Toronto and Region Conservation for The Living City

2013

Watershed Monitoring and Reporting Progress Report

Watershed Monitoring and Reporting Section

Restoration Services Division

April 2014

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1 Introduction

The mission of the WM&R is to improve the health and sustainability of the Toronto region's watersheds through the long-term collection, analysis and dissemination of scientifically defensible data which is used to guide decision making.

Healthy Rivers and Shorelines and Regional Biodiversity are key elements of TRCA's *Building the Living City: 10-Year Strategic Plan 2013-2023* (TRCA 2012). The ability of TRCA's Watershed Monitoring & Reporting (WM&R) group to track and report on long-term changes to these elements at local, watershed, and regional scales is vital to the success of an organization that is responsible for watershed planning, management and reporting in the greater Toronto region. To achieve our mission, WM&R coordinates with various agencies, groups and individuals involved in monitoring activities.

Measuring and reporting on the state and health of our watersheds allows us to identify when land-use practices and/or management strategies, techniques or actions may need to be modified such that negative trends can be reversed or prevented. The collected data and its reporting not only contributes to measuring the performance of management decisions, but also contributes to facilitating a region-wide approach to sustainability while telling the story of the Toronto region and its ecosystem health. Tracking the status of aquatic and terrestrial habitats and the vegetation and wildlife communities they support is an important step towards understanding how successful we are at protecting and managing these ecosystems. This knowledge can then be shared with others and applied to areas outside of TRCA's jurisdiction, accelerating innovation and fostering new partnerships with agencies, regional and local municipalities, community groups, businesses and other stakeholders.

This report is designed to provide an overview of the 2013 monitoring activities undertaken by the WM&R section throughout our region. The report identifies the types of data available along with project highlights from both the Regional Watershed Monitoring Program (RWMP) and special projects underway. Due to differences in project timelines and types of analysis, data interpretation and reporting is at varied stages of availability. A detailed list of the various data reports and other products that have been developed by WM&R staff is provided in Section 4. Since the work undertaken by WM&R staff is multi-faceted, a staff directory with contact information is also provided in Section 4. Tables in Appendices A and B provide a summary of the sampling effort undertaken by WM&R staff during 2013 and maps at the end of Section 2 and Section 3 identify sampling locations.

2 Regional Watershed Monitoring Program

The Regional Watershed Monitoring Program (RWMP) is a science based, long-term monitoring initiative developed by the TRCA. Its purpose is to collect aquatic and terrestrial ecosystem data at the watershed and sub-watershed scale, and across the region as a whole. The program provides the data and information that informs the key planning and reporting mechanisms of the TRCA. Since its inception in 2001, the program has enhanced the planning and coordination of monitoring activities, helped standardize protocols, and has filled several key data gaps that were identified. It also facilitates the communication of data availability and data sharing both internally and with external agencies.

The scope of the RWMP focuses on key components of the terrestrial and aquatic ecosystems, including:

- ***Terrestrial Habitat and Species*** - staff and trained volunteers monitor flora and fauna species and biological communities through biological inventories and fixed plot surveys,
- ***Aquatic Habitat and Species*** - including aquatic insects, fish populations, algae, stream temperature and the physical shape of the stream,
- ***Stream Water Quality*** - assesses a variety of water chemistry variables/parameters such as nutrients, metals, and bacteria,
- ***Stream Water Quantity*** - stream gauges and in-stream measurements monitor changes in the water levels of the region's watercourses,
- ***Groundwater Quantity and Quality*** - assessed at a series of wells throughout the region, and
- ***Climate & Hydrology***- assesses the contribution of rain and snow to the hydrology of the region.

The data collected is shared with partner municipalities and other agencies, and is used for planning, implementation and reporting purposes. Partnerships with academic institutions facilitate achievement of common research objectives as well as data sharing in support of academic study. All elements of the program are designed to provide data sets that allow for interpretation at the watershed and regional scales. In certain circumstances, data can be assessed at the site scale and can be used as a "flag" to identify potential issues or direct additional assessment. Where restoration and recovery plans are implemented, future monitoring will track the progress of such enhancement initiatives.

All program elements are strongly focused on the collection of scientific data. When possible, community outreach and education are incorporated. This is accomplished through the involvement of trained volunteers (e.g. Terrestrial Volunteer Monitoring Program), through partnerships with community groups and other non-governmental organizations, and through special events that demonstrate to or involve the community.

2.0 Terrestrial Habitat and Species

Staff Lead: Sue Hayes

Support Staff: Natasha Gonsalves, Gavin Miller, Paul Prior and Derek Tune

Seasonal Staff: Mike King, Ross Kresnick, Annette Lambert, Rivka Shachak and Chana Steinberg

Funding: City of Toronto, Durham Region, Peel Region, York Region and Toronto Remedial Action Plan

Figure 1. First confirmed record of Pickeral Frog (*Rana palustris)* identified during road kill study along Gore Road in Peel Region.

Background and Significance:

The Terrestrial Natural Heritage (TNH) component of the RWMP was established in 2000 and builds on data collected during the previous 15 years under the Environmentally Significant Areas work. The core focus of the TNH program has been systematic inventories of habitats and species throughout TRCA's nine watersheds (TRCA 2007a). In 2008, TRCA also implemented terrestrial monitoring at a number of fixed plots throughout our region. This new component of the program will identify trends in species and vegetation communities that are occurring over time.

Collecting terrestrial data is key to: advancing the goals of TRCA's *Terrestrial Natural Heritage System Strategy* (TRCA 2007b), developing and testing of terrestrial ecosystem modelling, updating the annual ranking of regional wildlife and vegetation communities of conservation concern, informing conservation, recovery and site restoration planning activities across our region, guiding planning activities across watersheds, conservation lands, and remedial action sites (RAP), and providing scientific information to partner municipalities and agencies.

2013 Program Highlights

- Fifteen biological inventory sites that covered approximately 1000 hectares were inventoried for vegetation communities as well as flora and fauna species. In addition, breeding bird surveys were updated at 3 sites and flora surveys at 6 sites. As part of the regional fixed monitoring plot program, data was collected at 24 vegetation, 29 bird, and 24 red-backed salamander forest plots; 21 vegetation, 22 bird, and 22 amphibian wetland plots; and 18 bird meadow plots across TRCA's jurisdiction.

- First documented record of Pickerel Frog by TRCA biologists was discovered in Peel Region while conducting road kill surveys along Gore Road (**Figure 1**). This record adds to our knowledge of regional biodiversity.

- From the recent biological inventory of Altona Forest, TRCA biologists noted a steep decline in species of conservation concern, especially around the time of development in the 1990s. Nineteen L1 to L3 ranked flora species observed in 1990 could not be found in 2013, such as Northern Maidenhair Fern (*Adiantum pedatum*). Many of the plants missing are found most often in cool moist forests and mixed and conifer swamps. A significant decline has also been noted in neotropical bird species, particularly in sensitive ground-nesting birds such as the Ovenbird (*Seiurus auracapilla*).

- Louisiana Waterthrush (*Seiurus motacilla*), a Species at Risk, was once again observed during breeding bird surveys. A pair was present again throughout the breeding season at an eastern TRCA property and for the first time on a northwestern TRCA property. This may be an example of a rare Carolinian species expanding its local geographical range.

- A new location for Spotted Salamander (*Ambystoma maculatum*) was discovered during the fauna biological inventories in the lower reaches of the Highland Creek watershed. This species is quite sensitive and is generally no longer found in urbanized landscapes as it requires top quality wetland habitat for breeding that is connected to upland forest for foraging and overwintering.

- An old-growth organic mixed swamp with a wide range of species of conservation concern, including Labrador-tea (*Ledum groenlandicum*), Two-seeded Sedge (*Carex disperma*), Three-seeded Sedge (Carex trisperma var. trisperma), Twinflower (*Linnaea borealis ssp. longiflora*) and Northern White Violet (*Viola macloskeyi ssp. pallens*) were discovered in the Stouffville expansion area.

2.1 Terrestrial Volunteer Monitoring Program

Staff Lead: Theresa McKenzie

Support Staff: Team of Volunteers

Funding: City of Toronto, Durham Region, Peel Region and York Region

Figure 2. Bullfrog (*Rana catesbeiana*), a Terrestrial Volunteer Monitoring Program indicator species.

Background and Significance:

The Terrestrial Volunteer Monitoring Program (TVMP), in operation since 2002, uses trained volunteers to survey 56 fixed sites (10 hectares in size) distributed throughout the region. Volunteers collect data on the presence of a set of 50 native amphibian, mammal, bird, plant and lichen indicator species (TRCA 2008b) (**Example in Figure 2**). Effective 2009, they also conduct two surveys each year to determine the extent of invasion of each site by eight invasive exotic plants (TRCA 2008b). Data are analyzed by TRCA to report on the condition of the terrestrial ecosystem and major habitats of the region, document differences between land-use zones, and to monitor change over time. These results contribute to the on-going implementation of TRCA's *Terrestrial Natural Heritage Strategy* (TRCA 2007b).

2013 Program Highlights

- In 2013, a total of 446 survey visits were completed across 54 sites by 126 volunteers (volunteers work in pairs).

- Tree damage (**Figure 3**) resulting from multiple severe weather events in 2013 prompted comments and photos from concerned volunteers.

Figure 3. (L to R) Winter 2013 storm damage to trees at Terrestrial Volunteer Monitoring Plots.

- A report entitled *Terrestrial Biodiversity in the Toronto Region 2003 - 2012: The First Decade of Monitoring under the Terrestrial Volunteer Monitoring Program* was completed, highlights include:

    - The report highlights observed biodiversity loss, with the region scoring 30 on a 0 - 100 scale for native indicator species richness. The magnitude of difference in species richness between urban and rural land-use zones was striking. Native indicator species richness in the urban context was just 65% of that in the rural, while the Regional Species of Conservation Concern richness scored at just 40% of the rural zone value.

    - No significant trend in biodiversity was found over the ten year period. This may relate either to the program's power to detect change, or a true lack of change. Continuing data collection will assist in providing answers.

- Species richness decreased more strongly with increasing percentage of urban land use than it increased with proportion of natural cover (habitat) in the watershed (**Figure 4**). This result emphasizes the importance of minimizing not just habitat loss, but also the negative influences that urban areas exert on remaining natural areas. An appendix to the report summarizes urbanization impacts, their effect on species richness, and the feasibility of restoration or reversal of impacts in the future.

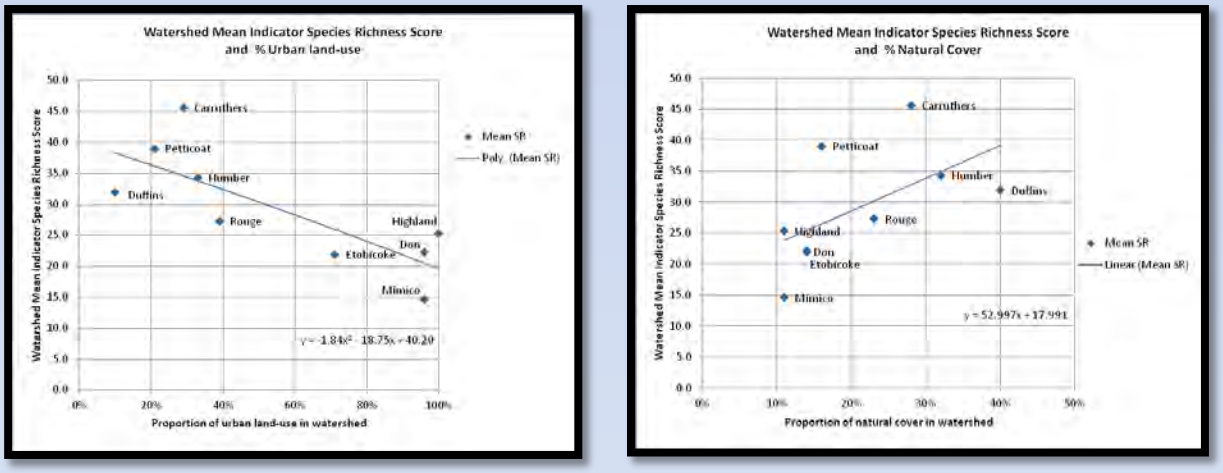

Figure 4. Native indicator species richness score decline with increasing % urban land use (R^2=0.62, p=0.01) and increase with increased % natural cover (R^2=0.34, p=0.098).

- Increasing road density was a predictor of declining species richness in the region. Impacts of roads include road mortality and road salt as an environmental toxin. Road impacts have been the subject of considerable research in recent years, resulting in the development and application of new mitigation methods. The Ontario Road Ecology Group is referenced as a resource for additional information on the subject.

- Species richness scores for fauna and Species of Conservation Concern, both measures highly sensitive to urbanization, are recommended as useful indices for biodiversity scoring in the region.

2.2 Fish Community Monitoring

Staff Lead: Jeff Vandenberg

Support Staff: Michael Brestansky, Samantha Everson, Mark Szonda

Seasonal Staff: Adam Aldworth, Alicia Bruneau, Samantha Delargy, Danielle Dellandrea, Russell Enslow, Paula Reynolds, Michael Swick, Jet Taylor

Funding: City of Toronto, Durham Region, Peel Region, York Region and Toronto Remedial Action Plan

Figure 5. Field crews involved in electrofishing for the RWMP.

Background and Significance:

The aquatic habitat and fish community monitoring component of the RWMP includes sampling fish communities (**Figure 5**) and physical habitat characteristics at regional sites. Fish communities are a combination of different fish species living and interacting with each other at a specific location and/or time (Strus 1994). Fish are excellent indicators of stream health because they: are easy to collect and identify, live for several years, and only in the water, are sensitive to changes in their environment, differ in their tolerance to amount and types of pollution, and are sensitive to forms of pollution that chemical tests may miss.

A total of approximately 150 sites are monitored annually on a three year rotation. Standardized sampling methods outlined in the Ontario Streams Assessment Protocol (OSAP) are used to allow for the comparison of the fish community within the physical habitat sampled, both geographically and over time across the region (Stanfield 2013).

2013 Program Highlights

- In 2013, a total of 46 RWMP sites were sampled in the Humber and Etobicoke watersheds. This is the 5th time that these sites have been monitored since RWMP's inception in 2001.
- A total of 5792 fish were sampled (captured, weighed and measured) in 2013. A total of 38 species were found.
- No new invasive fish species were found at RWMP sites monitored in 2013.
- Emerald Shiner (*Notropis atherinoides*) was captured in the Humber River watershed for the first time since RWMP sampling began.
- Round Gobies (*Neogobius melanostomus*) were captured at one site in the Humber River and one site in the Etobicoke Creek watersheds. There is no evidence yet that they are expanding their watershed range upwards, as they have been previously captured at these sites in the past. There was also a decrease in the number caught (46 individuals) since the last sampling event in 2010 (253 individuals). These fish were preserved and samples were sent to McMaster University for analysis (**see Section 3.7**).
- More than 10 years of Fish, Invertebrate, Site, and Habitat (F.I.S.H) data from over 150 sites are now available in an online tool to TRCA staff. The tool, which uses Google Earth as a user platform, allows for quicker data retrieval and geospatial association of site information and other attributes. The tool will be updated as new data becomes available.

2.3 Surface Water Quality

Staff Lead: Angela Wallace

Support Staff: Ray Biastoch, Michael Brestansky, Samantha Everson, Mark Szonda

Funding: City of Toronto, Durham Region, Peel Region, York Region and Toronto Remedial Action Plan

Figure 6. Collecting monthly water quality samples.

Background and Significance:

Surface water quality refers to the measure of stream water chemistry, including metals, nutrients and bacteria (e.g. *E. coli*). Since 2002, TRCA has been monitoring water quality (**Figure 6**) at a number of sites across the jurisdiction. This includes a partnership with the Ontario Ministry of the Environment (OMOE) whereby TRCA collects samples at 13 sites for the Provincial Water Quality Monitoring Network (PWQMN). In addition to the PWQMN sites, TRCA collects samples at several other sites to enhance our knowledge of water quality throughout the jurisdiction. Surface water quality data is used to help understand the impacts of land-use (e.g. agriculture, urban) on the water quality of local watercourses, which ultimately flow into Lake Ontario. Long-term data is used to show trends over time, which are used to help make informed decisions about managing and protecting our valuable water resources.

Across TRCA's watersheds, non-point sources of pollution such as stormwater runoff from impervious surfaces are the main contributors to water quality impairment. In addition, nutrient runoff from agricultural land, salting roads in winter, discharging wastewater from industries and sewage treatment plants can also affect water quality.

2013 Program Highlights

- Surface water quality samples were collected monthly at 46 sites. The 46 sites were comprised of 13 OMOE Provincial Water Quality Monitoring Network (PWQMN) sites, 30 TRCA sites and 3 special project sites (Seaton/Duffins Heights Development).

- The 30 TRCA sites included 5 new sites within the Etobicoke watershed. Samples at the new Etobicoke sites began in August 2013. These sites were established to provide water quality data for subwatersheds that were previously not included under the RWMP. This data will contribute to the next Conservation Ontario *Watershed Report Card*.

- The *2012 Surface Water Quality Summary Report* was completed in the spring of 2013. Elevated levels of chloride, copper, iron, *E. coli*, phosphorus and other contaminants were found at several sites within the region.

- At a few sites, surface water quality samples were collected on July 9, 2013, the day after the record-breaking rainfall and subsequent flooding on July 8, 2013. The severe thunderstorm delivered 126 mm of rain in 2 hours, more precipitation than what the GTA would receive in an average July. Results of this data collection will be available in spring 2014.

Figure 7. July 8th Flooding and storm damage to Mimico Creek and surrounding landscape.

2.4 Water Temperature Monitoring

Staff Lead: Melanie Croft-White, Jan Moryk

Support Staff: Michael Brestansky, Samantha Everson, Mark Szonda

Funding: City of Toronto, Durham Region, Peel Region, York Region and Toronto Remedial Action Plan

Figure 8. Brook Trout (*Salvelinus fontinalis)* are coldwater fish that rely on groundwater upwellings for spawning.

Background and Significance:

Water temperature data is collected as part of the aquatic monitoring component of TRCA's RWMP using seasonal and year-round temperature loggers. Since aquatic organisms are highly dependent on the temperature of the water they inhabit, much of the diversity of aquatic organisms within a stream can be associated with water temperature. Tracking water temperature can also help indicate the influence of groundwater on the watercourse. For example, coldwater streams are of particular importance since certain fish species such as Brook Trout (*Salvelinus fontinalis*) (**Figure 8**) rely on groundwater upwellings for spawning. In addition, the data collected by the RWMP may be able to show long-term changes in water temperature over time caused by land-use changes (e.g. urbanization) or climate change.

2013 Program Highlights

- A total of 71 water temperature loggers were active for 2013: 32 seasonal loggers (approximately April-October) and 39 year-round loggers (including 4 real-time loggers).

- Year-round temperature loggers have now been installed at several locations in all nine watersheds and the Frenchman's Bay watershed (**Figure 9**).

Figure 9. Installing a year-round temperature logger in a watercourse.

- A summarized seasonal dataset spanning 12 years of monitoring is now available. Analysis of the data and trends is currently underway.

2.5 Benthic Macroinvertebrates

Staff Lead: Jessica Fang, Angela Wallace

Support Staff: Ray Biastoch, Danielle Dellandrea, Russell Enslow

Seasonal Staff: Adam Aldworth, Alicia Bruneau, Samantha Delargy, Paula Reynolds, Michael Swick, Jet Taylor

Funding: City of Toronto, Durham Region, Peel Region, York Region and Toronto Remedial Action Plan

Figure 10. An example of a benthic macroinvertebrate, Baetis flavistriga is the most common mayfly found in TRCA's jurisdiction.

Background and Significance:

The benthic macroinvertebrates (BMI) biomonitoring program started in 2001 and has been used to track changes in aquatic biota and water quality across the TRCA jurisdiction for over 10 years. BMI monitoring is conducted yearly at approximately 150 sites across the TRCA jurisdiction as well as at a number of additional sites for special projects.

There are a wide variety of animals without backbones which inhabit the substrate and sediment of watercourses for at least portion of their lives. Those visible without the use of a microscope such as aquatic worms, juvenile insects, snails, etc. are referred to as benthic macroinvertebrates (**Figure 10**). Organisms in this diverse group have different ecological requirements and different sensitivities to disturbances in their environment: some may be tolerant and others may be intolerant of disturbances, environmental change, and poor water quality. BMI tend to be sedentary with short life cycles and therefore reflect the environmental conditions at that particular location. Additionally, the relatively high abundance of BMI and the low cost of equipment to collect make them ideal organisms for biomonitoring purposes.

2013 Program Highlights

- The study to compare TRCA's sampling method and the *Ontario Benthos Biomonitoring Network (OBBN) Protocol* (OMOE *et al*. 2007) was completed in 2012. In 2013, based on the analysis of the results, TRCA made the decision to switch to the OBBN methods as the primary BMI sampling method. The OBBN method is the standard protocol adopted by the Province of Ontario, therefore the RWMP data will be compatible on a provincial scale, while the integrity and continuity of the RWMP long-term dataset is maintained.

- A total of 143 RWMP sites were sampled; 429 samples were processed and identified to the OBBN 27 group level. The lowest practical level (LPL) identification was completed in March 2014.

- The TRCA is a provincial leader in identifying BMI to the LPL identification with its staff being certified in genus level identification by the Society of Freshwater Science (SFS). It is expected that the ecological information provided by LPL identification will improve analysis and reporting due to the increased ability to detect and track changes in its watersheds.

- The development of the BMI database is in progress. The BMI database is a Microsoft Access database; up-to-date BMI data can now be searched and queried on this database. The database will be enhanced with additional functions in 2014.

- BMI data from 2001-2012, identified to the genus level where possible, were analyzed for spatial and temporal trends at the jurisdiction and watershed scales. As well, the effects of road density on BMI communities were explored. Road density is a measurement to reflect overall urbanization in a watershed. **Figure 11** shows the influence of increasing road densities on BMI genus richness (number of individuals in a genus counted in a given area). Above road density of 9, genus richness plummets until, at road densities 13-14, only the most tolerant BMI genera remain.

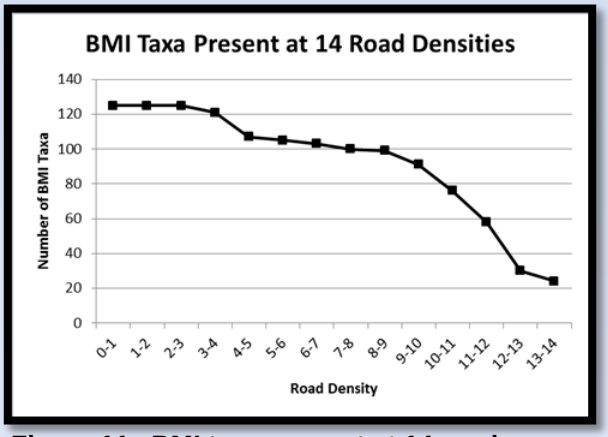

Figure 11. BMI taxa present at 14 road density levels.

2.6 West Nile Virus Vector Monitoring

Staff Lead: Jessica Fang

Support Staff: Danielle Dellandrea, Paula Reynolds, Sarah Scharfenberg

Funding: City of Toronto, Durham Region, Peel Region, York Region

Figure 12. (L) West Nile virus technician sampling for larval mosquitoes. (R) Mosquito larvae.

Background and Significance:

West Nile virus (WNV) primarily exists between birds and bird-biting mosquitoes. The virus transmits to humans through the bite of a mosquito which become infected by feeding on the birds carrying the virus. Humans are considered dead-end hosts, meaning we can be infected by the virus but do not spread it. For people who become infected, the majority will have no symptoms or only mild flu-like symptoms. Severe cases of WNV, including the development of meningitis and encephalitis, are extremely rare but can be fatal.

In Canada, human WNV case numbers fluctuate from year to year driven by complex environmental and biological factors. In 2013, a total of 108 human cases were reported from 5 provinces. In the Greater Toronto Area (GTA), 19 human WNV cases were reported: City of Toronto with 11 cases, Peel Region with 3 cases, Durham Region with 2 cases, Halton Region with 2 cases, and York Region with 1 case (Public Health Ontario 2013). In 2011, there was an increase in WNV activity compared the previous four seasons in Ontario, with this increase persisting through to 2013.

Due to TRCA's role in managing various aquatic habitats and at the request of TRCA's Regional Public Health partners, a WNV Surveillance and Monitoring Program was launched in 2003. The core objectives of the WNV Monitoring and Surveillance Program are to: assess the abundance of mosquito larvae, collaborate with the Regional Public Health Units, investigate standing water complaints associated with TRCA properties, educate the public about WNV risks, and take proactive management steps to reduce risk of WNV transmission when warranted.

2013 Program Highlights

- In 2013, monitoring began on June 3rd and ended on August 22nd. A total of 45 sites were monitored across TRCA's jurisdiction, including 39 wetlands and 6 stormwater management ponds (SWMPs) (**see Regional Maps**).

- A total of 7146 mosquito larvae were collected (**Figure 12**) from the routine monitoring sites in 2013, including 6650 larvae from 39 wetlands and 496 larvae from the 6 SWMPs.

- Ten mosquito species were identified including 6 WNV vector species and 4 non-vector species. The most widespread species was *Culex territans,* which inhabited 38 of the 45 sites. The two key vectors, *Culex restuans* and *Culex pipiens,* were found in 8 and 15 of the sites respectively. *Culex pipiens* was the primary species found in SWMPs.

- Risk assessment resulted in the identification of five WNV vector mosquito larvae hot spots: Grenadier Pond in High Park, Topham Pond in Eglinton Flats, Goldfish Pond in Tommy Thompson Park, an unnamed wetland in Vaughan, and L'Amoreaux Park North Pond. Larvicide treatments were applied to all of these hot spots.

- Since the launch of the program, in efforts to understand the correlation between water quality and mosquito larvae abundance, water quality data has been collected at each site. No conclusive results were discovered after numerous years of analyses; consequently in 2013 water quality data collection was terminated. With this change, field technicians were able to complete an additional sampling event compared to previous years, for a total of five sampling events.

- The data collected in 2013 were used to generate the *Annual Report: West Nile Virus Vector Mosquito Larval Monitoring and Surveillance – 2013*.

2.7 Groundwater Quality and Quantity

Staff Lead: Jeff Vandenberg

Support Staff: Michael Brestansky, Don Ford, Andrew Taylor, Jehan Zeb

Funding: Ontario Ministry of the Environment, Toronto and Region Conservation

Figure 13. Groundwater well with digital telemetry and permanent pump installed.

Background and Significance:

Approximately three million residents in Ontario rely on groundwater from municipal and private wells as their primary source of drinking water. Many communities are dependent on groundwater supplies to maintain existing domestic, commercial, industrial, agricultural and institutional operations. Overdrawing and contamination activities are elevating the stress placed on this vital resource.

The Provincial Groundwater Monitoring Network (PGMN) was established in April 2000 to assess current groundwater conditions and provide an early warning system for changes in water levels and water quality. The Provincial Groundwater Monitoring Network (PGMN) is a partnership program between the OMOE and all 36 Ontario conservation authorities, including 10 municipalities (in areas not covered by a conservation authority).

The role of OMOE in the network is to set policy direction, develop strategic objectives and maintain the Provincial Groundwater Monitoring Information System (PGMIS) program database, The mandate of the TRCA under the PGMN partnership is to maintain the digital telemetry systems (**Figure 13**), collect water level data and arrange for chemical analysis of water quality samples at dedicated wells.

2013 Program Highlights

- The regular maintenance of wells and instrumentation as well as manual level checks continued at 19 well sites in 2013.

- In 2013, a total of 14 groundwater wells were sampled for water quality in the fall. An annual report on groundwater quality will be produced later in 2014 by TRCA's Geoenvironmental Section.

- *Technical Memo: Peel Groundwater Levels – Follow-up* Study was produced by TRCA's Geoenvironmental Section using data collected from two wells in the Heart Lake Conservation Area. This memo highlights the research on the effects of rising groundwater levels in the Brampton Esker Aquifer.

- All of TRCA's logger data is now updated on the OMOE Provincial Groundwater Monitoring Information System database to Summer 2012. Updates will be on-going.

- The Provincial Groundwater Monitoring Network telemetry system was originally configured as an analog system, with 18 sites in our region having telemetry installed. The phone company converted the analog system to digital telemetry in December 2008, and additional site visits were conducted to capture the data manually. To date, the OMOE has been purchasing new digital telemetry equipment as funding becomes available. TRCA has equipped 17 sites with digital telemetry and is scheduled to install telemetry at the newly constructed Kortright Centre well in early 2014. The OMOE is currently looking into a new telemetry system and further upgrades have been postponed until the new system is available.

2.8 Water Quantity - Stream Flow, Precipitation and Snow Course

Staff Lead: Derek Smith

Support Staff: Matt Derro, Greg Dillane, Jamie Duncan, Paul Greck, Bill Kerr, Rita Lucero, Craig Mitchell, Amanda Slaght, Leland Wilbur

Funding: City of Toronto, Durham Region, Peel Region, York Region and Toronto Remedial Action Plan

Figure 14. Various TRCA stream gauges. From left to right, Petticoat Creek, West Duffins Creek and TRCA Hydrometrics staff conducting monthly maintenance.

Background and Significance:

One of the indicators monitored under TRCA's RWMP is water quantity which includes stream flow, precipitation, and snowpack accumulation.

Stream flow data has been collected in TRCA's jurisdiction for over 50 years and was originally implemented by the federal government to meet its international obligations related to the Great Lakes. Today, the TRCA has 36 stream gauges (**Figure 14**) as part of both the RWMP and Flood Management Services (FMS). Watercourse flow and level information is collected by TRCA stream gauges every 15 minutes. Each station is maintained monthly and flow measurements are taken throughout the year in order to develop a level-flow relationship (stage-discharge curve). Each curve is either verified or generated depending on the hydraulic conditions. Of the 36 stream gauges, 16 of them are part of the TRCA Real Time Flood Warning Network, where 4 are used to observe dam reservoir storage (**Figure 15**). Typically, stream flow data is used for stormwater management, water budget models, flood infrastructure operations, flood forecasting and warning, water quality studies, and impairment models in watercourses and Lake Ontario.

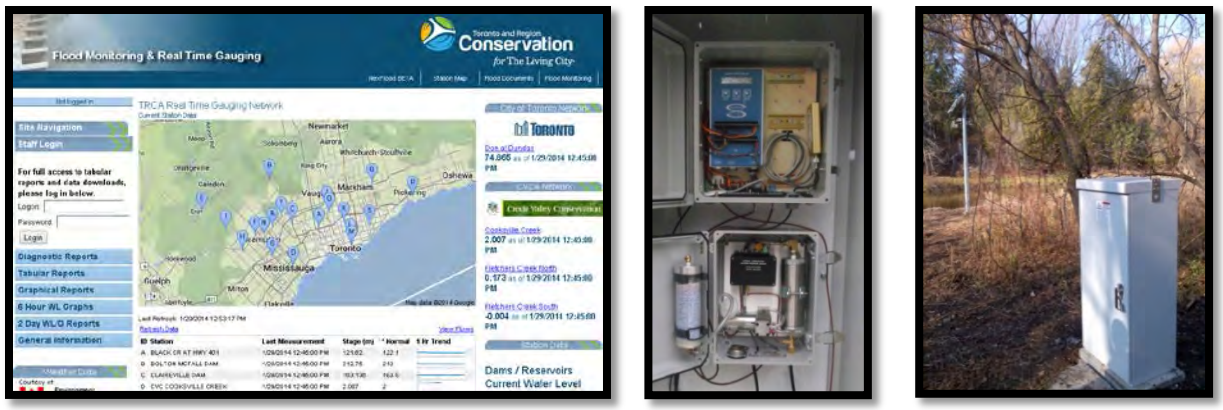

Figure 15. (L to R) TRCA real-time flood warning website (www.trcagauging.ca) and real-time stream gauge.

Generally used in context with stream flow, precipitation data is collected to document storm events, annual discharges, and for flood forecasting. The data is regularly found in road and sewer design details, water balance and flood models, water quality/quantity studies, calibrating/confirming Intensity Duration Frequency curves, and emergency bulletins. In Toronto and the surrounding area there are over 100 rain gauges (**Figure 16**) which are owned and operated by all levels of government, educational institutions, and the private sector; of that total, the TRCA has 34 gauges. Stations in this network were strategically located in order to provide maximum coverage of TRCA's jurisdiction and all of its watersheds. Originally conceptualized for the TRCA's FMS program and ambient monitoring initiatives, it has evolved into a regional database regularly utilized by numerous public and private organizations.

Figure 16. Various TRCA precipitation gauges. From left to right Grange Farm (stand alone, 3 season), Tullamore (real time, 3 season), and Oak Ridges (real time, 4 season).

Unlike the stream and precipitation networks, which are fully automated, the TRCA manually monitors snowpack accumulation (**Figure 17**) at ten locations in order to determine the condition of its watersheds prior to the spring thaw. The stations were selected to provide a jurisdictional assessment of snow characteristics including: snow depth, water equivalent, snow density, snow crust, and underlying soil attributes (e.g. frozen). The TRCA uses the MNR's snow course sampling protocols (OMNR 1985), where each snow course is visited twice a

month during the winter season (approx. the 1st and 15th day). The data is submitted to the Ministry of Natural Resources (MNR) and TRCA flood duty officers bi-weekly in order to assess the snow melt flood threat in our watersheds. Information has been collected at several stations since the late 1970s with one station having records as far back as 1957.

Figure 17. Snowcourse sampling kit (left) and data collection (right).

2013 Program Highlights

- TRCA's recent acquisition of Acoustic Dopplar Current Profiler (ADCP) and Acoustic Dopplar Velocimeter (ADV) technology have increased staff efficiency, safety, and data accuracy when collecting watercourse flow information. Using the ADCP, hydrometric staff were able to measure high flows safely and at rates previously unmeasured (**Figure 18**).

Figure 18. TRCA Hydrometrics staff deploying the ADCP during high flow conditions on Mimico Creek (left) and the East Don River (right).

- TRCA's recent acquision of new time-series data management software has drastically streamlined the Hydrometric programs operation and significantly improved Quality Assurance Quality Control (QAQC) processes.

- The technology and software advances described above gave Hydrometrics staff the tools needed to increase stage-discharge curve production rates, where new curves can be created in only a few months rather than years. Note: Production rates are weather dependent (number of wet/dry weather occurrances per month).

- Internal collaboration of both the Low Flow initiative and Hydrometrics program added numerous baseflow points to several TRCA stage-discharge curves and prevented duplication of efforts.

- Hydrometrics staff assisted TRCA's Survey and Drafting Services department by using the ADCP to conduct bathymetric surveys (measurement of water depth at various places in a body of water) of numerous stormwater ponds to determine sediment accumulation for partner municipalites.

- Precipitation information is collected by TRCA stations every five minutes. The network consist of both three and four seasons stations where nine gauges are part of the TRCA's real time flood warning network.

- Several TRCA real time precipitation stations are to be used in a real time forecasting model and data sharing pilot study with Environment Canada, Grand River Conservation Authority, and the Ministry of Natural Resources.

- Water quantity data collected by the TRCA's stream and precipitation gauging stations was used for the City of Toronto's Wet Weather Flow Monitoring study (a 50 year initiative). In addition, numerous requests for TRCA hydrometric data have been made by various governments, private sector agencies, educational institutions, and the public to be used in various studies and modeling projects.

- Updates/modifications to the stream and precipitation gauge networks in 2013 included the following; 1) A four-season precipitation gauge was deployed in Oak Ridges as part of both the TRCA real-time flood warning and RWMP networks. 2) Redeployment of the Kightswood real-time stream gauge after the station had been shut down due to local construction activity. 3) A "temporary" stream gauge was installed at Urfe Creek to prevent data interruptions during local construction initiatives and the relocation of the existing station.

- Hydrometrics staff technically advised numerous internal programs and external agencies with various projects requiring automated monitoring for groundwater, stream flow, water quality, pipe flow, and precipitation.

- TRCA Hydrometrics staff continues to monitor snowpack accumulation at 10 locations across its jurisdiction (5 stations in west, 5 stations in east). A summary of the average snow depth and average water equivalent from 2005 to 2013 is presented in **Figure 19**.

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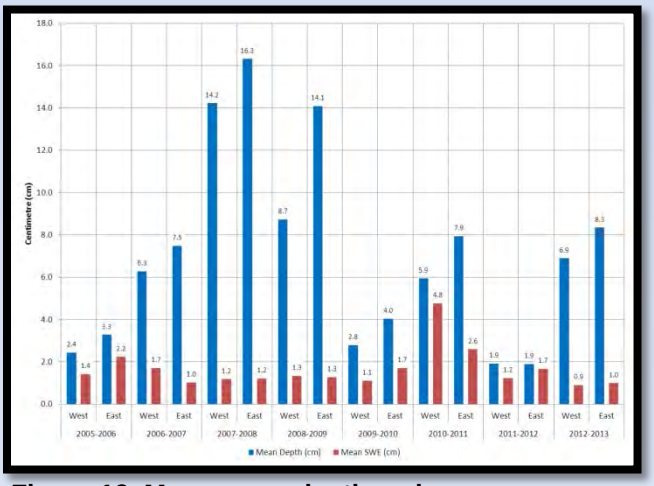


Figure 19. Mean snow depth and mean snow/water equivalent (SWE) of snowcourses from 2005 to 2013.

- On July 8th, 2013 a large intense storm occurred over the west end of TRCA's jurisdiction causing severe flooding in the Etobicoke Creek, Mimico Creek, Don River, and parts of the Humber River watersheds. Some flood event statistics are presented:
    - Maximum precipitation recorded by a TRCA gauging station was 113.2 mm in east-central Mississauga, and the highest rainfall intensity measured by a TRCA gauge was in south Etobicoke at 21.6 mm/5 minutes.
    - Stream flow rates in some parts of these watersheds were 150 times greater than baseflow conditions.
    - Peak flow discharge near the mouth of the Don River was 267 m^3/s (normal condition approximately 2.7 m^3/s)
    - Parts of the City of Toronto's Don Valley Parkway, Bayview Avenue, and Lower Don River Valley railways were flooded.
    - Watersheds east of the Don River were only two to five times higher than normal baseflow conditions.
    - General flow summary of selected stations during July 8th flood:

Watercourse	Station ID	Station Name	Low Flow	Peak Flow	Flow Increase (x)
West End					
Don River	*HY017*	*Don at Glenshields*	*0.320*	*44.444*	*138.9*
Don River	*HY019*	*Don at Todmorden*	*2.703*	*267.336*	*98.9*
Humber River	*HY067*	*West Humber at Hwy7*	*0.201*	*29.574*	*147.1*
Humber River	*02HC003*	*Humber at Weston Road*	*3.073*	*342.789*	*111.5*
Etobicoke Creek	*HY026*	*Etobicoke Creek at Brampton*	*0.278*	*36.536*	*131.4*
				Average	**125.6**
East End					
Highland Creek	*HY034*	*Highland Creek at Malvern*	*0.155*	*6.600*	*42.6*
Highland Creek	*HY048*	*Morningside at Finch*	*0.115*	*0.373*	*3.2*
Duffins Creek	*HY066*	*West Duffins at Hwy7*	*0.400*	*0.900*	*2.3*
				Average	**16.0**

2.9 Water Quantity - Baseflow

Staff Lead: Leland Wilbur, Greg Dillane

Support Staff: Jamie Duncan, Rita Lucero, Derek Smith

Seasonal Staff: Andrew Dent

Funding: City of Toronto, Durham Region, Peel Region, York Region and Toronto Remedial Action Plan

Figure 20. Baseflow measurements were conducted from the end of May to the start of September with the help of a summer intern.

Background and Significance:

Baseflow conditions represent the lowest stream flows that typically occur in a watercourse. Baseflow is usually supplied primarily by groundwater discharge occurring along the stream corridor and / or the gradual release of water from wetlands. The term low flow refers to the amount of stream flow that is sustained in a watercourse during extended periods of dry weather. In our watersheds, low flow conditions occur in the drier summer season between late May and September.

The TRCA Low Flow Monitoring Program was established in 2000 to conduct ongoing jurisdictional monitoring of low flows during the drier summer season. This program makes important contributions to the overall data collected by our RWMP. It consists of more than 1100 individual monitoring stations, with summer monthly monitoring occurring at an average of 68 stations per year. These 68 stations are called indicator stations and are usually located at the outflow of each major sub-watershed. The other monitoring stations are distributed within each

watershed and are measured systematically every 5 to 7 years in order to obtain provide a higher resolution of ground and surface water interactions.

The main purpose of TRCA's Low Flow Program is to develop data that allows for a better understanding of the interconnections between the groundwater and surface water systems in our watersheds. The program also helps to establish contacts and relationships with water users as a basis for promoting awareness of overdrawing and contamination issues. The long-term goal of the TRCA Low Flow Program is to guide the management and protection of baseflow levels to protect aquatic life and sustainable human use of surface water.

2013 Program Highlights

- A total of 123 transect measurements were conducted across all watersheds during the 2013 field season, which included 66 of the 68 summer indicator stations. Fieldwork for 2013 focused on the Duffins, Carruthers and Frenchman's Bay watersheds. Some sites were measured more than once due to special circumstances. The measurements were conducted from the end of May to the start of September with the help of a summer intern (**Figure 20**).

- A total of 57 non-indicator monitoring sites were measured in the Duffins, Carruthers, Petticoat and Frenchman's Bay watersheds. In the remaining watersheds, baseflow was measured at the summer indicator stations only. Baseflows across all watersheds were found to be generally higher this year as compared to previous years.

- There was an observed difference in baseflows between the east end of the jurisdiction (Duffins, Frenchman's Bay, Petticoat and Carruthers watersheds) as compared to the central and west end watersheds (Rouge, Highland, Don, Humber, Mimico and Etobicoke watersheds). Flows in the west portion of the jurisdiction were 100% to 150% of long-term averages while the east end was found to be 60% to 90% of the long-term averages. These differences could be due to a number of rain events which were more intense in the western watersheds than the east. The sites were also sampled from the west to east over the summer, which may have helped to yield higher flows earlier in the season before the typical summer dry period resulted in lower flows.

2.10 Meteorological Monitoring

Staff Lead: Derek Smith

Support Staff: Greg Dillane, Jamie Duncan, Bill Kerr, Rita Lucero, Craig Mitchell, Leland Wilbur

Seasonal Staff: Andrew Dent

Funding: City of Toronto, Durham Region, Peel Region, and York Region

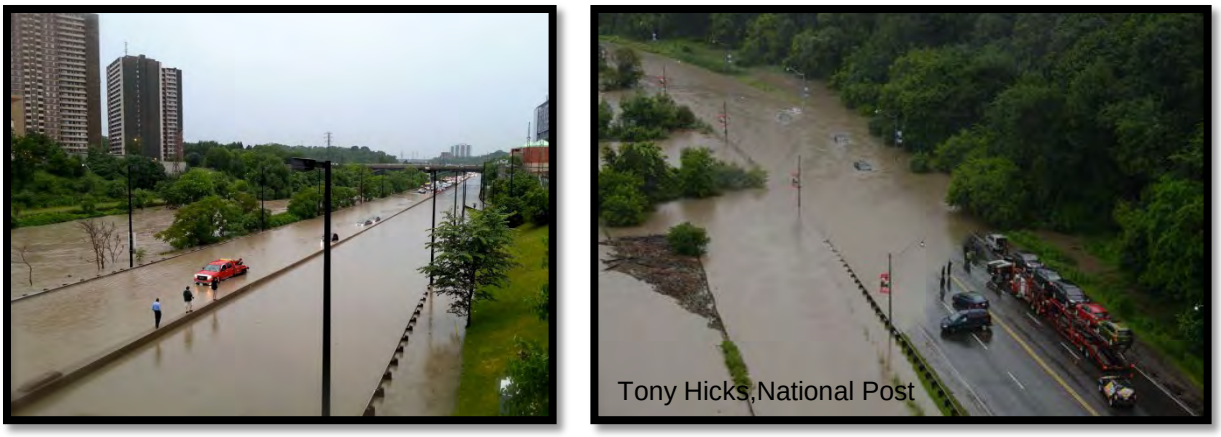


Figure 21. (L to R) Flooding along the Don Valley Parkway and Bayview Extension July 8th, 2013 Toronto, 126 mm rain within 2 hours.

Background and Significance:

The TRCA identified Climate Change as an important issue related to its watershed management mandate in the mid-1990s. While it is well known that urbanization has an impact on natural systems, the additional stress of climate change can further modify our natural systems and create new or increased challenges to the TRCA's management objectives (Haley 2006). For example, early attempts to deal with increased volumes of water in waterways were centered on stormwater management by reducing peak flow to match pre-development conditions. While this practice is now commonplace, urban infrastructure falls short of dealing with extreme weather (Figure **21**) such as rainfall greater than a 100 year storm (Haley 2006).

Conservation Authorities provide their clients with effective direction and input around mitigation and adaptive management of local ecosystems under the challenges that climate change can create (Haley 2006). Numerous TRCA programs (e.g. RWMP and FMS) and partners continue to rely on our data collection services and monitoring expertise to give them as much information regarding their watersheds as possible; ultimately leading to the development of the TRCA's meteorological (MET) network.

Construction of the MET network began in the spring of 2006 with the acquisition of two MET stations from Natural Resources Canada and one from Guelph University. Since that time,

partnerships with both Guelph and York Universities have surfaced where they are investigating evapotranspiration (ET) respectively. Currently, the TRCA has six MET stations consisting of a variety of sensory devices and eight air temperature stations. Monitored parameters include: rainfall, wind direction and speed, air and soil temperature, relative humidity, solar radiation, snow depth, barometric pressure, soil moisture, evaporation, ET and leaf wetness. Similar to our water quantity monitoring, the MET network is designed for remote operations and long-term deployment (>15 years).

2013 Program Highlights

- All MET stations continued to operate normally in 2013.

Figure 22. Various TRCA MET stations, pictured from left to right: Claremont (Transport Canada), King City (Seneca College), and Richmond Hill (16th Ave Fire Hall).

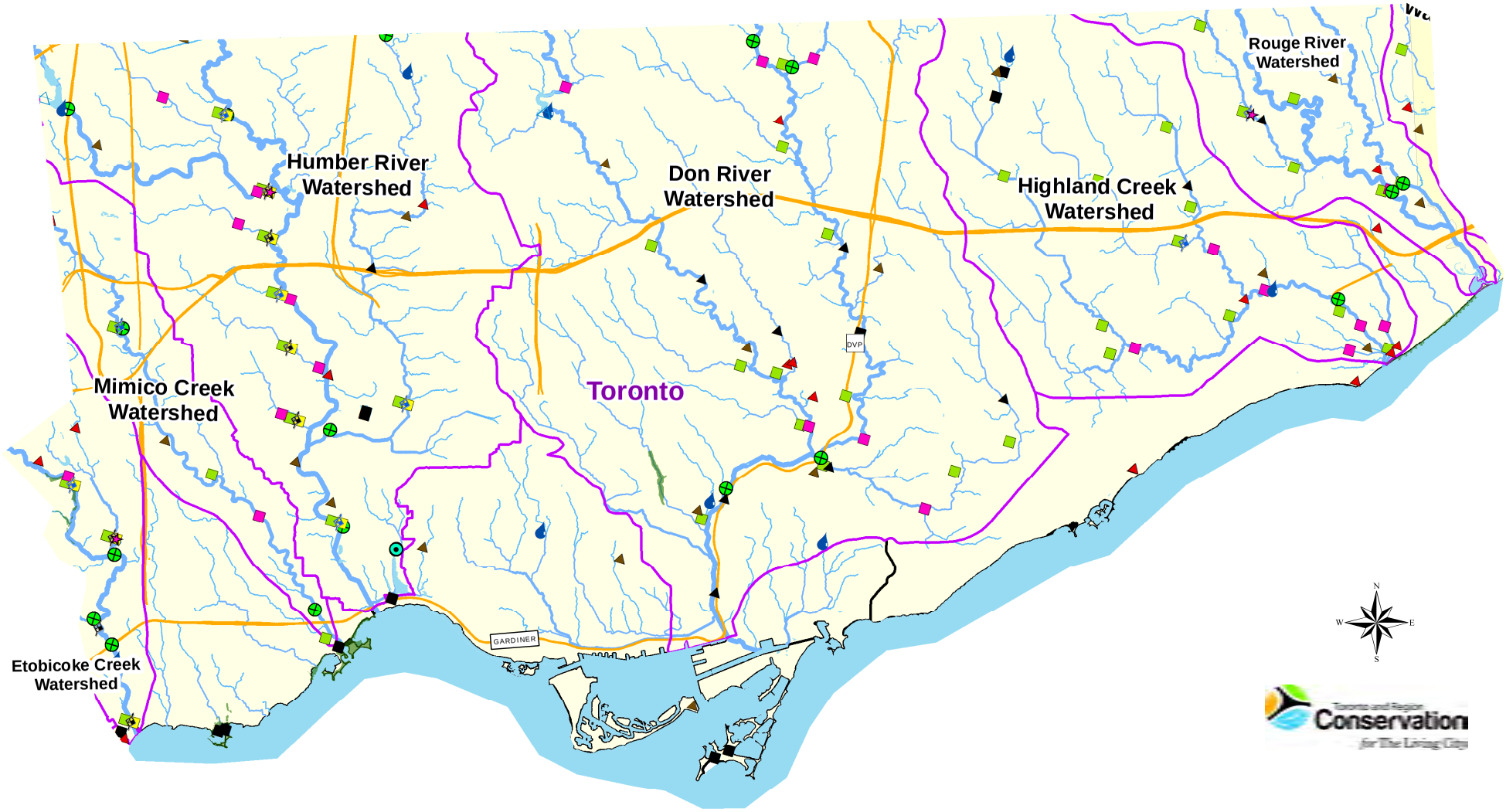
- The Kortright, Downsview, and Richmond Hill ET monitoring stations continue to operate normally and are maintained by York University. Several reports and Master Thesis' have been produced using the data from these stations.

- The air temperature monitoring for TRCA's aquatic biology program continued in 2013. Since 2005, eight air temperature stations were deployed with the intent to correlate air temperature fluctuations with tributary water temperatures. The sensors have been recording data every five minutes and operate year round.

- Numerous requests for TRCA's MET data have been made by various governments, private sector agencies, educational institutions, and the public for use in various studies and modelling projects. Information from several stations was used to determine the antecedent conditions of several watersheds prior to the July 8th flood.

Toronto & Region Conservation Authority

City of Toronto Monitoring Locations



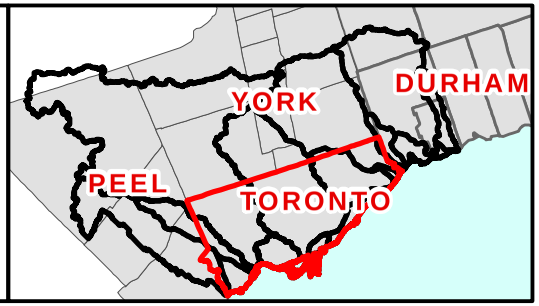
Legend

- Air Temperature Loggers
- Aquatic Species & Habitat
- Baseflow Stations
- Benthic Macroinvertebrates
- Climate Stations
- Groundwater Quality
- Groundwater Wells
- Precipitation Gauges
- Snow Gauges
- Stream Gauges
- Stream Water Quality
- Terrestrial Fixed Plots
- Terrestrial Inventories
- Terrestrial Volunteer Program
- Water Temperature (Seasonal)
- Water Temperature (Year Round)
- West Nile Virus
- Highway
- Watercourse
- Watershed Boundary
- Waterbodies

Date: 3/31/2014

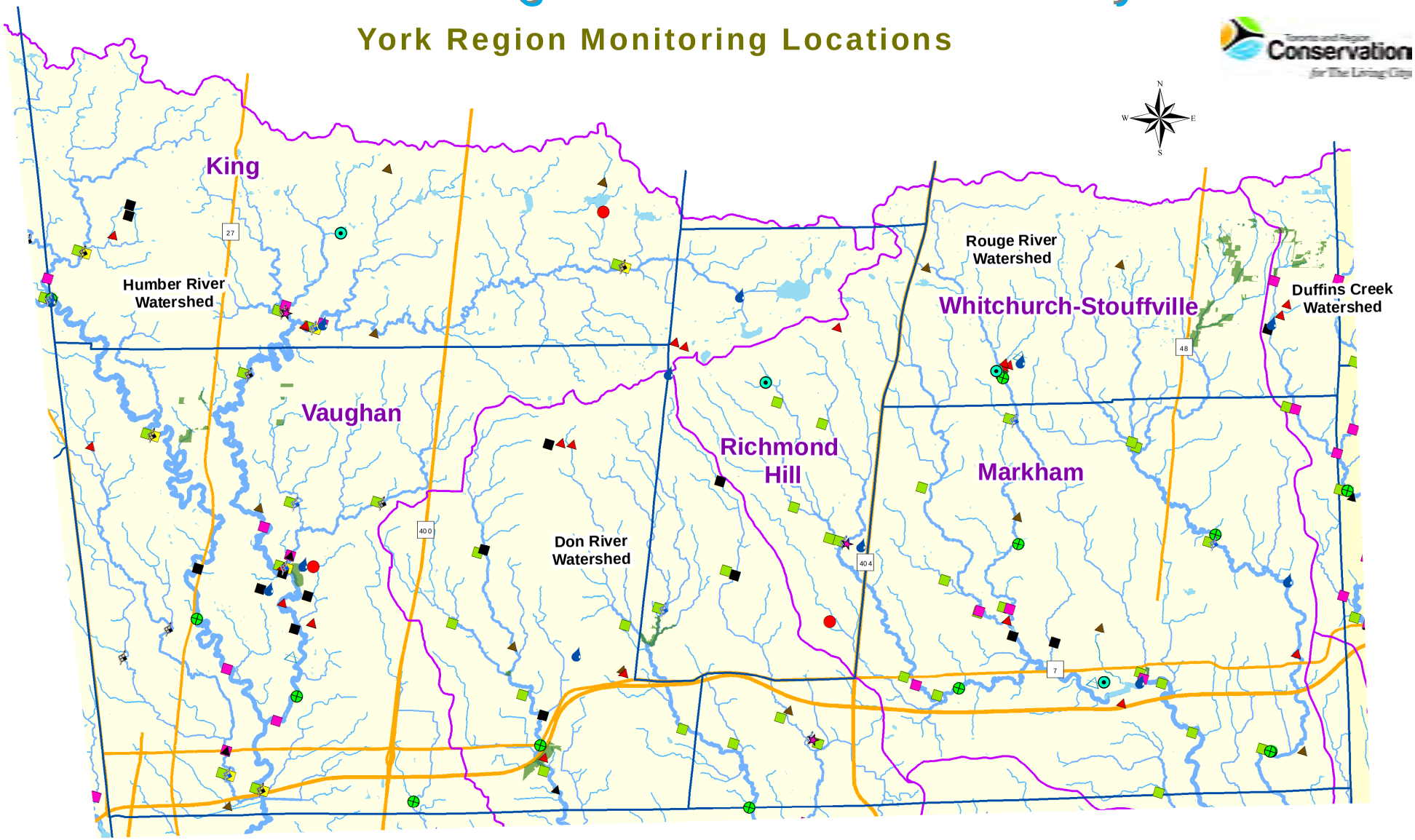
Created by: T.R.C.A. Information Services/ Information Technologies

0 0.5 1 2 3 4 Kilometers



Toronto & Region Conservation Authority

York Region Monitoring Locations



Legend

- Air Temperature Loggers
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- Highway
- Watercourse
- Municipal Boundary
- Watershed Boundary
- Waterbodies

Date: 3/31/2014

Created by: T.R.C.A. Information Services/ Information Technologies

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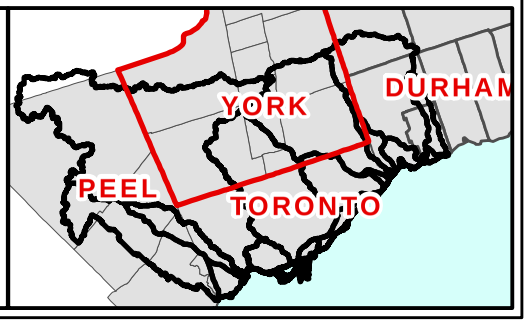


Toronto & Region Conservation Authority

Peel Region Monitoring Locations

Legend

- Air Temperature Loggers
- Aquatic Species & Habitat
- Baseflow Stations
- Benthic Macroinvertebrates
- Climate Stations
- Groundwater Quality
- Groundwater Wells
- Precipitation Gauges
- Snow Gauges
- Stream Gauges
- Stream Water Quality
- Terrestrial Fixed Plots
- Terrestrial Inventories
- Terrestrial Volunteer Program
- Water Temperature (Seasonal)
- Water Temperature (Year Round)
- West Nile Virus
- Municipal Boundary
- Watercourse
- Watershed Boundary
- Waterbodies

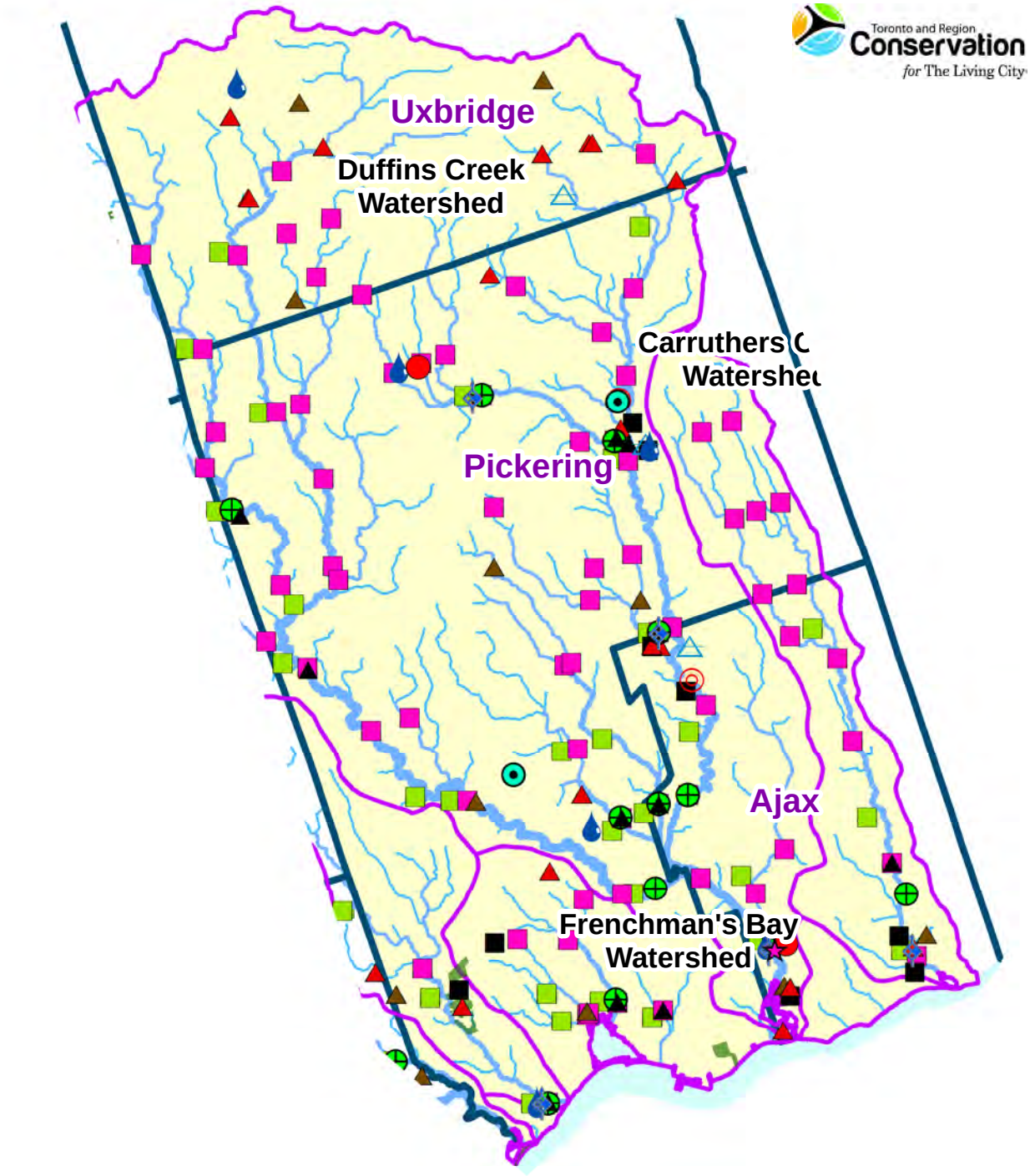
Date: 4/29/2014

Created by: T.R.C.A. Information Services/ Information Technologies

0 0.5 1 2 3 4 Kilometers

Toronto & Region Conservation Authority

Durham Region Monitoring Locations



Legend

- Air Temperature Loggers
- Aquatic Species & Habitat
- Baseflow Stations
- Benthic Macroinvertebrates
- Climate Stations
- Groundwater Quality
- Groundwater Wells
- Precipitation Gauges
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- Water Temperature (Seasonal)
- Water Temperature (Year Round)
- West Nile Virus
- Municipal Boundary
- Watercourse
- Watershed Boundary

Date: 4/29/2014

Created by: T.R.C.A. Information Services/ Information Technologies

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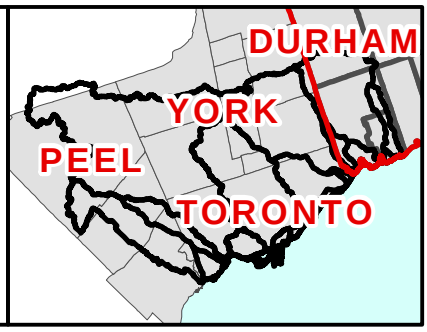


3 Special Projects

In addition to the RWMP, numerous special projects are undertaken annually by TRCA. These projects employ staff from various sections and divisions within the TRCA in order to address research questions related to restoration and mitigation techniques and to provide valuable baseline information on watershed condition. These projects are often centered around localized issues and are often shorter in duration and narrower in focus compared to the RWMP. Where possible the monitoring for these special projects follows the same sampling methodology and protocols as the RWMP. This consistency in methodology increases efficiency and provides continuity in the data, allowing the data to be easily compared to RWMP monitoring sites. Both data sets are often relied upon for hypothesis testing and trend analysis at various geographical scales. The following sections give a brief overview of each of the special projects that the WM&R section was involved in during 2013. A map outlining monitoring locations of the various described special projects is located at the end of this Section.

3.1 Natural Channel Design

Staff Lead: Dean Young

Support Staff: Michael Brestansky, Samantha Everson, Natasha Gonsalves, Sue Hayes, Gavin Miller, Paul Prior, Mark Szonda, Derek Tune, Jeff Vandenberg

Seasonal Staff: Adam Aldworth, Alicia Bruneau, Samantha Delargy, Danielle Dellandrea, Russell Enslow, Mike King, Ross Kresnick, Annette Lambert, Paula Reynolds, Rivka Shachak, Chana Steinberg, Mike Swick, Jet Taylor

Funding: City of Toronto, Durham Region, Peel Region, York Region

Figure 23. TRCA field staff collecting geomorphic sample for natural channel design monitoring.

Background and Significance:

Reconstruction of stream channels to restore, rehabilitate or enhance its geomorphic and ecological functions is becoming an increasingly common management approach in urban areas both in Canada and internationally. The intent of the natural channel design (NCD) approach is to replicate the channel form that would naturally occur given the hydrologic and sediment conditions of the upstream drainage area. This approach also tries to re-establish in-stream and riparian habitats that exhibit healthy ecological functions, populated by diverse and productive aquatic and terrestrial communities. Natural channel designs incorporate the characteristics of natural rivers and streams including meandering plan form, bed forms, channel bed and banks constructed of natural materials, bioengineering techniques and native vegetation plantings. Considering the complexity of channel forming processes and the inherent uncertainty associated with approaches to natural channel design, projects are largely experimental with long-term outcomes subject to considerable uncertainty. Due to the large

uncertainty in predicting river response to design intervention, the need for an adaptive approach to natural channel management and design is acknowledged and advocated in Ontario. There is little evidence broadly available regarding the short and long-term effectiveness of natural channel designs, making it difficult to evaluate and improve current practices.

To address the general lack of systematic evaluations of the effectiveness of NCD projects in Ontario, the Toronto and Region Conservation Authority (TRCA) initiated a program to monitor and evaluate completed projects in the Greater Toronto Area watersheds in 2005. The first project undertaken as part of the Natural Channel Design Monitoring Program involved identifying a suite of monitoring parameters and data collection methods / frequencies suitable for evaluating if the original design objectives of NCD projects are being met. The monitoring protocol *Evaluating the Effectiveness of Natural Channel Design Projects: A Protocol for Monitoring Natural Channel Design Projects* (TRCA 2009a), was developed based on an extensive literature review and input from experienced practitioners of natural channel design and watershed monitoring (TRCA 2009b).

The second project of the Natural Channel Design Monitoring Program, initiated in 2005 and continuing to 2014, involves monitoring and evaluating a number of completed NCD projects in the TRCA jurisdiction (**Figure 23**). The project scope includes periodic monitoring and evaluation of 30 NCD project sites over a 10 year time period from 2005 to 2014. Each project is examined at a midway point, in case adjustments to the study design or monitoring protocols being applied are needed. Monitoring parameters assessed include: geomorphic characteristics (cross-sections, longitudinal profiles, bank and substrate, erosion pins), engineered elements (e.g. functioning of riffles, pools, vanes, bioengineering, mitigation of fish barriers), aquatic habitat and communities (fish and benthic invertebrates), riparian vegetation communities (ELC vegetation type and regional species of concern inventories, including invasive species), and amphibian and breeding bird surveys.

2013 Program Highlights

- One new Natural Channel Design (NCD) geomorphic station, located in the headwaters of Mimico Creek, was setup and sampled in 2013.

- TRCA staff returned to four existing geomorphic stations to locate cross-section monuments and erosion pins originally installed between 2005 and 2011, and repeat surveys and sampling. This allows for comparison of 2013 data with the original survey and sampling data. Such data sets are valuable as they allow: (1) analysis of changes to the cross sectional profiles and (2) show the magnitude of various erosion processes acting upon the channel, which affect channel stability and ultimately influence stream sediment composition and habitat.

- Sampling of fish and benthic communities and characterization of aquatic habitat was repeated at four NCD project sites in 2013. Information from 2013 will be compared to results of sampling done between 2005 and 2008 to examine if: (1) changes have taken place in aquatic habitat and communities, and (2) if the sites continue to show signs of improvement over the 5 to 10 year or 5 to 15 year timeframes assigned.

- In 2013, four NCD sites were re-surveyed for breeding fauna (breeding birds and amphibians) and three sites were re-surveyed for both fauna and vegetation communities. Information will be compared to that from previous surveys done between 2007 and 2009 to examine how terrestrial communities are evolving over time and what types of species are utilizing the habitats created.

- An invasive species, Rusty Crayfish (*Orconectes rusticus*) was detected at Lower Milne reach of the Rouge River watershed.

3.2 Caledon East

Staff Lead: Don Ford, Sharon Lingertat, Jan Moryk, Christine Tu-Parker

Support Staff: Ray Biastoch, Mike Brestansky, Samantha Everson, Mark Szonda

Funding: Region of Peel

Figure 24. Sampling turbidity in Boyce's Creek, Caledon East following recent silt spills.

Background and Significance:

With population growth expanding within Caledon East, the Region of Peel completed a Class Environmental Assessment (EA) in November 2007. The EA assessed the impacts to natural water features posed by increased draws from existing water supply wells. One of the EA recommendations was for the Region of Peel and TRCA to coordinate the monitoring activities outlined in the Region of Peel's *Natural Heritage Monitoring Program (NHMP)* (TRCA 2008a) on an annual basis. The *Natural Heritage Monitoring Program (NHMP)* was developed by TRCA in 2008 for the Region of Peel's *Environmental Management Plan (EMP) for the Caledon East Existing Water Supply System*. The monitoring activities currently underway include:

- biological monitoring of the fish community, including trout spawning activity,
- groundwater seepage meter data collection,
- stream turbidity, flow, sediment particle size distribution in Boyce's Creek, and
- biological monitoring of the benthic macroinvertebrate ('aquatic insects') community in Boyce's Creek.

2013 Program Highlights

- In addition to the NHMP, 2013 marked the beginning of water quality monitoring activities in Boyce's Creek in response to periodic sediment releases that began in 2010. The Region of Peel has implemented long term mitigation and management efforts intended to prevent future silt releases. Water quality monitoring (**Figure 24**) is in place to track stream recovery post-siltation and is anticipated to continue for at least 3 years. Once sediment conditions return to pre-existing conditions, water quality monitoring activities will be discontinued. For more detail on this initiative and some preliminary results please refer to the *2013 Caledon East Technical Brief.*

- Every August since 2007, fish communities are monitored in the two creeks that flow though Caledon, Centreville Creek and Boyce's Creek. In 2013, fish communities were also sampled in the spring in order to assess Brook Trout (*Salvelinus fontinalis*) hatching success. 2013 marked the lowest ever recorded abundance for Brook Trout juveniles in both creeks, continuing the steady decline in abundance observed since 2009/10. In Boyce's Creek specifically, increasing Brook Trout size coupled with decreasing abundance (**Figure 25**) is signifying that only the largest fish are currently able to occupy this stressed reach. The multiple silt releases are considered the main cause of recent impacts to Brook Trout size and abundance.

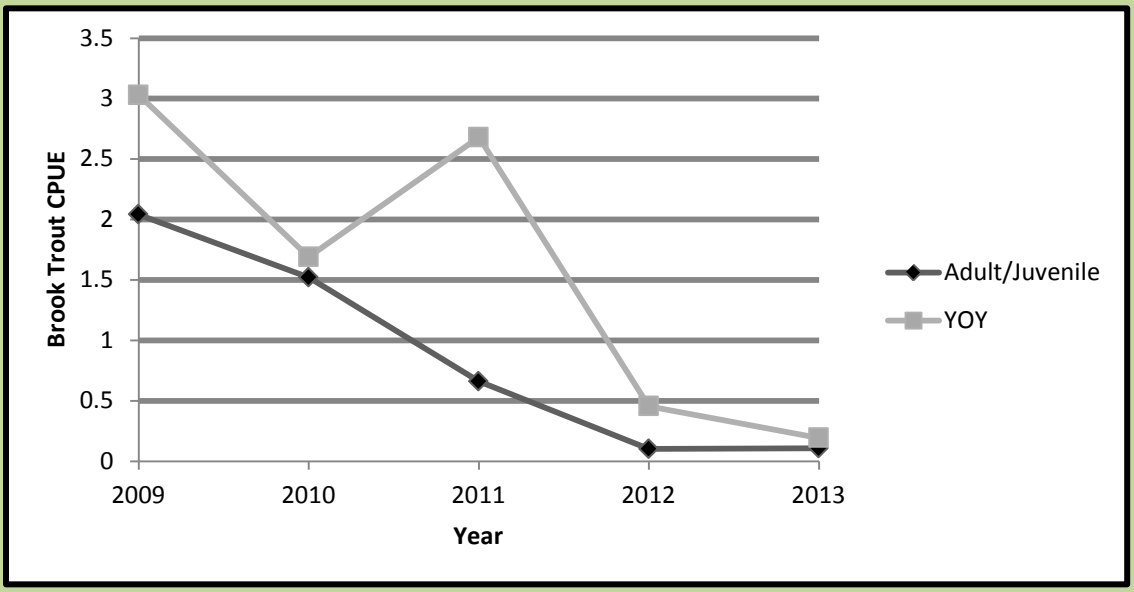


Figure 25. Boyce's Creek Brook Trout CPUE line graph showing abundance.

- Since 2007, annual fall spawning surveys have been completed in the two creeks that flow through Caledon, Centreville Creek and Boyce's Creek. The purpose of these surveys is to quantify the amount of Brook Trout spawning redds; a hollow in sand or gravel on a river bed, scooped out as a spawning place by fish. Between the end of September and early November 2013, 38 redds were identified in both creeks, indicating the occurrence of spawning. This year's surveys discovered more redds than previous years. For example, only 6 redds were observed in 2012.

- The *2013 Caledon East Technical Brief* is scheduled to be completed in Summer 2014. The report synthesizes and interprets stream flow, temperature, and turbidity, groundwater levels, and biological data (both fish and benthic macroinvertebrates), as it relates to the impacts of increased groundwater draws on the health of local aquatic habitat and species. In addition to the NHMP annual monitoring activities listed here, this report also discusses the water quality data in context of the silt releases, which have been occurring since December 2011.

3.3 Nobleton Phosphorus Offset

Staff Lead: Angela Wallace

Support Staff: Michael Brestansky, Mark Szonda

Funding: York Region

Figure 26. Measuring stream flow in Nobleton.

Background and Significance:

Local creeks in Nobleton showed a combination of high phosphorus, ammonia, nitrate and *E.coli* counts, consistent with failing septic systems. A new water pollution control plant (WPCP) was built to service the Village of Nobleton in York Region and began treating water in June 2012 (Township of King 2012a). The new plant is expected to reduce contaminant load (e.g. phosphorus, *E. coli*) to local waterways as the leaky septic systems are no longer in use. At the end of December 2013, there were 248 connections to the new sewer system with approximately 236 septic systems completely decommissioned. This is approximately 34% of the total number of septic systems to be decommissioned (Saleem Khowaja, Township of King, *pers. comm.).* Decommissioning of all septic tanks is scheduled to be completed by the end of 2014.

TRCA, on behalf of York Region, has been conducting a surface water monitoring program since 2009 to track the contaminant levels in local waterways before, during, and after the septic tank decommissioning in order to measure its effectiveness (**Figure 26**). TRCA has completed the surface water quality monitoring from 2009 to 2013, and will continue monitoring during the final decommissioning phase in 2014. The intention is to monitor water quality for one year after all the septic systems have been removed.

2013 Program Highlights

- Baseline sampling (prior to septic tank decommissioning) indicated that phosphorous, ammonia and bacteria were all elevated in the streams downstream of the older residential area of Nobleton.

- Seven water quality samples as well as flow measurements were collected in 2013 as part of the decommissioning phase. The water quality parameters measured were: total phosphorus, total ammonia, E. coli, TSS, pH, conductivity, water temperature, and dissolved oxygen. Data analysis and reporting will be completed in Spring 2014.

3.4 South-central Ontario Reference Conditions / Biocriteria Project

Staff Lead: Angela Wallace

Support Staff: Michael Brestansky, Jessica Fang, Mark Szonda

Funding: Regional Watershed Monitoring Program (RWMP)

Figure 27. RWMP field staff collecting benthic macroinvertebrate samples.

Background and Significance:

In 2011, the Reference Conditions / Biocriteria Project's was initiated by the OMOE to help describe the normal range of biological condition for streams in the different ecoregions of southern Ontario. Currently there is very little information to date about what constitutes a "normal" benthic macroinvertebrate (aquatic bugs that inhabit stream bottoms) community for southern Ontario. Once this is done, biocriteria (pass-fail guidelines) can be developed for indices that define a "normal" benthic macroinvertebrate community. The OMOE and various Conservation Authorities are participating in the collection of benthic macroinvertebrate and water quality samples (**Figure 27**) across south-central Ontario. The collaborative study hopes to collect almost 500 samples over a 5 year period. Priorities for project partners in 2014 include sampling as many new sites as possible, entering the data into a database and generating interim biocriteria by combining similar ecoregions.

2013 Program Highlights

- Benthic macroinvertebrate and water quality samples were collected from 12 sites in 2013.
- To date, the collaborative team has collected over 200 samples from 2011-2013 throughout south-central Ontario and hope to collect another 80-100 samples in 2014.
- Separate sampling in south-eastern Ontario, which began in 2010, will be completed in 2014.
- Data analysis for south-eastern Ontario will begin in 2015 by the OMOE and will include:
  - characterizing normal ranges of variability for each of the ecoregions (Chapman and Putnam 1984),
  - evaluating stressor responses,
  - evaluating biomonitoring indices, and
  - setting biocriteria for biomonitoring indices that are sensitive to stressors common in the study regions.
- In 2015, the south-central Ontario data will be analyzed in the same way to complement and compare with the results of the south-east monitoring program.

3.5 Duffin Heights Monitoring Program

Staff Lead: Sue Hayes

Support Staff: Natasha Gonsalves, Gavin Miller, Patricia Moleirinho, Paul Prior

Funding: York Region

Figure 28. Nesting Osprey (*Pandion haliaetus*) on top of hydro transmission tower in the DHN neighbourhood.

Background and Significance:

The Duffin Heights Neighbourhood (DHN) is an approved development area in the City of Pickering. Construction began in the DHN in 2009. This area is generally located on both sides of Brock Road between Rossland Road and Taunton Road. The specific site is bounded by the Canadian Pacific Rail line to the north, the hydro transmission tower line to the south, the municipal boundary with the Town of Ajax to the east, and the Ganatsekiagon Creek to the west.

The specific monitoring objective at Duffin Heights is to gather information on the site under pre- and post-development conditions in order to quantify changes in the terrestrial (**Figure 28**) and aquatic flora and fauna communities, as well as physical site attributes that can be related to urbanization impacts. This data, gathered using standardized scientific protocols, can be used to support adaptive management and additional mitigation measures during the development phases.

In 2008, TRCA established several terrestrial monitoring "fixed plots" at Duffin Heights in forest habitat types using the TRCA's *Long Term Monitoring Project (LTMP) protocols* (TRCA 2011a to 2011g). The general purpose of the regional LTMP plots is to detect changes and trends in the flora and fauna communities over time. Forest habitats were identified across the entire area in 2002, when it was subject to an inventory of vegetation communities and flora and fauna species. This biological inventory provided a one-time picture of the flora and fauna communities present. Data regarding surface water quality, fluvial geomorphology, stream flow and discharge, as well as aquatic fish and benthic community were also gathered.

The monitoring methodology employed at Duffin Heights is the same as that used for the TRCA's RWMP. By implementing the same monitoring protocols at this site, a larger data set is available for comparison. This is truly advantageous as the data collected at Duffin Heights can be validated by being placed into a larger regional context which is important during the data analysis stages. For the full monitoring methodology used by TRCA for its forest stations please refer to TRCA 2007a.

2013 Program Highlights

- A report on the *Terrestrial Monitoring Baseline Conditions* was prepared, based on data collected in the forest monitoring fixed plots between 2008 and 2012. This report identifies the status of forest health and terrestrial biological communities, from which changes and trends can be assessed throughout the on-going development and build-out of the Duffin Heights Community.

- Based on five years of data, the overall proportion of forest species within the local bird community dropped from the initial 45% (at baseline conditions) to 29% in 2012. As residential development continues it will be important to continue to monitor these conditions to determine if the initial disturbance caused by construction has long-term impacts on the forest bird community.

3.6 Remedial Action Plan Aesthetics Monitoring

Staff Lead: Ray Biastoch

Support Staff: Mike Brestansky, Melanie Croft-White, Mark Szonda

Summer Staff: Adam Aldworth, Alicia Brunea, Samantha Delargy, Danielle Dellandrea, Russell Enslow, Paula Reynold, Michael Swick, James Taylor

Funding: Environment Canada, Ontario Ministry of the Environment, Toronto and Region Remedial Action Plan

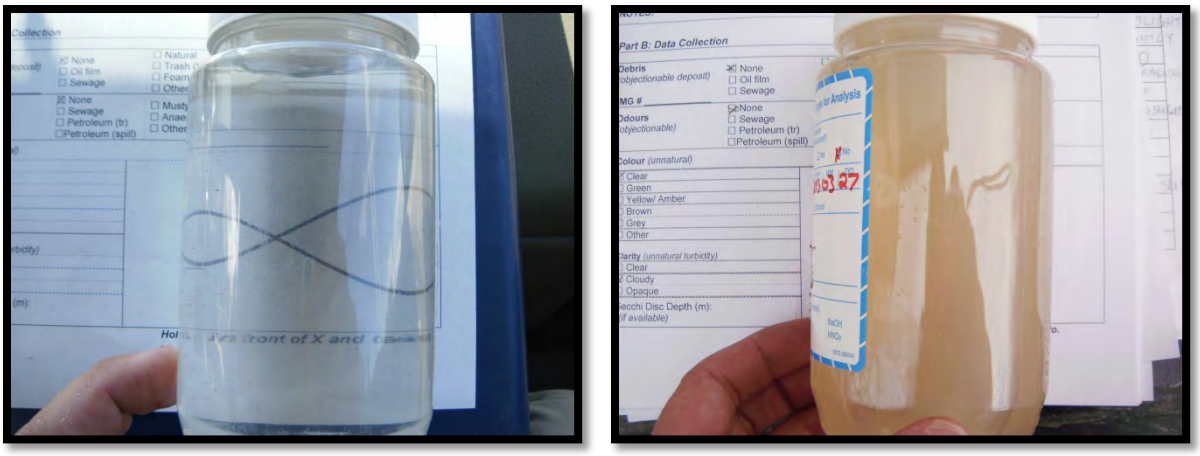


Figure 29. (**L to R) Field staff examining stream water for aesthetic categories 'Colour' and 'Clarity' of water.**

Background and Significance:

Toronto and Region is one of 43 areas in the Great Lakes identified as an Area of Concern (AOC). The status of an AOC is determined by assessing the state of the region's environmental conditions against 14 different 'Beneficial Use Impairments' (BUIs), aesthetics (primarily debris and turbidity) being one of them. The monitoring of aesthetic sites involves assessing the presence, absence, or degree of non-natural debris, water turbidity, and odour. Each site was assessed for water colour, water clarity (**Figure 29**), water odour, and debris by trained staff using a standardized protocol (Heidtke and Tauriainen 1996). Monitoring occurred from January to December, 2013.

2013 Program Highlights

- 917 aesthetic records were collected at 262 sites across TRCA's jurisdiction.
- Over 98% of records had no debris, no odour, and clear water colour, and 92% had clear water.
- Only 1.2% of records were found to have trash (in large amounts).
- Precipitation was found to have significant impact on aesthetics. For example, sites with lower amounts of precipitation on the day of sampling had better Aesthetics Quality Index (AQI) scores.
- Sites with shorter distances to the nearest road had lower/worse AQI scores.
- AQI scores were lower/worse at sites with 'fast' stream currents.
- Mimico Creek, Don River, and Highland Creek watersheds had significantly better AQI scores in 2013 than 2012.
- AQI scores were significantly better in 2013 than 2012; however, fewer waterfront sites were sampled in 2013. Waterfront sites tended to have poor aesthetics in 2012.
- The 2013 report on Aesthetics Quality Monitoring data was completed and submitted to the Toronto RAP team.

3.7 Round Goby partnership with McMaster University's Sigal Balshine Laboratory

Staff Lead: Jan Moryk

Support Staff: Mike Brestansky, Samantha Everson, Mark Szonda, Jeff Vandenberg

Seasonal Staff: Adam Aldworth, Alicia Brunea, Samantha Delargy, Russell Enslow, Mike Swick, James Taylor

Funding: Regional Watershed Monitoring Program (TRCA), McMaster University

Figure 30. **Round Goby (Neogobius melanostomus) captured by RWMP.**

Background and Significance:

It is estimated that the Round Goby (*Neogobius melanostomus)* (**Figure 30**) has been present in Lake Ontario since the early 1990s. Its first occurrence was in Lake St. Clair and by 1997 it had invaded all the Great Lakes. Its presence has negatively impacted native Ontario fish communities (Charlebois *et al*. 1997). Only between 2007 and 2009 has the TRCA's RWMP captured the Round Goby in our rivers and streams, and only at sites relatively close to Lake Ontario. Continued monitoring is necessary in order to assess how our native fish community responds to the Round Goby's expansion into our streams and rivers.

Starting in 2010, TRCA has partnered with McMaster University's Sigal Balshine Laboratory to further Round Goby research. Select samples of Round Gobies captured within TRCA's nine watersheds are preserved and analyzed by McMaster University. Professor Sigal Balshine, along with her colleagues and students, try to answer various gaps in scientific research surrounding the Round Goby and their expansion into various lotic (moving water) and lentic (still water) systems, some of which are adjacent to or within TRCA's jurisdiction. This

partnership will continue in 2014 as more specimens are anticipated to be captured by staff throughout the field season.

2013 Program Highlights

- To date, RWMP has captured Round Gobies during aquatic surveys at a total of six RWMP sampling locations across the following watersheds; Etobicoke, Mimico, Humber, Don, Duffins, and Carruthers. All fish specimens contributed to McMaster (approximately 30 in total) have been preserved by university students.

- In 2013 RWMP, Round Gobies were captured at two sites; HU003WM and EC001WM. Both sites have previous capture records of Round Gobies.

3.8 Ontario Power Generation

Staff Lead: Sue Hayes

Support Staff: Natasha Gonsalves, Gavin Miller, Paul Prior, Derek Tune

Seasonal Staff: Annette Lambert, Rivka Shachak, Chana Steinberg

Funding: Ontario Power Generation

Figure 31. (L to R) Ontario Power Generation landfill hill and landfill shoreline, September 2013.

Background and Significance:

In 2009 TRCA biologists were contracted by Ontario Power Generation (OPG) to establish a local monitoring project on their land in the vicinity of the Pickering power plant, to the east of Frenchman's Bay (**Figure 31**). Several terrestrial fixed plots were established on the designated study area following TRCA's *Long-Term Monitoring Project (LTMP) protocols* for forest, wetland and meadow habitat types (TRCA 2011a to 2011g). The purpose of these study plots is to detect changes and trends in the flora and fauna (**Figure 32**) communities over time. Standardized scientific data collection protocols enable us to assess the response of the terrestrial ecosystem to various landscape changes. For example, the effects of increased natural cover through reforestation or the increased use of the natural area due to urbanization can be quantitatively documented. The assessment of changes in these natural systems can be used to better guide management actions on site with the aim of improving overall biodiversity.

2013 Program Highlights

- In 2013, TRCA Terrestrial Biologists collected the fifth year of data at ten long-term monitoring stations on Ontario Power Generation lands. A summary report discussing all five years of data will be completed in 2014.

Figure 32. Warbling Vireo (*Virio gilvus*) nesting on Ontario Power Generation lands.

3.9 Natural Feature Water Balance Monitoring Study

Staff Lead: Sue Hayes

Support Staff: Natasha Gonsalves, Gavin Miller, Paul Prior, Derek Tune

Seasonal Staff: Annette Lambert, Rivka Shachak, Chana Steinberg

Funding: Great Lakes Sustainability Fund, Peel Region, Toronto Remedial Action Plan (RAP), and York Region

Figure 33. **Vegetation transects, delineated by white PVC poles, were set up in Baif Wetland, Richmond Hill.**

Background and Significance:

Natural features, such as wetlands, woodlands, and watercourses are important components of our regional watersheds, and their hydrology is often negatively affected by urban development. For example, the hydrology of a wetland can dramatically change if the flow of stormwater is either directed towards or away from it, following the installation of stormwater drainage systems to support new development. The wetland may either become too wet or too dry to provide conditions for the wildlife and vegetation it supports. Negative impacts to the hydrology of natural features can also occur in the catchment area upstream where there is not adequate consideration for stormwater management and its effects downstream.

The purpose of this monitoring project is to gain a better understanding of how sensitive wetlands, woodlands and watercourses are to changes in hydrology caused by urbanization. Hydrological and ecological conditions at fixed sites are monitored on a long-term basis to

examine baseline conditions before and after development. This information helps both TRCA and Credit Valley Conservation assess and address the hydrologic impacts of urban development on natural features when reviewing development proposals, as well as establish defensible water management criteria for their protection. This data also assists with future land-use planning and impact assessment, and may possibly influence ecological restoration initiatives and the evaluation of overall watershed health.

2013 Program Highlights

- Four vegetation transects (**Figure 34**), four amphibian stations and three bird stations were monitored at Baif Wetland in Richmond Hill.

Figure 34. Vegetation transects at Baif Wetlands, Richmond Hill.

- Three vegetation transects (**Figure 35**), three amphibian stations and one bird station were established at two additional wetlands on Seaton lands in Durham Region.

Figure 35. Vegetation transects newly established on Seaton Lands, Durham Region in 2013.

4.0 Rusty Cray Fish Monitoring Study

Staff Lead: Jessica Fang

Support Staff: Michael Brestansky, Samantha Everson, Mark Szonda

Seasonal Staff: Adam Aldworth, Alicia Bruneau, Samantha Delargy, Paula Reynolds, Michael Swick, Jet Taylor

Funding: Regional Watershed Monitoring Program (TRCA)

Figure 36. (L to R) Rusty Crayfish (*Orconectes rusticus*).

Background and Significance:

The Rusty Crayfish (*Orconectes rusticus*) **(Figure 36),** is an invasive species that outcompetes native crayfish species. Thus, native crayfish are not expected to buffer the range expansion of this large and aggressive invader, which is present in southern and western Ontario (Phillips *et al.* 2009). Originally from the northeastern United States, Rusty Crayfish has expanded its range presumably due its bait bucket releases (Phillips *et al.* 2009). Once established, it can reduce the benthic macroinvertebrate community, macrophyte biomass, as well alter aquatic habitats.

Rusty Crayfish was first collected by TRCA staff in 1983 in Duffins Creek. However, there is limited historic data available. In 2012, RWMP initiated the Rusty Crayfish Monitoring Project in conjunction with the fish community monitoring. Electrofishing crews collected and preserved the Rusty Crayfish, whereas captured native crayfish species were recorded and released. The objective of this project is to examine the health conditions of the Rusty Crayfish, including

abundance, sex ratio, hybridization, length-weight relationship (condition factor), and the correlation to a variety of habitat characteristics.

The collection of this data will fill in data gaps regarding the current distribution and abundance of the Rusty Crayfish within the TRCA jurisdiction. Analyses are expected to reveal Rusty Crayfish's habitat preference, overall health of the populations, and the hybridization between the Rusty Crayfish and the Northern Clearwater Crayfish (*Orconectes propinquus)*. This project is an important first step in assessing if and how to prevent the Rusty Crayfish from spreading into other streams and watersheds.

2013 Program Highlights

- Data collected in 2012 showed that the Rusty Crayfish had become the dominant crayfish species in both the Rouge River and Duffins Creek.
- In 2013, 34 sites in the Humber River watershed, and 14 sites in the Etobicoke watershed were sampled. No Rusty Crayfish was captured in the Humber River watershed; only one Rusty Crayfish was captured in Etobicoke Creek.
- Monitoring sites located in the Don River, Highland Creek, and Mimico Creek watersheds will be sampled in 2014, which will conclude this three-year long project.

4.1 Mayfield West Comprehensive Adaptive Management Plan

Staff Lead: Angela Wallace (Aquatic), Sue Hayes (Terrestrial)

Support Staff: Michael Brestansky, Samantha Everson, Natasha Gonsalves, Mark Szonda, Derek Tune

Seasonal Staff: Mike King, Ross Kresnick, Annette Lambert, Rivka Shachak

Funding: Town of Caledon

Figure 37. TRCA biologists setting up a forest transect.

Background and Significance:

The Mayfield West (Phase 1) development is part of the planned community of Mayfield located between Hurontario Street and Dixie Road, north of the Highway 410 extension in the Town of Caledon. Mayfield West has been designated as a "Rural Service Centre" and is the product of a substantial and comprehensive planning process. A Comprehensive Adaptive Management Plan (CAMP) was prepared by a consultant on behalf of the Town of Caledon. The goal of the CAMP was to design a long-term environmental monitoring program that would measure the performance and adherence to the Town's environmental management policies as well as to help provide guidance for future developments. TRCA was contracted by the Town of Caledon to conduct all the monitoring activities related to the CAMP. Ecological monitoring began in 2013 and activities are expected to continue for at least 10 more years. Aquatic monitoring includes stream flow, water chemistry, fish and benthic invertebrate habitat and communities, and fluvial geomorphology. Terrestrial monitoring includes amphibians, breeding birds and vegetation in forest **(Figure 37**), wetland and meadow habitats.

2013 Program Highlights

- Six water quality samples were collected at seven sites in the Mayfield study area.
- An automated continuous water quality probe, that measures turbidity (**Figure 38**), suspended solids, temperature, was installed in Etobicoke Creek.

Figure 38. Continuous water quality probe installed in Etobicoke Creek on the Mayfield West property. The probe will be used to record changes in water quality caused by a new development upstream.

- Six pressure transducers were installed and rating curves were developed to monitor stream flow (discharge) in the Etobicoke Creek and the Humber River.
- Fish and benthic macroinvertebrates (aquatic bugs that inhabit stream bottoms) were sampled at seven sites (five in Etobicoke Creek, two in Humber River). The Redside Dace (*Clinostomus elongates*), a provincially endangered minnow species, was caught at one site in the Humber River.
- Vegetation community and wildlife species (flora and fauna) were inventoried across the Mayfield study area. In Mayfield forest communities, three long-term vegetation plots, four bird stations, and one salamander plot were set-up and monitored. In Mayfield wetland communities, two vegetation transects, one bird station, and three amphibian stations were set-up and monitored.

4.2 Copper Creek Golf Course Monitoring

Staff Lead: Sue Hayes (Terrestrial), Angela Wallace (Aquatic)

Support Staff: Michael Brestansky, Samantha Everson, Natasha Gonsalves, Gavin Miller, Paul Prior, Mark Szonda, Derek Tune

Seasonal Staff: Annette Lambert, Rivka Shachak, Chana Steinberg

Funding: Copper Creek Golf Course

Figure 39. (**L) Set-up of terrestrial vegetation 50 meter monitoring transect. (R) Terrestrial monitoring quadrat measuring plant richness and species cover.**

Background and Significance:

The Copper Creek Golf Course (CCGC), located near Kleinburg, Ontario, was opened to the public in late 2002. TRCA, along with various consulting firms, have been conducting monitoring to:

(1) measure any changes in vegetation (**Figure 39**) and wildlife communities due to the golf course's intrusion into a previously forested natural area, and

(2) assess any changes to water quality and quantity in the East Humber River resulting from the initial golf course development and its on-going operation.

2013 Program Highlights

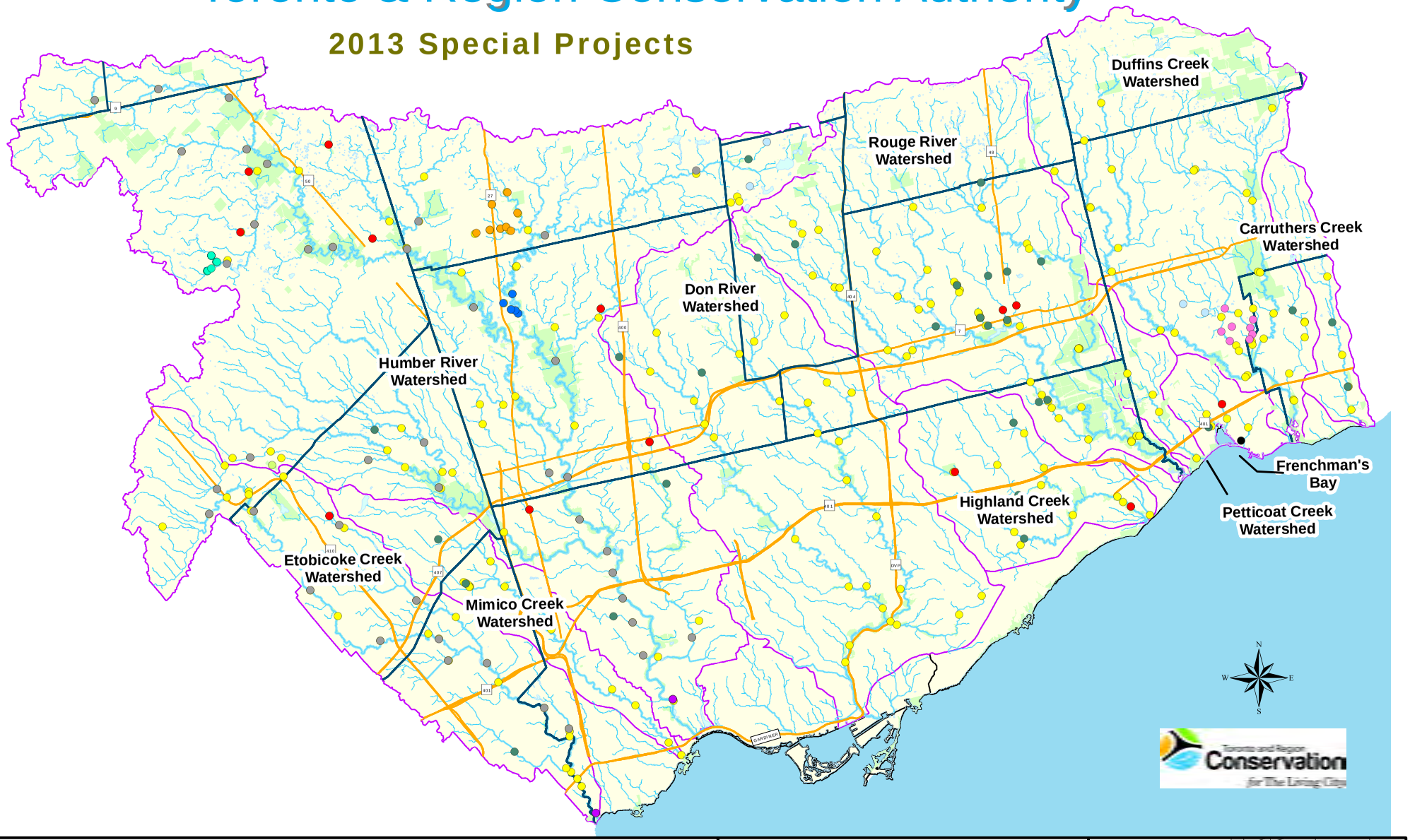
- Two of the final four water quality samples were collected in 2013. The final two samples will be collected in Spring 2014. Samples were analyzed for nutrients, metals and pesticides.

- Breeding bird surveys (**Figure 40**) were completed throughout the property, and all 12 vegetation transects were re-located and surveyed.

Figure 40. Adult Yellow-throated Vireo (*Vireo flavifrons*) feeding a fledgling Brown-headed Cowbird (*Molothrus ater*). Brown-headed Cowbirds are brood parasites, meaning they lay their eggs in other bird nests. They pose a threat to forest birds where land clearing has fragmented their habitat, exposing them to fields and edges where the cowbirds reside.

Toronto & Region Conservation Authority

2013 Special Projects



Legend

- Caledon East
- Copper Creek Golf Course
- Duffin Heights
- Mayfield West Monitoring
- Natural Channel Design
- Natural Feature Water Balance Study
- Nobleton Phosphorous Offset
- Ontario Power Generation
- Remedial Action Plan Aesthetics
- Round Goby Study
- Rusty Crayfish Study
- SC Ontario Reference Conditions/Biocriteria
- Municipal Boundary
- Highway
- Waterbodies
- Watercourse
- TRCA Property
- Watershed Boundary

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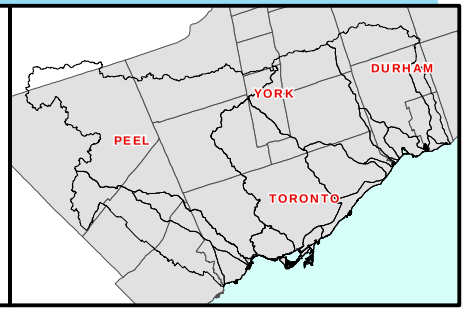

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Paula Reynolds
Sarah Scharfenberg
Rivka Shachak
Amanda Slaght
Chana Steinberg
Michael Swick
Mark Szonda
Andrew Taylor
Jet Taylor
Derek Tune
Jehan Zeb

4.1 Training and Workshops

TRCA's Restoration Services Division is committed to the belief that both the transfer of knowledge and continuous education are critical elements to effective management of our environmental resources. In addition to attending various training sessions, staff in the Watershed Monitoring and Reporting Section conducted several workshops for both internal and external participants.

4.1.1 Conducted by TRCA Staff

- Class 2 Backpack Crew Leader Electrofishing Certification Course was conducted on May 29, 2013 at Boyd Office with a total of 17 participants. (Jeff Vandenberg)
- Mosquito Larvae Identification Workshop was conducted on May 7, 2013 at Boyd Office with a total of 7 participants for Durham Region Public Health Unit. (Jessica Fang)
- Ontario Stream Assessment Protocol Certification Course was conducted on June 10-14, 2013 at Durham College, Oshawa with a total of 25 participants. (Jeff Vandenberg)
- Ontario Stream Assessment Protocol Fish Identification Workshop was conducted on June 8-9, 2013 at Durham College, Oshawa with a total of 19 participants. (Scott Jarvie, Jeff Vandenberg)
- Ontario Stream Assessment Protocol Benthic Invertebrate ID Workshop was conducted on June 8-9, 2013 at Durham College, Oshawa with a total of 15 participants. (Jeff Vandenberg, Jessica Fang)
- Ontario Stream Assessment Protocol Internal Training Session began on May 28, 2013. (Jeff Vandenberg, Jessica Fang)
- Terrestrial Volunteer Monitoring Seasonal Training was conducted during March, May, September and November 2013 with a total of 176 participants. (Theresa McKenzie)
- Water Safety Training Course (Internal) was conducted on April 10 & May 22 2013. (Jeff Vandenberg)

4.1.2 Attended by TRCA Staff

- A.D. Latornell Conservation Symposium. Conservation Ontario. November 20-22, 2013. (Gavin Miller, Jan Moryk, Paul Prior)
- Ecological Land Classification for Southern Ontario. June 2013. (Natasha Gonsalves)
- Ontario Fish Identification Workshop – Cyprinids, University of Guelph; Guelph, Ontario; April 2013. (Mark Szonda, Michael Brestansky)
- Working on Ice Safety Workshop, Where and When? (Michael Brestansky)
- Society for Freshwater Science Taxonomic Certification Program, Acadia University; Wolfville, Nova Scotia; May 2013. (Jessica Fang)
- Sutron Programming and Peripheral Sensors Workshop, Credit Valley Conservation, Mississauga, Ontario; October 2013. (Derek Smith, Leland Wilbur, Greg Dillane)
- Provincial Flood Forecasting and Warning Workshop, Black Creek Pioneer Village; Toronto, Ontario; September, 2013. (Derek Smith, Craig Mitchell, Leland Wilbur, Greg Dillane, Rita Lucero, Jamie Duncan)
- Canadian Dam Association Annual Workshop, Montreal, Quebec; October 2013. (Leland Wilbur)

4.2 Professional Activities

Watershed Monitoring and Reporting Section staff annually participates in a variety of professional activities such as presenting at conferences and contributing to numerous committees. In addition numerous reports or journal articles are completed based on the data collected under RWMP or through special projects.

4.2.1 Presentations

- A.D. Latornell Conservation Symposium. Preserving Biodiversity in Rouge Park: Identifying and Meeting the Challenges. November 2013. (Gavin Miller)

4.2.2 Reports and Publications

- 2010 – 2012 Addendum: Oak Ridges Moraine Corridor Park – Terrestrial Long-term Monitoring Project. May 2013.
- 2012 Addendum: Ontario Power Generation - Terrestrial Long-term Monitoring Project. February 2013.
- 2012 Regional Watershed Monitoring Program Progress Report. April 2013.
- 2012 West Nile Virus Larval Mosquito Monitoring Program Annual Report. March 2013.
- Annual Fish Collection Records Report. 2013. December 2013.
- Baseline Terrestrial Monitoring and Assessment of Zipline / Rope Course at TRCA Sites – Terrestrial Monitoring Summary. December 2013.
- Caledon East 2012 Technical Brief. In Progress.
- City of Toronto Wet Weather Flow Monitoring Network: Baseline Conditions 2008 to 2011. December 2013 (Draft).
- Duffin Heights Terrestrial Monitoring Baseline Conditions Report. March 2013.

- Ontario Power Generation Landfill Terrestrial Biological Inventory and Assessment. December 2013.
- Technical Memo: Peel Groundwater Levels – Follow-up Study.
- Terrestrial Biodiversity in the Toronto Region 2003 - 2012: A Decade of Monitoring Under the Terrestrial Volunteer Monitoring Program. December 2013.
- Terrestrial Biological Inventory and Assessments
  - Altona Forest. February 2013
  - Bolton Camp. February 2013
  - Goodwood Resource Management Tract. January 2013
  - Ontario Power Generation Landfill. December 2013
  - The Living City Campus. July 2013

4.3 Committees

Watershed Monitoring and Reporting Section staff participated on the following committees:

- Conservation Ontario Database Working Group – Toronto and Region Conservation (Scott Jarvie, Angela Wallace, Sue Hayes, Ray Biastoch)
- Conservation Ontario Watershed Report Card – Technical Working Group (Scott Jarvie)
- Durham Region West Nile Virus Response Committee (Jessica Fang)
- Environment Canada's Meteorological and Environmental Monitoring "Network of Networks" Initiative (Derek Smith, Jamie Duncan)
- Jefferson Salamander Implementation Team – Ontario Ministry of Natural Resources (Sue Hayes)
- Modelling Climate Change Impacts on Ecology of Vector-borne Diseases Committee, York University (Jessica Fang)
- Ontario Ministry of Natural Resources Ecological Land Classification Update Technical Team (Gavin Miller)
- Provincial Groundwater Monitoring Network Central Working Group (Jeff Vandenberg)
- Southern Ontario Conservation Authorities Terrestrial Monitoring Network – Toronto & Region Conservation, Conservation Halton, Credit Valley Conservation, Central Lake Ontario Conservation (Theresa McKenzie & Sue Hayes)
- Southern Ontario Stream Monitoring and Research Team (SOSMART) (Scott Jarvie)
- York Region West Nile Virus Liaison Committee (Jessica Fang)

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Appendix A

2013 WM&R Monitoring Activities by Watershed

	Etobicoke	Mimico	Humber	Don	Highland	Rouge	Petticoat	Duffins	Carruthers	Other[1]	Total
Fish Species & Aquatic Habitat	13	0	33	0	0	0	0	0	0	0	46
Benthic Macroinvertebrates	14	5	35	23	11	25	4	21	3	4	145
West Nile Virus Monitoring	4	2	13	5	1	8	1	9	1	1	45
Surface Water Quality	8	2	11	5	1	7	1	9	1	1	46
Baseflow	4	4	24	7	6	5	2	53	12	6	123
Stream Flow	4	1	7	9	1	2	1	8	1	2	36
Precipitation	4	0	11	4	2	5	1	6	0	1	34
Snow	1	0	3	1	0	2	0	3	0	0	10
Groundwater Quality & Quantity	2	0	9	0	0	3	0	6	0	0	20
Terrestrial Natural Heritage[2]	129	0	361	88	0	159	61	63	0	139	1000
Terrestrial Natural Heritage Fixed Plots	19	3	60	17	5	14	6	29	2	5	160
Terrestrial Volunteer Monitoring	5	1	18	8	2	7	1	7	1	4	54
Meteorological (Climate Monitoring)[3]	1	0	6	0	0	3	0	4	0	0	14
Water Temperature	14	1	39	4	1	4	1	4	1	1	70

[1]Other minor watersheds including tributaries of Frenchman's Bay and Toronto Waterfront

[2]Italicized numbers are the number of hectares monitored

[3] Includes both meteorological stations and "stand alone" air temperature stations

Appendix B

2013 WM&R Monitoring Activities by Region

	Durham	Peel	Toronto	York	Other[1]	Total
Fish Species & Aquatic Habitat	0	25	11	10	0	46
Benthic Invertebrates	30	27	47	39	2	145
West Nile Virus Monitoring	12	7	13	13	0	45
Surface Water Quality	12	8	13	13	0	46
Baseflow	71	13	25	14	0	123
Stream Flow	11	9	11	5	0	36
Precipitation	6	9	7	12	0	34
Snow	3	3	1	3	0	10
Groundwater	6	7	1	6	0	20
Terrestrial Natural Heritage[2]	61	337	161	441	0	1000
Terrestrial Natural Heritage Fixed Plots	31	56	32	41	0	160
Terrestrial Volunteer Monitoring	10	12	18	13	1	54
Meteorological (Climate Monitoring)[3]	4	2	1	7	0	14
Water Temperature	7	26	20	15	2	70

[1]Dufferin/Simcoe

[2]Italicized numbers are the number of hectares monitored

[3] Includes both meteorological stations and "stand alone" air temperature stations