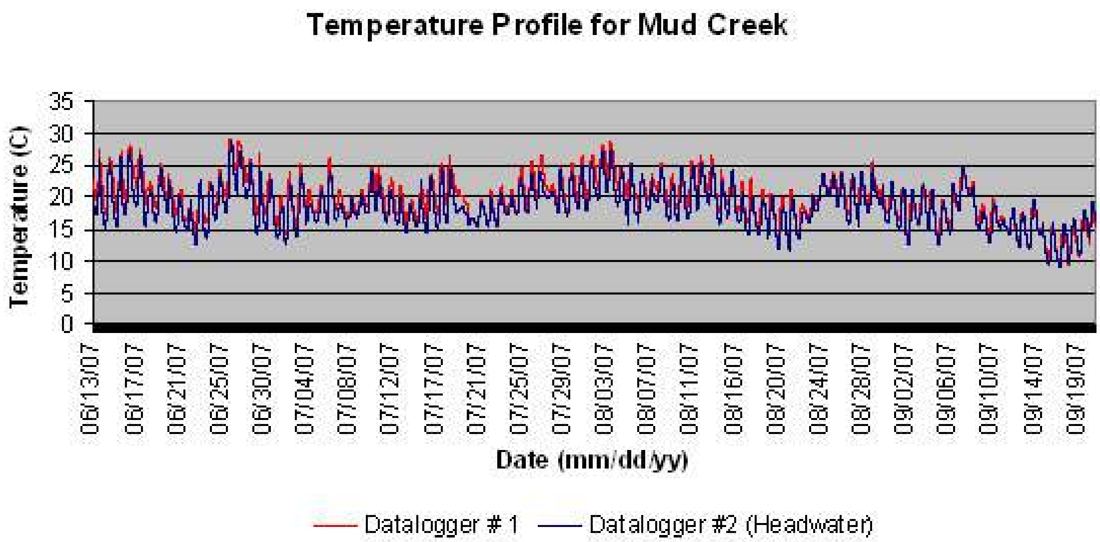

Figure 45. Temperature Profile of Mud Creek.

Figure 45 shows a consistent trend of fluctuating temperatures throughout the stream. Changes in temperature are seen consistently at both dataloggers. Over the 100-day period this stream reached a maximum temperature throughout the summer months (July/Aug) of 28.77°C and a minimum of 11.74°C.

The thermal classifications for cold, cool and warm water are as follows:

Status	Water Temperature
Cold	<19 Degrees Celsius
Cool	19-25 Degrees Celsius
Warm	>25 Degrees Celsius

Table 9. Water temperature classifications (Minns et al. 2001)

Mud Creek can be classified as a warmwater stream with cool water reaches. Although no springs were identified while sampling, there are likely groundwater inputs along this stream which help keep the waters cool. One of the greatest factors of fluctuating temperature is solar radiation and runoff from developed areas. Streams with large amounts of riparian canopy cover will yield lower temperatures where areas with no trees will be warmer. Much of Mud Creeks stretches are exposed and lack overhead tree cover which helps keep the stream cool and shaded. The stream also has a lot of erosion along its shores and many banks have failed causing removal of stream side vegetation and the falling of large trees along the bank.

No fish sampling was completed along Mud Creek, therefore fish communities could not be used in the classification of the stream's temperature.

3.2.6 Borthwick Creek

Borthwick Creek is approximately four kilometres long, flowing from the Mer Bleue wetland and joining Ramsay Creek north of Walkley Road to form Greens Creek. Figure 46 shows a more detailed look at the stream and its location.

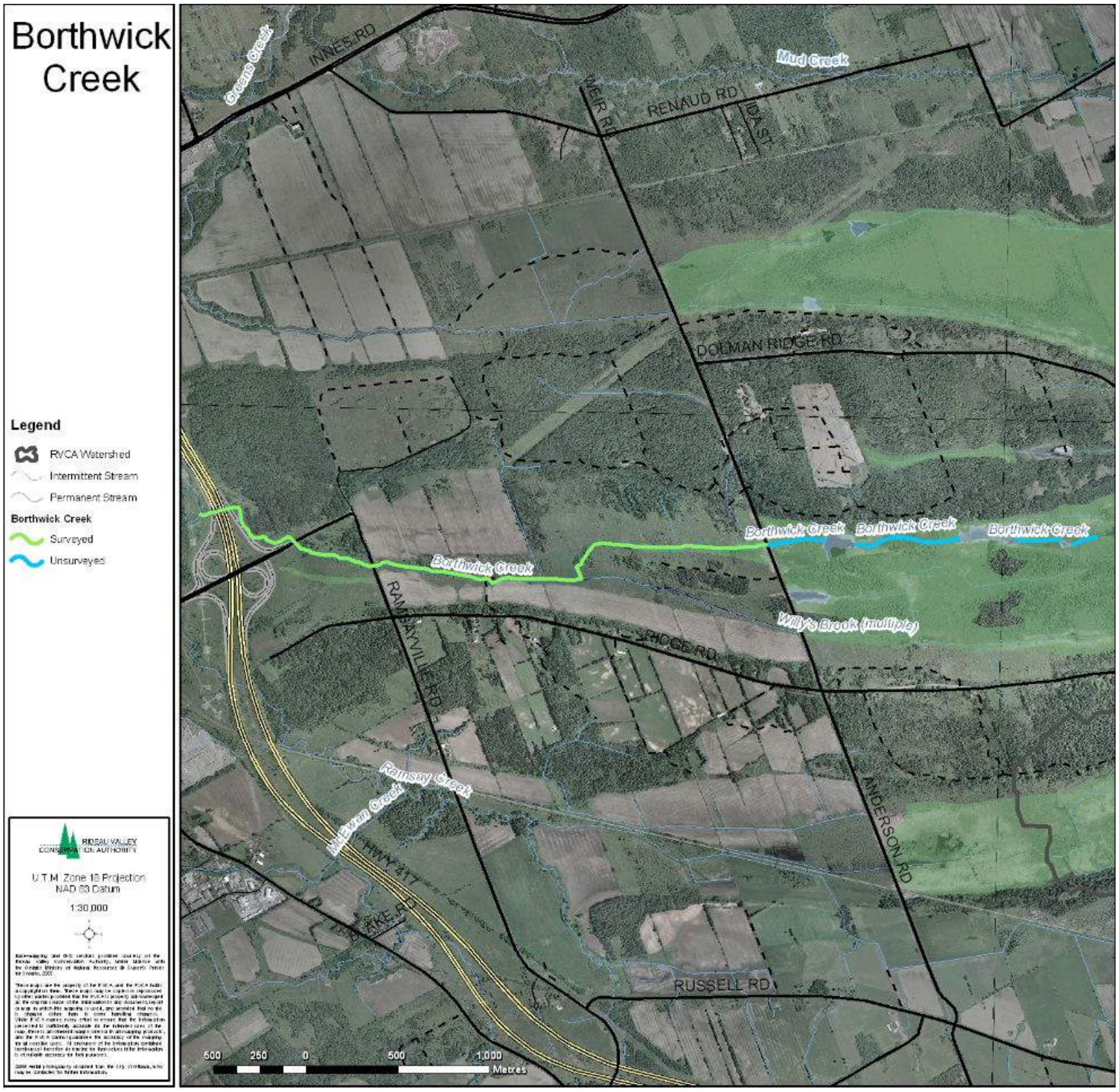

Figure 46. Air Photo of Borthwick Creek and Surrounding Area.

A total of 3.2 kilometres of Borthwick Creek was surveyed in 2007. In the upper reaches of the stream, an area of approximately 200m (two sites) was skipped as there was no clearly defined channel. Wetland areas such as these fall outside the stream assessment protocol and are therefore not surveyed. This was also the case for a 600 meter section west of Anderson Rd.

The following is a summary of the 32 macro-stream assessment forms filled out by volunteers. Observations for anthropogenic alterations, land use, instream vegetation, bank stability, wildlife and pollution are discussed.

1. Observations of Anthropogenic Alterations and Land Use

Figure 47 illustrates the classes of anthropogenic alterations observed by volunteers along Borthwick Creek. Of the 32 sections sampled, volunteers identified nine (28%) sections that displayed no human alterations. Highly altered sections represented 6% of sampled sections as stream passed under two large underground bridges for Highway 417 and Walkley Road. Volunteers observed five consecutive sections (16%) in the final reaches of stream as being altered. For approximately 500m Borthwick Creek flows along side an on ramp for Highway 417. This area is cleared of trees, though a small buffer of grasses and wetland vegetation has been left. The remaining 16 sections (50%) make up natural areas with some minor alterations observed. These alterations include cleared powerline areas and active agriculture

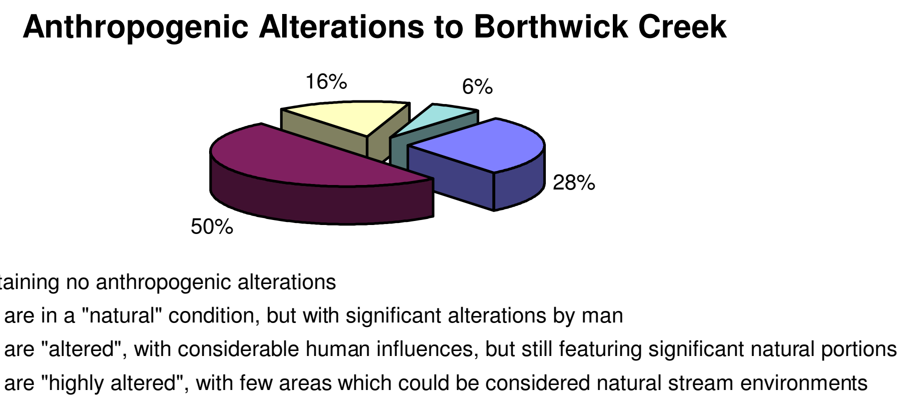

Figure 47. Classes of Anthropogenic Alterations Occurring Along Borthwick Creek.

Volunteers observed three major land use patterns occurring along the banks of Borthwick Creek. Figure 48 demonstrates the different land uses identified. Natural areas made up the greatest percentage of stream surveyed with 77% of the area being classed as natural. These natural areas were made up of tall/short grasses and woody shrubs with few sections that had large trees. Active agriculture made up 12% of the streams land use. Some sections of active agriculture were identified to have a potential for field erosion, though none was observed at the time of sampling. Cleared powerline areas and roadways made up the remaining 11% of land use along the stream.

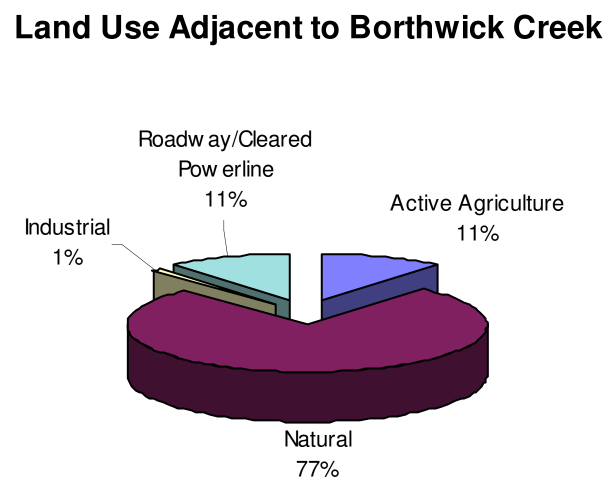

Figure 48. Land Use Identified by Volunteers Along Borthwick Creek.

2. Observations of Instream Vegetation

Figure 49 shows the abundance of instream vegetation in Borthwick Creek. Vegetation was only found to be rare or non-existant in one section and this was due to the stream flowing under a concrete bridge under highway 417. Instream vegetation was categorized as being common to normal in 63% of sections sampled. Areas such as these offer essential nursery habitat to fish and nesting habitat for wildlife. Much of Borthwick Creek, in its headwater area, supports a wetland area and hosts a healthy vegetative community. Extensive vegetation was found along 8 sections (25%) of Borthwick Creek. Many of these sections were thick with floating plants and grasses, both submergent and emergent. Extensive vegetation negatively affects BOD and can impact migration for aquatic organisms. Borthwick Creek has a healthy vegetative community although invasive species were found throughout the stream.

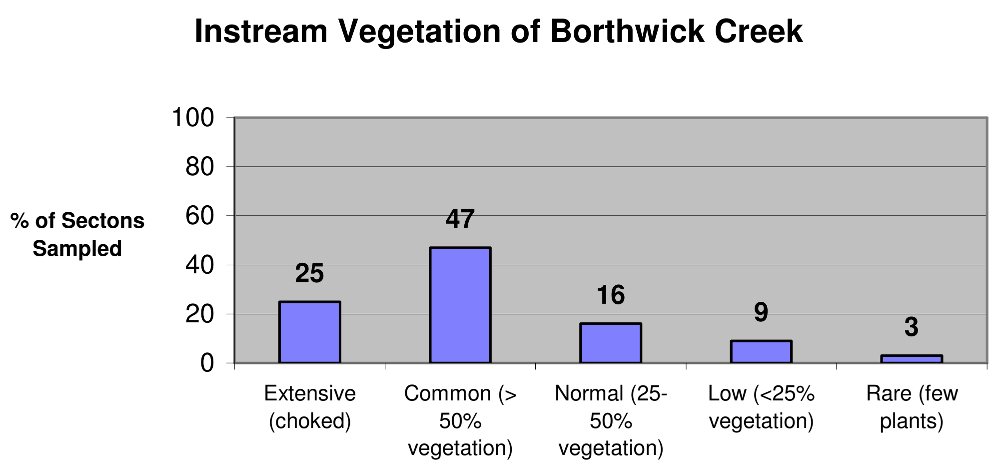

Figure 49. Frequency of Instream Vegetation in Borthwick Creek.

Purple loosestrife and European Frogbit was found in 90% of sections sampled. Areas where invasive species exist have been identified on aerial photographs in Appendix H.

3. Observations of Bank Stability

Figure 50 demonstrates the overall bank stability of Borthwick Creek. The banks of Borthwick Creek were found to be quite stable. Stable banks represented 85% of the shoreline. Evidence of erosion was observed along 15% of the shoreline, coinciding with areas of little or no vegetation. Buffers of tall grasses and woody shrubs are a major contributor to the small amount of erosion observed as well as the diverse vegetative community. Much of the erosion identified is found downstream of human alterations such as culverts and bridges for roadways.

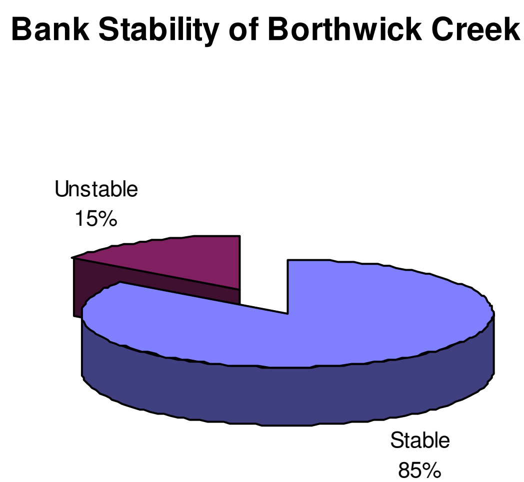

Figure 50. Bank Stability of Borthwick Creek.

Areas of erosion have been identified on an aerial photo of Borthwick Creek and can be found in Appendix G.

4. Observations of Wildlife

Volunteers recorded the presence of many types of wildlife in and around Borthwick Creek. Table 25 is a summary of wildlife observed during stream surveys.

Wildlife	Observed While Sampling
Birds	sparrow, red-wing blackbird, tree swallow, mallard ducks, common yellowthroat, warbling vireo, catbird, green heron, pileated woodpecker, turkey vulture, goldfinch
Mammals	white-tailed deer, raccoon, squirrel, coyote (tracks), skunk, beaver, groundhog, muskrat
Reptiles/Amphibians	green frog, bullfrog, leopard frog
Aquatic Insects	waterstriders, dragonfly, damselfly, gastropods, leech, caddisfly, giant water beetle
Other	various arthropods

Table 25. Wildlife Observed on Borthwick Creek During Stream Surveys.

5. Observations of Pollution

Figure 51 demonstrates the incidence of pollution in Borthwick Creek. Floating debris and garbage on the stream bottom was observed in 22% of surveyed sections. The frequency of the garbage in these sections was quite low and unnatural pollution is not a major problem in this stream. Although the majority of the stream is natural and isolated from development, pollution can still make its way into the stream from littering by passing motorists. The majority of pollution observed was in the vicinity of, or downstream from road crossings. The garbage found consisted of styrofoam, scrap metal, tires, plastic, food wrappers, and plastic bags.

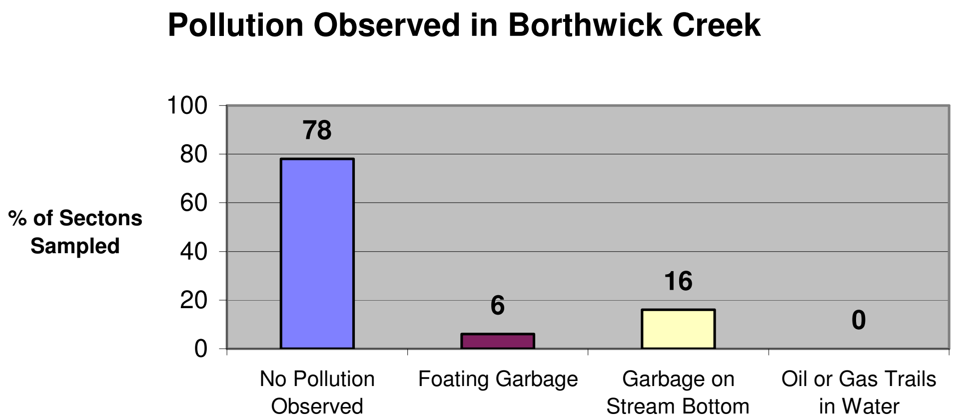

Figure 51. Frequency of Pollution Occurring in Borthwick Creek

6. Fish Community Sampling

Electrofishing

RVCA staff electrofished one site along Borthwick Creek on July 11, 2007. A total of nine different species were identified. Figure 52 shows the location of the electrofishing site.

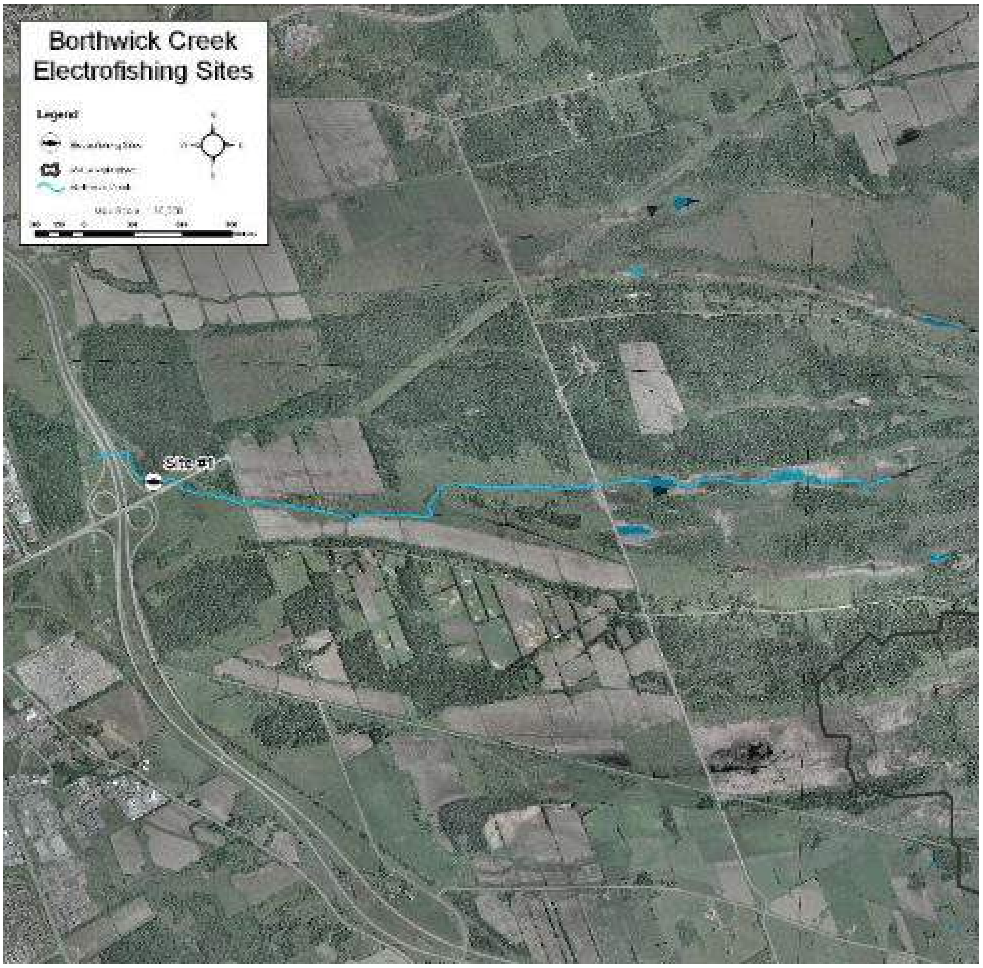

Figure 52. Air photo of Borthwick Creek Showing Electrofishing Sites.

Table 26 illustrates the water chemistry values obtained at the time of electrofishing. No water chemistry data was recorded for Site 1, as the YSI probe was not available.

Location	E-fish #	Date (mm/dd/yy)	Air Temp (C)	Water Temp (C)	DO (mg/L)	pH	Conductivity (uS/cm)	Substrate	Vegetation
Borthwick Creek	1	07/11/2007	NA	NA	NA	NA	NA	clay, sand, gravel	pondweed, European frogbit, grasses

Table 26. Water Chemistry Results for Electrofishing Sites Along Borthwick Creek

Table 27 summarizes the biological data obtained through electrofishing on Borthwick Creek.

E-fish #	Species	Number	Total Length (mm)	Weight (g)	Comments
1	Common Shiner	11	NA	108.4	
	Northern Redbelly Dace	21	NA	55.8	
	Brook Stickleback	24	NA	39	
	Golden Shiner	3	NA	21.2	
	Johnny Darter	5	NA	12.9	

	Creek Chub	13	NA	252.1	
	Common White Sucker	30	NA	472.6	
	Central Mudminnow	86	NA	423.4	
	Emerald Shiner	1	NA	3.3	

Table 27. Fish Community Results for Electrofishing Sites along Borthwick Creek

Fish Species Status, Trophic, and Reproductive Guilds - Borthwick Creek

The following table was generated by taking the fish community structure of Borthwick Creek and classifying the recreational, commercial, or bait fishery importance, the Species at Risk status, reproductive guild (spawning habitat requirements), thermal classification, and trophic guild (feeding preference).

Mainly cool water fish species were found in Borthwick Creek although species such as northern redbelly dace, central mudminnow and golden shiner are tolerant of both temperature ranges. The fish community of Borthwick Creek is made up of primarily bait fish populations. The reproductive guild of fish species existing in Borthwick Creek is fairly diverse and represents a number of reproductive behaviours.

MNR Code	Common Name	Scientific Name	Recreational Fishery	Commercial Fishery	Bait Fishery	Status	Reproductive Guild	Thermal Classification	Trophic Guild
163	White Sucker	Catostomus commersoni				None	(non guarder) Lithophils	cool	Insectivore/ Omnivore
182	Northern redbelly dace	Phoxinus eos			X	None	(non guarder) Phytophils	cool/warm	Herbivore
141	Central mudminnow	Umbra limi			X	None	(non guarder) Phytophils	cool/warm	Insectivore/ Omnivore
281	Brook stickleback	Culaea inconstans			X	None	(guarders) Ariadnophils	cool	Insectivore
212	Creek chub	Semotilus atromaculatus			X	None	(brood hiders) Lithopils	cool	Insectivore/ Generalist
194	Golden shiner	Notemigonus crysoleucas			X	None	(non guarder) Phytophils	cool/warm	Omnivore
198	Common shiner	Luxilus cornutus			X	None	(guarders) Lithopils	cool	Insectivore
341	Johnny darter	Etheostoma nigrum			X	None	(guarder) Speleophils	cool	Insectivore
196	Emerald shiner	Notropis atherinoides			X	None	(open substrate) Pelagophils	cool	Insectivore

Table 28. Fish Species Status, Trophic, and Reproductive Guilds for Borthwick Creek
(Source: MTO Environmental Guide to Fish and Fish Habitat, 2006)

The following table summarizes the fish community found in Borthwick Creek and their sensitivity to sediment and turbidity for reproduction, feeding, and respiration. The composition of the fish community ranges from species that are fairly tolerant to those that are intolerant to sediment and turbidity. However, the majority of the species would be classified in the moderately tolerant range for sediment and turbidity for reproduction and feeding.

Fish Species Sensitivity to Sediment/Turbidity for Borthwick Creek

MNR Code	Common Name	Scientific Name	Reproduction	Feeding	Respiration
163	White Sucker	Catostomus commersoni	M	L	H

182	Northern redbelly dace	Phoxinus eos	M	L	L
141	Central mudminnow	Umbra limi	M	M	L
281	Brook stickleback	Culaea inconstans	L	M	unknown
212	Creek chub	Semotilus atromaculatus	M	H	H
194	Golden shiner	Notemigonus crysoleucas	M	M	L
198	Common shiner	Luxilus cornutus	M	M	unknown
341	Johnny darter	Etheostoma nigrum	M	M	unknown
196	Emerald shiner	Notropis atherinoides	M	L	H

Table 29. Fish Species Sensitivity to Sediment/Turbidity (High, Moderate, Low, unknown) for Borthwick Creek (Source: MTO Environmental Guide to Fish and Fish Habitat, 2006)

7. Temperature Profiling

Two temperature dataloggers were set in Borthwick Creek for a 100-day period. Readings began on June 13 and continued to September 20, 2007. Figure 53 shows the locations of dataloggers in Borthwick Creek. It can be noted that Borthwick Creek ends at Anderson Road (first road east of site 2) that can be seen in the image below.

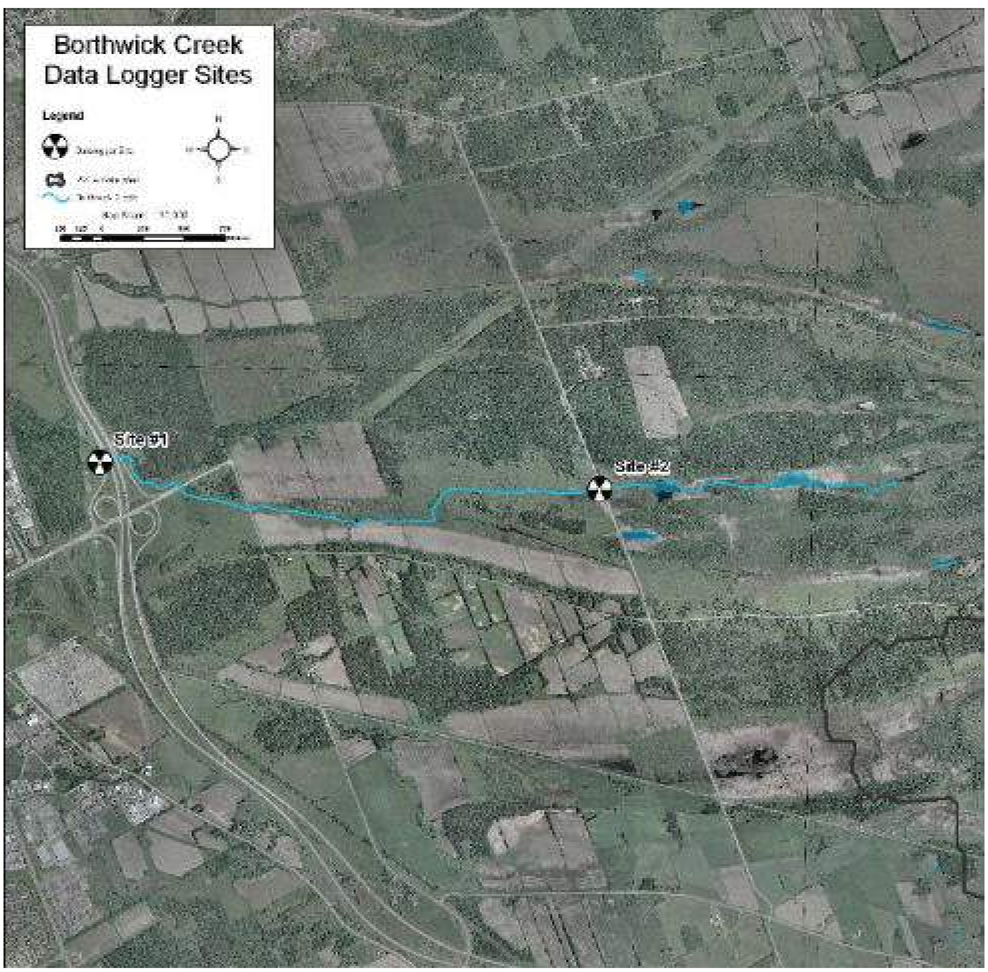

Figure 53. Datalogger Locations Along Borthwick Creek.

Dataloggers were set in two different locations along the stream to give a representative sample of how temperature fluctuates and differs throughout the course of the stream. One was set approximately 50 meters upstream of where the stream joins Ramsay Creek and the other was set just downstream of the Mer Bleue wetland (Anderson Road).

Figure 54 shows the results from the two dataloggers relative to one another.

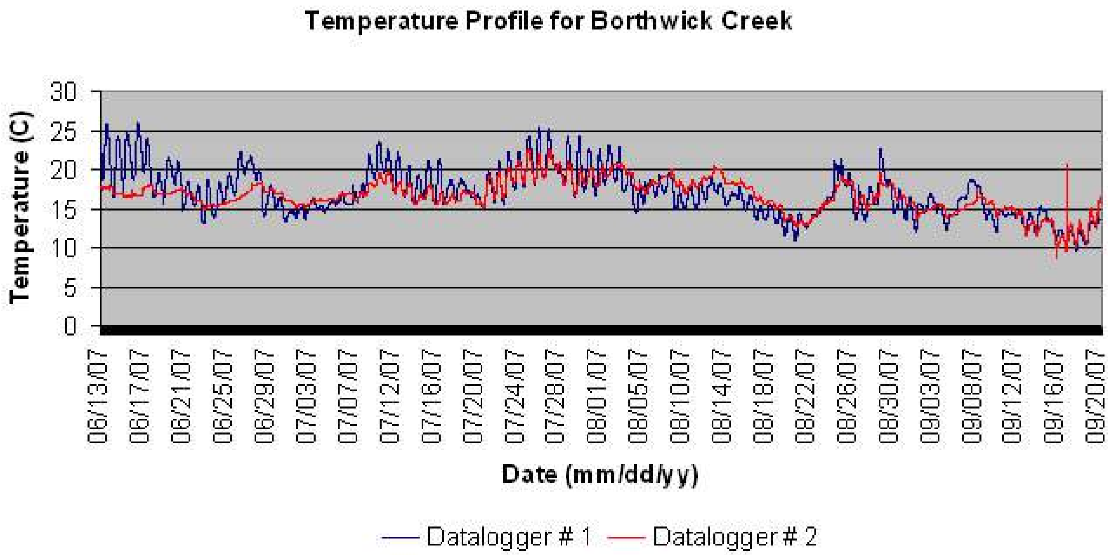

Figure 54. Temperature Profile for Borthwick Creek.

The thermal classifications for cold, cool and warm water are as follows:

Status	Water Temperature
Cold	<19 Degrees Celsius
Cool	19-25 Degrees Celsius
Warm	>25 Degrees Celsius

Table 9. Water temperature classifications (Minns et al. 2001)

Borthwick Creek reached a maximum temperature of 25.26 in the months of July and August. From the temperature data obtained Borthwick, can be classified as a coolwater stream with cold water inputs. These cold water inputs are often from underground springs which release cold water into the stream. One possible spring was observed during stream surveys and was located approximately 2 kilometers upstream from Datalogger 1. Temperatures below 19°C were observed throughout the summer months and the minimum temperature recorded of 11.09°C was recorded at Datalogger 1.

A spike in Datalogger 2 around September 18th is seen in the temperature graph above. This temperature spike was due to maintenance of the data logger. It was removed from the water briefly by RVCA technicians and then re-set and the resulting temperature increase was due to air temperatures while out of water.

3.2.7 Ramsay Creek

Ramsay Creek is approximately ten kilometres long, flowing from north of Leitrum Road, east of Ramsayville Rd. and joining Borthwick Creek north of Walkley Rd. to form Greens Creek. Figure 55 shows a more detailed look at the stream and its location.

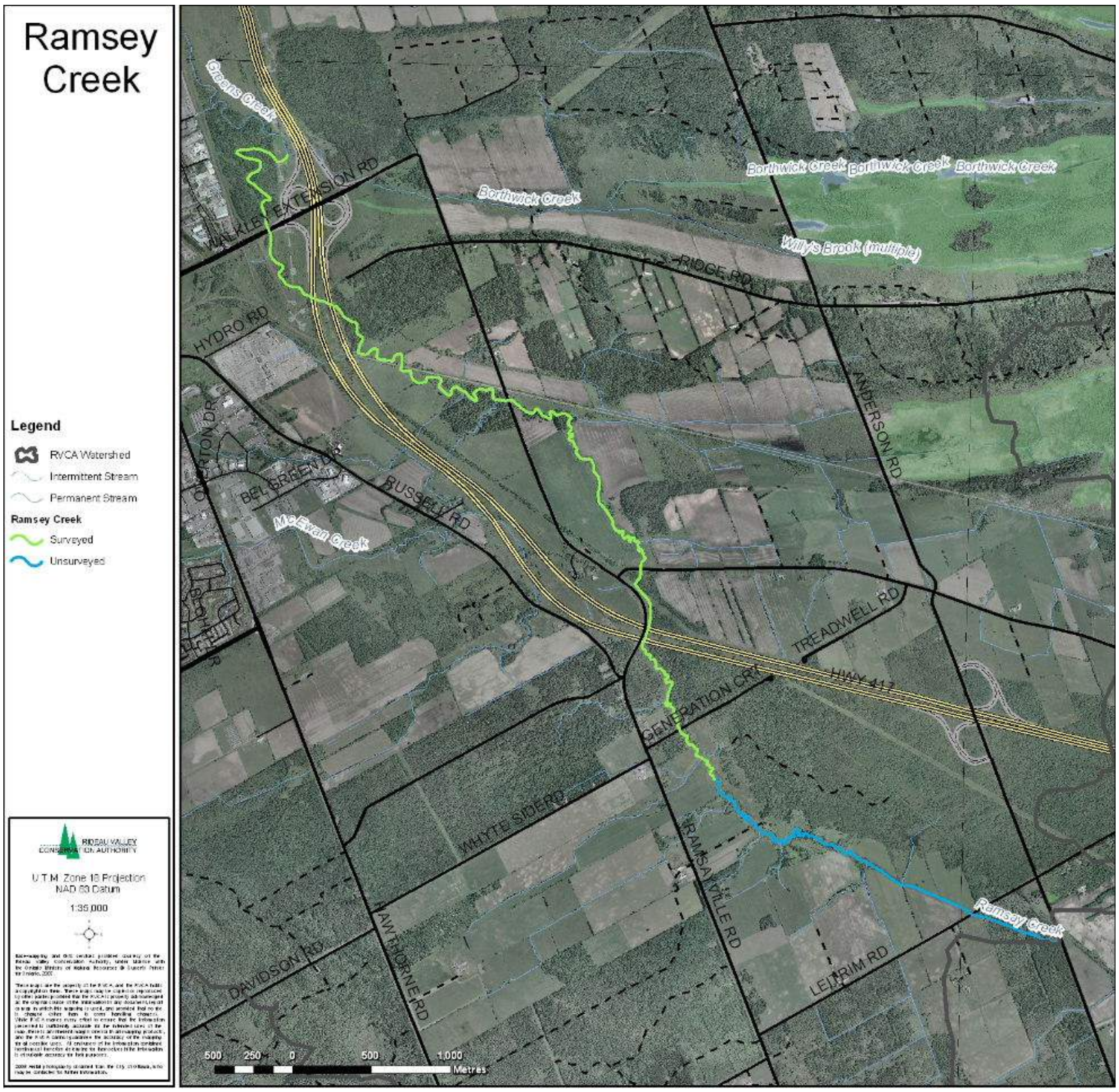

Figure 55. Air Photo of Ramsay Creek and Surrounding Area.

A total of 7.4 kilometres of Ramsay Creek was sampled throughout the 2007 season. In the headwater reaches, approximately 3km (30 sites) from the source, no water was recorded in the stream channel and therefore it was not sampled. Stream surveys were concluded at this location and may be continued in the 2008 season.

The following is a summary of the 74 macro-stream assessment forms filled out by volunteers.

1. **Observations of Anthropogenic Alterations and Land Use**

Figure 56 illustrates the three classes of anthropogenic alterations observed along Ramsay Creek. Volunteers identified 23 sections (31%) of stream that displayed no human alterations. Those sections in a natural condition with some human alterations made up 42% of stream. Alterations that occurred in natural areas included active agricultural fields and areas of stream that ran parallel to roadways and railroad tracks. Altered areas made up 20 sections (27%) of stream sampled. These alterations included active agricultural operations as well as the stream crossings at roadways and cleared powerline areas.

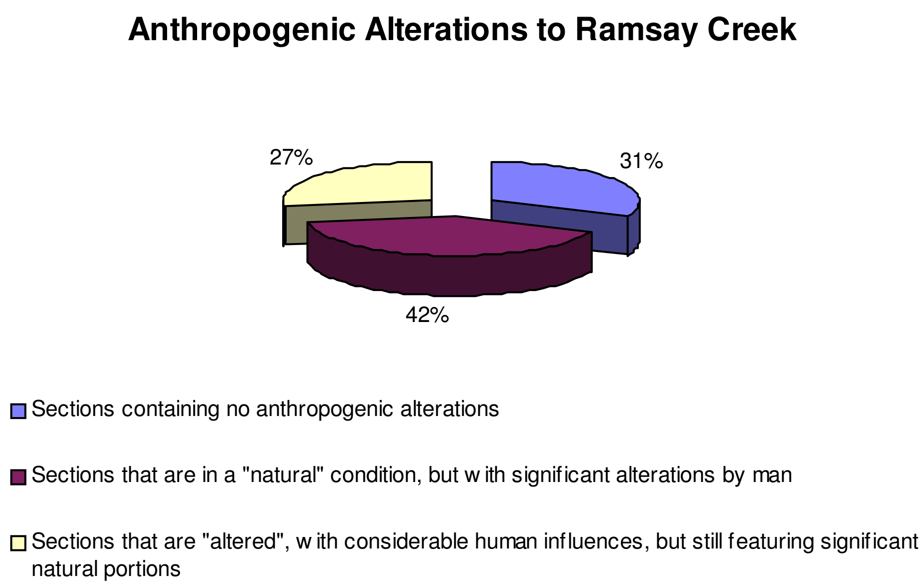

Figure 56. Classes of Anthropogenic Alterations Occurring Along Ramsay Creek.

Volunteers observed three major land use patterns occurring along the banks of Ramsay Creek. Figure 57 demonstrates the different land uses identified. Natural areas were found to exist along 74% of stream. Much of Ramsay Creek runs through natural land and where development and disturbances occur, natural buffers are found throughout most sections. Active agriculture occupied 14% of Ramsay Creek's land use. No major agricultural impacts were observed. In some instances, where fields expanded to the stream bank and small riparian buffers were left, a potential for field erosion was identified. Roadway crossings, railroad tracks, and cleared powerlines accounted for 12% of the stream. These areas occurred over many locations of stream and major road crossings included Walkley Rd, Highway 417 and minor roads such as Ramsayville Rd and Russell Rd. The stream also flows parallel to the Via Rail tracks for approximately 1.5km.

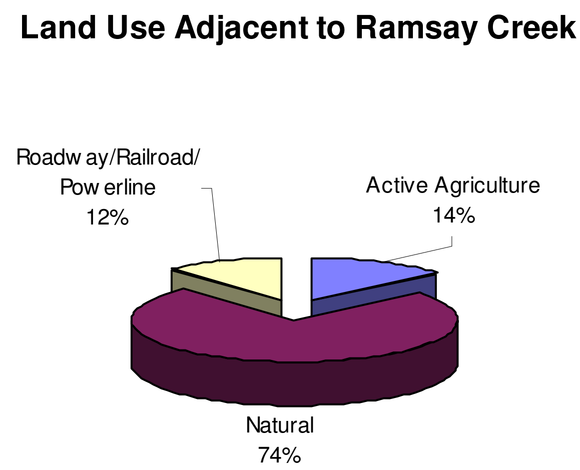

Figure 57. Land Use Identified by Volunteers Along Ramsay Creek.

2. Observations of Instream Vegetation

Figure 58 shows the incidence of instream vegetation in Ramsay Creek. A healthy and diverse mix of vegetation was found throughout the stream. A diverse plant community throughout the stream improves the water quality and offers a variety of habitats for fish and wildlife. Common and normal vegetative communities were found in 42 sections, making up 57% of the stream. Dominant species included pondweed, grasses, arrowhead and water lily. Low instream vegetation existed in 14 sections (19%) while rare vegetation made up 18 sections (24%). As some sites of Ramsay Creek were sampled in late October, well into fall die-off, it can be said that normal vegetative communities may exist along those sections identified as having low to rare instream vegetation.

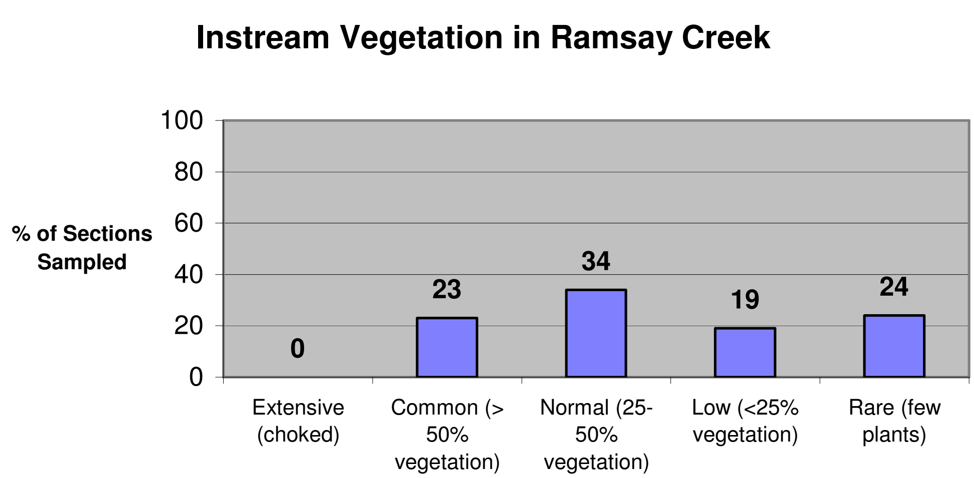

Figure 58. Frequency of Instream Vegetation in Ramsay Creek.

Purple loosestrife was found in 56% of sections sampled. European frogbit was also found but was concentrated in a few sections. Areas where invasive species exist have been identified on aerial photographs in Appendix H.

3. Observations of Bank Stability

Figure 59 shows the overall bank stability of Ramsay Creek. Evidence of erosion from the stream bank was observed along 54% of the shoreline, coinciding with areas of little or no vegetation. Areas of erosion were found in 90% of sections surveyed although in many sections it only occurred in isolated areas. Stable banks were observed in 46% of the sections. Some areas identified as being stable were due to artificial features such as concrete bridge structures and rip rap stone. Erosion is a natural stream process though it is often accelerated by human alterations to the stream channel and adjacent land use. Much of the erosion observed can be considered natural, though the clearing of streamside vegetation for the installation of railroad tracks, roadways and large concrete bridges do contribute to accelerated erosion along the stream.

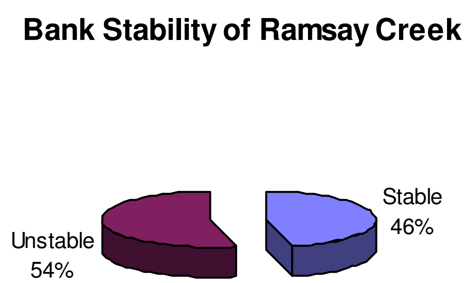

Figure 59. Bank Stability of RamsayCreek.

Areas of erosion have been identified on an aerial photo of Ramsay Creek and can be found in Appendix G.

4. Observations of Wildlife

Volunteers recorded the presence of many types of wildlife in and around Ramsay Creek. Table 30 is a summary of wildlife observed during stream surveys.

Wildlife	Observed While Sampling
Birds	grey catbird, song sparrow, red-winged blackbird, common yellowthroat, robin, tree swallows, goldfinch, eastern kingbird, cedar waxwing, mourning dove, northern flicker, crows, pileated woodpecker, chickadee, belted kingfisher, blue jay, rose-breasted grosbeak, brown-headed cowbird, eastern phoebe, warbling vireo, flycatcher, veery, flycatcher, eastern meadow lark, chipping sparrow, turkey vulture
Mammals	white-tailed deer, raccoon, muskrat, groundhog, beaver, skunk, fox (tracks), coyote (tracks)
Reptiles/Amphibians	green frog, bullfrog, leopard frog
Aquatic Insects	waterstriders, dragonfly, damselfly, gastropods, whirligig beetle, waterboatman, crayfish
Other	various arthropods

Table 30. Wildlife Observed on Ramsay Creek During Stream Surveys.

5. Observations of Pollution

Figure 60 demonstrates the incidence of pollution in Ramsay Creek. Pollution was observed in 71% of sampled sections. This high abundance of pollution can be attributed to debris being blown and washed into the stream and by work done historically along the stream. Many items found in the system have been there for a long period of time.

Of the 72 sections sampled, garbage on the stream bottom was observed in 38%, while floating garbage was observed in 33%. Pollution found in Ramsay Creek included plastic bags and bottles, scrap metal, styrofoam, over 20 tires, construction materials, food wrappers, machinery parts, and scrap lumber. Ramsay Creek would benefit from some rehabilitation work in the form of a cleanup, although access is a concern, making removing large items such as tires and machinery parts a problem.

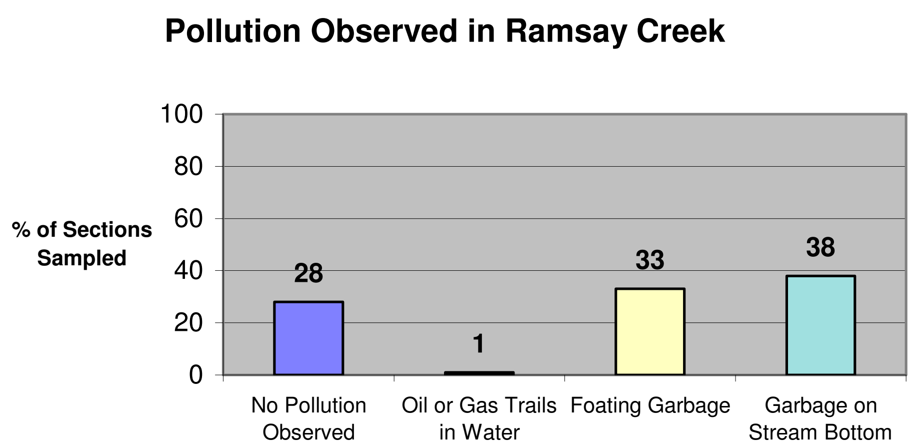

Figure 60. Frequency of Pollution Occurring in Ramsay Creek.

6. Fish Community Sampling

<u>Electrofishing</u>

RVCA staff electrofished two sites along Ramsay Creek on July 11, 2007. A total of eleven different species were identified. Some cyprinid (minnow) species could not be identified. Figure 61 shows the locations of the electrofishing sites.

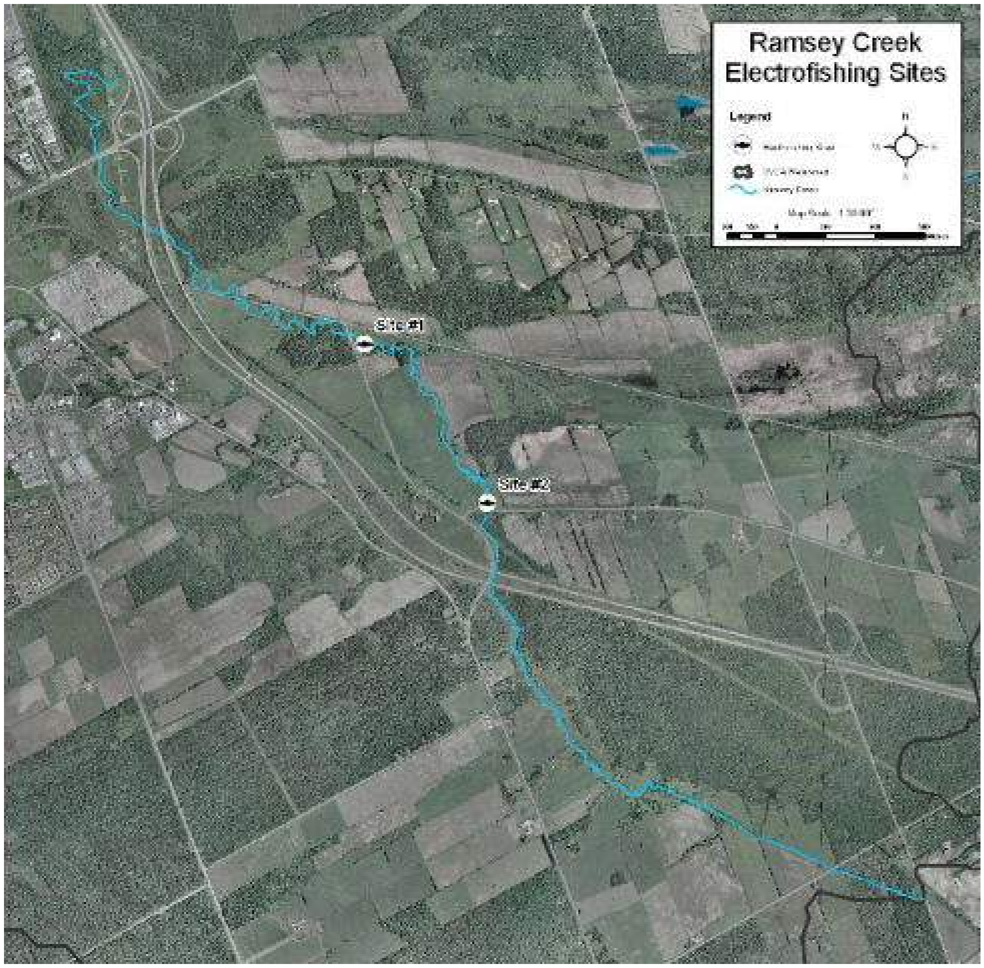

Figure 61. Air photo of Ramsay Creek Showing Electrofishing Sites.

Table 31 illustrates the water chemistry values obtained at the time of electrofishing. No detailed water chemistry data was recorded for Site 1, as the YSI probe was not available.

Location	E-fish #	Date (mm/dd/yy)	Air Temp (C)	Water Temp (C)	DO (mg/L)	pH	Conductivity (uS/cm)	Substrate	Vegetation
Ramsay Creek	1	07/11/2007	NA	NA	NA	NA	NA	clay with muck	pondweed, grasses, European frogbit, duckweed
Ramsay Creek	2	07/11/2007	NA	NA	NA	NA	NA	clay, gravel	pondweed, grasses, rushes

Table 31. Water Chemistry Results for Electrofishing Sites Along Ramsay Creek.

Table 32 summarizes the biological data obtained from each electrofishing event on Ramsay Creek. Top predators identified are highlighted in bold.

E-fish #	Species	Number	Total Length (mm)	Weight (g)	Comments
1	Trout Perch	1	85	8.6	
	Creek Chub	19	NA	259	
	Common Shiner	21	NA	93	

	Brook Stickleback	2	NA	2.1	
	Johnny Darter	2	NA	2.7	
	Largemouth Bass	1	62	3.1	
	Largemouth Bass	1	55	2.1	
	Largemouth Bass	1	59	1.8	
	Largemouth Bass	1	54	2	
	Largemouth Bass	1	49	1.5	
	Central Mudminnow	41	NA	184.3	
	Common White Sucker	16	NA	242.6	
	Northern Redbelly Dace	25	NA	33.1	
	Fathead Minnow	3	NA	7.3	
	Cyprinids	5	NA	NA	
	Unknown	6	NA	NA	YOY
2	Creek Chub	29	NA	468.6	
	Trout Perch	9	NA	35.5	
	Common White Sucker	21	NA	476.8	
	Common Shiner	20	NA	63.2	
	Central Mudminnow	8	NA	31.6	
	Johnny Darter	36	NA	34.1	
	Brook Stickleback	16	NA	14.8	
	Blacknose Dace	5	NA	9.2	
	YOY	13	NA	NA	
	Fathead Minnow	1	NA	3.7	
	Unknown Cyprinids	4	NA	14.2	

Table 32. Fish Community Results for Electrofishing Sites along Ramsay Creek.

Fish Species Status, Trophic, and Reproductive Guilds -Ramsay Creek

The following table was generated by taking the fish community of Ramsay Creek and classifying the recreational, commercial, or bait fishery importance, the Species at Risk status, reproductive guild (spawning habitat requirements), thermal classification, and trophic guild (feeding preference).

The majority of the species within Ramsay Creek are significant to the baitfish fishery. The fish community consists of mainly cool water species although largemouth bass which is a warm water species were caught. The spawning habitat requirements for the fish community of Ramsay Creek is primarily guarders and non-guarders.

MNR Code	Common Name	Scientific Name	Recreational Fishery	Commercial Fishery	Bait Fishery	Status	Reproductive Guild	Thermal Classification	Trophic Guild
163	White Sucker	Catostomus commersoni				None	(non guarder) Lithophils	cool	Insectivore/ Omnivore
182	Northern redbelly dace	Phoxinus eos			X	None	(non guarder) Phytophils	cool/warm	Herbivore
141	Central mudminnow	Umbra limi			X	None	(non guarder) Phytophils	cool/warm	Insectivore/ Omnivore
281	Brook stickleback	Culaea inconstans			X	None	(guarders) Ariadnophils	cool	Insectivore
212	Creek chub	Semotilus atromaculatus	X		X	None	(brood hiders) Lithopils	cool	Insectivore/ Generalist
291	Trout-perch	Percopsis			X	None	(non guarder)	cool	Insectivore

		omiscomaycus					Lithophils		
317	Largemouth bass	Micropterus salmoides	X	past		None	(nest spawners)	warm	Insectivore/ Piscivore
209	Fathead minnow	Pimephales promelas			X	None	(guarder) Speleophils	cool	Omnivore
198	Common shiner	Luxilus cornutus			X	None	(guarders) Lithopils	cool	Insectivore
341	Johnny darter	Etheostoma nigrum			X	None	(guarder) Speleophils	cool	Insectivore
210	Blacknose dace	Rhinichthys atratulus			X	None	(non guarder) Lithophils	cool	Insectivore/ Generalist

Table 33. Fish Species Status, Trophic, and Reproductive Guilds for Ramsay Creek
(Source: MTO Environmental Guide to Fish and Fish Habitat, 2006)

The following table summarizes the fish community found in Ramsay Creek and their sensitivity to sediment and turbidity for reproduction, feeding, and respiration. The composition of the fish community in Ramsay Creek ranges from species that are fairly tolerant to species that are intolerant to sediment and turbidity. However, the majority of the species would be classified in the moderately to high tolerance range for sediment and turbidity for reproduction and feeding.

Fish Species Sensitivity to Sediment/Turbidity for Ramsay Creek

MNR Code	Common Name	Scientific Name	Reproduction	Feeding	Respiration
163	White Sucker	Catostomus commersoni	M	L	H
182	Northern redbelly dace	Phoxinus eos	M	L	L
141	Central mudminnow	Umbra limi	M	M	L
281	Brook stickleback	Culaea inconstans	L	M	unknown
212	Creek chub	Semotilus atromaculatus	M	H	H
317	Largemouth bass	Micropterus salmoides	L	H	H
198	Common shiner	Luxilus cornutus	M	M	unknown
341	Johnny darter	Etheostoma nigrum	M	M	unknown
209	Fathead minnow	Pimephales promelas	L	L	unknown
291	Trout-perch	Percopsis omiscomaycus	M	M	H
210	Blacknose dace	Rhinichthys atratulus	M	M	H

Table 34. Fish Species Sensitivity to Sediment/Turbidity (High, Moderate, Low, unknown) for Ramsay Creek
(Source: MTO Environmental Guide to Fish and Fish Habitat, 2006)

7. Temperature Profiling

Two temperature dataloggers were set in Ramsay Creek for a 100-day period beginning on June 13 and ending on September 20, 2007. Figure 62 shows the locations of dataloggers in Ramsay Creek.

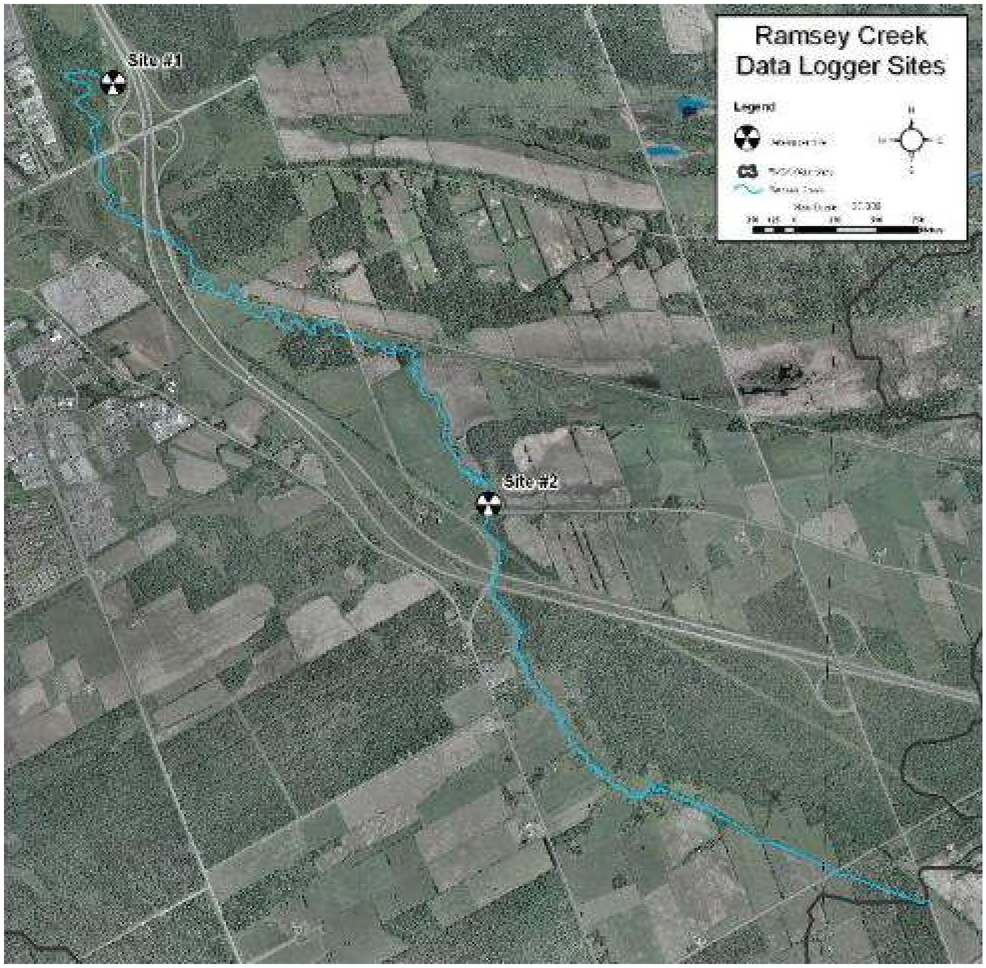

Figure 62. Datalogger Locations Along Ramsay Creek.

Dataloggers were set in two different locations along the stream to give a representative sample of how temperature fluctuates and differs throughout the course of the stream. Datalogger 1 was placed approximatly. 50 meters upstream of where Borthwick Creek empties into Ramsay Creek. Datalogger 2 was set approximatly. 50 metres downstream of the Russell Road culvert. Datalogger 2 was damaged and temperature readings could not be retrieved. Temperature classifications are based on Datalogger 1 only and temperatures which were recorded at the time of stream surveys.

Figure 63 shows the results from Datalogger 1 in Ramsay Creek.

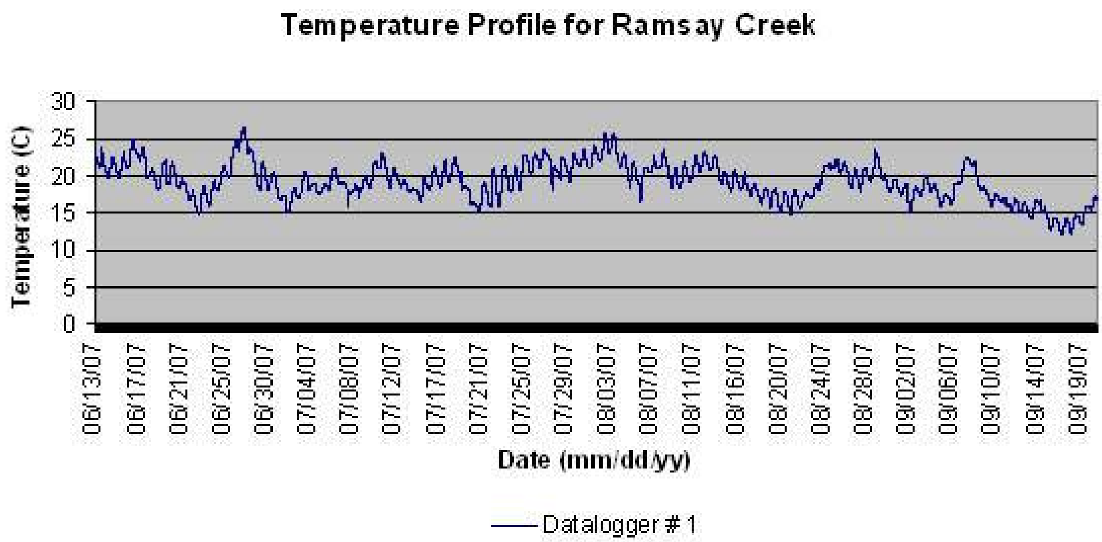

Figure 63. Temperature Profile of Ramsay Creek.

The thermal classifications for cold, cool and warm water are as follows:

Status	Water Temperature
Cold	<19 Degrees Celsius
Cool	19-25 Degrees Celsius
Warm	>25 Degrees Celsius

Table 9. Water temperature classifications (Minns et al. 2001)

Based on the fish community structure and temperature data collected from Datalogger 1, Ramsay Creek can be classified as a cool water stream. The maximum temperature of the stream throughout the summer months (July/August) reached 25.8°C. The fish communities collected represent a majority of cool water species such as creek chub, common shiner and trout-perch.

In 2007 no data was collected on the headwater areas of Ramsay Creek as much of the Rideau valley watershed was in a level 1 drought. The lack of water made stream assessment, fish sampling and temperature profiling impossible. In 2008, stream data will be collected from the upper reaches and reported in the 2008 report.

3.2.8 Becketts Creek

Seine Netting

Two seine netting sites were completed along Becketts Creek on July 22, 2007. Seven stream watch volunteers assisted in netting and processing of fish contributing 21 hours toward the program. Volunteers were introduced to fish sampling methods as well as taught how to identify and process seine net catches.

Figure 64 shows the locations of the sampling sites, and Table 36 is a summary of the fish caught seining in Becketts Creek.

Figure 64. Air photo of Becketts Creek Showing Seining Sites.

Table 35 summarizes water chemistry data for each seining site.

Location	Seine #	Date (mm/dd/yy)	Air Temp (C)	Water Temp (C)	DO (mg/L)	pH	Conductivity (uS/cm)	Substrate	Instream Vegetation
Becketts Creek	1-1	07/22/07	28	19.4	10.71	8.1	383	hard clay bottom with muck at banks	none
Becketts Creek	1-2	07/22/07	28	19.4	10.71	8.1	383	cobble stone, clay, muck	broad-leaved arrowhead, grasses, pondweed
Becketts Creek	2-1	07/22/07	28	19.5	9.18	7.7	401	hard clay with muck at edges	aroowhead, grasses
Becketts Creek	2-2	07/22/07	28	19	9.18	7.7	401	hard clay with muck at edges, rubble from bridges	cattail, arrowhead

Table 35. Water Chemistry Results for Seining Sites Along Becketts Creek

Table 36 summarizes the biological data obtained from each seine netting event on Becketts Creek. A total of eleven different fish species were collected. Top predators within the stream ecosystem are highlighted in bold.

Seine #	Species	Number	Total Length (mm)	Weight (g)	Comments
1-1	Pumpkinseed	1	84	14	
	Yellow Perch	1	180	77.5	Unidentified disease on caudal fin
	Yellow Perch	1	119	20.3	
	Largemouth Bass	1	51	1.9	YOY
	Rock Bass	1	90	16.1	
1-2	Log Perch	1	NA	1	
	Yellow Perch	1	197	99.9	Unidentified disease on caudal fin
	Yellow Perch	1	165	53.7	Unidentified disease on caudal fin
	Yellow Perch	1	111	13.9	
	Rock Bass	1	113	30.8	
	Rock Bass	1	66	6.5	
	Brown Bullhead	1	165	53.6	
	Brown Bullhead	1	174	63.3	
	Pumpkinseed	1	84	9.4	
	Pumpkinseed	1	114	31.9	
	Pumpkinseed	1	82	9.4	
	Largemouth Bass	1	61	3.3	YOY
	Unknown Cyprinid	2	NA	1.9	
	Persid.	1	NA	NA	YOY
2-1	Common Shiner	2	NA	4.3	
	Johnny Darter	2	NA	1.9	
	Brook Stickleback	1	NA	0.5	
	Unknown Cyprinid	8	NA	1.5	
2-2	Common Shiner	75	NA	158.9	
	Brook Stickleback	15	NA	6.5	
	Johnny Darter	4	NA	2.8	
	Common White Sucker	4	NA	13.8	
	Creek Chub	13	NA	63	

Table 36. Fish Community Results for Seining Sites Along Becketts Creek.

Electrofishing

RVCA staff electrofished two sites along Becketts Creek on July 26, 2007. Figure 65 shows the locations of the electrofishing sites.

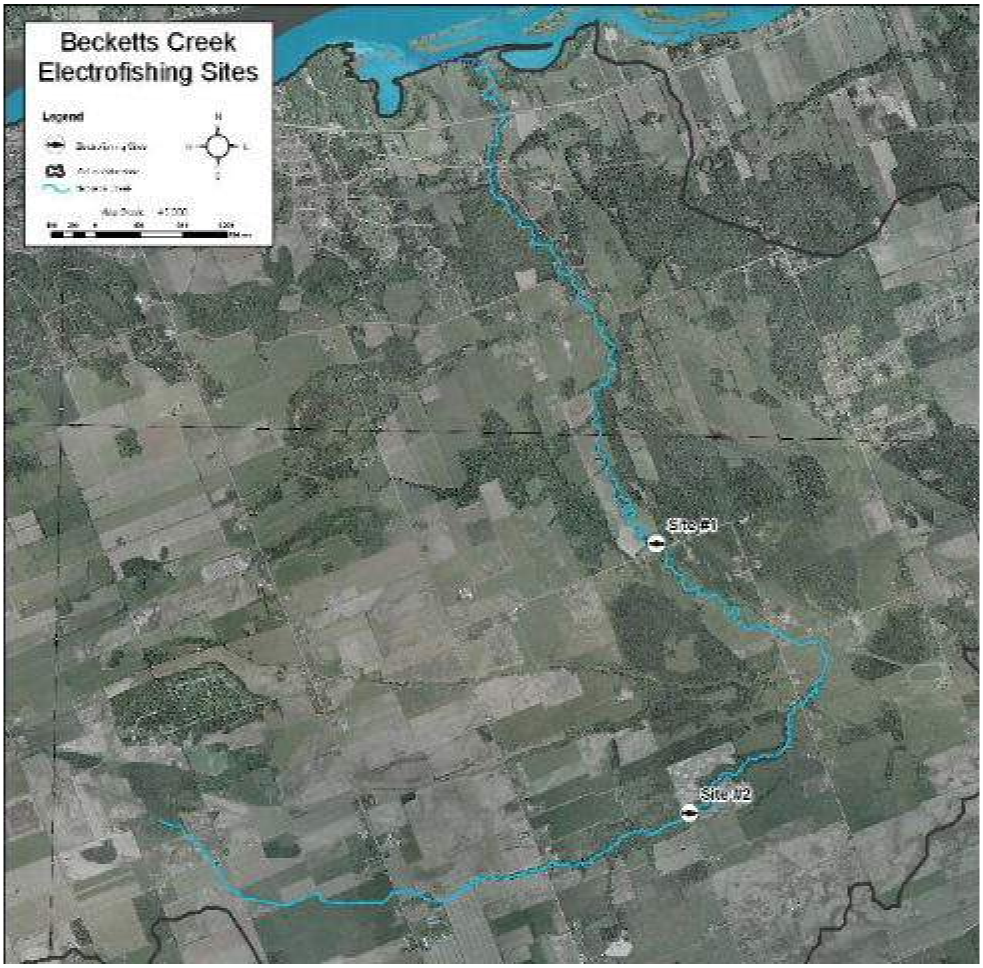

Figure 65. Air Photo of Becketts Creek Showing Electrofishing Sites.

Table 37 illustrates the water chemistry values obtained at the time of electrofishing. No detailed water chemistry data could be obtained as the YSI was not available at the time of sampling.

Location	E-fish #	Date (mm/dd/yy)	Air Temp (C)	Water Temp (C)	DO (mg/L)	pH	Conductivity (uS/cm)	Substrate	Vegetation
Becketts Creek	1	26/07/2007	28	21	NA	NA	NA	clay with boulders and rubble	Algae, grasses
Becketts Creek	2	26/07/2007	28	22	NA	NA	NA	clay, muck and rubble	Algae, grasses

Table 37. Water Chemistry Results for Electrofishing Sites Along Becketts Creek.

Table 38 summarizes the biological data obtained from each electrofishing event on Becketts Creek.

E-fish #	Species	Number	Total Length (mm)	Weight (g)	Comments
1	Johnny Darter	73	NA	57.6	NA
	Common Shiner	51	NA	168.8	many have black spot
	Central Mudminnow	26	NA	72.8	NA
	Common White Sucker	10	NA	336.2	NA

	Creek Chub	60	NA	648.5	NA
	Longnose Dace	20	NA	79.7	NA
	Blacknose Dace	4	NA	5.1	NA
	Northern Redbelly Dace	4	NA	4.9	NA
	Bluntnose Minnow	2	NA	7.4	NA
	Brook Stickleback	1	NA	1.2	NA
	Fathead Minnow	1	NA	1.6	NA
2	Fathead Minnow	7	NA	21.9	NA
	Bluntnose Minnow	12	NA	26.5	NA
	Johnny Darter	41	NA	55.7	NA
	Central Mudminnow	3	NA	4.7	NA
	Northern Redbelly Dace	11	NA	31.4	NA
	Common White Sucker	46	NA	681	NA
	Common Shiner	77	NA	364.5	NA
	Creek Chub	57	NA	429.7	NA
	Brook Stickleback	2	NA	1.6	NA
	Blacknose Dace	1	NA	0.8	NA
	Unknown	1	NA	NA	need to ID, sample taken

Table 38. Fish Community Results for Electrofishing Sites along Becketts Creek.

Fish Species Status, Trophic, and Reproductive Guilds - Becketts Creek

The following table was generated by taking the fish community structure of Becketts Creek and classifying the recreational, commercial, or bait fishery importance, the Species at Risk status, reproductive guild (spawning habitat requirements), thermal classification, and trophic guild (feeding preference).

The majority of the species within Becketts Creek are significant to the recreational and baitfish fisheries. The fish community structure consists of both cool and warm water species, though most warm water species such as pumpkinseed, bullhead and largemouth bass were caught in the reaches close to the Ottawa River. The spawning habitat requirements for the fish community of Becketts Creek is primarily guarders and non-guarders with the exception of the centrarchids (basses and sunfish family).

MNR Code	Common Name	Scientific Name	Recreational Fishery	Commercial Fishery	Bait Fishery	Status	Reproductive Guild	Thermal Classification	Trophic Guild
163	White Sucker	Catostomus commersoni				None	(non guarder) Lithophils	cool	Insectivore/ Omnivore
182	Northern redbelly dace	Phoxinus eos			X	None	(non guarder) Phytophils	cool/warm	Herbivore
141	Central mudminnow	Umbra limi			X	None	(non guarder) Phytophils	cool/warm	Insectivore/ Omnivore
281	Brook stickleback	Culaea inconstans			X	None	(guarders) Ariadnophils	cool	Insectivore
212	Creek chub	Semotilus atromaculatus	X		X	None	(brood hiders) Lithopils	cool	Insectivore/ Generalist
209	Fathead minnow	Pimephales promelas			X	None	(guarder) Speleophils	cool	Omnivore
313	Pumpkinseed	Lepomis gibbosus	X			None	(nest spawners) Polyphils	warm	Insectivore

311	Rock bass	Ambloplites rupestris	X			None	(nest spawners) Lithophils	cool	Insectivore
317	Largemouth bass	Micropterus salmoides	X	past		None	(nest spawners)	warm	Insectivore/ Piscivore
210	Blacknose dace	Rhinichthys atratulus			X	None	(non guarder) Lithophils	cool	Insectivore/ Generalist
331	Yellow perch	Perca flavescens	X	X		None	(non guarder) Phyto-lithophils	cool	Insectivore/ Piscivore
233	Brown bullhead	Ameiurus nebulosus	X	limited	X	None	(guarder) Speleophils	warm	Insectivore
198	Common shiner	Luxilus cornutus			X	None	(guarders) Lithopils	cool	Insectivore
341	Johnny darter	Etheostoma nigrum			X	None	(guarder) Speleophils	cool	Insectivore
211	Longnose dace	Rhinichthys cataractae			X	None	(non guarder) Lithophils	cool	Insectivore
342	Log perch	Percina caprodes			X	None	(non guarder) Psammophils	cool	Insectivore
208	Bluntnose minnow	Pimephales notatus			X	None	(guarder) Speleophils	warm	Omnivore

Table 39. Fish Species Status, Trophic, and Reproductive Guilds for Becketts Creek.
(Source: MTO Environmental Guide to Fish and Fish Habitat, 2006)

The following table summarizes the fish community found in Becketts Creek and their sensitivity to sediment and turbidity for reproduction, feeding, and respiration. The majority of fish species are low to moderately tolerant of sediment and turbidity for reproduction and feeding. Top predators and aggressive fish such as rock bass, largemouth bass and perch rely on sight for catching their prey. Most fish in the system have an intolerance to turbidity for respiration, although some are tolerant and for some species it is not known what the sensitivity is.

Fish Species Sensitivity to Sediment/Turbidity for Becketts Creek

MNR Code	Common Name	Scientific Name	Reproduction	Feeding	Respiration
163	White Sucker	Catostomus commersoni	M	L	H
182	Northern redbelly dace	Phoxinus eos	M	L	L
141	Central mudminnow	Umbra limi	M	M	L
281	Brook stickleback	Culaea inconstans	L	M	unknown
212	Creek chub	Semotilus atromaculatus	M	H	H
313	Pumpkinseed	Lepomis gibbosus	L	M	unknown
311	Rock bass	Ambloplites rupestris	L	H	unknown
317	Largemouth bass	Micropterus salmoides	L	H	H
331	Yellow perch	Perca flavescens	M	H	unknown
342	Log perch	Percina caprodes	M	M	H
233	Brown bullhead	Ameiurus nebulosus	L	L	L
198	Common shiner	Luxilus cornutus	M	M	unknown
341	Johnny darter	Etheostoma nigrum	M	M	unknown
210	Blacknose dace	Rhinichthys atratulus	M	M	H

209	Fathead minnow	Pimephales promelas	L	L	unknown
211	Longnose dace	Rhinichthys cataractae	M	M	H
208	Bluntnose minnow	Pimephales notatus	M	L	unknown

Table 40. Fish Species Sensitivity to Sediment/Turbidity (High, Moderate, Low, unknown) for Becketts Creek (Source: MTO Environmental Guide to Fish and Fish Habitat, 2006)

3.2.9 Jock River

Invertebrate Sampling Sessions

Freshwater benthic macroinvertebrates, or more simply "benthos", are animals without backbones. These animals live on rocks, logs, sediment, debris and aquatic plants during some period in their life. The benthos includes crustaceans such as crayfish, mollusks such as clams and snails, aquatic worms and the immature forms of aquatic insects such as stonefly and mayfly nymphs. Benthos represents 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.

As a result of the high level of interest in the “Benthic Invertebrate Sampling/ID Session” in 2006, another was held on June 10th at Jock River Landing. This session taught the importance of aquatic invertebrates as part of the food chain and their role as bioindicators of aquatic heath. Volunteers learned the basics of the OBBN protocol (Ontario Benthos Biomonitoring Network), the various methods of capture, and how to process and identify many different species. In total eighteen eager volunteers attended and contributed 54 hours toward the program.

3.3 Community Stream Cleanups

3.3.1 Rideau River

The City Stream Watch Program joined forces with the Urban Rideau Conservationists (URC) to help clean the Rideau River as part of their “Mother’s Day Cleanup” held on May13th, 2007. The URC received a grant from the City of Ottawa to carry out this cleanup and recruited a number of partners from around the City of Ottawa. Long time City Stream Watch supporter, Monterey Inn Resort and Conference Centre, provided sandwiches, vegetable platters and beverages for hungry volunteers at the end of the day.

In total, over 120 volunteers attended this event, which aimed at cleaning from Rideau Falls to the Carleton University area. Volunteers walked the banks, waded the near shore areas, and cleaned nearby parks to help rid the Rideau of unnatural waste and debris. City Stream Watch volunteers focused on the deeper areas of the river where other volunteers could not reach. A flotilla of four canoes manned by Stream Watch technicians and volunteers paddled up and down the Rideau from St. Paul University to the Bank St. bridge and tried to remove all unnatural debris. Items such as construction equipment, scrap metal, food wrappers, plastic bags, styrofoam, tires, scrap lumber and even an 8 foot tall bird feeder were removed.

The annual Mother's Day Cleanup put on by the Urban Rideau Conservationists is a great event. The Rideau River needs annual cleanups such as these to help maintain the health and beauty of one of Ottawa's natural treasures.

To learn more about the "Mother's Day Cleanup" in 2008 and other work by the Urban Rideau Conservationists on the Rideau River please visit: http://urbanrideauconserve.blogspot.com

3.3.2 Sawmill Creek

On September 23rd, City Stream Watch volunteers teamed up with members of Heron Park Community Association and National Defence Headquarters Fish and Game Club to cleanup Sawmill Creek as part of TD Canada Trust – Great Canadian Shoreline Cleanup. The Vancouver Aquarium started the Great Canadian Shoreline Cleanup over 12 years ago, and with support from the TD Canada Trust, the program has grown from a local beach cleanup to a national program with participants in every province and territory. Each September, hundreds of thousands of participants from around the world join Canadians to clean up their shorelines. Figure 66 shows the stretches of creek that were successfully cleaned by the volunteers at the Great Canadian Shoreline Cleanup (GCSC).

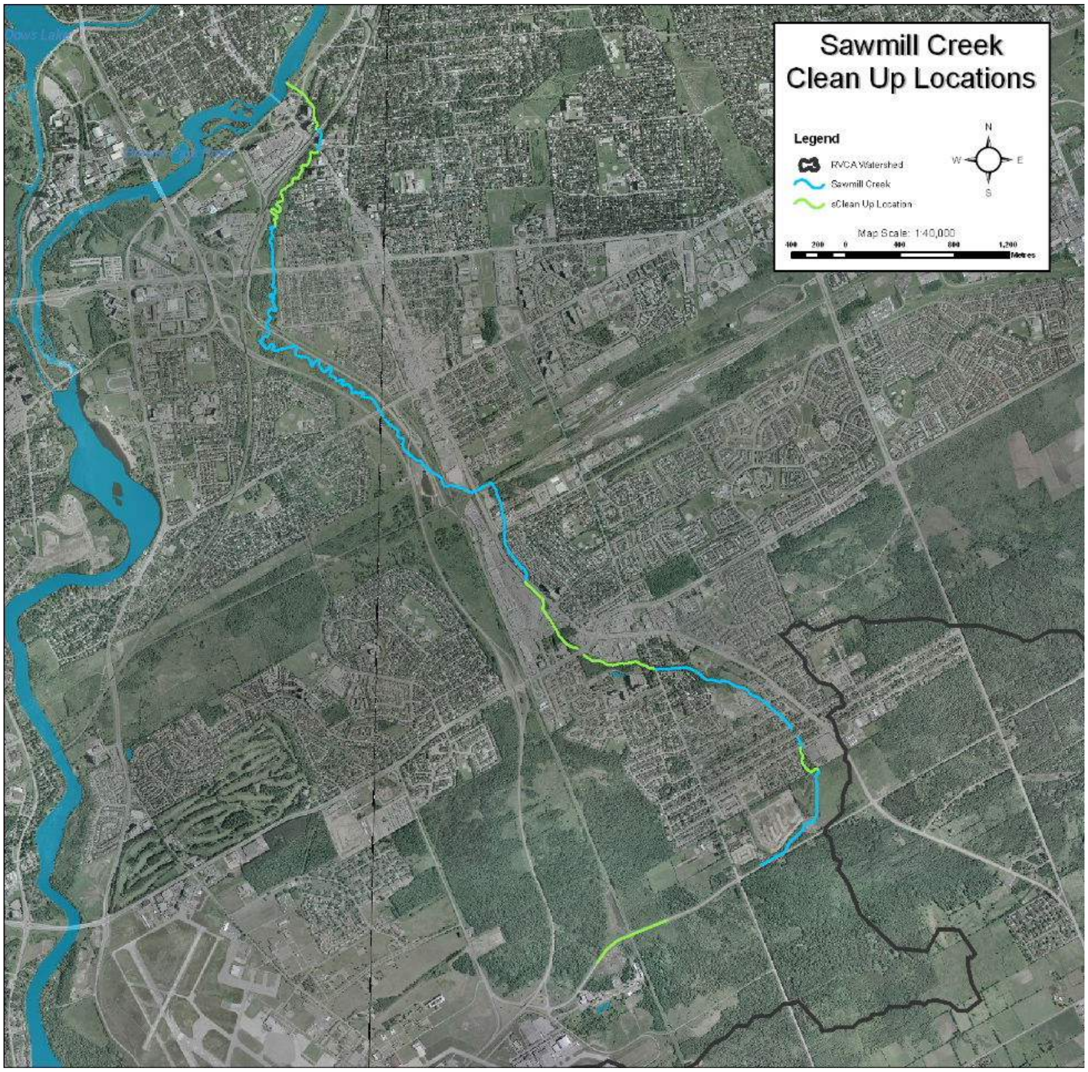

Figure 66. Map of Sawmill Creek Showing Sections Cleaned in 2007.

Councillor Clive Doucet kicked off the event by offering some words about the environmental importance of Ottawa's local streams along with assisting with the cleanup effort by providing an extra set of hands. Volunteers focused on five polluted sites, which extended from the Bank & Lester Road area to the Rideau River. Again this year, due to community interest, a section of the Lester Road wetland area, between the Airport Parkway and Albion Rd, was also cleaned. This was necessary due to litter which collects along the road and eventually ends up in the surrounding wetlands.

After a morning on the stream, volunteers were treated to a delicious lunch provided by the Monterey Inn Resort and Conference Centre, who is a long time supporter of the program as well as the first carbon neutral Company in Canada.

This year, Stream Watch volunteers joined over 40,000 other Canadians as part of the Great Canadian Shoreline Cleanup. A total of 34 volunteers from the community contributed 136 hours (combined) to cleaning Sawmill Creek.

3.3.3 Taylor Creek

City Stream Watch joined forces with the Fallingbrook 4th Orleans Scouts on Octoboer 13 to clean up a section of Taylor Creek from St. Joseph Blvd. to Princess Louise Falls (green).

Figure 67. Map of Taylor Creek Showing Sections Cleaned in 2007.

The goal of the cleanup was to emphasize the importance of local urban streams and the need to ensure they are healthy and natural for everyone to enjoy. A total of 16 scouts turned out despite the rain and cleaned approximately half a kilometre of stream.

This stream section is heavily polluted with unnatural debris and a cleanup was long overdue. Scouts removed items such as a number of tires, four bikes, plastic bags and scrap metal. Everyone worked hard and the stream has never looked better.

After cleaning the stream, the scouts were treated to hot chocolate and various prizes awarded to recognize their hard work, which were donated by Bushtukah Great Outdoor Gear in Westboro.

3.3.4 Graham Creek

On October 20, the 19th Nepean-Briargreen Scouts waded through Graham Creek in the west end to help clean approximately a one-kilometre stretch from Richmond Road to Baseline Road in the Nanaimo Park area.

Figure 68. Map of Graham Creek Showing Sections Cleaned in 2007.

Four scouts and two troop leaders removed all un-natural debris from a one-kilometre stretch of Graham Creek. Items removed from the stream included scrap metal, garbage cans, plastic bags, and countless food wrappers. After a morning of hard work the scouts were treated to a pizza lunch provided by City Stream Watch.

A huge thank you goes out to the scouts and leaders who participated and assisted in organizing these cleanups. The City Stream Watch program is pleased to help deliver new projects for communities to get involved with and build on its partnerships to help make Ottawa a better place.

3.4 Riparian Planting Projects

Riparian zones are the vegetated transition areas between aquatic and terrestrial habitat. They make up one of the most important aspects of stream health because they protect surface water from polluted runoff, siltation and most importantly, erosion. Riparian zones also offer very important habitat for many fish and wildlife species. Healthy riparian zones are densely populated, and thus have an intricate root system that helps to stabilize the bank and prevent erosion. In a stream surrounded by a healthy riparian zone, sediment pollution is controlled. Waterbodies that have lost this essential vegetation require rehabilitation projects such as these to help restore stream health.

It is crucial for landowners who live around water to leave a natural buffer of vegetation between their property and the water edge. Removing this vegetation eliminates root systems, which are required to stabilize banks, and increases runoff, which allows pollutants and silt to degrade habitat for aquatic life. For more information on how to naturalize your property and eliminate erosion of your property visit "Living By The Water Project" on the web.

3.4.1 Sawmill Creek – Planting Project Update

City Stream Watch, in cooperation with Heron Park Community Association has completed two phases of a shoreline rehabilitation project on Sawmill Creek. The goal of this project is to restore a failed bank on the east side of the stream just north of Heron Road. Phase I planting was done in 2005 where 350 small shrubs were planted along a failed bank to help re-vegetate the lower areas of the bank failure near the stream. Phase II was completed in the spring of 2006 with the planting of 600 more trees along the upper sections of the bank failure and in areas where more planting was necessary.

No planting was done in 2007 in order to give the plants a chance to grow for a year. Below is a comparison of the site in 2005 and a picture taken late summer, 2006.

2005 Pre-planting - Prior to Phase I Planting

2006 Post-planting – Phase II Complete

Figure 69- Sawmill Creek Planting Site in Heron Park.

This site will be monitored and a Phase III planting may be initiated if erosion has continued or if damage has occurred to the young trees.

3.4.2 Graham Creek

Based on recommendations in the 2006 Annual Report, Phase II of a riparian planting project was carried out in the spring of 2007 on an eroded bank on Graham Creek. Figure 70 shows where Phase II of this planting project was completed.

Figure 70- Air Photo of Graham Creek Planting Site in Andrew Haydon Park.

In 2006, 50 small shrubs were planted along the bank. Due to storm events in the spring and fall some plants were damaged. Phase II of the planting project was undertaken in 2007. The goal was to further rehabilitate the eroded section along the stream in Andrew Haydon Park. Two volunteers from the program successfully planted 100 red osier, white spruce and highbush cranberry along the bank on the east side of the stream. Planting efforts were completed on May 17, 2007.

Below is a comparison of a picture taken in 2006 before planting and a picture taking in the summer of 2007.

2006 Pre-planting *2007 Post-planting*

Figure 71- Graham Creek Planting Site in Andrew Haydon Park.

This stream section is found in a well-used city park and some grass areas are cut close to the stream, thereby reducing riparian buffers. After discussion with park maintenance crews, an area above the eroded bank is now blocked off and will no longer be cut. This will allow natural regeneration of plant species to supplement our planting efforts. The Graham Creek planting site will be monitored and accessed for impacts or evidence of further erosion. New rehabilitation efforts will be initiated if necessary.

To view a slideshow presentation of the 2007 riparian planting initiatives visit: http://www.rideauvalley.on.ca/programs/streamwatch/

3.4.3 Mosquito Creek

The Mosquito Creek bank rehabilitation project was based on community interest and concern for the health of the stream. Phase II of this planting project was carried out on May 17th on an eroded section just north of Spratt Road in the Riverside South community. Figure 72 shows the area that was planted.

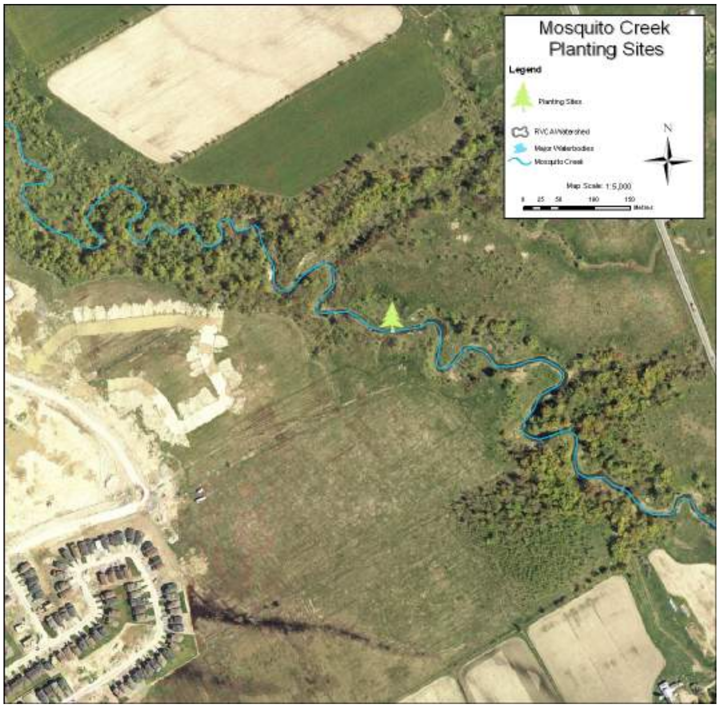

Figure 72- Air Photo of Mosquito Creek Planting Site in Riverside South.

In 2006 the program planted 150 small trees along the eroded banks of Mosquito Creek. In 2007 Phase II of planting along Mosquito Creek was carried out. Four volunteers assisted in planting 300 small shrubs along the bank to help stabilize bank, reduce sedimentation and promote regeneration of vegetation.

Below is a comparison of a picture taken in 2006 before planting and a picture taken post planting.

2006 Pre-planting

2007 Post-planting

Figure 73- Mosquito Creek Planting Site in Riverside South.

The planting along Mosquito Creek has been very successful and a natural vegetative community is being re-established. The site will be monitored and if necessary, new planting projects initiated.

3.4.4 Tree Donation

In the spring of 2007 a donation of 100 red osier dogwood was made from the City Stream Watch program to the Cardinal Creek Community Association (CCCA). The CCCA also received 200 small trees from the City of Ottawa's Community Partnership Tree Planting Program. These trees were planted along the walking path beside Cardinal Creek in the Springbridge neighbourhood.

4.0 A Look Ahead to 2008

The City Stream Watch program is currently planning projects for the 2008 season. Stream surveys run on a 5-year cycle and 2007 was the final year for new streams. In 2008 the program will be returning to streams sampled in 2003. This allows managers to update data and do comparative analysis to see if the stream has undergone change in the intervening years and to determine what may have caused those changes.

The streams to be re-surveyed in 2008 include Sawmill, Mud (Manotick), Cardinal and Black Rapids Creek. Figure 74 below, illustrates the stream watersheds in relation to the City of Ottawa. Maps of 2008 streams in relation to other years can be found in Appendix F.

The program is always looking to extend its efforts to new initiatives and goals. For the 2008 program various projects have been identified and plan to be implemented beginning in the spring. Some projects include:

- Stream Surveys on Sawmill, Mud, Cardinal and Black Rapids
- Biothon – A event where volunteers and professionals inventory all species in a given area over a day-long event
- Fish community sampling through seine netting and electrofishing
- Aquatic invertebrate sampling/ID sessions
- Flyfishing demonstration by OFS members along with invertebrate ID session
- Temperature profiling of 2008 streams
- Sawmill Creek Cleanup (Fall)
- Rehabilitation work on Sawmill Creek
- Mud Creek (tributary of Greens Creek) riparian planting
- Cardinal Creek stream cleanup
- Cardinal Creek rehabilitation work
- Cleanups on city streams as part of Canadian Rivers Day and Great Canadian Shoreline Cleanup.
- Mud Creek (Manotick) rehabilitation planting in lower reaches of stream

Many of these projects are explained further in the special projects section. New projects continue to be identified and included in the 2008 program in hopes of continuing the success of City Stream Watch as well as keeping volunteers interested in the program. For more information refer to the RVCA website (http://www.rideauvalley.on.ca) in the spring for updates and information on the program and how to sign up.

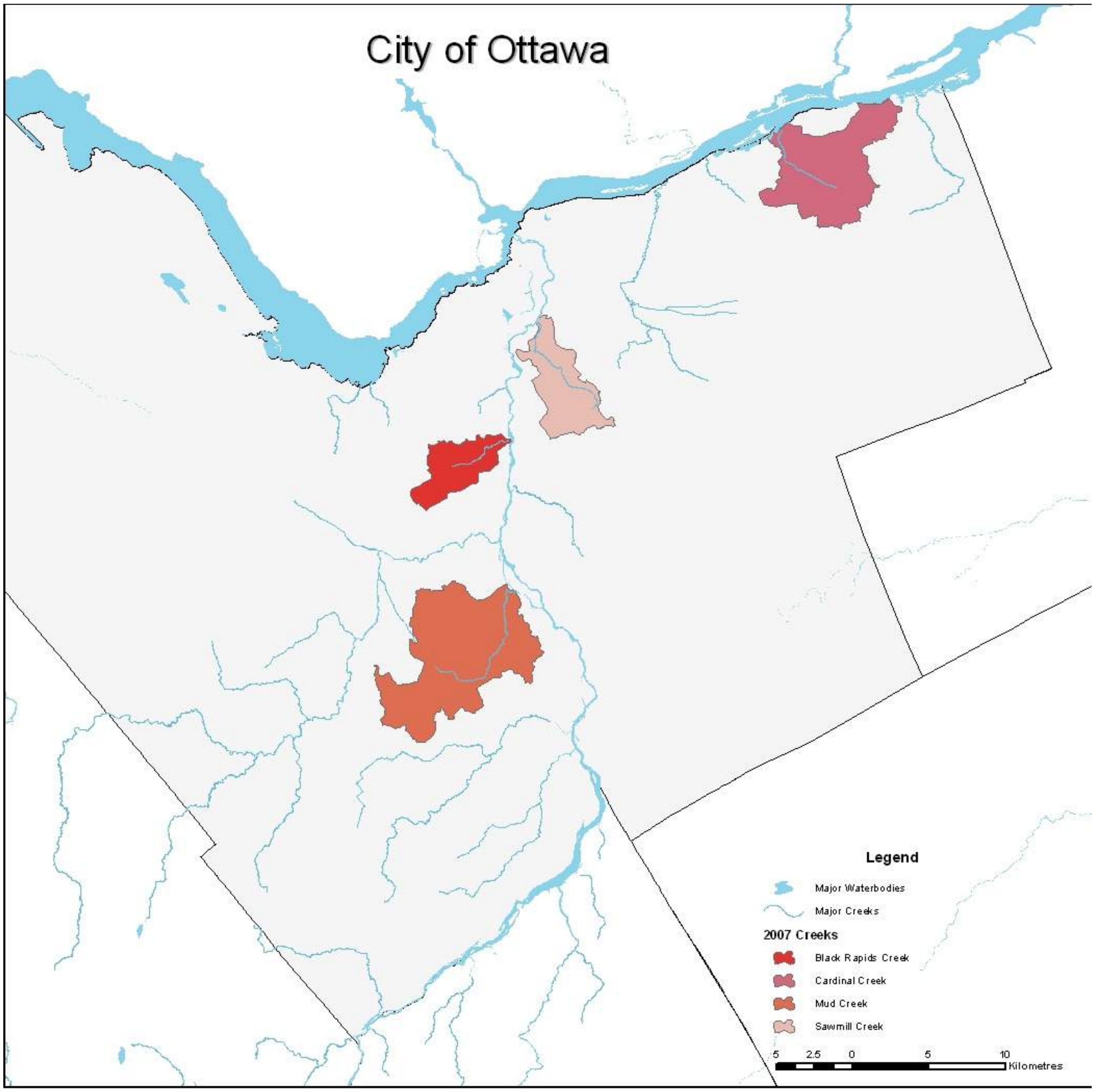

Figure 74 – Map of 2008 Sample Streams

4.1 Recommendations

It is important that City Stream Watch be sustained in order to inform, involve, and educate community residents on the state of urban creeks and streams, as well as to encourage restoration projects and sound stewardship practices. To this end, the City Stream Watch program should build on the successes achieved during the past five years. Through its ongoing activities, temporal and spatial environmental trends of streams in the Ottawa area may be observed and recorded. The data will complement work conducted by a few municipal and watershed-based programs, most of which do not monitor the smaller urban streams that are the focus of this program. As well, the intrinsic value of community-based environmental monitoring and stewardship through personal involvement.

4.2 Program Improvement

The following are recommendations to improve the program.

- Continue to develop creative means in order to contact, as well as ensure, the involvement and ongoing interest of all concerned members of the community.
- Build a strong relationship with collaborative groups and continue to look for new organizations which could strengthen the program
- Employ a summer student to assist with fieldwork and allow more flexibility to match volunteer schedules
- Continue contacting community early in the year to maximize both the involvement and the diversity of participants.
- Foster relationships with environmentally oriented groups (i.e. Scouts Canada) to facilitate student involvement.
- Continue to run stream cleanups on city streams to enhance fish and wildlife habitat and maintain the natural beauty of our city's streams.
- Develop a more aggressive approach to youth recruitment to entice educators and highschool students to participate in the program. Hours of participation can be counted toward the student's volunteer hours to graduate.
- Develop new, creative projects to keep volunteer interest high
- Continue to ensure that the needs of the participating community are satisfied as they relate to their continued involvement in the program.
- Attract funding opportunities from outside funders for the program and rehabilitation projects
- Develop relationships with universities to attract students to participate to gain experience
- Reformat Annual Report into small stream specific reports to cut down on size and make more reader friendly.

4.3 Special Projects

The following are projects that have been developed from information obtained through monitoring, and could be implemented through City Stream Watch or other community based environmental initiatives.

Table 41 Identifies possible rehabilitation projects where were developed through monitoring.

Table 41. City Stream Watch – Project Proposals

Location	Issue	Picture	Remediation Strategy	Expected Results
Sawmill Creek just north of Hunt Club Road.	Woody debris has accumulated at a culvert area along Sawmill Creek. The wood has dammed the stream, thereby pooling water above the culvert making it impossible for the culvert to allow high water to pass. This, in turn, has caused the stream to alter its course, creating an erosion and siltation problem. Secondly a cement wall has failed, as seen in the picture, creating a flow deflector, which is severely eroding the east bank.		• Get City of Ottawa involved to provide equipment to remove woody debris and old culvert • Utilize existing volunteer base of the City Stream Watch program to participate in this rehabilitation effort. • Plant shrubs and trees to stabilize banks to help stop erosion.	• Community involvement • Enhance fish and wildlife habitat • Reduce erosion of banks • Eliminate possibility of bank failure causing tree collapse into stream

Location	Issue	Picture	Remediation Strategy	Expected Results
Sawmill Creek just North of Heron Park Community Centre (Heron Rd.).	A bank failure just upstream of the Phase II planting site on Sawmill Creek is an area of concern. This bank failure has caused many trees to fall into the stream, causing blockages as well as a considerable amount of siltation.		Utilize existing volunteer base of the City Stream Watch and residents from the Heron Park area to participate in this rehabilitation effort. Interested members can monitor progress of areas planted and report back to the coordinator with updates.	• Promote community involvement in rehabilitation projects • Enhance fish and wildlife habitat; • Enhance the creek's aesthetic qualities. • Erosion control

Location	Issue	Picture	Remediation Strategy	Expected Results
Many sections of Sawmill Creek (South Keys Shopping Area of primary concern)	The accumulation of garbage and refuse along various stretches of Sawmill Creek is a ongoing problem. Not only does man-made pollution take away from the aesthetic quality of the stream but it limits and degrades the quality of fish and wildlife habitat.		Utilize existing volunteer base of the City Stream Watch to participate in annual cleanup efforts. Sawmill Creek cleanup days should be carried out in the summer and fall to facilitate the removal of garbage and to rid the stream and riparian areas of unnatural debris.	• Community involvement; • Enhancement of fish and wildlife habitat; • Enhancement of the creek's aesthetic qualities.

Location	Issue	Picture	Remediation Strategy	Expected Results
Mud Creek (Greens Trib) – Various Locations	Erosion of stream banks along Mud Creek is common problem along the system. There is little disturbance along the stream although a lot of erosion was observed throughout sampling. Mud Creek would benefit from planting along its banks and in some areas the clearing of wood debris jams.		Utilize existing volunteer base of the City Stream Watch program and recruit volunteers from neighbouring communities to participate in this rehabilitation effort.	• Community involvement • Effective stream bank protection; • Reduce siltation of fish spawning habitat; • The enhancement of conditions for natural colonization of existing plant community; • Produce streamside wildlife habitat.

Location	Issue	Picture	Remediation Strategy	Expected Results
Graham Creek at Andrew Haydon Park. On right bank just downstream from bridge.	The planting site on Graham Creek in Andrew Haydon Park needs to be continually monitored. It is important that a small buffer is left from grass cutting operations to help the bank re-establish a plant community.		Phase I and II of planting along this section have been completed. It is important to monitor the site to ensure plants continue to grow. If plant die-off is observed or damage is done to the site new planting initiatives will be initiated.	• Effective stream bank protection; • Reduce siltation of fish spawning habitat; • Enhance conditions for natural colonization of existing plant community; • Produce streamside wildlife habitat. • Enhancement of the creek's aesthetic qualities.

Location	Issue	Picture	Remediation Strategy	Expected Results
Mosquito Creek downstream of Spratt Road in the Riverside South Subdivision	Erosion of stream banks along Mosquito Creek is a problem. Heavy development over the past few years along with creation of roads, bridges, and residential properties has increased runoff and caused significant erosion along the stream. Planting is completed and continued monitoring is important.		Phase I and II of planting along this section have been completed. It is important to monitor the site to ensure plants continue to grow. If plant die-off is observed or damage is done to the site new planting initiatives will be initiated.	• Enhance fish and wildlife habitat; • Enhance the creek's aesthetic qualities. • Protect stream bank. • Erosion control.

Location	Issue	Picture	Remediation Strategy	Expected Results
Sawmill Creek just North of Heron Park Community Centre (Heron Rd.).	Phase I and Phase II planting took place on in 2005 and 2006 to help rehabilitate a failed bank on Sawmill Creek. Planting work has been successful although monitoring needs to be done often to ensure planting communities are successful. If trampling and further erosion are noticed, more planting may be needed.		Utilize existing volunteer base of the City Stream Watch program and residents from the Heron Park community to monitor success of planning site and report back to the coordinator with updates.	• Promote community involvement in rehabilation projects • Enhance fish and wildlife habitat; • Enhance the creek's aesthetic qualities. • Erosion control

Location	Issue	Picture	Remediation Strategy	Expected Results
Mud Creek (Greens Trib) – Various Locations	There are areas where the accumulation of garbage and debris has collected in debris jams along Mud Creek. Some pollution is large and has been in and around the stream for a long time. Man-made pollution takes away from the aesthetic quality of the stream and also limits and degrades the quality of fish and wildlife habitat.		Utilize existing volunteer base of the City Stream Watch to participate in annual cleanup efforts. Sawmill Creek cleanup days should be carried out in the summer and fall to facilitate the removal of garbage and to rid the stream and riparian areas of unnatural debris.	• Community involvement; • Enhancement of fish and wildlife habitat; • Enhancement of the creek's aesthetic qualities.

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Appendix A

Volunteer Interest Form
Rideau Valley Conservation Authority
City Stream Watch Program

Date (Contacted): ____

Volunteer: Name: ____

Phone #:____

E-mail: ____

Have you ever helped with the Stream Watch program before?

- ❑ **No**
- ❑ **Yes** **When/Where:**____
____

Do you have a preference as to what project you would work on?

- ❑ **No**
- ❑ **Yes** **Circle Interests:** **Tree Planting**
Stream Rehab Work
Stream Cleanups
Stream Assessment

Do you have a particular area that you would prefer to work?

- ❑ **Yes** **Circle: Greens Creek Tribs (East End, Orleans)**
Cranberry Creek (South, Kars)
Nepean Creek (Nepean)
Others: __________________________________
- ❑ **No Preference**

Are there specific days you would prefer to sample?

- ❑ **Weekends**
- ❑ **Weekdays**
- ❑ **No Preference**

Are there specific times you would prefer to sample?

- ❑ **Mornings**
- ❑ **Afternoons**
- ❑ **Evenings**
- ❑ **No Preference**

Will you be/did you attend a training session?

- ❑ **May 12th, 2007**
- ❑ **May 26th, 2007**
- ❑ **Won't be attending/did not attend**

Appendix B

MACRO STREAM ASSESSMENT

Date:_____________
Time: Start________ Photo Upstream_____
Section:__________ Photo Downstream_____
Start: UTM Easting _________ Northing _________
End: UTM Easting__________Northing_________

Stream Survey Overview (100m)

Name of Stream/River/Drain:____

Water Temp (ºC): S_____ M______ E______ Overhead Cloud Cover (%): dense(75-100)____

Stream Width (m): S_____ M_____ E______ part open(25-75)___

Stream Depth (m): S_____ M_____ E______ open (0-25) ____

Air Temp (ºC): _______

Overall

1. Has this section of water been altered? Yes No
If yes, would you generally characterize this altered section as being:

In a "**natural**" condition, but with significant alterations by man? ________

An "**altered**" waterway, with considerable human influences, but still featuring significant "natural" portions? ________

A "**highly altered**" stream section, with few areas which could be considered natural stream environments? ________

2. What would you say is the general land use pattern along this 100m section? %

Active agriculture	_______
Pasture	_______
Abandoned agricultural fields	_______
Residential	_______
Natural (i.e forests, meadows, wetlands, etc.)	_______
Industrial/Commercial	_______
Recreational	_______
Other (please specify) _________________________	_______

INSTREAM SUBSTRATE

3. Having surveyed the substrate, how would you characterize overall the type of substrate in the stream? %

Bedrock-exposed rock ______
Boulders-rock over 25cm (10in) ______
Rubble-8-25cm (3-10in) ______
Gravel-0.2-8cm (1/8-2in) ______
Sand- >0.05-0.10 will feel some grit ______
Silt- 0.05 feels soft like a powder ______
Clay- 0.01greasy between fingers ______
Muck-combo of sand, silt, clay, marl, organic ______
Detritus-organic material ______
Other (i.e. marl) ______

4. Is the substrate type fairly: Homogenous/Heterogeneous?

INSTREAM STRUCTURE

5. How would you characterize the type of major structures in this 100m stretch? (Relative to each other) %

Woody debris ______
Downed trees ______
Boulders ______

B) How would you characterize the stream morphology in this 100m segment? %

Pools ______
Riffles ______
Reaches ______

6. A) Active beaver dams #______
Abandoned beaver dams #______

B) Tree cropping: (Check one)
Extensive ________
Common ________
Low ________
None ________

C) Beaver Lodges #_______

INSTREAM VEGETATION

7. How would you characterize the abundance of aquatic vegetation? (Check one)

Extensive (choked with weeds) ______
Common (more than 50% vegetation) ______
Normal (25-50% vegetation) ______
Low (less than 25 % vegetation) ______

Rare (instream plants Afew and far between@) ______

8. Are there dominant types of instream vegetation? Yes No

	%
Algae	________
Leafed submergents	________
Narrow submergents	________
Lily-type plants	________
Narrow emergents	________
Leafed emergents	________
Other (please Specify) ______________________________	________

TRIBUTARIES

9. Are there any major tributaries? Yes No

10. If yes: How many does this 100m section have? #_______

11. Do any of these tributaries obviously alter the character of the stream after they enter it? Yes No

12. If yes: In what way (i.e. pollution) ______________________________________

13. What are the types of tributaries? (Check one)

Small intermittent natural streams ________
Large permanent natural streams ________
Other: (eg. Ditch/ravine) ______________________________________

14. Are any of the tributaries worthy of being surveyed further? Yes No
If Yes, Which one(s): ______________________________________

15. Is this tributary flowing at present? Yes No

BANK CHARACTERISTICS

16. In terms of erosion of banks, how would you generally characterize this section? %

Stable (little or no erosion) _______
Unstable (eroding, little or no vegetation) _______
Undercut banks _______

17. In general, what is the composition of banks along this section? %

	Left Bank	Right Bank
Bedrock- exposed rock	______	______
Boulders- rock over 25 cm (10in)	______	______
Rubble- 8-25cm (3-10in)	______	______
Gravel- 0.2-8cm (1/8-2in)	______	______
Sand- **>**0.05-0.10 will feel some grit	______	______
Silt- 0.05 feels soft like a powder	______	______
Clay- 0.01greasy between fingers	______	______
Organic	______	______
Gabion Cage	______	______
Rip Rap Stone	______	______
Logs and Trees	______	______
Bridge Structures	______	______

Other: (please specify) ___________________________ ______ ______

18. How would you characterize the general steepness of banks along this section? %

	Left Bank	Right Bank
Very Steep (>25%)	_____	_____
Steep (16%-25%)	_____	_____
Moderate (9%-15%)	_____	_____
Low (4%-8%), gently sloping banks	_____	_____
Broad flat banks, (0-3%) little slope	_____	_____

19. What are the dominant vegetation type along the banks? %

	Left Bank	Right Bank
Coniferous trees	_____	_____
Hardwood trees	_____	_____
Dead trees	_____	_____
Woody Shrubs	_____	_____
Tall grasses	_____	_____
Short grasses	_____	_____
Agricultural crops	_____	_____
Wetland vegetation	_____	_____
Ferns	_____	_____
Mosses	_____	_____
Other (please specify) __________________	_____	_____

20. Are their any agricultural impacts? Yes No

If yes, what kinds:

a) **Cattle access**	Yes	No	extreme (>20m) moderate (10-20m) low (<10m)
b) **Field erosion**	Yes	No	observed / potential
c) **Agricultural drain**	Yes	No	
d) **Barnyard runoff**	Yes	No	
e) **Tile Drain**	Yes	No	How Many?______
f) **Distance to field from stream**	_________m		

21. Did you notice any wildlife? Yes No

If yes, what kinds? (Check one or more)

Waterfowl	_______
Birds	_______
Mammals	_______
Reptiles/amphibians	_______
Fish	_______
Aquatic Insects	_______
Other	_______

Observed: ____

____

____

22. Is this 100m section fish habitat? Yes No
If yes, what class? (Check one or more)

1. **Critical** (nursery) _______
2. **Normal** _______
3. **Degraded** (drainage) _______

23. Did you observe any springs in this 100m stretch? Yes No

If yes, how many? #________

24. Did you notice any pollution in the stream or entering the stream? Yes No
If yes, which kinds:

a) Oil or gas trails in the water Yes No
b) Floating Garbage Yes No
c) Garbage on the stream bottom Yes No

Observed____
____

25. Are there any invasive species in the stream? Yes No
If yes, list them____
____
____

26. Dominant types of instream vegetation, if present, are__________________________
____
____

27. Are there any observed invertebrate species present in the stream? Yes No
If yes, identify____
____

28. Is there any visible angling pressure present within this section? Yes No
If yes, identify____
____

COMMENTS
____
____
____
____

NAME OF SURVEYORS:_________________________________
____
____
____

DATE INPUTTED INTO DATABASE ______________

Appendix C

Protocol Summary and Definitions

Descriptive Information at Top

Date is the date sampling occurred.

Time is the time sampling started.

Section is the section # of the current 100m of stream being sampled.

Starting and Ending UTM coordinates: UTM coordinates are needed for both the starting and ending points of the 100m sections. These are taken using the GPS receivers. The GPS supplies both an easting and northing. The UTM grid number is 18 for all of Eastern Ontario.

Upstream and Downstream Photos: Photos are taken at the starting and ending points of each 100m section. Please record the camera name and exposure number for each photo.
(ie. Sawmill 1, exposure 25).

Stream Survey Overview (100m)

Water temperature in °C at the starting point, middle, and end of the 100m section.

Stream width in meters at the starting point, middle, and end of the 100m section.

Stream depth in meters at the starting point, middle, and end of the 100m section.

Air temperature in °C

Overhead cloud cover in percent.

Overall

1. An **unaltered natural section of stream** is one characterized as having a series of meanders, pools, and riffles, with a significant amount of riparian (transitional zone between aquatic and terrestrial habitats that contains moist soils and lush plant growth) area.

   A **natural stream** can be altered in a number of ways:
   - shoreline can be armored to varying extents (retaining walls, rip-rap);
   - can be diverted;
   - riparian vegetation replaced by lawn, beaches, etc;
   - docks or other structures extending into the stream.

2. **Active agricultural:** refers to land that is currently being farmed.

   Pasture: refers to land being used by grazing livestock.

   Abandoned agricultural fields: refers to land previously, but not currently, farmed.

   Residential: refers to land occupied by homes.

   Natural: refers to unaltered land free from human development.

Industrial/Commercial: refers to land occupied by industry/businesses.

Instream Substrate

3. **Instream substrate** is the material that constitutes the stream bed.

4. It can be **homogenous** (all of one type), or **heterogenous** (diverse types).

Instream Structure

5. **Stream morphology** refers to the physical structure and shape of the stream.

6. **Active beaver dams** are those which are still functioning, while abandoned beaver dams are visible but are not holding back water.

   Tree cropping is the cutting down of trees by beavers.

   Beaver lodges are homes built by beavers out of sticks and muck.

Instream Vegetation

7. **Aquatic vegetation** refers to vegetation occurring within the stream.

   Extensive: weeds within entire stream

   Common: >50%

   Normal: 25-50%

   Low: <25%

   Rare: weeds very sparse

8. **Dominant types of instream vegetation** are dominant plant types that occur in the waterway.

   Algae: simple photosynthetic organisms, often covering substrate; feels slimy.

   Leafed submergents: completely underwater, these plants have leaves branching from the main stem.

   Narrow submergents: completely submerged sedges/grasses

   Lily-type plants: characterized by having a leaf floating on the surface attached to a main stem

   Narrow emergents: sedges/grasses with submerged roots and stems emerging from the water

   Leafed emergents: plants with submerged roots, stems emerging from the water with leaves attached to main stem.

Tributaries

9. **Tributaries** are waterways that flow into/enter the stream.

10. Total number of tributaries flowing into current 100m section.

11. Tributaries drain water into the stream, as well as anything suspended or dissolved in the water. Tributaries can alter the character of the stream in a number of ways, including **sediment deposition**, **nutrient loading**, **and other pollutants**.

12. How is the tributary altering the character of the stream.

13. **Intermittent natural streams** are natural streams that flow periodically throughout the year, usually in the spring and in times of high amounts of precipitation.

    Permanent natural streams are natural streams that flow year round.

14. Is the tributary significant enough to justify further surveying?

15. Is water entering the stream from the tributary?

Bank Characteristics

16. **Stable** means no sign of erosion.

    Unstable means signs of erosion.

    Undercut banks refers to the excavation of material under the vegetation on the bank by the stream.

17. **Bedrock** – exposed rock.

    Boulders – rock over 25 cm (10 in) in diameter.

    Rubble – rock between 8 cm and 25 cm (3 – 10 in) in diameter.

    Gravel – rock between 0.2 cm and 8 cm (1/8 – 2 in) in diameter.

    Sand – rock between 0.05cm and 0.2cm in diameter (feels gritty between fingers)

    Silt – approximately 0.05 cm in diameter (feels powdery/velvety between fingers)

    Clay – approximately 0.01cm in diameter (feels greasy between fingers)

    Organic – not of mineral origin.

    Gabion Cage – a square or rectangular cage filled with rocks used to armor a shoreline.

    Rip Rap Stone – chunks of broken concrete/brick used to armor a shoreline.

18. **Steepness** of the shoreline is represented by the general slope, calculated by the rise divided by the run multiplied by 100%.

19. **Coniferous trees**: evergreens

    Hardwood trees: deciduous

    Woody shrubs: shrubs with stems that are brown, hard and woody (not green and herbacious).

    Tall grasses: >1m

Short grasses: <1m

Agricultural crops: wheat, corn, soybeans, etc.

20. **Cattle access:** evidence of cattle using the stream, such as tracks or manure.

    Field erosion: evidence of excavation/deposition of material from fields in or around the stream

    Agricultural drain: a drainage ditch from agricultural fields entering the stream.

    Barnyard runoff: evidence of runoff from agricultural outbuildings entering the stream.

    Tile Drain: a tile is a perforated pipe buried under ground that drains an area. It usually drains water into the stream by a protruding pipe from the bank.

    What is the approximate distance from the stream to the field (if present).

21. **Waterfowl:** Ducks, geese, etc.

    Birds: Osprey, king fisher, etc.

    Mammals: Beaver, muskrat, weasels, mink, etc.

    Reptiles/amphibians: snakes, turtles, frogs, toads, salamanders, etc.

    Fish: minnows, bass, pike, perch, sunfish, etc.

    Aquatic Insects: water striders, whirligig beetles, dragonflies/nymphs, etc.

22. **Critical fish habitat** are areas that are directly responsible for the level of recruitment of individuals into a population. **Spawning habitat** are areas fish utilize for laying eggs.
    Pike spawning habitat includes submerged vegetation ie. grasses/sedges
    Nursery habitat are areas where young of the year individuals live. These are usually backwater areas out of current with vegetation/cover for protection against predators.

23. Springs are areas where groundwater flows out of the ground.

24. Is there any pollution in the stream, entering the stream, or near the stream?

25. **Invasive species** are non-native plant and animal species. See attached notes for invasive species in our area.

26. Are there any dominant types of instream vegetation species that you can identify?

27. Are there any invertebrate animals that you can identify ie. Crayfish, insects, etc?

Visible angling pressure includes presence of anglers, used/old fishing line, bait containers, lures, etc.

Appendix D

Equipment List / Stream Watch Crew (2 person minimum)

1 handheld GPS unit
1 60m Tape / 50-meter length of rope
1 meter stick
1 thermometer
1 clipboard with several stream assessment forms
2 Pencils
Insect repellent
Sunscreen
1 waders/person
1 camera
2 extra batteries for GPS unit
Bottled water
1 garbage bag

Appendix E

Landowner Permission Form

Dear Landowner:

The Rideau Valley Conservation Authority, in partnership with a collaborative of six other agencies

- City of Ottawa
- Heron Park Community Association
- National Defense HQ – Fish and Game Club
- Ottawa Flyfishers Society
- Rideau River Roundtable

is conducting surveys that are designed to document basic stream characteristics, including instream as well as bank characteristics of three city streams. This year's focus will be on Nepean Creek, Cranberry Creek, and Greens Creek tributaries including Mud and Ramsay. The survey examines and collects information regarding fish community/habitat, aquatic invertebrates, aquatic and riparian vegetation, bank stability, stream temperatures, etc.

The program is designed to increase public participation and awareness concerning the state of streams within the city. These efforts will provide officials with valuable information needed to better manage stream resources.

We seek your permission to carry out these surveys on the creeks adjacent to your land. The work will involve a crew of 2-5 people working for approximately 1 hour on the site. We will respect all private property and leave the site clean and with minimal disturbance.

If you would like more information on the project or have any concerns, feel free to contact me. To learn more about the program and view 2003 – 2006 reports, visit us on the web at:

www.rideauvalley.on.ca/programs/streamwatch/index.html

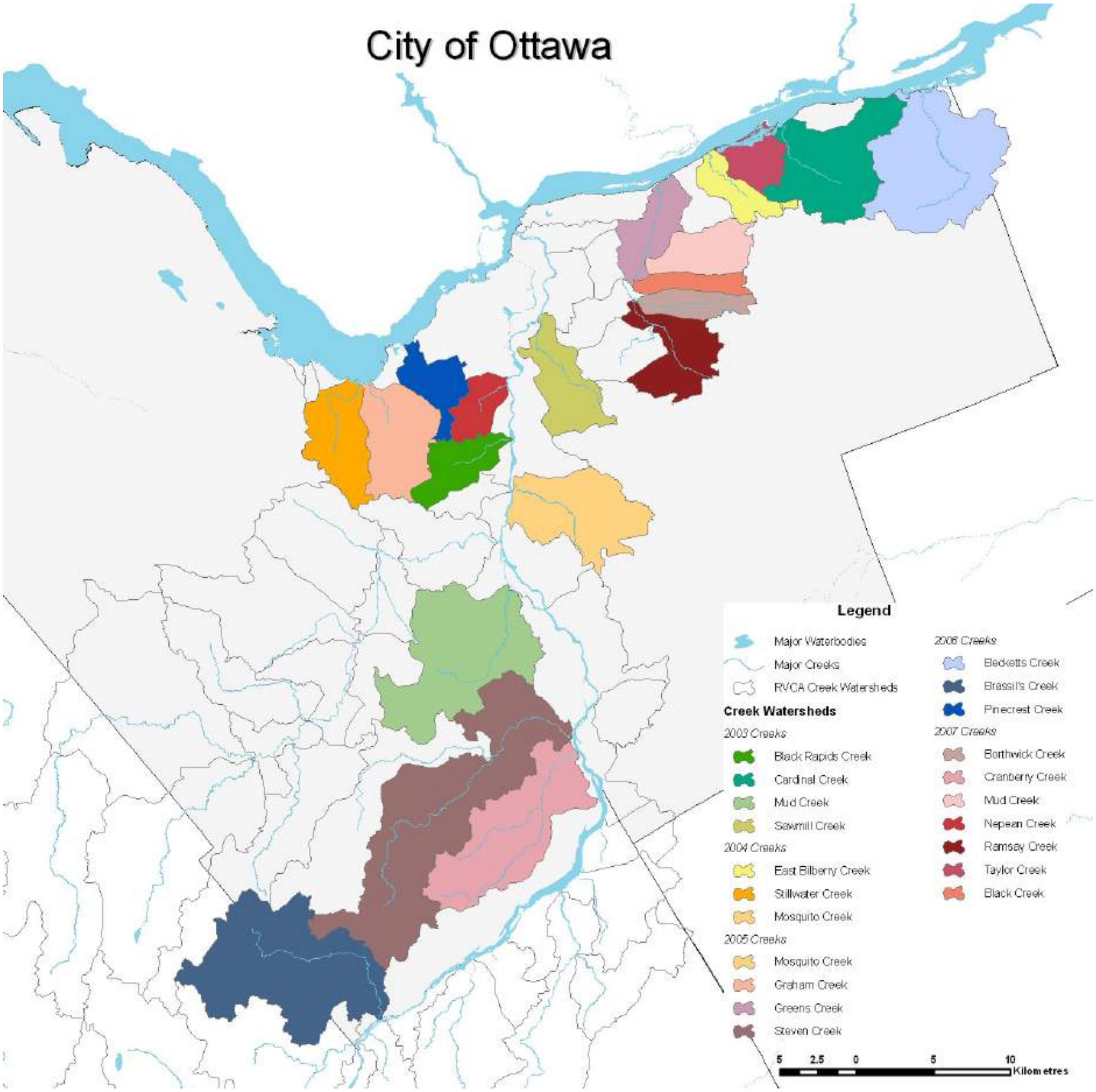
Thank you for your cooperation.

Grant Nichol
City Stream Watch Coordinator
Rideau Valley Conservation Authority
(613) 580-2424 Ext. 22886
Grant.Nichol@ottawa.ca

Jennifer Lamoureux
Aquatic and Fish Habitat Biologist
Rideau Valley Conservation Authority
(613) 692-3571 Ext. 1108
Jennifer.Lamoureux@rideauvalley.on.ca

Appendix F

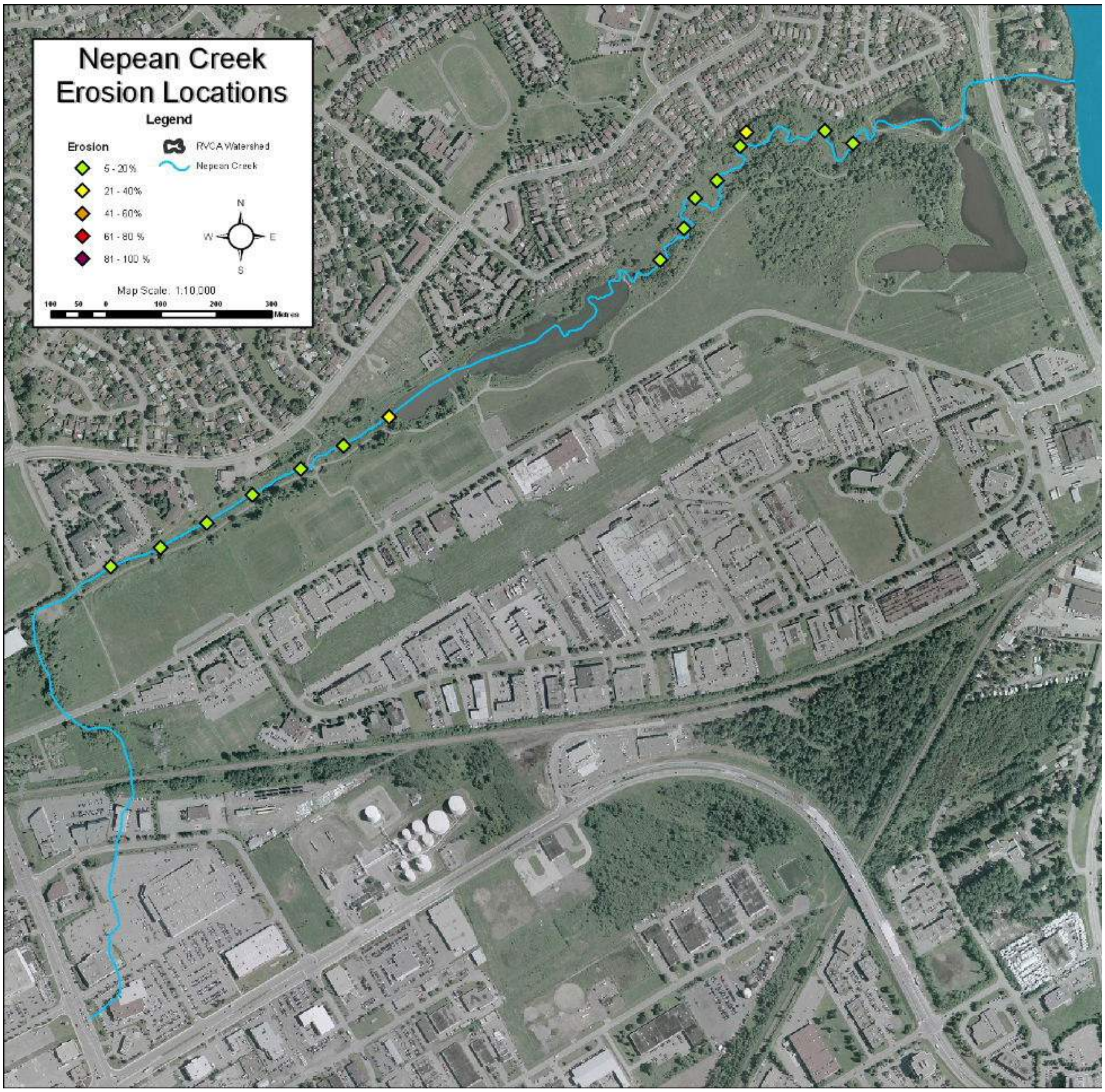
2003 to 2007 Stream Survey Creeks (Five year cycle stream selection)



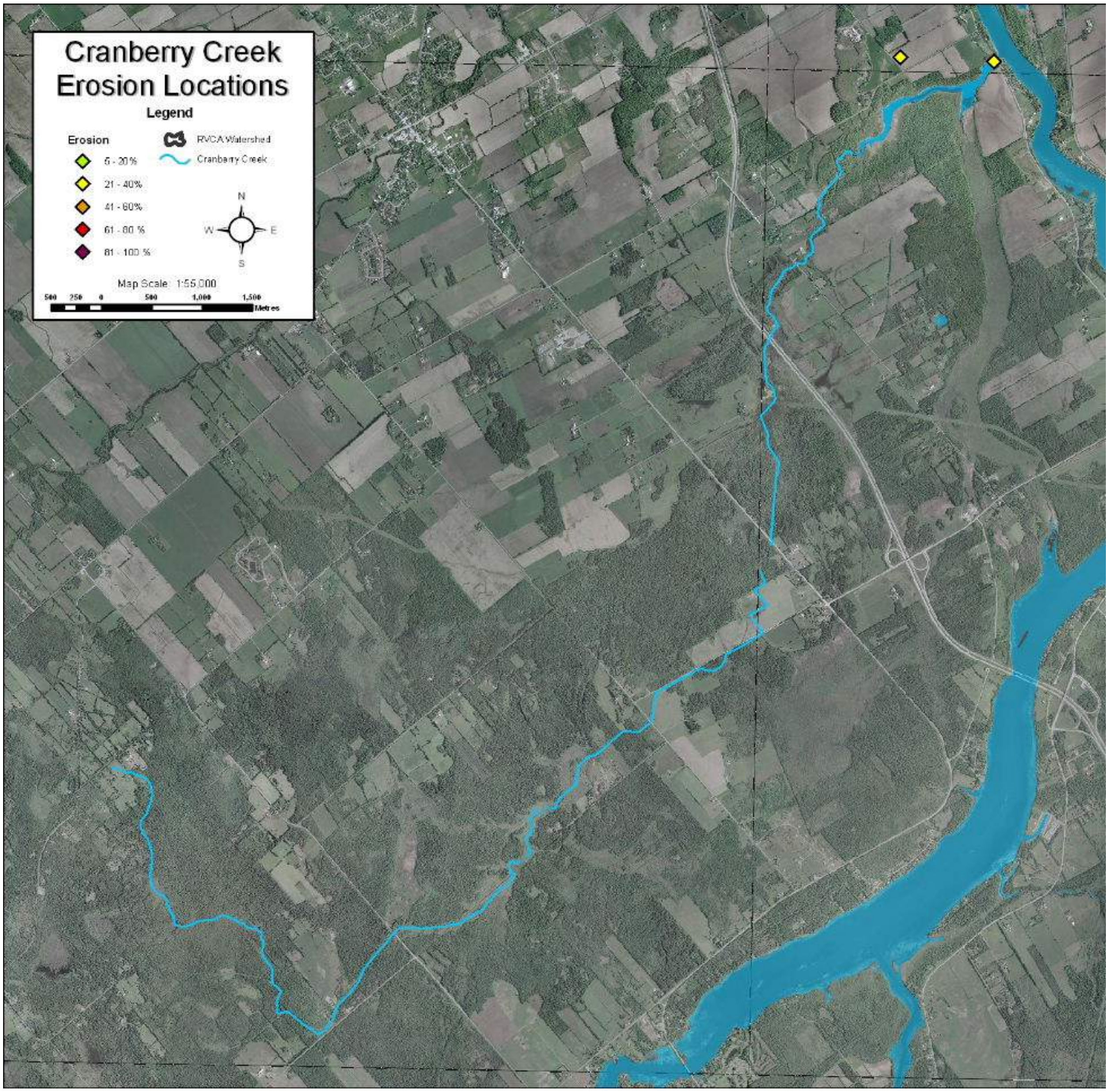
Appendix G

Map of Erosion Sites

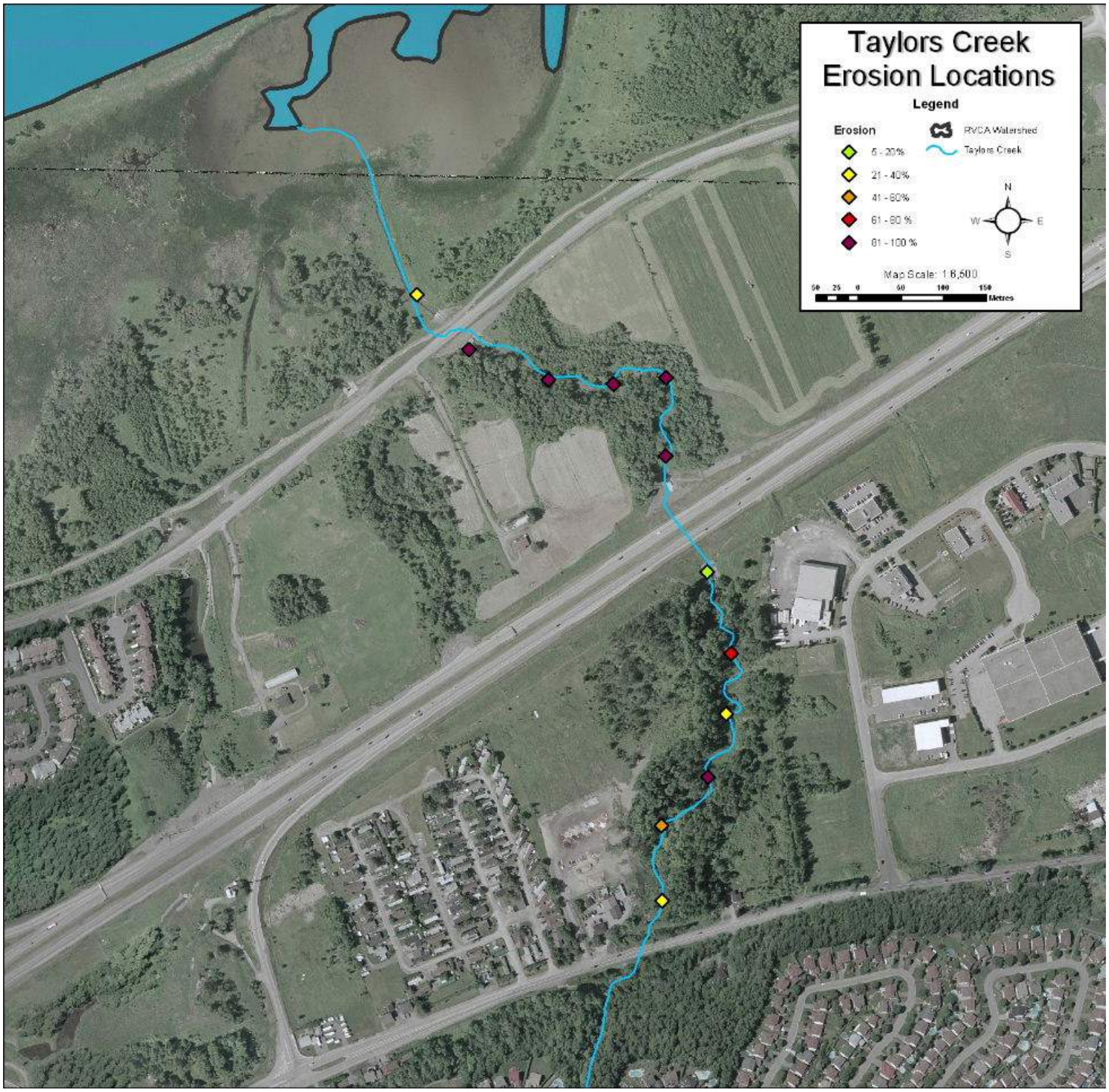
i) Nepean Creek Erosion



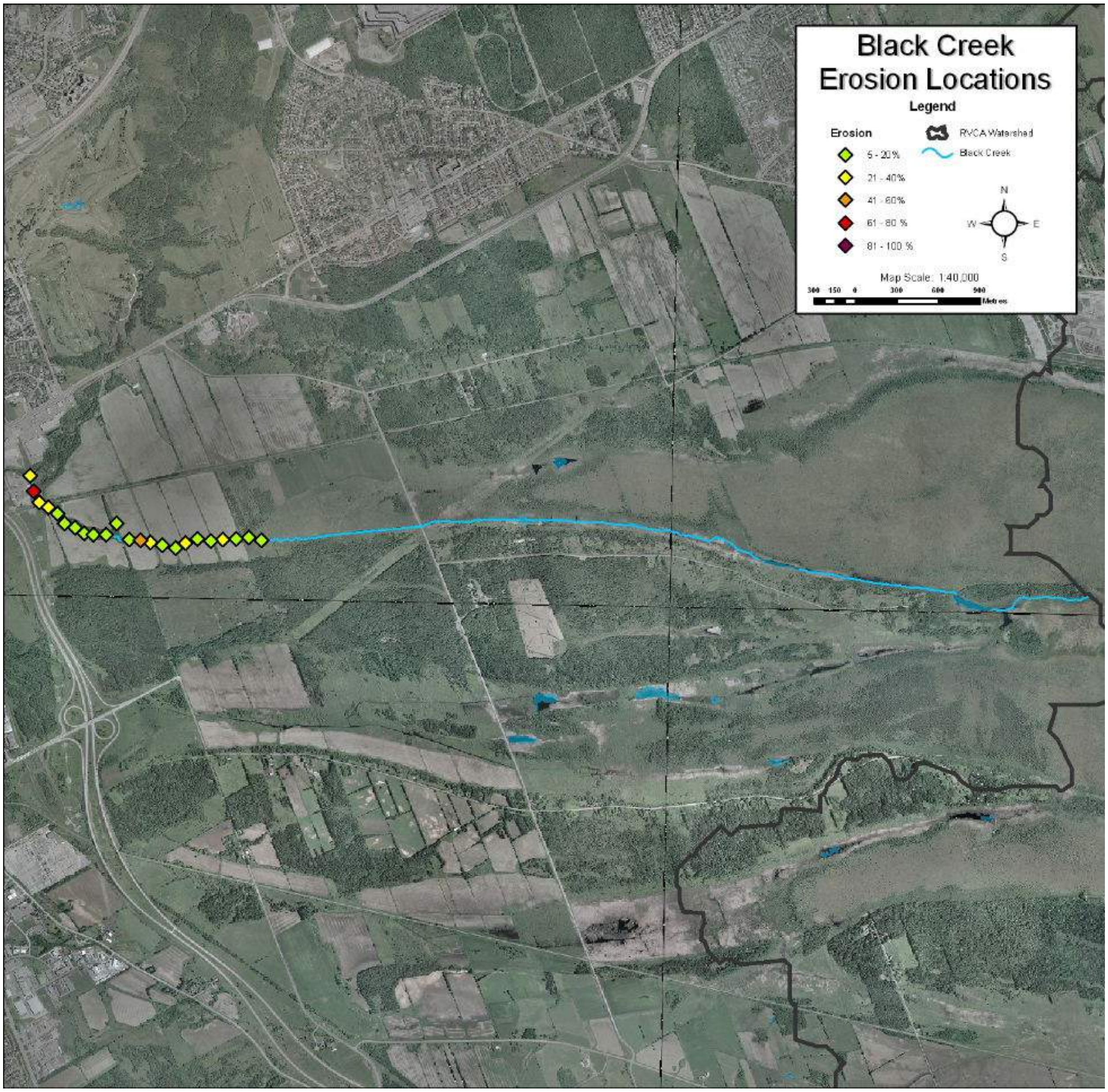
ii) *Cranberrry Creek Erosion*



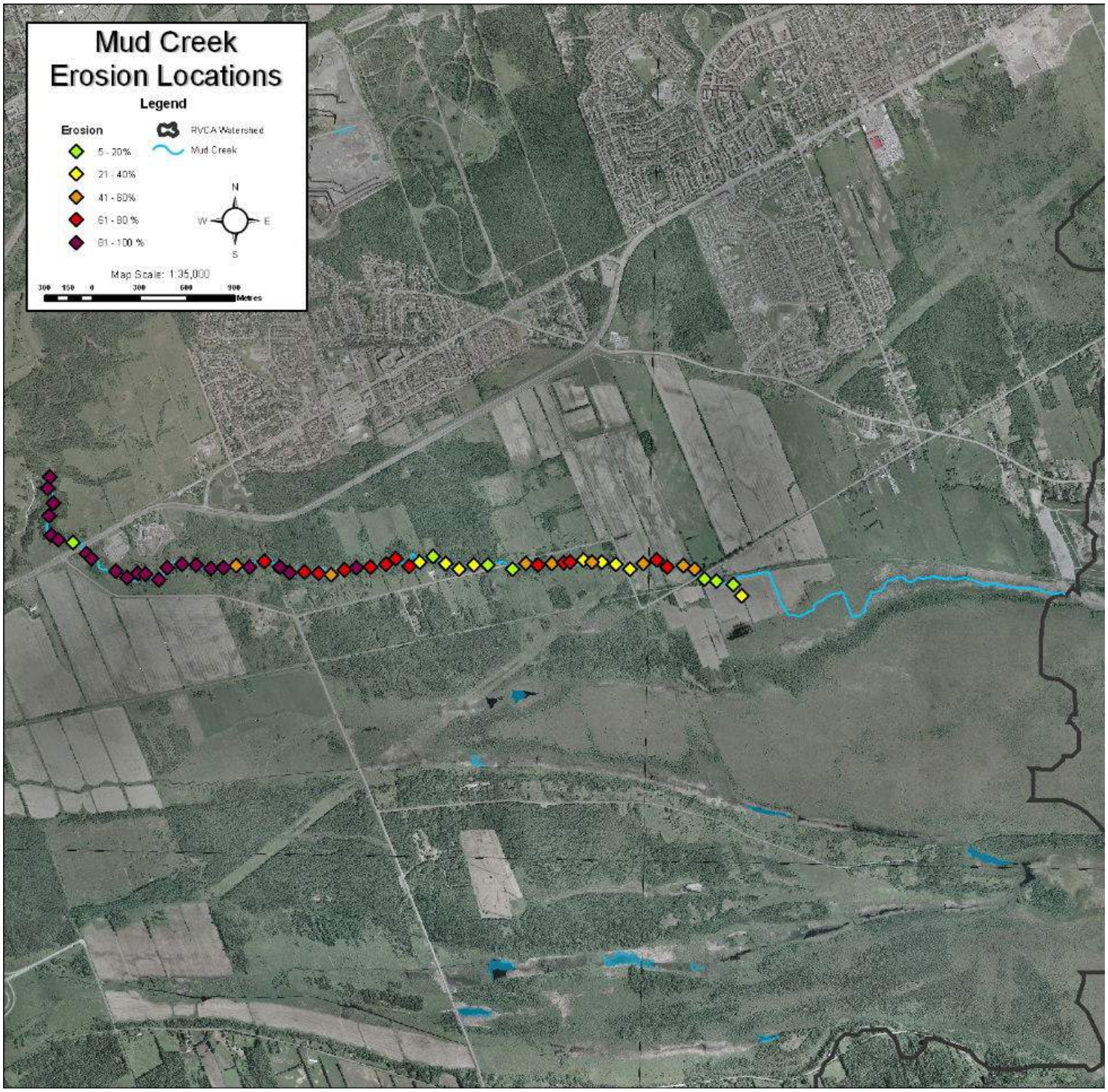
iii) Taylor Creek Erosion



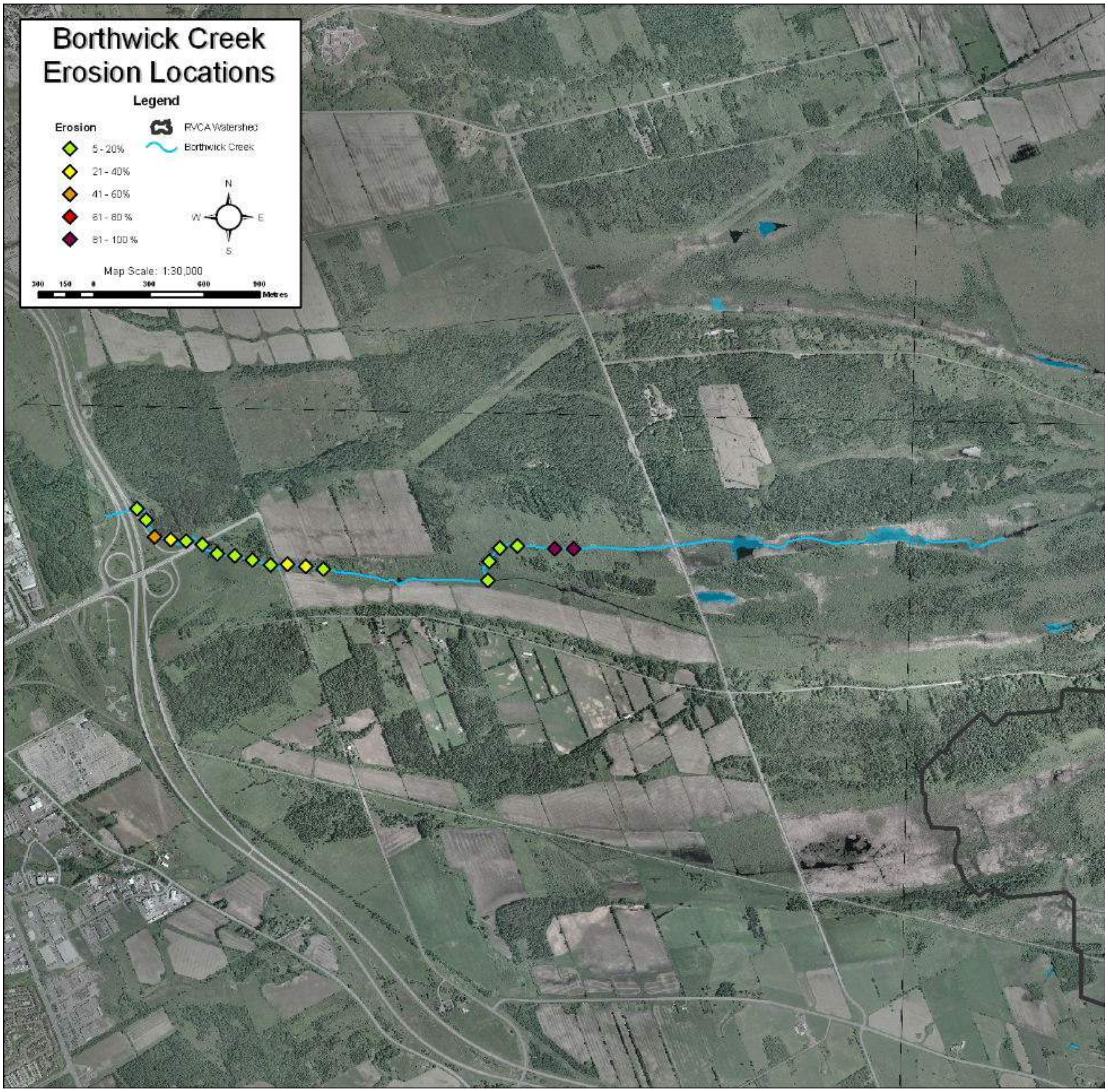
iv) *Black Creek Erosion*



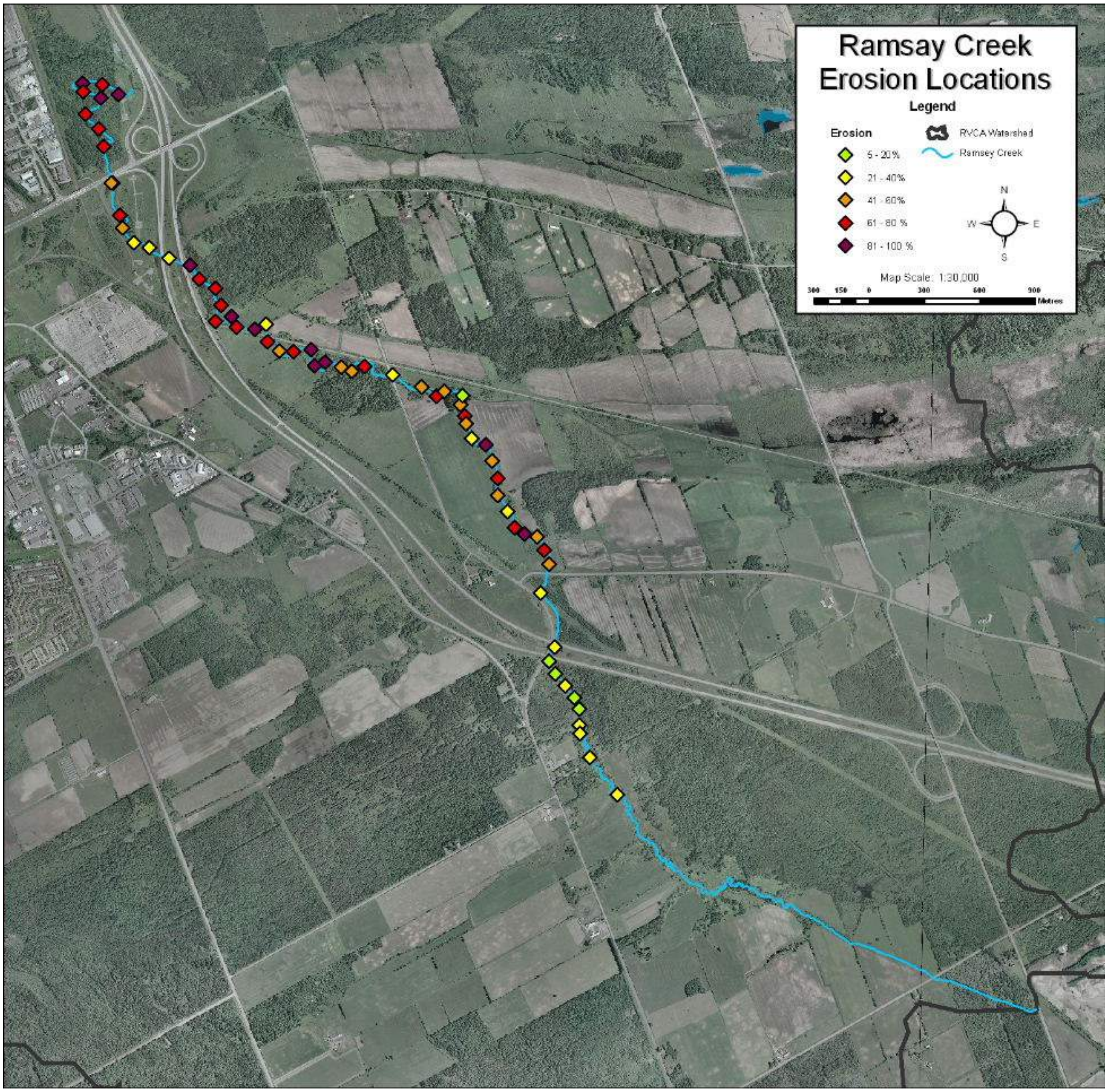
v) Mud Creek Erosion



vi) Borthwick Creek Erosion



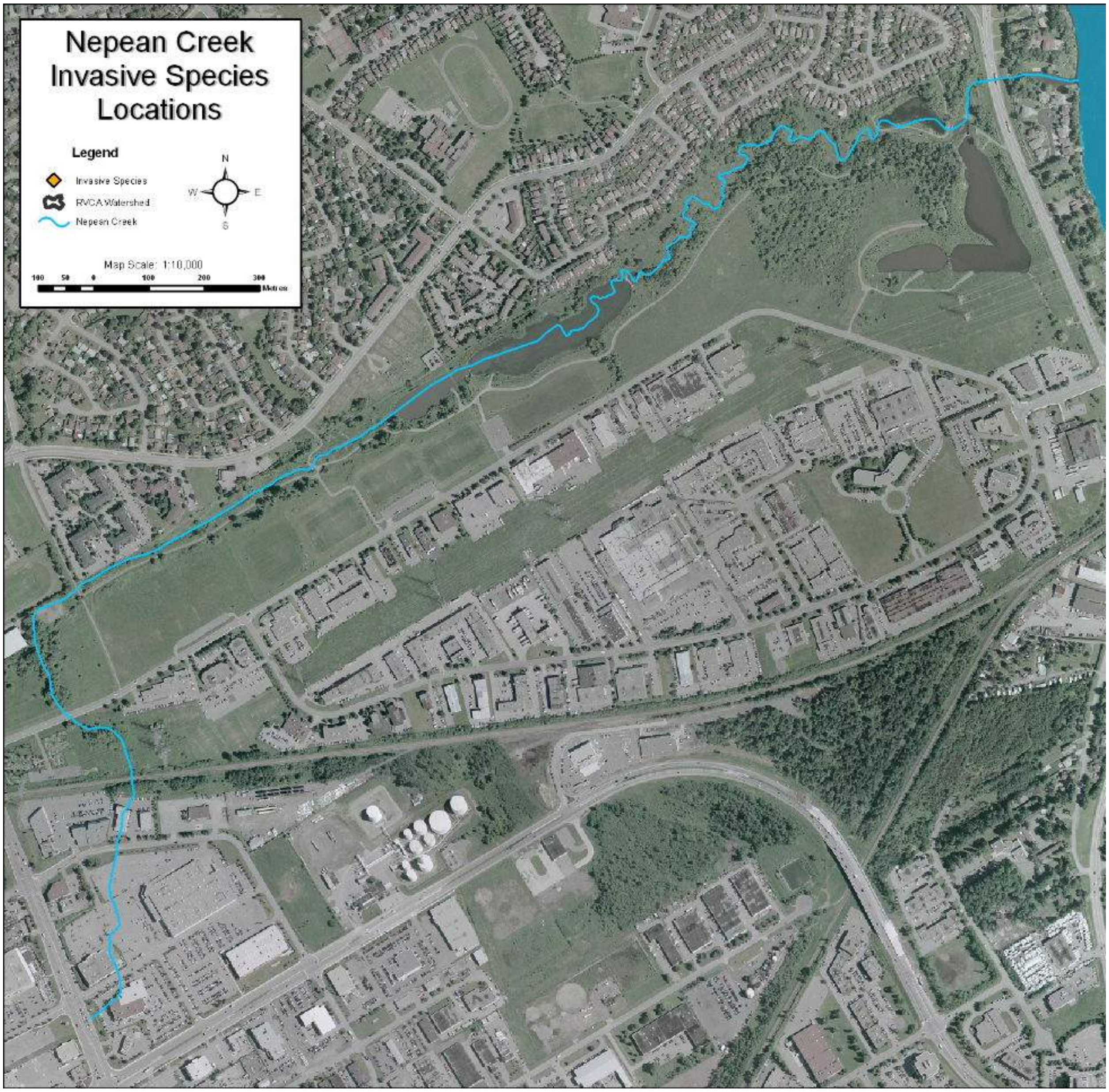
vii) Ramsay Creek Erosion



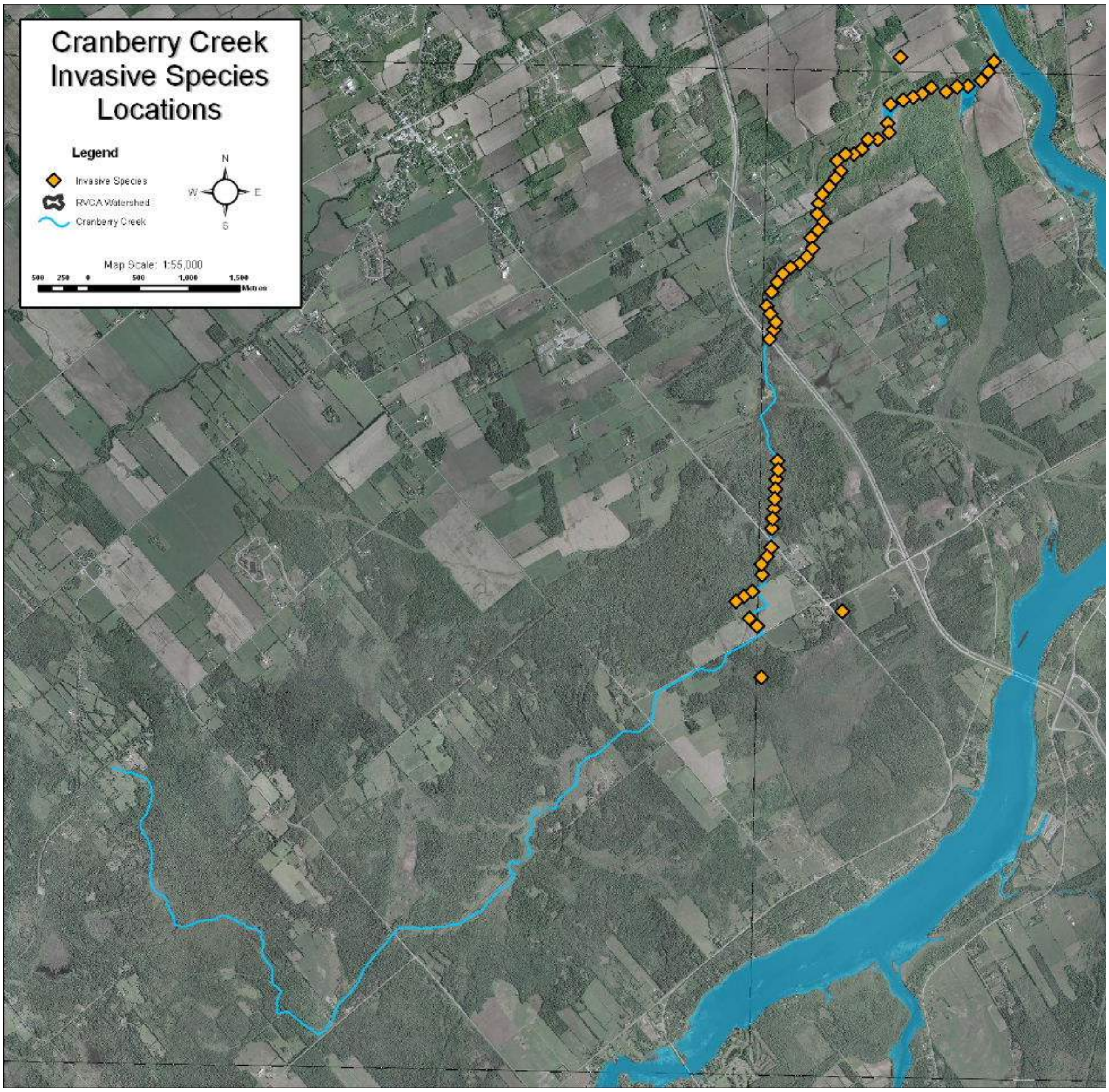
Appendix H

Maps of Invasive Species Areas

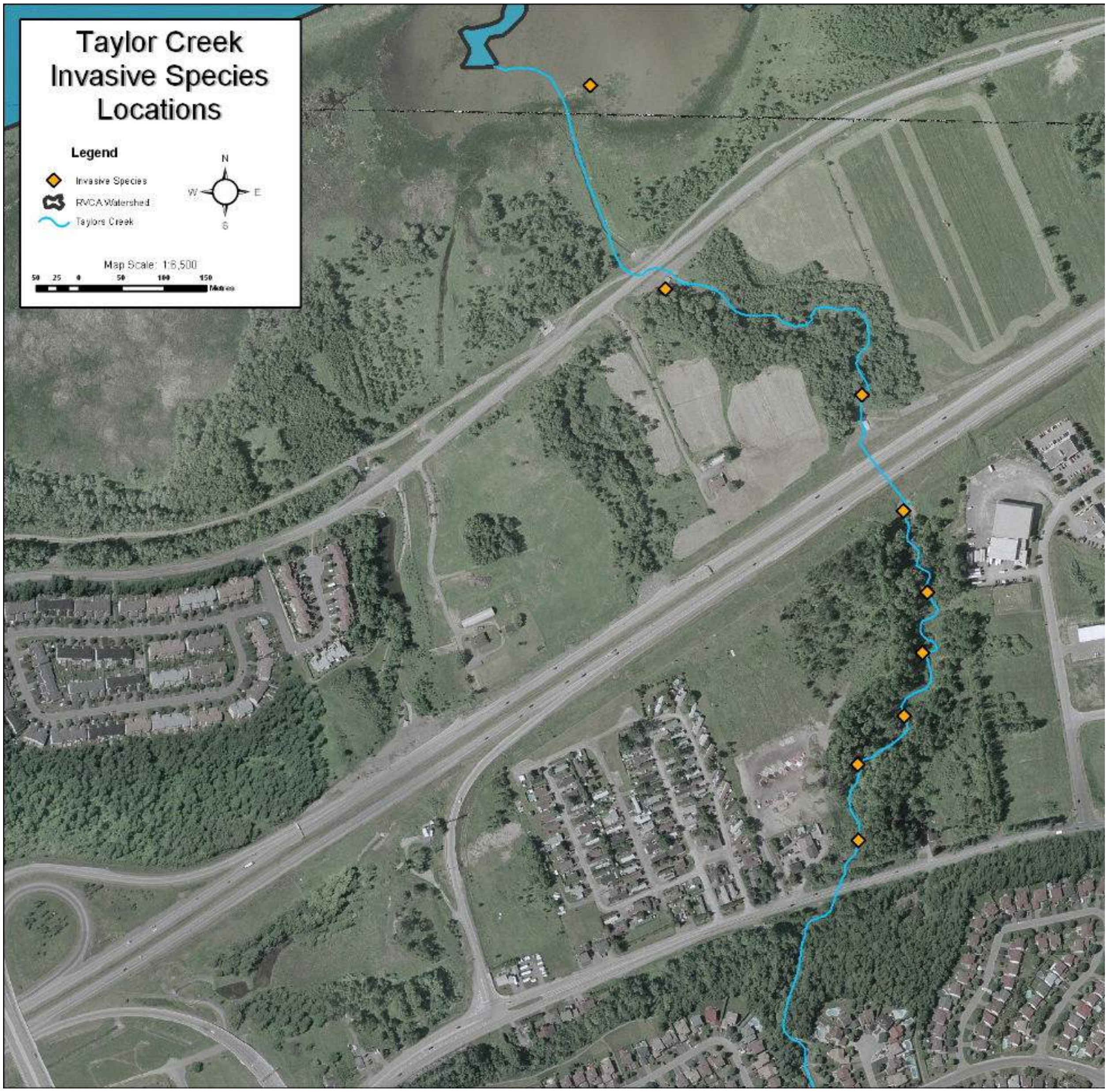
i) Nepean Creek Invasive Species Sites



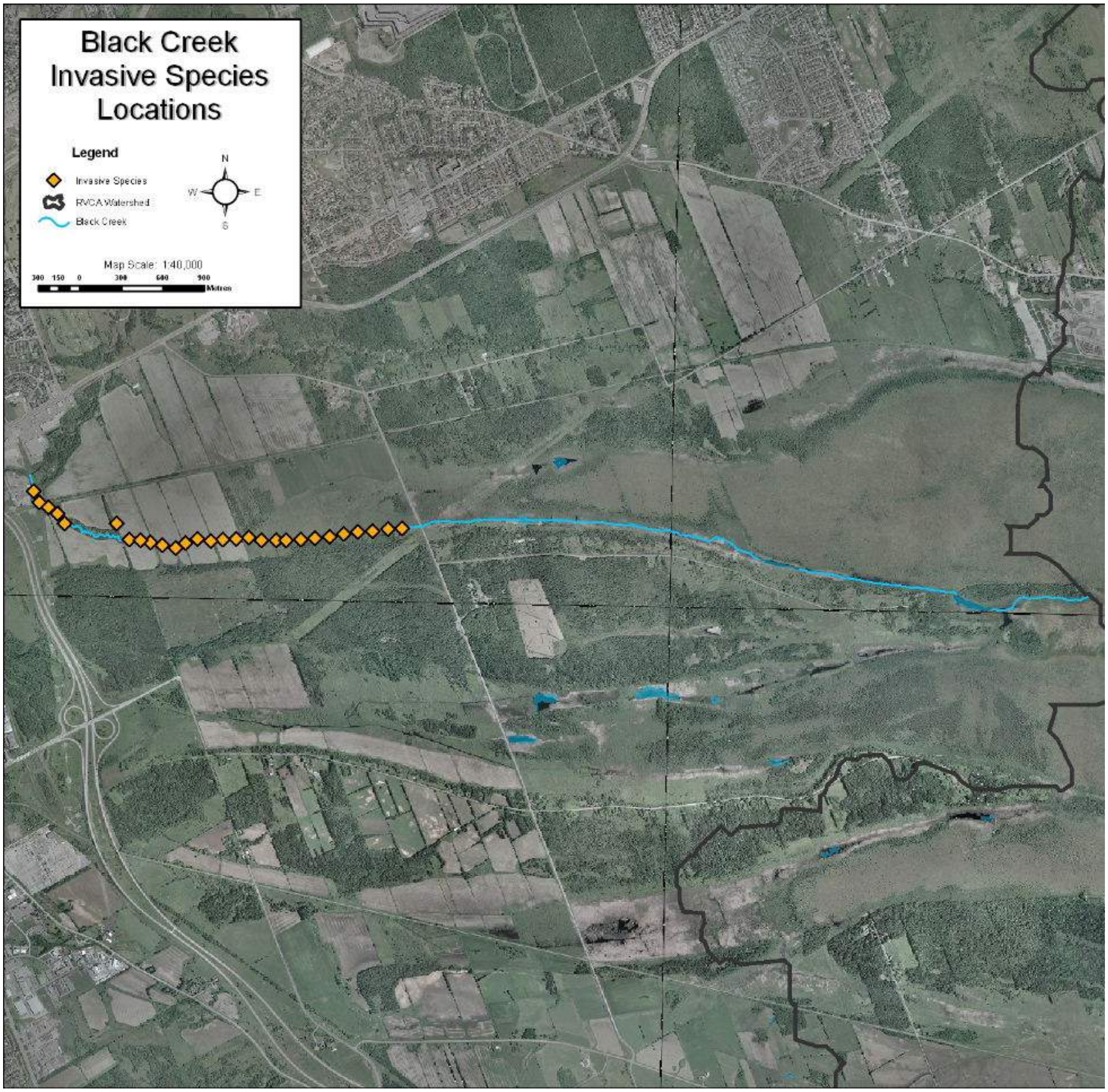
ii) Cranberrry Creek Invasive Species Sites



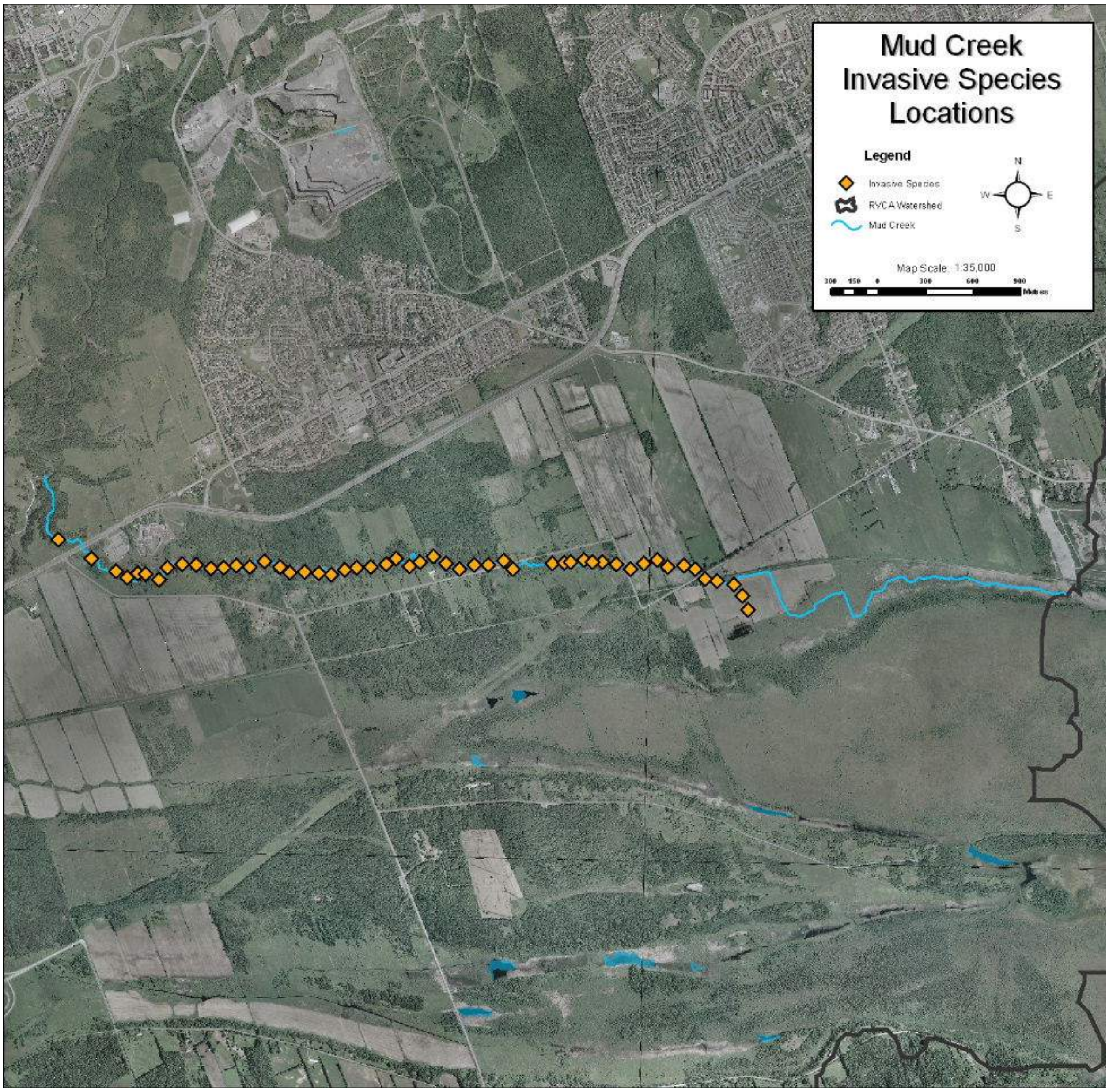
iii) Taylor Creek Invasive Species Sites



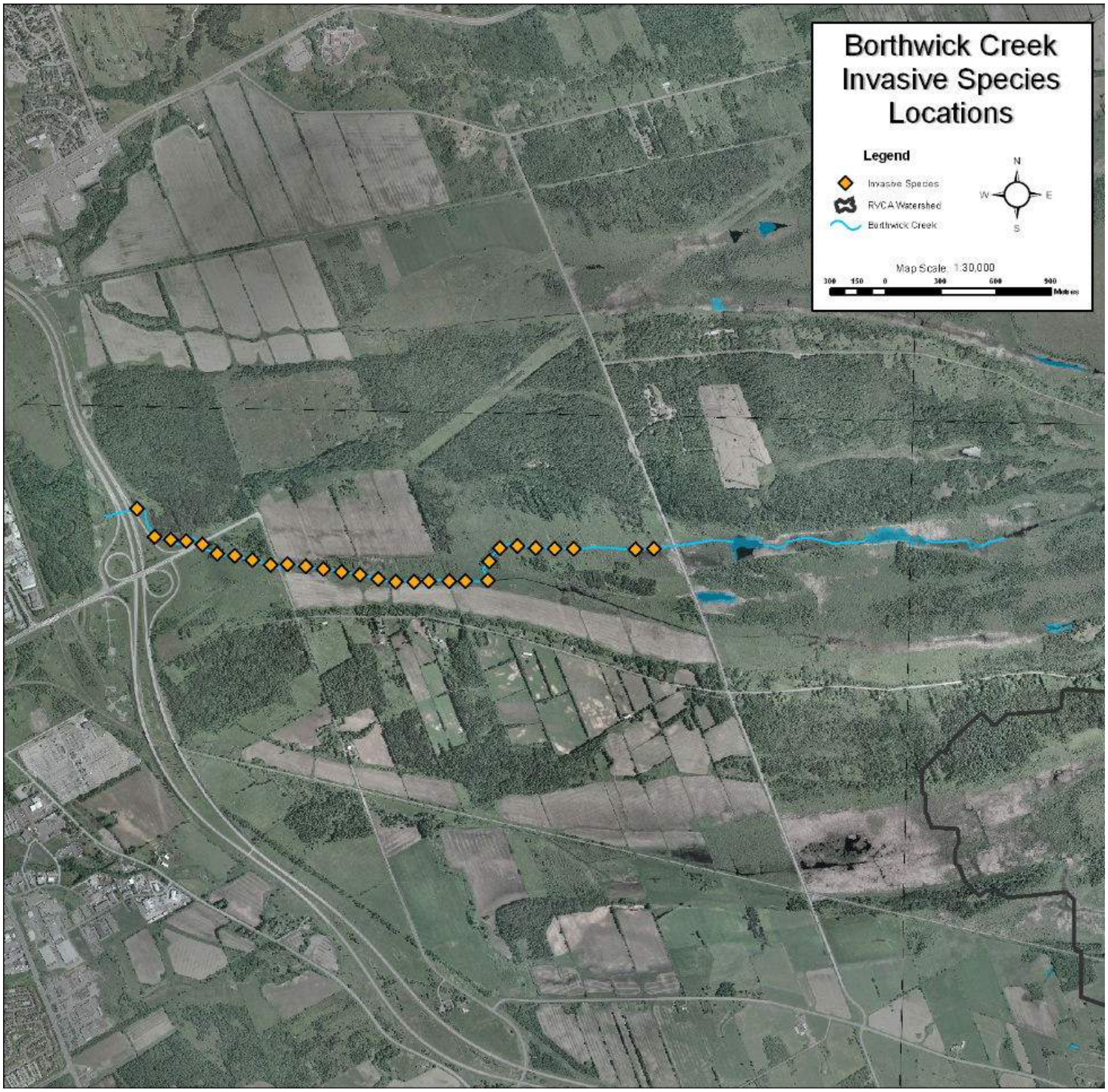
iv) Black Creek Invasive Species Sites



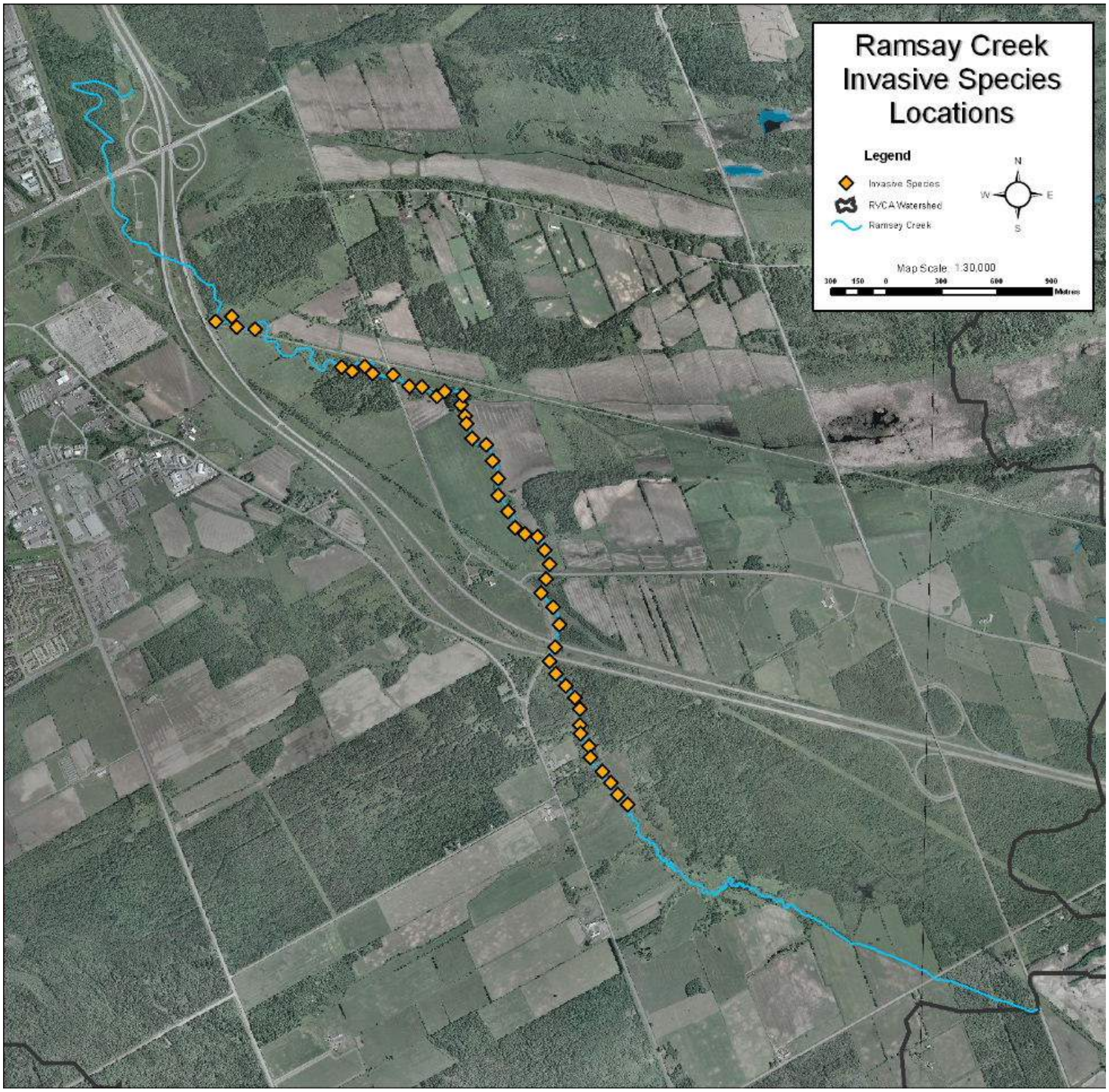
v) *Mud Creek Invasive Species Sites*



vi) Borthwick Creek Invasive Species Sites



vii) Ramsay Creek Invasive Species Sites



Appendix I

Ontario Fish Species		
Reproductive Guild	**Common Names**	**Scientific Name**
A. NON-GUARDER		
A.1 Open Substrate Spawners		
A.1.1 Pelagophils		
• non-adhesive eggs scattered in open water in areas where current direction is favourable to egg distribution and survival	American eel	*Anguilla rostrata*
	American shad	*Alosa sapidissima*
	longjaw cisco	*Coregonus alpenae*
	blackfin cisco	*C. nigripinnis*
	shortnose cisco	*C. reighardi*
	shortjaw cisco	*C. zenithicus*
	emerald shiner	*Notropis atherinoides*
	freshwater drum	*Aplodinotus grunniens*
A.1.2 Litho-pelagophils		
• fishes which undergo full range of transition from lithophils to pelagophils • eggs initially deposited on rocks/gravel but eggs or embryos become buoyant and are carried away from spawning substrates	lake sturgeon	*Acipenser fulvescens*
	gizzard shad	*Dorosoma cepedianum*
	cisco (lake herring)	*Coregonus artedi*
	bloater	*C. hoyi*
	deepwater cisco (chub)	*C. johannae*
	kiyi	*C. kiyi*
	goldeneye	*Hiodon alosoides*
	mooneye	*H. tergisus*
	burbot	*Lota lota*

Ontario Fish Species		
Reproductive Guild	**Common Names**	**Scientific Name**
A.1.3 Lithophils		
• deposit eggs on a rock, rubble or gravel bottom (streams or lakes) • usually well oxygenated waters; embryos hatch early and are highly photophobic	lake whitefish	*Coregonus clupeaformis*
	pygmy whitefish	*Prosopium coulteri*
	round whitefish	*P. cylindraceum*
	Arctic grayling	*Thymallus articus*
	rainbow smelt	*Osmerus mordax*
	redside dace	*Clinostomus elongatus*
	lake chub	*Couesius plumbeus*
	pugnose shiner	*Notropis anogenus*
	blacknose dace	*Rhinichthys atratulus*
	longnose dace	*R. cataractae*
	pearl dace	*Margariscus margarita*
	longnose sucker	*Catostomus catostomus*
	white sucker	*C. commersoni*
	northern hog sucker	*Hypentelium nigricans*
	spotted sucker	*Minytrema melanops*
	silver redhorse	*Moxostoma anisurum*
	river redhorse	*M. carinatum*
	black redhorse	*M. duquesnei*
	golden redhorse	*M. erythrurum*
	shorthead redhorse	*M. macrolepidotum*
	greater redhorse	*M. valenciennesi*
	trout-perch	*Percopsisomiscomaycus*
	sauger	*Stizostedion canadense*
	blue pike (blue pickerel) walleye (yellow pickerel)	*S. vitreum*
A.1.4 Phyto-lithophils		
• deposit eggs usually in clear water habitats on submerged plants, if available or on other submerged debris such as logs, gravel and rocks • late hatching, presence of cement glands	alewife	*Alosa pseudoharengus*
	finescale dace	*Phoxinus neogaeus*
	brassy minnow	*Hybognathus hankinsoni*
	silvery minnow	*H. nuchalis*
	gravel chub	*Erimystax x-punctata*
	spotfin shiner	*Cyprinella spiloptera*
	silver chub	*Macrhybopsis storeriana*
	redfin shiner	*Lythrurus umbratilis*
	mimic shiner	*Notropis volucellus*
	brook silverside	*Labidesthes sicculus*
	white perch	*Morone americana*
	white bass	*M. chrysops*
	yellow perch	*Perca flavescens*
	Iowa darter	*Etheostoma exile*

Ontario Fish Species		
Reproductive Guild	**Common Names**	**Scientific Name**
A.1.5 Phytophils		
• scatter or deposit eggs with an adhesive membrane that sticks to submerged, live or dead, aquatic plants, or to recently flooded terrestrial plants • sometimes deposited on logs and branches but never on the bottom • adapted to low oxygen concentrations • cement glands present	spotted gar	*Lepisosteus oculatus*
	longnose gar	*L. osseus*
	central mudminnow	*Umbra limi*
	grass pickerel	*Esox americanus vermiculatus*
	northern pike	*E. lucius*
	muskellunge	*E. masquinongy*
	chain pickerel	*E. niger*
	northern redbelly dace	*Phoxinus eos*
	golden shiner	*Notemigonus crysoleucas*
	bridle shiner	*Notropis bifrenatus*
	pugnose minnow	*Opsopoeodus emiliae*
	blackchin shiner	*Notropis heterodon*
	lake chubsucker	*Erimyzon sucetta*
	bigmouth buffalo	*Ictiobus cyprinellus*
	banded killifish	*Fundulus diaphanus*
	greenside darter	*Etheostoma blennioides*
	least darter	*E. microperca*
A.1.6 Psammophils		
• eggs scattered directly on sand or near fine roots of plants that hang over the sandy bottom • usually adapted to running water • eggs adhesive • usually in highly oxygenated waters	quillback	*Carpiodes cyprinus*
	blacknose shiner	*Notropis heterolepis*
	spottail shiner	*N. hudsonius*
	sand shiner	*N. stramineus*
	eastern sand darter	*Ammocrypta pellucida*
	logperch	*Percina caprodes*

Ontario Fish Species		
Reproductive Guild	**Common Names**	**Scientific Name**
A.2 BROOD HIDERS		
A.2.1 Lithophils		
• hide eggs in natural or specially constructed places • none guard deposited eggs through to emergence • in most cases the hiding places are excavated in gravel • generally eggs are buried under gravel • clean gravel or rocks and cold, clean fast flowing water or springs are almost essential to assume some exchange of water around eggs to provide sufficient oxygen	chum salmon	*Oncorhynchus keta*
	pink salmon	*O. gorbuscha*
	coho salmon	*O. kisutch*
	sockeye salmon	*O. nerka*
	chinook salmon	*O. tshawytscha*
	rainbow trout	*O. mykiss*
	Atlantic salmon	*Salmo salar*
	Arctic char	*Salvelinus alpinus*
	brook trout	*S. fontinalis*
	lake trout	*S. namaycush*
	hornyhead chub	*Nocomis biguttatus*
	river chub	*N. micropogon*
	creek chub	*Semotilus atromaculatus*
	fallfish	*S. corporalis*
	rainbow darter	*Etheostoma caeruleum*
	channel darter	*Percina copelandi*
	blackside darter	*P. maculata*
	river darter	*P. shumardi*
B. GUARDERS		
B.1. SUBSTRATUM CHOOSERS: spawning site is guarder and kept clean by parent		
B.1.1 Phytophils		
• eggs are scattered or attached onto submerged plants • male guards and fans eggs	white crappie	*Pomoxis annularis*
B.2 NEST SPAWNERS: variable structures built for egg deposition and guarding		
B.2.1 Lithophils		
• eggs deposited in single layer or multi layer clutches on cleaned rocks or in pits dug in gravel	common shiner	*Luxilus cornutus*
	cutlips minnow	*Exoglossum maxillingua*
	black bullhead	*Ameiurus melas*
	rock bass	*Ambloplites rupestris*
	green sunfish	*Lepomis cyanellus*
	bluegill	*L. macrochirus*
	longear sunfish	*L. megalotis*
	smallmouth bass	*Micropterus dolomieu*
	fourhorn sculpin	*Myoxocephalus quadricornis*

Ontario Fish Species		
Reproductive Guild	**Common Names**	**Scientific Name**
B.2.2 Phytophils		
• nests built on a soft, muddy bottom usually amid algae, plants, plant roots, leaves	bowfin	*Amia calva*
	largemouth bass	*Micropterus salmoides*
	black crappie	*Pomoxis nigromaculatus*
B.2.3 Speleophils		
• guard spawn in natural holes and cavities or in specially constructed burrows • frequently eggs are deposited on a cleaned area of the undersurface of flat stones	bluntnose minnow	*Pimephales notatus*
	fathead minnow	*P. promelas*
	yellow bullhead	*Ameiurus natalis*
	brown bullhead	*A. nebulosus*
	channel catfish	*Ictalurus punctatus*
	stonecat	*Noturus flavus*
	tadpole madtom	*N. gyrinus*
	brindled madtom	*N. miurus*
	fantail darter	*Etheostoma flabellare*
	johnny darter	*E. nigrum*
	mottled sculpin	*Cottus bairdi*
	slimy sculpin	*C. cognatus*
	spoonhead sculpin	*C. ricei*
B.2.4 Polyphils		
• fishes that are not particular in the selection of nest building material and substrate • usually circular nests with sticks and roots left in place • often among or next to plants growing in muddy or sandy shallows of slow rivers or lagoons	pumpkinseed	*Lepomis gibbosus*
B.2.5 Ariadnophils		
• skill nest building and parental care remarkably well developed • nest materials are bound together by a viscid thread secreted by male	brook stickleback	*Culaea inconstans*
	threespine stickleback	*Gasterosteus aculeatus*
	ninespine stickleback	*Pungitius pungitius*

References: Balon (1975) and Robins *et al.* (1991)

Appendix J

City Stream Watch 2007 Organizational Chart