2010 Surface Water Quality Summary

Regional Watershed Monitoring Program

June 2011

Watershed Monitoring and Reporting Section
Ecology Division

TORONTO AND REGION Conservation
for The Living City

Acknowledgments

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Funding and/or in-kind support for the projects and activities outlined in this report has been made available from the following partners:

Region of Peel
Region of York
City of Toronto
Region of Durham
Toronto Remedial Action Plan
Ministry of the Environment

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This report may be referenced as:
Toronto and Region Conservation Authority (TRCA). 2011. 2010 Surface Water Quality Summary – Regional Watershed Monitoring Program.

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1. Introduction

Since 2002, the Toronto and Region Conservation Authority (TRCA) has monitored monthly stream water quality at selected locations within the watersheds of the greater Toronto region. These activities have been undertaken as part of TRCA's Regional Watershed Monitoring Program (RWMP) in partnership with the Ontario Ministry of the Environment (MOE). The data collected is shared with partner municipalities and other agencies, and is used for planning, implementation and reporting activities including the development of watershed plans and report cards as well as watershed characterization reports in support of source water protection planning.

This report presents the 2010 laboratory results from the RWMP surface water quality sampling program and provides a general overview and description of the range of water quality conditions across the TRCA jurisdiction. This report and associated data can assist in identifying areas of concern, elevated levels of contaminants, and can be used to affirm both poor and good water quality in different land use areas. However, results should be interpreted with caution, since sampling events were not targeted to capture specific stream flow conditions (e.g. wet weather events) and this report only presents one year of data which may not represent normal conditions.

2. Methods

In 2010, surface water quality samples were collected at 41 stations (Figure 1) throughout the TRCA's jurisdiction. Sample collection and laboratory analysis were carried out through several partnerships. These partnerships are outlined below.

- 13 stations were sampled by TRCA under the MOE's Provincial Water Quality Monitoring Network (PWQMN).
- 28 stations were sampled by TRCA for the Regional Watershed Monitoring Program (RWMP) including 3 special project sites (104028, 104026 and 104023) which were established in October 2010 as part of the Seaton/Duffins Heights Development Project.

Sample collection was undertaken monthly using in-stream "grab" techniques following the MOE PWQMN protocol. Sampling also included in-situ measurements (e.g. water temperature, conductivity, and dissolved oxygen) collected using a hand-held YSI meter (Model 600QS). Sampling occurred year-round, typically the third week of each month, and was independent of precipitation. Samples were submitted to the MOE Rexdale Laboratory and the York-Durham Regional Environmental Laboratory for analysis. Samples for months not covered by the PWQMN partnership (e.g. December to March) were submitted to the York-Durham Laboratory for January, February, March and December in order to augment water quality data from these sites and to maintain a year-round dataset.

Stream conditions were noted at the time of sampling in order to characterize the sample with respect to flow response to recent or occurring precipitation. These field notes (Appendix A) along with 2010 precipitation records from Pearson International Airport (Figures 3 and 4) are included in this report to provide context to assist with interpretation of results.

Parameters assessed are listed in Table 1 and include a standard suite of nutrients, metals and conventional water quality parameters used by the PWQMN. Microbiological samples were collected by TRCA at all 41 stations in 2010 and submitted to the York-Durham Regional Environmental Laboratory or the MOE Rexdale Laboratory for analysis.

Laboratory results were compared to the Provincial Water Quality Objectives (PWQO) where applicable. The PWQO are a set of numerical and narrative ambient surface water quality criteria that represent a desirable level of water quality that will protect all forms of aquatic life and all aspects of the aquatic life cycles during indefinite exposure to the water as well as protecting recreational water usage based on public health considerations and aesthetics (OMOEE 1994). When PWQO were not available, other objectives such as Water Quality Guidelines (CWQG) (CCME 2007) and Recommended Water Quality Guidelines for the Protection of Aquatic Life under the Canadian Environmental Sustainability Indicators (CESI) Initiative (EC 2005) were used. All laboratory results that were reported as less than the minimum detection limit (MDL) were set to the MDL value for the purposes of interpretation.

Surface water quality data is stored in "*Water"*, a relational Microsoft Access database that is part of the TRCA's corporate database *EnviroBase*. The *Water* database includes laboratory results and metadata such as laboratory analysis methods and sampling equipment.

Table 1. Standard suite of water quality parameters analyzed[1]

General Chemistry	Water Temperature	Biochemical Oxygen Demand	*Total Suspended Solids	Total Dissolved Solids	Dissolved Oxygen
	Conductivity	Hardness	Magnesium	pH	Potassium
	Alkalinity	Sodium	Calcium	*Chloride	Turbidity
Nutrients	Nitrogen, Total Kjeldahl	*Total Phosphorus	Phosphate	Ammonia	*Nitrate/Nitrite
Microbiological	Escherichia coli	Background Colonies			
Metals	Aluminum	Barium	Beryllium	Cadmium	Chromium
	Cobalt	*Copper	Iron	*Lead	Manganese
	Molybdenum	Nickel	Strontium	Vanadium	*Zinc

Note: [1]Additional parameters may be analyzed on a site/project specific basis
*PWQMN recommended indicator parameters

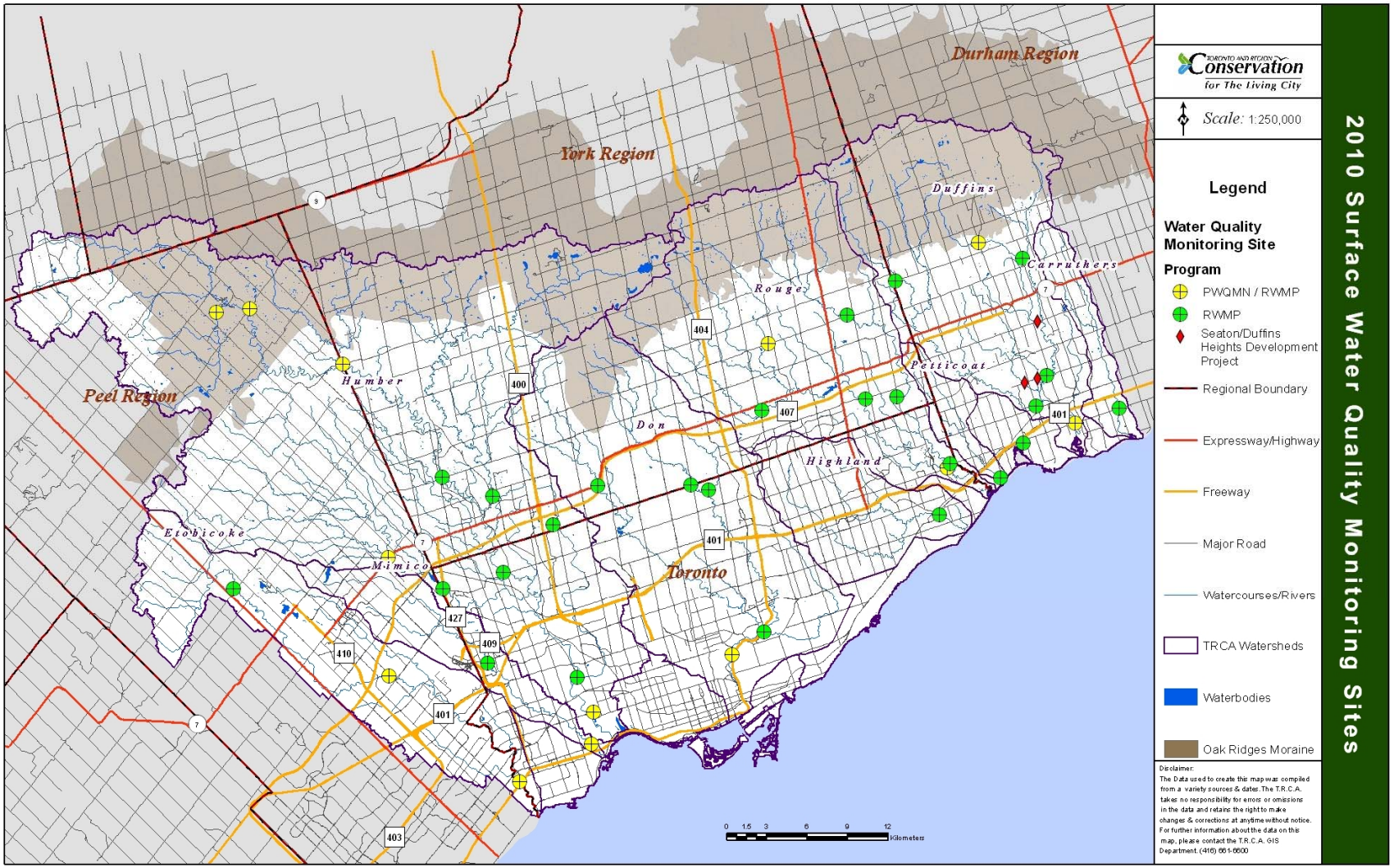

Figure 1. 2010 surface water quality monitoring sites

Table 2. 2010 RWMP surface water quality sites and associated laboratories

Station	Watershed	UTM Coordinates		General Chemistry, Metals, Nutrients and Bacteria		
		Northing	Easting	Jan- Mar	Apr-Oct	Nov-Dec
Mayfield	Etobicoke	4843488	595028	Y	Y	Y
80007	Etobicoke	4836746	606933	Y	M	Y
80006	Etobicoke	4829016	616234	M	M	M
MM003WM	Mimico	4837916	613849	Y	Y	Y
82003	Mimico	4831713	621585	M	M	M
83104	Humber	4864112	593560	Y	M	Y
83018	Humber	4864329	595961	Y	M	Y
83009	Humber	4860243	602980	Y	M	Y
83020	Humber	4851861	610386	Y	Y	Y
83004	Humber	4850423	614148	Y	Y	Y
HU010WM	Humber	4844744	615027	Y	Y	Y
83103	Humber	4845870	606385	Y	M	Y
83002	Humber	4843562	610459	Y	Y	Y
HU1RWMP	Humber	4848311	618678	Y	Y	Y
83012	Humber	4836845	620488	Y	M	Y
83019	Humber	4834265	621663	M	M	M
85004	Don	4851207	622014	Y	Y	Y
85003	Don	4851256	628954	Y	Y	Y
DN008WM	Don	4850889	630236	Y	Y	Y
DM 6.0	Don	4840251	634378	Y	Y	Y
85014	Don	4838576	632000	M	M	M
94002	Highland	4849056	647429	Y	M	Y
97018	Rouge	4861770	634680	Y	M	Y
97999	Rouge	4863887	640589	Y	Y	Y
97777	Rouge	4856823	634214	Y	Y	Y
97003	Rouge	4857669	641985	Y	Y	Y
97007	Rouge	4857816	644300	Y	Y	Y
97013	Rouge	4852830	648243	Y	Y	Y
97011	Rouge	4852511	648007	M	M	M
FB003WM	Pine Creek	4854151	653659	Y	Y	Y
PT001WM	Petticoat	4851804	652005	Y	Y	Y
104008	Duffins	4869299	650372	Y	M	Y
104037	Duffins	4866462	644191	Y	Y	Y
104029	Duffins	4868158	653641	Y	Y	Y
104028*	Duffins	4863433	654742	-	Y	Y
104023*	Duffins	4858867	653796	-	Y	Y
104026*	Duffins	4859199	654730	-	Y	Y
104027	Duffins	4859419	655458	Y	Y	Y
104025	Duffins	4857115	654656	Y	Y	Y
104001	Duffins	4855880	657579	M	M	M
107002	Carruthers	4856972	660850	Y	Y	Y

M:MOE Laboratory; Y: York-Durham; *: Sampling started in October 2010

3. Results & Discussion

Sampling results are presented in box plots (e.g. Figure 2) which summarize the distribution of results for each parameter over the course of the year. Box plots display the range of data that falls within 1.5 times the upper and lower quartiles and excludes extreme values. The use of box plots allows the reader to view the range of results with the majority (50%) of results being located within the box section.

The ends of the boxes represent the 25th and 75th quartiles. The difference between the quartiles is the interquartile range. The line across the middle of the box identifies the median sample value. The "whiskers" represent the calculated value of plus or minus 1.5 times the interquartile range.

Sample stations are arranged in each graph from upstream to downstream (left to right) and watersheds are arranged from west to east along the x-axis of each graph.

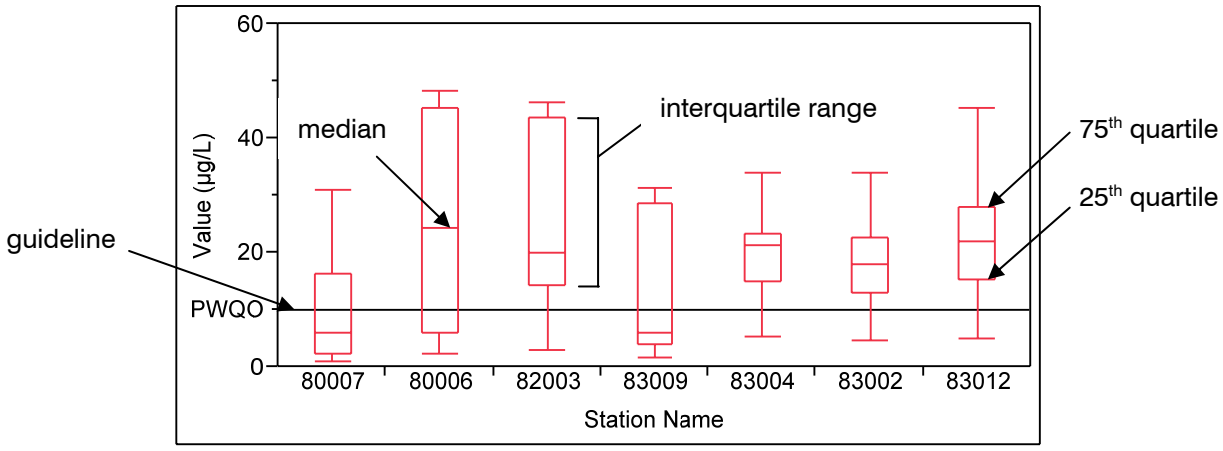

Figure 2. Box plot graphic example

The MOE recommends a minimum sample size of 30, as this sample size will help reduce the influence of unusual conditions such as spills, extreme runoff events and drought. Due to the low annual sample size (n=12) for each site, only a limited number of high results (e.g. wet weather flow) are required to skew the median results upwards.

3.1 Precipitation

The total amount of precipitation recorded in 2010 at the Lester B. Pearson International Airport measured 763 mm. This is slightly below the 10 year average of 794 mm (Figure 3). Seasonal precipitation values for 2010 are displayed in Figure 4. Precipitation quantity peaked in June of 2010 (Figure 4) and may have contributed to the levels of pollutants found at some sites.

Sampling occurred year round and was independent of precipitation, however, one quarter (26%) of the samples collected in 2010 were taken during and/or immediately after precipitation events (Appendix A).

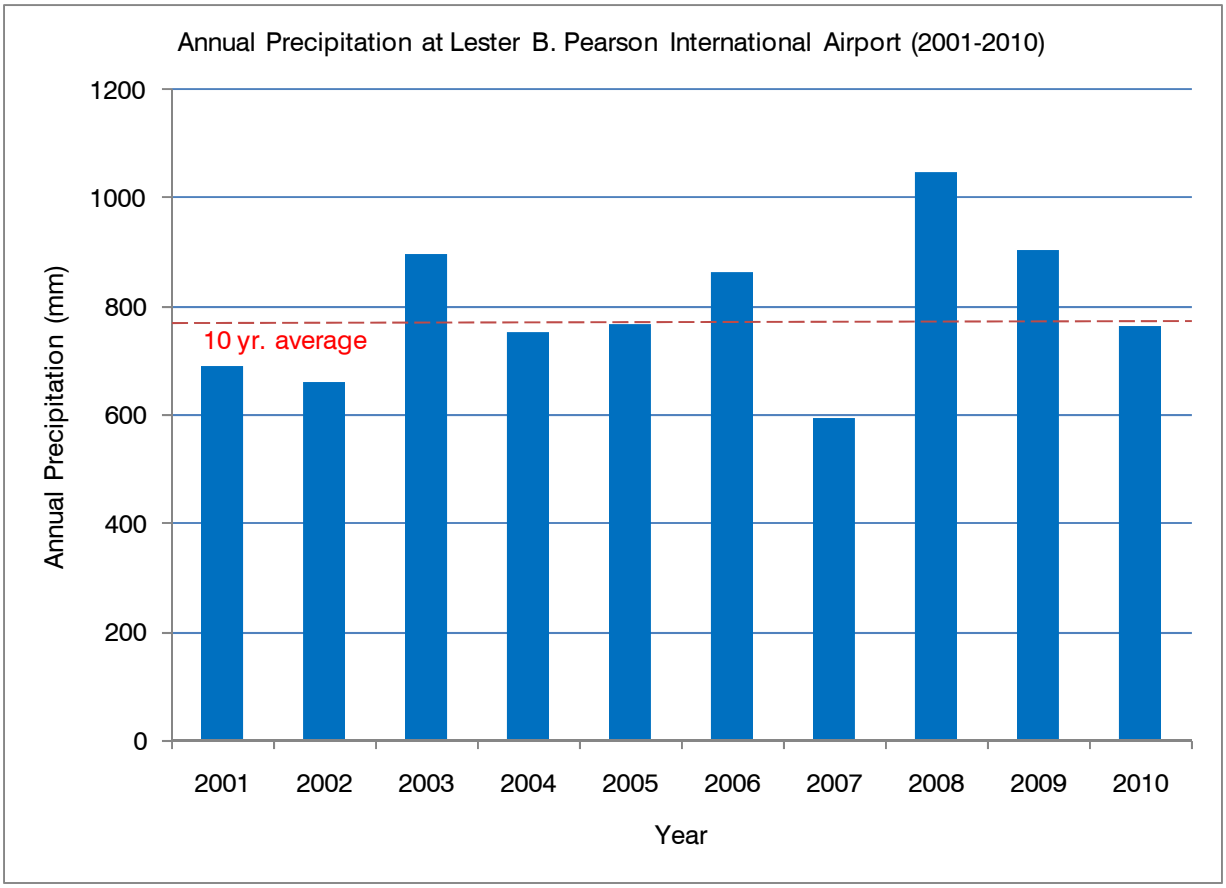

Figure 3. Annual precipitation at Lester B. Pearson International Airport (2001-2010)

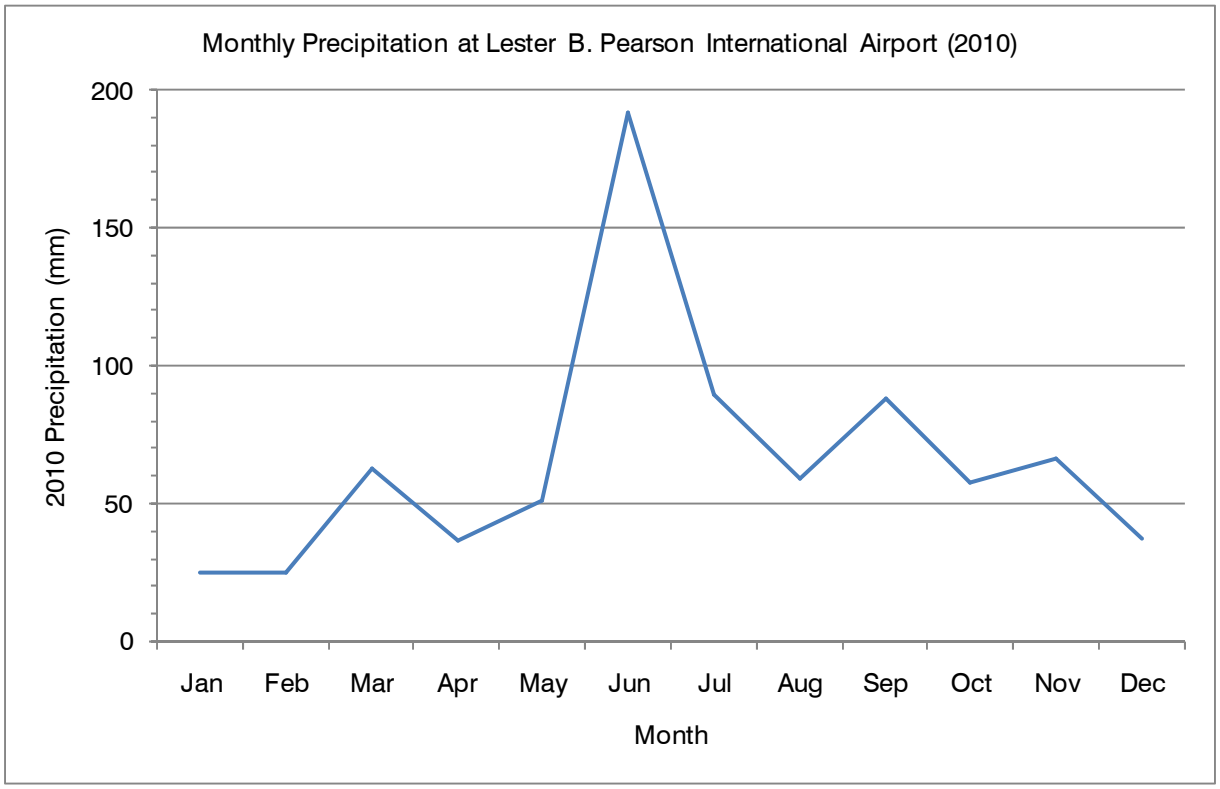

Figure 4. Monthly precipitation at Lester B. Pearson International Airport (2010)

3.2 General Chemistry Parameters

Chloride and Specific Conductivity

Chloride (Figure 5) and specific conductivity (Figure 6) displayed similar patterns with higher levels associated with urban areas. Approximately half (20/41) had a median value which surpassed the proposed CWQG chloride guideline of 128 mg/L for chronic exposure. Included in these 20 stations were MM003WM and 82003 which exceeded the proposed CWQG acute chloride guideline of 586 mg/L. Both of these stations are located in Mimico Creek. Station HU1RWMP had a median value slightly below the 586 mg/L objective and had a range which exceeded 3000 mg/L.

The high levels, both range and median, of chloride at all 20 stations was likely a result of the surrounding land-use. All stations are located in developed urban areas with varying land uses (i.e. industrial, commercial, residential etc). Road salting is directly linked to urbanization and increased chloride and specific conductivity levels. In contrast, stations 104025, 104027 and 104001 located on Duffins Creek close to the watershed outlet in a developed area did not display elevated chloride or specific conductivity levels, likely because of a lower road density. Similarly, stations located in natural/rural areas do not display elevated levels of chloride or specific conductivity.

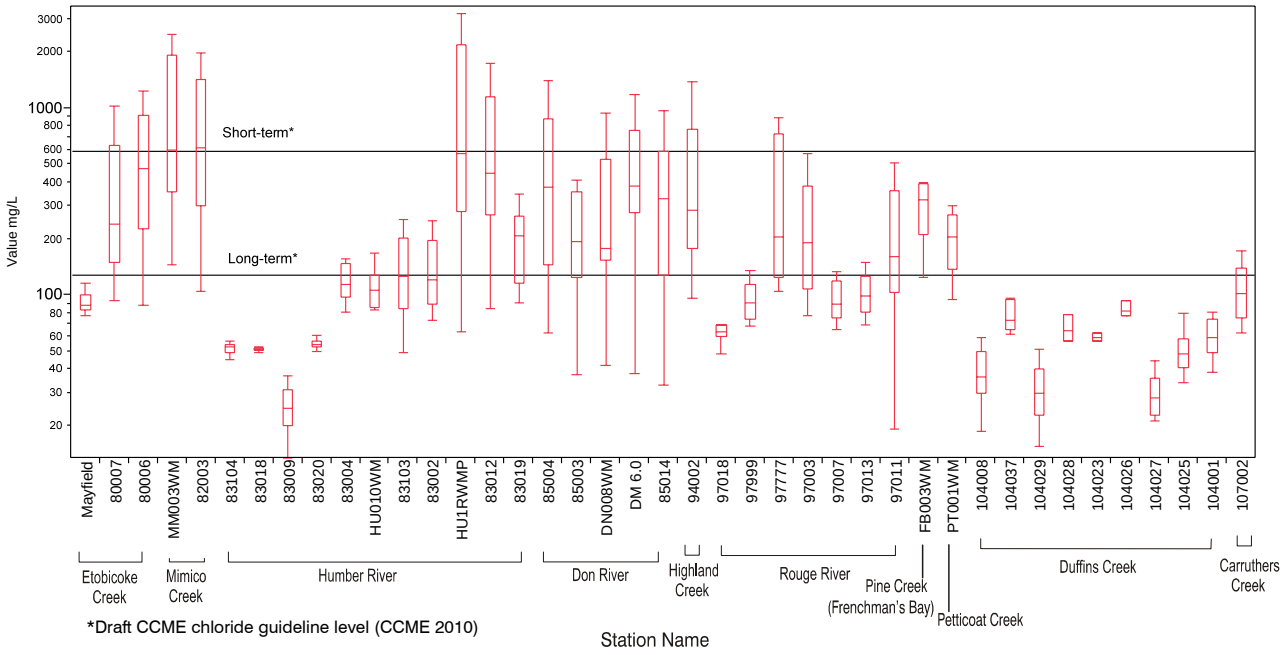

Figure 5. Chloride concentrations (mg/L) at 41 sites within TRCA jurisdiction (Draft CWQG: 128 mg/L (chronic) and 586 mg/L (acute); CCME 2010)

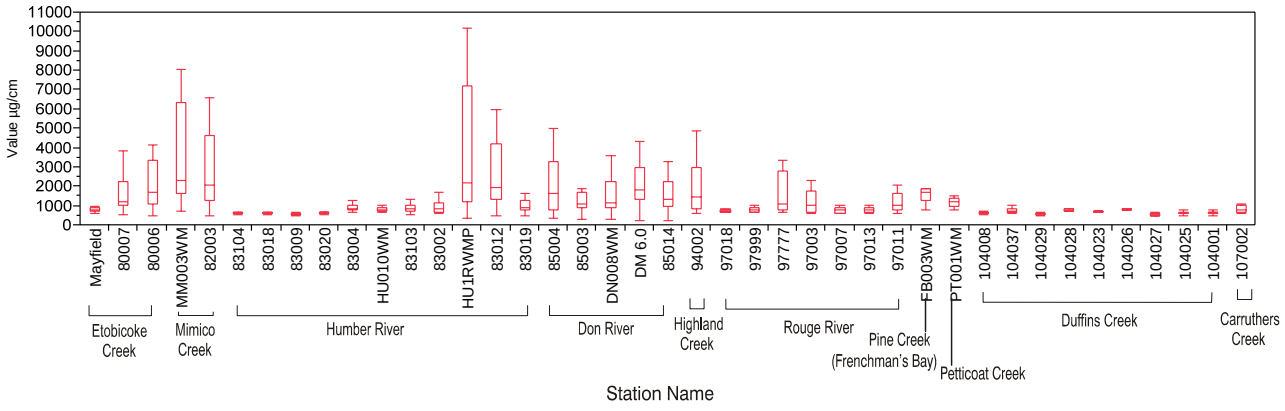

Figure 6. Specific conductivity (*µ*S/cm) at 41 sites within TRCA jurisdiction

Total Suspended Solids

Median values for total suspended solids remained below the CWQG of 30 mg/L for all stations (Figure 7). The interquartile range of values however exceeded the objective at 6 of the 41 sites. Furthermore, the Humber River and Don River exhibited the highest levels of total suspended solids when compared to all other watersheds.

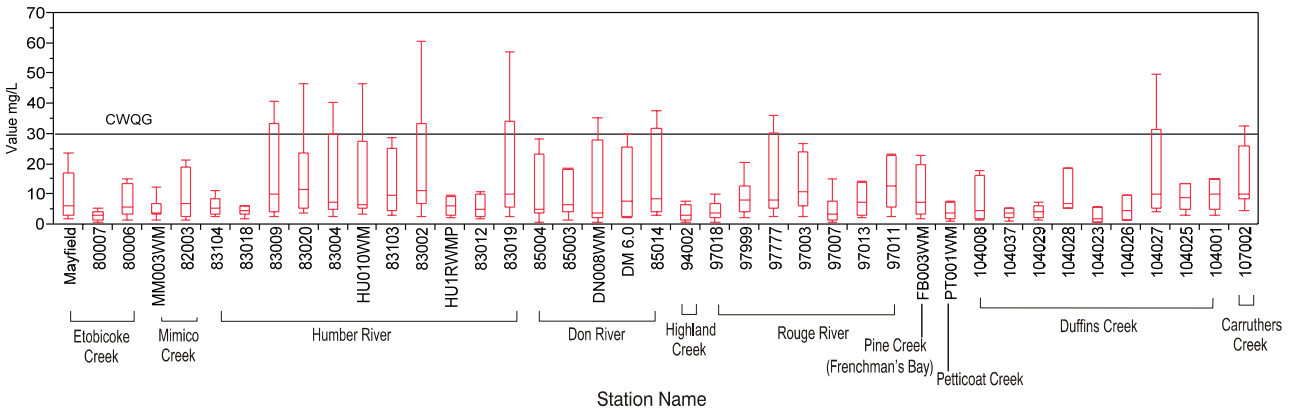

Figure 7. Total suspended solids (TSS) concentrations (mg/L) at 41 sites within TRCA jurisdiction (CWQG: 30 mg/L)

pH

Median pH values were within PWQO range of 6.5 to 8.5 for all stations (Figure 8). The majority of median values were within 8 to 8.5 and only 2 stations had upper range values that slightly exceeded the PWQO.

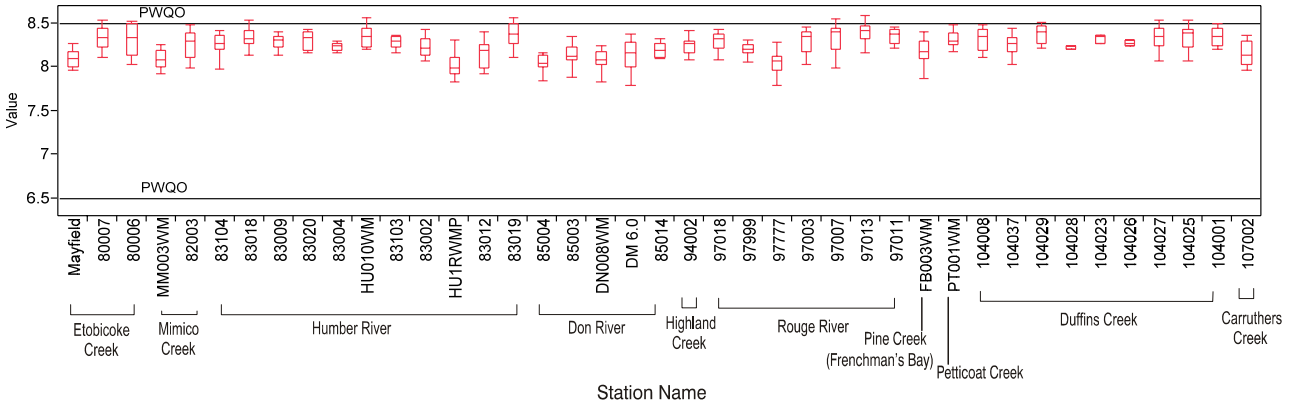

Figure 8. pH values at 41 sites within TRCA jurisdiction (PWQO: 6.5-8.5 pH)

3.3 Metals

Metals occur naturally in the environment, but human activities such as industrial processes and urban runoff can dramatically alter their distribution and increase their occurrence. When metals are released into the environment in higher than natural concentrations, they can be toxic, cause disruptions to aquatic ecosystems and decrease a waterbody's suitability for supporting aquatic life and domestic uses.

Aluminum

Currently, there is no PWQO, CWQG or CESI guidelines which define the amount of allowable total aluminum for the protection of aquatic life. Relatively higher levels were found at sites located in urban areas within all the watersheds (Figure 9).

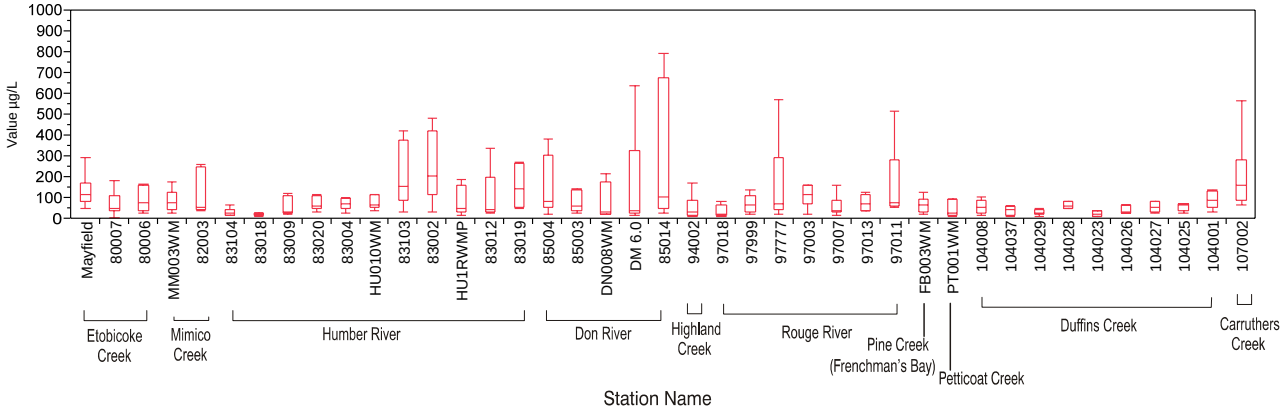

Figure 9. Total aluminum concentrations (µg/L) at 41 sites within TRCA jurisdiction

Arsenic

Arsenic data presented in this report is based on a limited dataset since all stations were not analyzed regularly for this parameter. Only samples submitted to the York-Durham Environmental laboratories were analyzed for arsenic since this parameter is not analyzed by MOE under the PWQMN (See Table 1). This includes station 83019 and 85014 from which samples are analyzed exclusively by MOE. Arsenic levels in 2010 (Figure 10) were well below the PWQO of 5 µg/L.

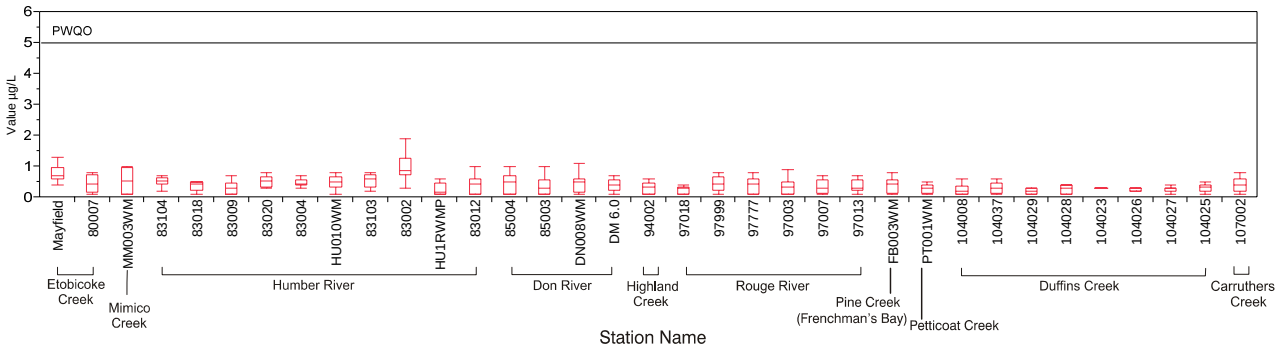

Figure 10. Arsenic concentrations (µg/L) at 35 sites within TRCA jurisdiction (PWQO: 5 µg/L)

Copper

Copper (Figure 11) displayed elevated median levels at sites located closest to the mouths of Etobicoke Creek, Mimico Creek and the Don River and at one station of the Humber River. Concentrations in Etobicoke Creek and the Humber River were lowest at the most northern (upstream) stations (Mayfield and 83104) and generally showed increases further south (downstream) in the watersheds. Duffins Creek exhibited copper levels well below the PWQO for all nine sites. Stations MM003WM and DM 6.0 displayed reduced median copper concentrations in 2010 relative to 2009.

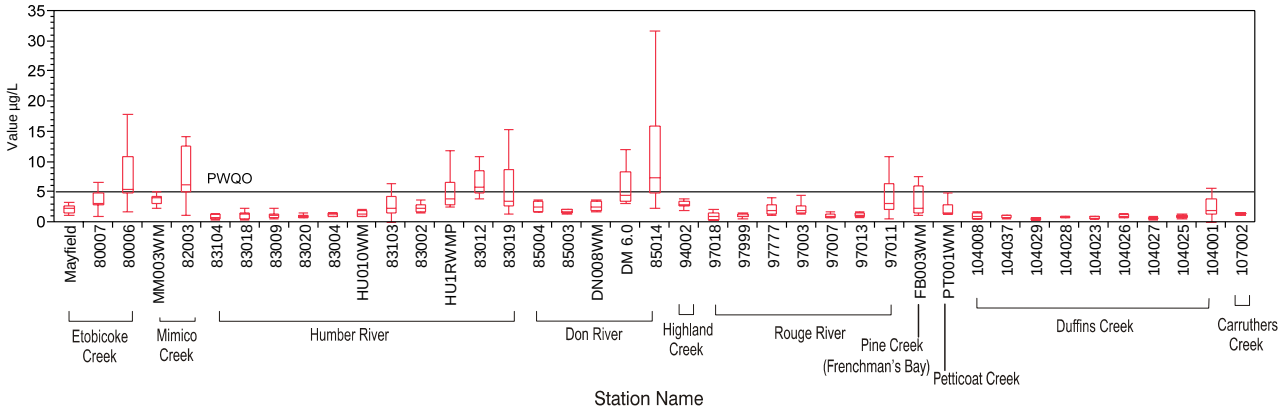

Figure 11. Copper concentrations (µg/L) at 41 sites within TRCA jurisdiction (PWQO: 5 µg/L)

Iron

Stations where median iron values exceeded or approached the PWQO of 300 µg/L were predominantly located in urbanized areas in the mid-lower Humber River, the Don River, Pine Creek (Frenchman's Bay) and Carruthers Creek stations (Figure 12). Many of these stations showed similar elevated concentrations in 2009. Iron concentrations appeared to be highest at station DN008WM. This site is located downstream

of an industrial/commercial complex located southeast of Highway 404 and Steeles Ave. Sources of iron include the production of paint pigments, plastics and electrical materials (CCME 2007). Stations 83009, 83002, HU1RWMP, 83012, 85004 and DM 6.0 exceeded the PWQO in 2010 as well as in 2009. Station 83019 displayed an elevated median value for 2010 which exceeded the PWQO contrary to 2009.

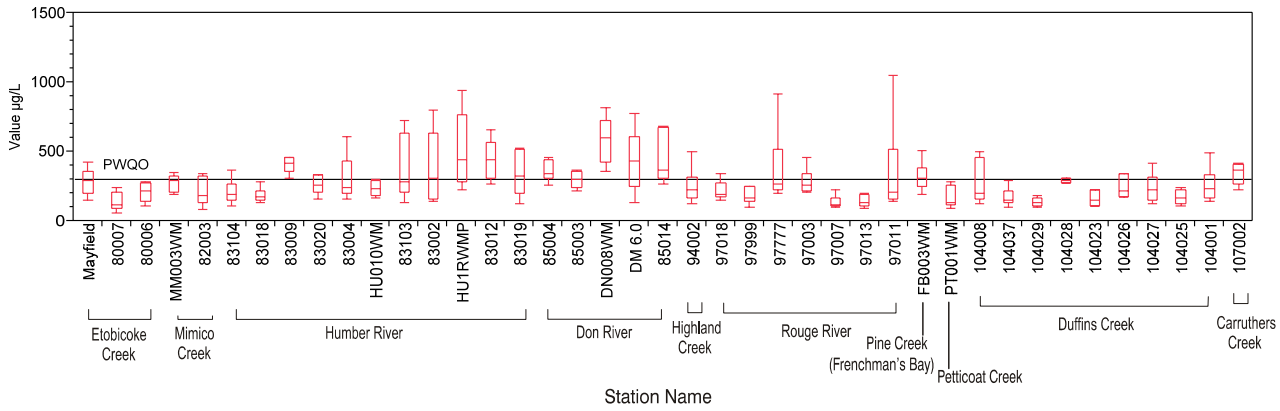

Figure 12. Iron concentrations (µg/L) at 41 sites within TRCA jurisdiction (PWQO: 300 µg/L)

Lead

The MOE laboratory lead values were omitted due to the MOE reporting detection limit being 11µg/L, which is well above the PWQO of 5 µg/L. Therefore, the MOE lead dataset is not comparable due to higher variability at low concentrations. As a result, the lead dataset for stations analyzed at the MOE laboratory is greatly reduced (n=6) and results should be interpreted with caution. Outlet stations (80006, 82003, 83019, 85014, 97011 and 104001) were excluded as well because all samples were analyzed by the MOE laboratory in 2010. Median levels of lead were below the PWQO for all 35 stations shown in Figure 13.

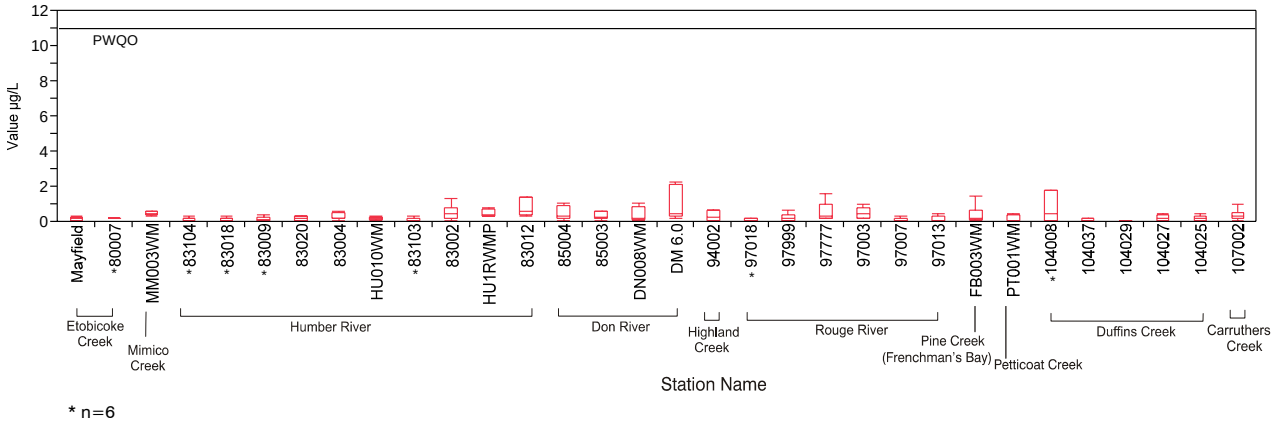

Figure 13. Lead concentrations (µg/L) at 35 sites within TRCA jurisdiction (PWQO: 5 µg/L)

Nickel

Nickel (Figure 14) results were all well below the PWQO OF 25 µg/L. Stations located lower in each watershed displayed slightly higher levels of nickel.

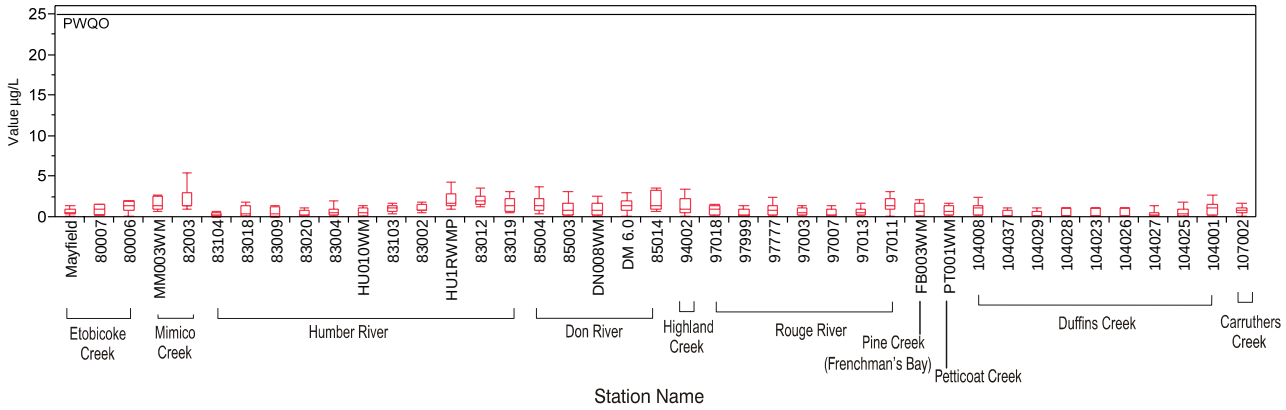

Figure 14. Nickel concentrations (µg/L) at 41 sites within TRCA jurisdiction (PWQO: 25 µg/L)

Zinc

Median zinc concentrations (Figure 15) did not exceed the PWQO, although station 83012 was found to have a median value almost equal to the PWQO. In addition, several locations in Etobicoke Creek, Mimico Creek, the Humber River and the Don River had some samples that greatly exceeded the PWQO, which may be a potential concern in the future. These stations with excessive values were indentified in 2009 as well.

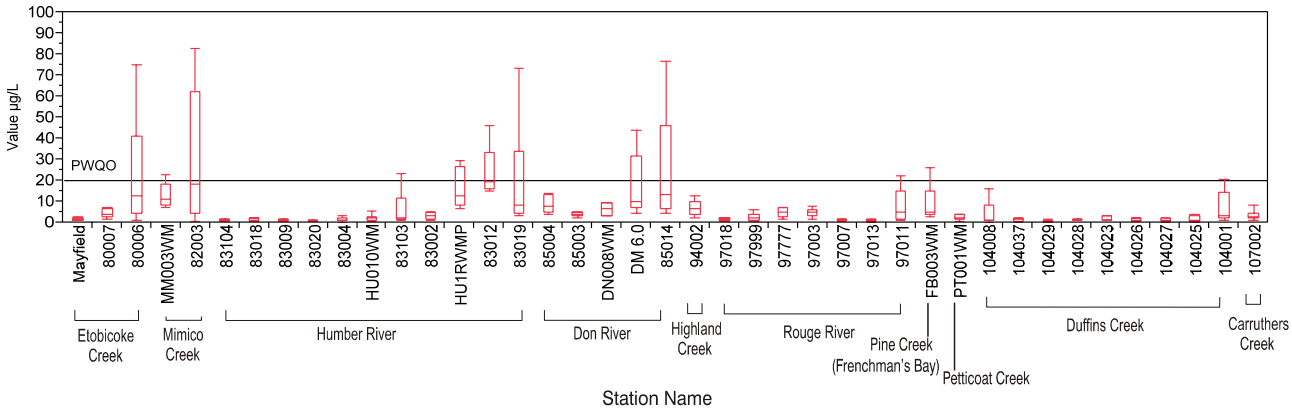

Figure 15. Zinc concentrations (µg/L) at 41 sites within TRCA jurisdiction (PWQO: 20 µg/L)

3.4 Bacteria

Escherichia coli (*E. coli)* median levels met or exceeded the PWQO of 100 colony forming units (CFU)/100 mL at 25 of 41 stations in 2010 (Figure 16). The median values for 6 stations were above 500 CFU/100 mL and 5 of those were above 1000 CFU/100 mL (83012, 85003, DM 6.0, 94002 and FB003WM). Areas of concern include Etobicoke Creek, Mimico Creek, lower Humber River, the Don River, Highland Creek, and a mid-section of the Rouge River. The two stations with the most extreme median values are located in the lower portion of the Humber River (83012) and the Don River (85014). Station 83012 is located on a heavily urbanized tributary of the Humber River that is serviced by combined sewers with large portions of the channel hardened with concrete banks. These conditions appear to result in an influx of contaminants from the upstream urban areas, which then travel downstream with little opportunity to be filtered or absorbed by the riparian zone. Station 85014 is located approximately 1.5 km downstream of the North Toronto Wastewater Treatment Plant which contributes to elevated *E. coli* concentrations in the lower Don River.

In contrast, Duffins Creek displayed relatively low levels of *E. coli* overall. Only one station (104037) had a median value over the PWQO with a value of 150 CFU/100 mL. This station is surrounded by agricultural lands which likely is the source of elevated *E. coli levels.* Station 83009, which is also located in an agricultural area, as well as in close proximity to the Town of Bolton, displayed median *E. coli* levels above 100 CFU/100mL as well.

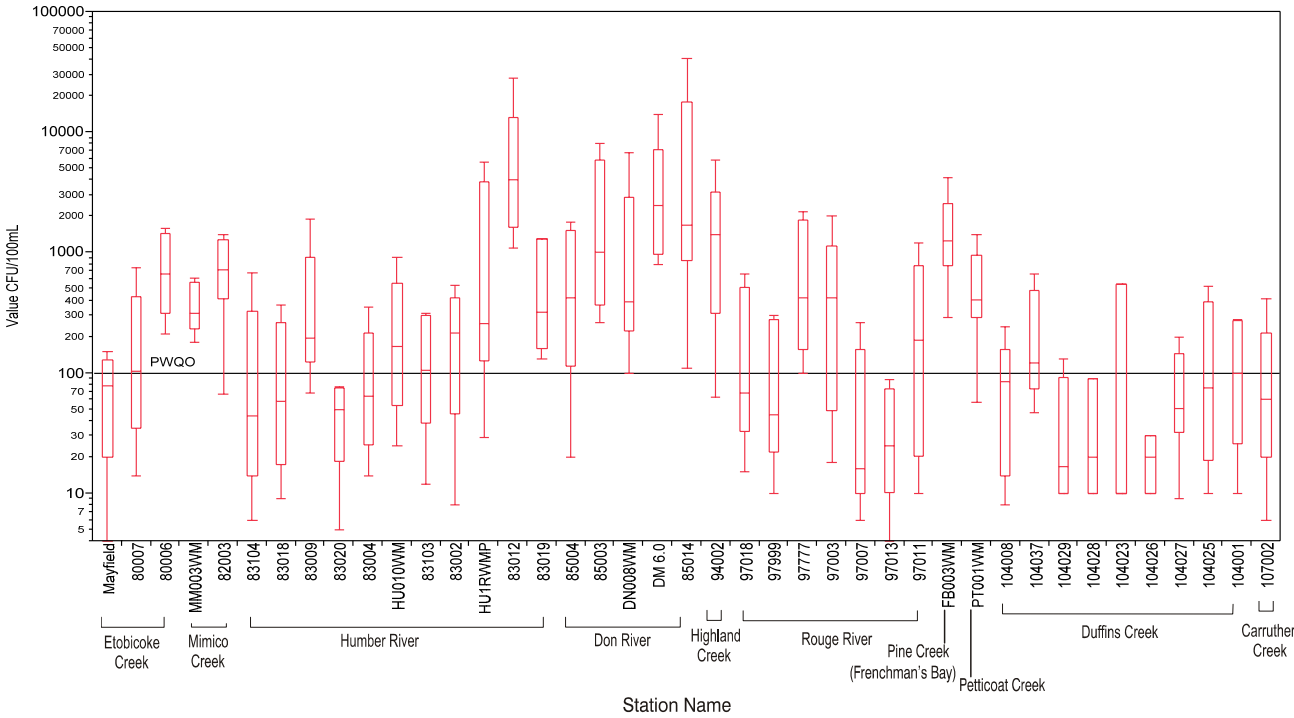

Figure 16. ***Escherichia coli*** **concentrations (CFU/100mL) at 41 sites within TRCA jurisdiction (PWQO: 100 CFU/100 mL)**

3.5 Nutrients

Nutrient levels are presented in Figures 17-21. Mimico Creek and portions of the Humber River and Don River display elevated nutrient levels. The highest median total ammonia value was recorded at station 83012 in the Humber River (392 mg/L). Total Ammonia levels at this station are a result of the input of nutrients from combined sewers and the surrounding urban area. Stations 83002, DM 6.0, 85014 and DN008WM had median values above 100 mg/L. This can be also be attributed to combined sewer systems and 85014 being located 1.5 km downstream of the North Toronto Wastewater Treatment Plant which discharges effluent into the lower Don River.

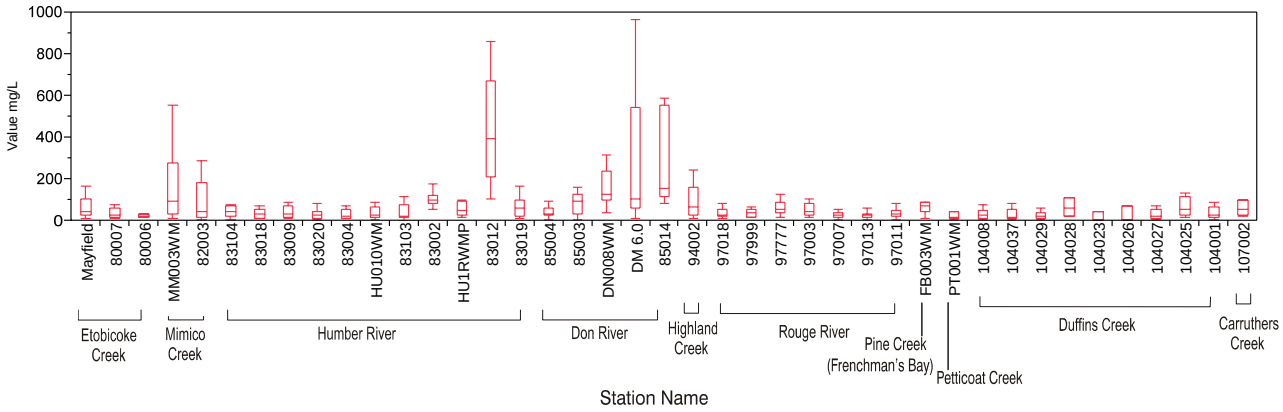

Figure 17. Total ammonia concentrations (mg/L) at 41 sites within TRCA jurisdiction

Median phosphorus levels exceeded the PWQO of 0.03 mg/L at 24 out of 41 stations in 2010. The majority of stations were located in Etobicoke Creek, Mimico Creek, Don River and Carruthers Creek. Approximately three-quarters of the stations located in the Humber River exceeded the PWQO. Stations 85014 and 83002 displayed the highest elevated levels of phosphorus.

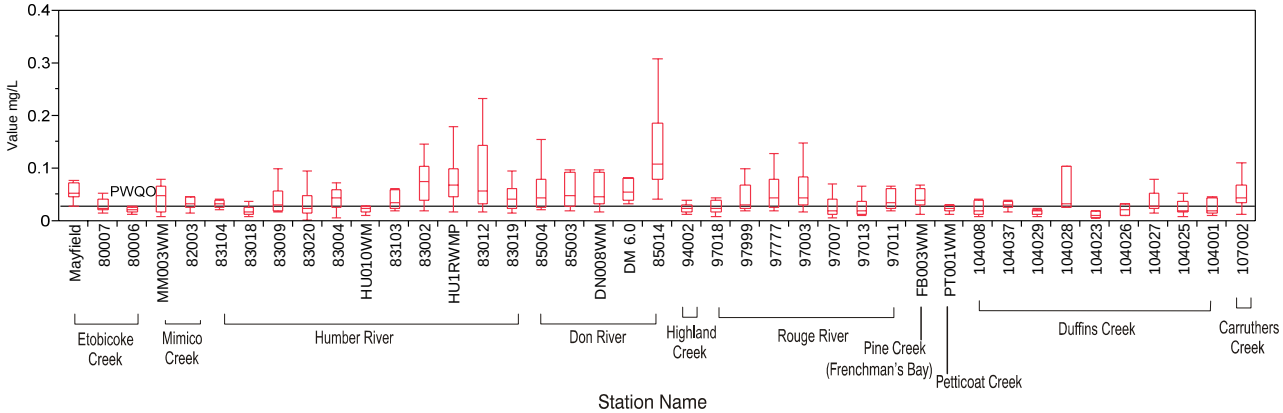

Figure 18. Total phosphorus concentrations (mg/L) at 41 sites within TRCA jurisdiction (PWQO: 0.03 mg/L)

In contrast, only one of the 41 stations exceeded the water quality objectives for nitrite, while no stations exceeded the objectives for nitrate. Station 83012 had a median nitrite concentration slightly above the PWQO of 0.06 mg/L. Nitrite interquartile ranges were greater at stations 80006, MM003WM, 82003, HU1RWMP, 83012, DN008WM, DM 6.0, and 85014 relative to the other stations. Median nitrate values appeared elevated at stations MM003WM, 82003, DN008WM, DM 6.0 and 85014. In general, nitrate concentrations increased with urbanization. Total Kjehldahl Nitrogen median values were elevated in the Etobicoke Creek, Mimico Creek, portions of the Humber River and the Don River with stations 83012 and 85014 having the highest median values. Total Kjehldahl Nitrogen is the total concentration of organic nitrogen and ammonia.

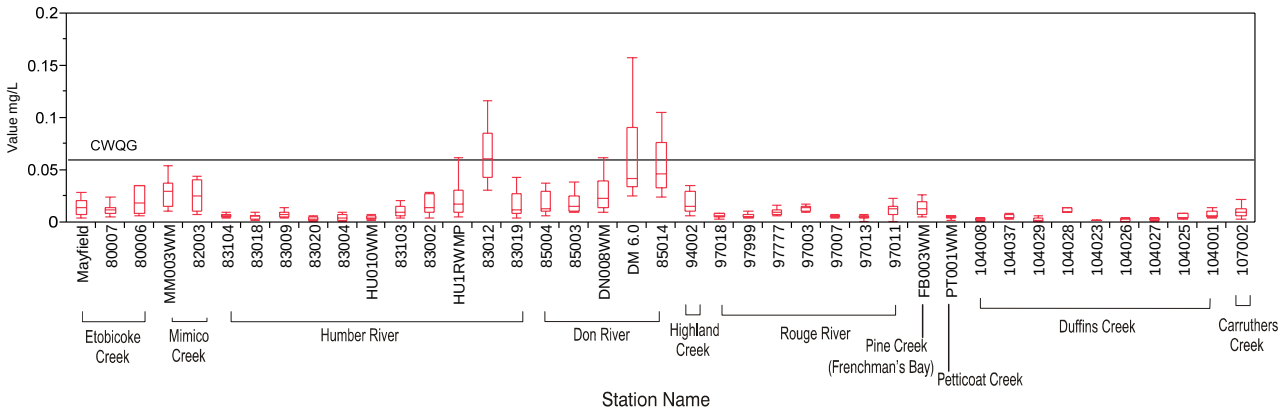

Figure 19. Nitrite concentrations (mg/L) at 41 sites within TRCA jurisdiction (CWQG: 0.06 mg/L)

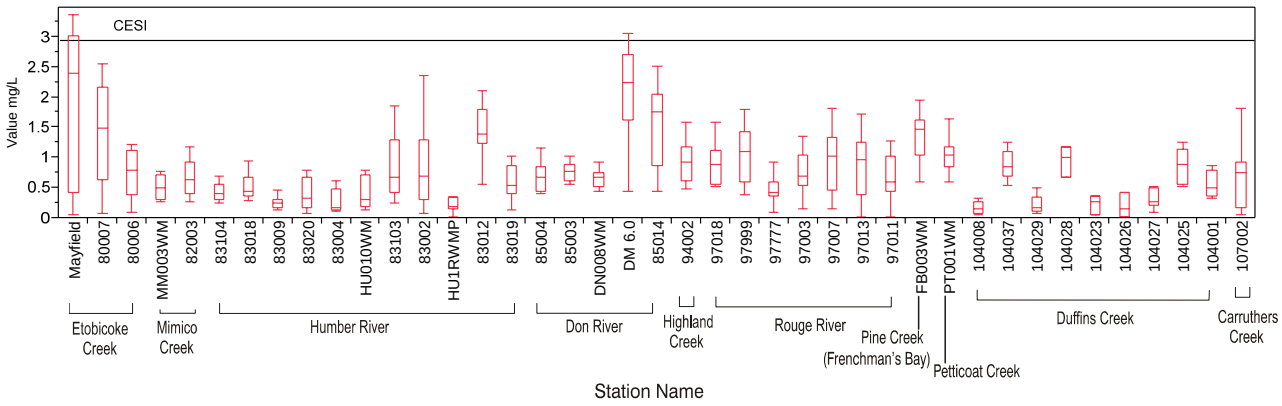

Figure 20. Nitrate concentrations (mg/L) at 41 sites within TRCA jurisdiction (EC: 2.93 mg/L)

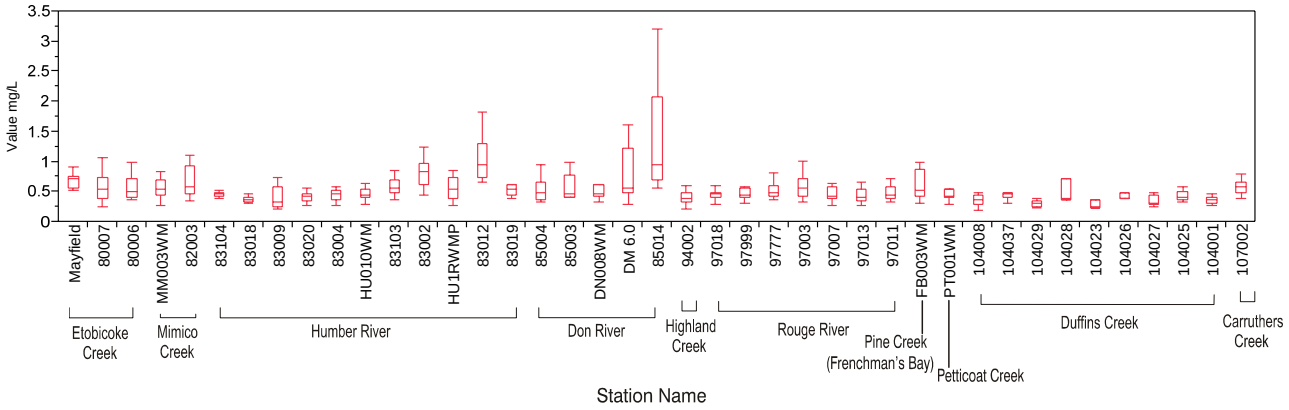

Figure 21. Total kjeldahl nitrogen (TKN) concentrations (mg/L) at 41 sites within TRCA jurisdiction

4. Summary

The results in this report represent ambient water quality conditions found in 2010 since samples are collected irrespective of precipitation and flows. It is expected that levels of many of the parameters presented in this report would be higher when mobilized by storm events. Non-point source pollution (e.g. stormwater runoff) continues to influence water quality within the Greater Toronto Area. As water flows through each watershed towards Lake Ontario, water quality becomes degraded as it passes through agricultural and urban areas. Stations located in developed areas of Etobicoke Creek, Mimico Creek, the Humber River and the Don River all had elevated levels of several contaminants such as chloride, *E. coli*, iron and phosphorus. Point sources of pollution also contribute to the degradation of Toronto's water quality. In particular, the lower Don River and Humber River displayed the greatest levels of degradation within the TRCA jurisdiction. Areas of concern identified in 2008 and 2009 continue to display elevated levels of contaminants.

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Appendix A – Water quality stream conditions from field notes

Site	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Wet (# samples)	Dry (# samples)
80006	Clear	Turbid	Turbid, high	Clear	Clear	Turbid, high	Clear	Clear	Turbid, high	Clear	Clear	Frozen, partly	4	8
80007	Frozen	Frozen, partly	High , slightly	Clear	Clear	Clear	Clear	Clear	Low	Clear	Clear	Frozen, partly	1	11
82003	Frozen, partly	Turbid	Turbid, high	Clear	Clear	Turbid, high	Clear	Clear	Turbid, high	Clear	Clear	Frozen	4	8
83002	Frozen, partly	Frozen, partly	Turbid	Turbid	Clear	Clear	Clear	Turbid, high	Clear	Turbid, high	Turbid, and slightly high	Frozen, partly	5	7
83004	Clear	Frozen, partly	Turbid, high	Clear	Clear	Clear	Turbid, slightly	Turbid, high	Clear	Clear	Clear	Frozen, partly	3	9
83009	Clear	Frozen, partly	Turbid, high	Turbid, slightly	Clear	Clear	Clear	Turbid	Clear	Clear	Clear	Frozen, partly	3	9
83012	Clear	Turbid	Turbid, high	Low	Clear	Turbid, extremely high, sampled after large storm event.	Clear	Clear	High	Clear	Clear	Clear	4	8
83018	Frozen	Frozen	High	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Frozen	1	11
83019	Frozen	Frozen	Turbid, high	Turbid, slightly	Clear	Turbid, extremely high, sampled after large storm event.	Clear	Turbid, slightly	Turbid, high	Clear	Turbid	Frozen	6	6
83020	Clear	Frozen, partly	Turbid, high	Turbid, slightly	Clear	Clear	Turbid, slightl	Turbid, high	Clear	Clear	Clear	Frozen, partly	4	8

Site	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Wet (# samples)	Dry (# samples)
							y							
83103	Frozen	Frozen	Turbid, high	Clear	Clear	Clear	Clear	Turbid, high	Clear	Clear	Turbid, and slightly high	Frozen	3	9
83104	Frozen, partly	Frozen	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Frozen, partly	0	12
85003	Frozen, partly	Frozen, partly	Clear	Turbid, slightly	Clear	Turbid, extremely high, sampled after large storm event.	Clear	Turbid, slightly	Turbid, high	Clear	Clear	Clear	4	8
85004	Frozen, partly	Frozen, partly	Turbid, slightly	Clear	Clear	Turbid, extremely high, sampled after large storm event.	Clear	Turbid	Turbid	Clear	Clear	Frozen, partly	4	8
85014	Clear	Turbid	Turbid	Turbid	Clear	Turbid, extremely high, sampled after large storm event.	Clear	Turbid, slightly	Turbid, high	Clear	Clear	Clear	6	6
94002	Clear	Turbid	Turbid, high	Clear	Clear	Turbid	Clear	Clear	Clear	Clear	Turbid, slightly	Frozen, partly	4	8
97003	Frozen, partly	Frozen	Turbid, high	Turbid	Clear	Turbid	Clear	Turbid	Clear	Clear	Turbid, and slightly high	Frozen, partly	5	7
97007	Frozen	Frozen	Turbid, high	Clear	Clear	Turbid	Clear	Turbid, slightly	Clear	Clear	High, slightly	Frozen, partly	4	8
97011	Frozen	Frozen	Turbid, high	Turbid, slightly	Clear	Turbid, high	Clear	Turbid	Clear	Clear	Turbid, slightly	Frozen, partly	5	7

Site	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Wet (# samples)	Dry (# samples)
97013	Partly frozen	Frozen, partly	Turbid, high	Clear	Clear	Turbid	Clear	Turbid, slightly	Clear	Clear	Turbid, slightly	Frozen, partly	4	8
97018	Partly frozen	Frozen, partly	High	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Frozen, partly	1	11
97777	Clear	Frozen, partly	Turbid, high	Turbid, slightly	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Frozen, partly	2	10
97999	Frozen	Frozen	Turbid, high	Clear	Clear	Clear	Clear	Turbid, slightly	Clear	Clear	High, slightly	Frozen	3	9
104001	Frozen	Frozen	Turbid, high	Low	Clear	Turbid, Slightly	water Low	Turbid, slightly	Clear	Clear	Turbid, and slightly high	Frozen	4	8
104008	Frozen, partly	Frozen, partly	Turbid, high	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Frozen, partly	1	11
104023	-	-	-	-	-	-	-	-	-	Clear	Clear	Frozen, partly	0	3
104025	Frozen	Frozen	Turbid, high	Turbid, slightly	Clear	Turbid	Clear	Clear	Clear	Clear	Clear	Turbid slightly, and frozen partly	4	8
104026	-	-	-	-	-	-	-	-	-	Clear	Clear	Frozen, partly	0	3
104027	Frozen	Frozen, partly	Turbid, high	Turbid, slightly	Clear	Turbid	Clear	Turbid, slightly	Clear	Clear	Clear	Frozen, partly	4	8
104028	-	-	-	-	-	-	-	-	-	Clear	Turbid, slightly	Frozen, partly	1	2
104029	Frozen, partly	Frozen, partly	Turbid, high	Clear	Clear	Clear	Clear	Clear	Turbid, high	Clear	Clear	Frozen, partly	2	10
104037	Frozen, partly	Frozen	Turbid, high	Clear	Clear	Clear	Clear	Clear	Turbid, high	Clear	Clear	Frozen	2	10
107002	Frozen	Frozen, partly	Turbid, high	Turbid	Clear	Turbid, high	Clear	Turbid	Clear	Clear	Turbid, and slightly high	Frozen, partly	5	7

Site	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Wet (# samples)	Dry (# samples)
DM 6.0	Clear	Turbid, high	Turbid	Clear	Clear	Turbid, extremely high, sampled after large storm event.	Clear	Clear	Clear	Clear	Clear	Frozen, partly	3	9
DN008WM	Clear	Frozen, partly	Clear	Turbid, high	Clear	Turbid, extremely high, sampled after large storm event.	Clear	Clear	Clear	Clear	Clear	Clear	2	10
FB003WM	Turbid	Turbid	Turbid, high	Low	Clear	Turbid, Slightly	Clear	Clear	Clear	High	Turbid	Clear	5	7
HU010WM	Frozen, partly	Frozen, partly	Turbid, high	Turbid, High	Clear	Clear	Clear	Turbid, high	Low	Clear	High, slightly	Frozen, partly	3	9
HU1RWMP	Frozen, partly	Frozen, partly	Clear	Clear	Clear	Turbid, extremely high, sampled after large storm event.	Clear	Turbid, slightly	Clear	Clear	Turbid, high	Frozen, partly	3	9
Mayfield	Frozen, partly	Partly frozen	Turbid, slightly high	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Turbid, slightly	Frozen, partly	2	10
MM003WM	Frozen, partly	Partly frozen	High	Clear	Clear	Clear	Clear	Turbid	Clear	Clear	Clear	Frozen, partly	3	9
PT001WM	Frozen, partly	Turbid	Turbid, high	Clear	Clear	Turbid, high	Clear	Clear	Clear	Clear	Turbid, and slightly high	Frozen	4	8
Note: Sampling at stations 104023, 104025 and 104028 began in October 2010.													128	337