Toronto and Region Remedial Action Plan

BUI Status Re-designation Report:

Degradation of Aesthetics

August 2017

TORONTO & REGION
REMEDIAL ACTION PLAN

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The Toronto and Region Remedial Action Plan is managed by representatives from Environment and Climate Change Canada, Ontario Ministry of the Environment and Climate Change, Ontario Ministry of Natural Resources and Forestry, City of Toronto, and Toronto and Region Conservation Authority.

Introduction

The Toronto and Region Area of Concern (AOC) is one of 43 locations around the Great Lakes where degradation of local environmental conditions may be causing harm to the wider Great Lakes system. The AOC extends along the north shore of Lake Ontario from Etobicoke Creek in the west to the Rouge River in the east. The 2000 km^2 area includes the Toronto waterfront and 6 watersheds: Etobicoke Creek, Mimico Creek, Humber River, Don River, Highland Creek and Rouge River. The drainage basin of these watersheds, which originate from the southern slopes of the Oak Ridges Moraine, makes the AOC a study in contrasts: more than 40% of the area is still rural and contains one of the world's largest urban parks; at the same time, more than three million people live in the AOC and the City of Toronto is in the centre of the most densely urbanized and fastest growing areas in the Great Lakes.

Degradation of Aesthetics was one of 11 Beneficial Use Impairments (BUIs) that was identified in the AOC's Stage 1 Remedial Action Plan (RAP) report *Environmental Conditions and Problem Definition* (RAP, 1989). The Degradation of Aesthetics BUI is considered impaired when substances, typically man-made and non-natural, produce a persistent deposit on the waterfront or along the watercourses that are objectionable and appear in sufficient quantities to interfere with, or impair, the aesthetic quality of water.

Originally this beneficial use was intended to be impaired when excess foam and slicks from industrial discharges (e.g., pulp and paper mills and steel mills) that led to degraded environmental conditions in AOCs. In the Toronto and Region AOC aesthetic concerns related primarily to the presence of debris and litter (RAP, 1989). Overflows of combined sewers, direct discharge of poorly treated industrial wastewater, contaminated stormwater and littering contributed to excessive floating debris, odour and unnatural turbidity along parts of the Toronto waterfront and in some sections of local watersheds.

Considerable efforts to improve the management of municipal and industrial stormwater and sewage, and increased public education have led to improved aesthetic conditions throughout the Toronto and Region since being listed as an AOC in 1987.

Assessment of the Degradation of Aesthetics BUI

Current Status

Impaired

The AOC's Stage 1 RAP Report *Environmental Conditions and Problem Definition* (RAP, 1989) classified Degradation of Aesthetics as impaired, stating:

"Aesthetic concerns relate primarily to debris and litter. Turbidity is also a concern near river mouths and in the vicinity of lakefilling operations. Weed growth is a concern along the western shoreline."

Criteria for BUI Re-designation

The AOC's Stage 2 RAP Report *Clean Waters, Clear Choices* (RAP, 1994) adopted the International Joint Commission (IJC) de-listing criteria for Degradation of Aesthetics, stating that the beneficial use would no longer be considered impaired when:

"Waters are free of any substance that produces a persistent objectionable deposit, unnatural colour or turbidity, or unnatural odour (for instance, oil slick or surface scum)" (IJC, 1991)

Status Assessment

Because the Toronto and Region RAP – like most RAPs for Great Lakes Areas of Concern – does not have specific, quantitative re-designation targets or criteria for the Degradation of Aesthetics BUI, multiple lines of evidence were used to inform the status assessment. This report summarizes the evidence gathered to support re-designating the Degradation of Aesthetics beneficial use as not impaired for the Toronto and Region AOC.

Data Collection and Sampling Methodology

In order to assess the Degradation of Aesthetics BUI for the Toronto and Region AOC, an assessment protocol was developed that utilized existing monitoring programs and local expertise within the Toronto and Region Conservation Authority (TRCA). The objective of the aesthetics monitoring program was to identify substances that produce persistent objectionable or unnatural debris, turbidity, colour, or odour in local watersheds or along the waterfront, and to compare aesthetics within the AOC to regional conditions.

The protocol's sampling and analytical methodologies for assessing the Degradation of Aesthetics BUI were adapted from similar work conducted by Heidtka and Tauriainen (1996) in the Rouge River AOC in Detroit, Michigan. The results of a pilot study led by TRCA during 2001 and 2002 (TRCA, 2003), which had community volunteers assess aesthetic conditions of watersheds, were used to further inform the development of a standardized sampling protocol and training for TRCA field crews. Detailed methodology can be found in *Method to Assess Beneficial Use Impairment (BUI) Degradation of Aesthetics (Toronto)* (Mutton, 2012; Appendix A).

Study Area

Samples (i.e., observations) were collected from nine watersheds within TRCA's jurisdiction, as well as from Frenchman's Bay and the Lake Ontario waterfront at Toronto. The area was divided into the "RAP area" and "Non-RAP area" to allow a comparison of conditions within the AOC, to regional conditions. The RAP area includes the six watersheds from Etobicoke Creek in the west to the Rouge River in the east – and corresponding 42 km of waterfront – along the western portion of the jurisdiction, while the Non-RAP area includes the watersheds and waterfront to the east of the Rouge River.

Sample Collection

The aesthetics monitoring program was implemented during 2012, 2013, and 2015 as part of TRCA's ongoing waterfront and watershed monitoring activities. Aesthetics observations were recorded each time a site was visited by field crews. Observations were made during daylight hours and not during heavy rain. In 2012 and 2015 both stream and waterfront sites were sampled; However during 2013 only stream sites were sampled.

Environmental Endpoints

At each sampling site observations were recorded for four endpoints: water clarity, water colour, water odour, and the presence of debris at the site. Observations were matched to a pre-defined descriptor for

each category (Table 1). The list of category descriptors used for the Toronto and Region RAP aesthetics monitoring program were expanded beyond those suggested by Heidtka and Tauriainen (1996) to account for the expected range of conditions observed in the Toronto Region. Additional descriptors included a yellow/amber colour, petroleum odour, and the presence of non-natural foam or oil films/sheens.

Aesthetic descriptors were then converted to an aesthetic score for each category (Table 1). The scores ranged from 0 (the aesthetically worst condition) to 10 (the aesthetically best condition). If more than one descriptor was present, the lowest score was recorded.

Table 1 Environmental endpoints (clarity, colour, odour, debris) with descriptors and assigned scores for determining overall aesthetic condition. Adapted from Heidtka and Tauriainen (1996).

Environmental Endpoint	Descriptor	Score
Clarity	Clear	10
	Cloudy	7
	Opaque	0
Colour	Clear	10
	Green	7
	Yellow/Amber	6
	Brown	5
	Grey	2
	Black	0
Odour	None	10
	Musty	6
	Petroleum *(transitory)*	5
	Sewage	2
	Petroleum *(spill)*	0
	Anaerobic	0
Debris	None	10
	Natural *(unusual accumulation)*	8
	Oil film *(non-natural)*	3
	Trash *(large amount)*	2
	Foam *(non-natural)*	2
	Sewage	0

Aesthetic Condition

An index value for aesthetic condition – referred to as the Aesthetic Quality Index (AQI) and originally developed by Heidtke and Tauriainen (1996) – was calculated using the scores from the clarity, colour, odour, and debris observations at a given time and location. The AQI for the Toronto and Region AOC aesthetic monitoring program was calculated by giving an equal weighting to each of the four environmental endpoints as follows:

$$AQI = \frac{colour\ score + clarity\ score + odour\ score + debris\ score}{4}$$

AQI values were converted to an aesthetic condition of poor, fair, good, or excellent (Table 2), as proposed by Heidtke and Tauriainen (1996). If a sample was assigned a low score for one of the four endpoints it could not attain an AQI value above 8. An AQI value of 9 or greater was considered representative of excellent aesthetic condition, while samples with an AQI score below 6 were assessed as poor and considered to have unacceptable aesthetic condition.

Table 2 Aesthetics Quality Index scores and corresponding aesthetic conditions

AQI Range	Aesthetic Condition
AQI ≥ 9	Excellent
8 ≤ AQI < 9	Good
6 ≤ AQI < 8	Fair
AQI < 6	Poor

Data Analysis

Complete details related to the data analysis and results from this assessment can be found in *Toronto and Region Remedial Action Plan Degradation of Aesthetic Beneficial Use Technical Summary Report 2012–2015* (Dahmer, 2017; Appendix B).

In total, 2177 aesthetic observations (1667 RAP and 510 Non-RAP) were collected from 427 unique sites (320 RAP and 107 Non-RAP) throughout the study area. The number of times a particular site was sampled for aesthetics condition ranged from 1 to 29 over the three year period.

Results Summary

Environmental Endpoints

Of the 1667 samples collected from the RAP area, the majority were clear (90%), colourless (91%), odourless (96%), with no debris (91%) present during sampling (Table 3). Similar observations were made at sites throughout Non-RAP watersheds. Aesthetically unpleasing conditions for each category were observed at sites in both the RAP and Non-RAP areas but were not considered to be indicative of a persistent condition.

A 'sewage' odour was reported in 10 RAP samples, with similar distribution across each of the RAP watersheds (1 or 2 samples per watershed) except for the Rouge River which had no instances of sewage odour reported. Of the RAP samples with sewage odour reported only one was rated as having poor overall aesthetic condition, and none appear to be persistent. There were no reports of sewage debris or petroleum odour at any sites during the aesthetics monitoring program, however the presence of an oil film or sheen was reported on multiple occasions. Upon further investigation it was determined that the majority of reports were likely natural oil-like films produced by bacteria –as described by the Michigan Department of Environmental Quality (2016).

Large amounts of trash were reported at one or more sites in all RAP watersheds (33 samples total) with the largest number of samples recorded in the Don River watershed. Don River samples with large amounts of trash ranged in aesthetic condition from poor (2 samples) to good (3 samples). Of these samples, all but one site were sampled multiple times over the course of this study and included sampling dates when no debris was reported. In the Non-RAP area large amounts of trash were reported in the Carruthers Creek, Duffins Creek, and Frenchman's Bay watersheds.

Table 3 Number (percent) of sample collected in the RAP study area by watershed during the study period (2012, 2013, and 2015).

		Etobicoke	Mimico	Humber	Don	Highland	Rouge	RAP Waterfront	Total
Clarity	**Clear**	214 (92%)	71 (90%)	487 (91%)	149 (81%)	63 (94%)	362 (94%)	159 (85%)	1505 (90%)
	Cloudy	10 (4%)	5 (6%)	35 (7%)	17 (9%)	4 (6%)	12 (3%)	25 (13%)	108 (6%)
	Opaque	9 (4%)	3 (4%)	12 (2%)	17 (9%)	0	11 (3%)	2 (1%)	54 (3%)
Colour	**Colourless**	226 (97%)	73 (92%)	521 (98%)	154 (83%)	61 (91%)	374 (97%)	107 (58%)	1516 (91%)
	Green	0	1 (1%)	0	1 (1%)	2 (3%)	0	57 (31%)	61 (4%)
	Yellow/Amber	4 (2%)	1 (1%)	0	2 (1%)	0	0	4 (2%)	11 (1%)
	Brown	2 (1%)	2 (3%)	11 (2%)	15 (8%)	4 (6%)	11 (3%)	14 (8%)	64 (4%)
	Grey	1 (<1%)	2 (3%)	2 (<1%)	11 (6%)	0	0	4 (2%)	20 (1%)
	Black	0	0	0	0	0	0	0	0
Odour	**None**	225 (97%)	77 (97%)	527 (99%)	160 (87%)	65 (97%)	376 (98%)	173 (93%)	1603 (96%)
	Musty	4 (2%)	1 (1%)	5 (1%)	20 (11%)	0	6 (2%)	11 (6%)	47 (3%)
	Petroleum (transitory)	0	0	0	0	0	0	0	0
	Sewage	2 (1%)	1 (1%)	2 (<1%)	2 (1%)	2 (3%)	0	1 (1%)	10 (1%)
	Petroleum (spill)	0	0	0	0	0	0	0	0
	Anaerobic	2 (1%)	0	0	1 (1%)	0	3 (1%)	1 (1%)	7 (<1%)
Debris	**None**	221 (95%)	71 (90%)	519 (97%)	155 (85%)	50 (75%)	359 (93%)	144 (77%)	1519 (91%)
	Natural	7 (3%)	2 (3%)	10 (2%)	21 (11%)	10 (15%)	20 (5%)	41 (22%)	111 (7%)
	Oil Film (unnatural)	1 (<1%)	0	0	0	0	1 (<1%)	0	2 (<1%)
	Trash (lrg amount)	4 (2%)	5 (6%)	5 (1%)	7 (4%)	6 (9%)	5 (1%)	1 (1%)	33 (2%)
	Foam (unnatural)	0	1 (1%)	0	0	1 (1%)	0	0	2 (<1%)
	Sewage	0	0	0	0	0	0	0	0

Aesthetic Condition

Acceptable aesthetic conditions (i.e., excellent, good, or fair) were reported for the majority of observations from both the RAP (88% of samples) and Non-RAP (94% of samples) areas (Figure 1) throughout the three years of aesthetics monitoring. A similar distribution was found when assessing median AQI scores for each site (Figure 2).

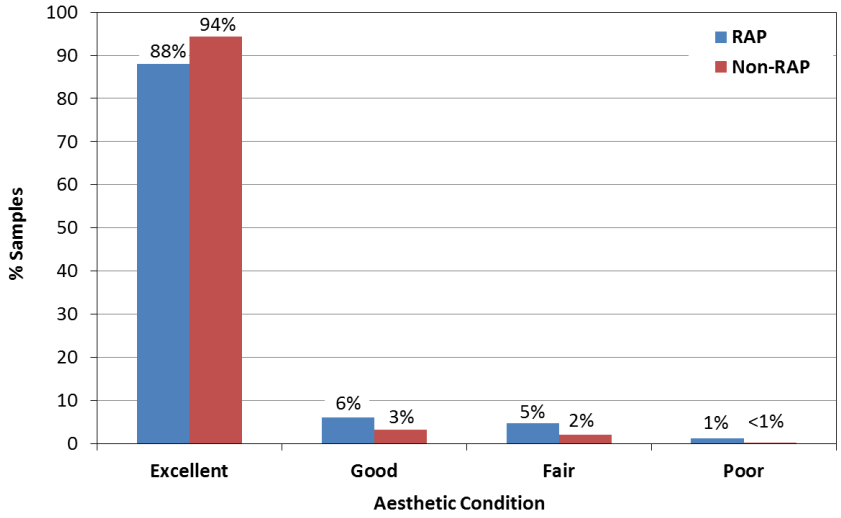

Figure 1 Percentage of samples assessed as having Excellent, Good, Fair, or Poor Aesthetic Condition in the RAP (blue) and Non-RAP (red) areas during the study period (2012. 2013 and 2015).

When separated by monitoring year, an excellent aesthetic condition was found in >80% of samples collected during 2012, 2013, and 2015 in both the RAP and Non-RAP areas (Table 4).

Table 4 Total number (percentage) of samples assessed as having Excellent, Good, Fair, or Poor Aesthetic Condition in the RAP and Non-RAP watersheds during 2012, 2013 and 2015.

		Excellent	Good	Fair	Poor	Total
RAP	**2012**	498 (80%)	73 (12%)	37 (6%)	18 (3%)	626
	***2013**	701 (95%)	13 (2%)	27 (4%)	1 (<1%)	742
	2015	271 (91%)	16 (5%)	11 (4%)	1 (<1%)	299
Non-RAP	**2012**	206 (94%)	10 (5%)	4 (2%)	0	220
	***2013**	166 (97%)	1 (<1%)	5 (3%)	0	172
	2015	109 (92%)	6 (5%)	2 (2%)	1 (<1%)	118

*In 2013 no aesthetics samples were collected from waterfront sites in the RAP or Non-RAP areas

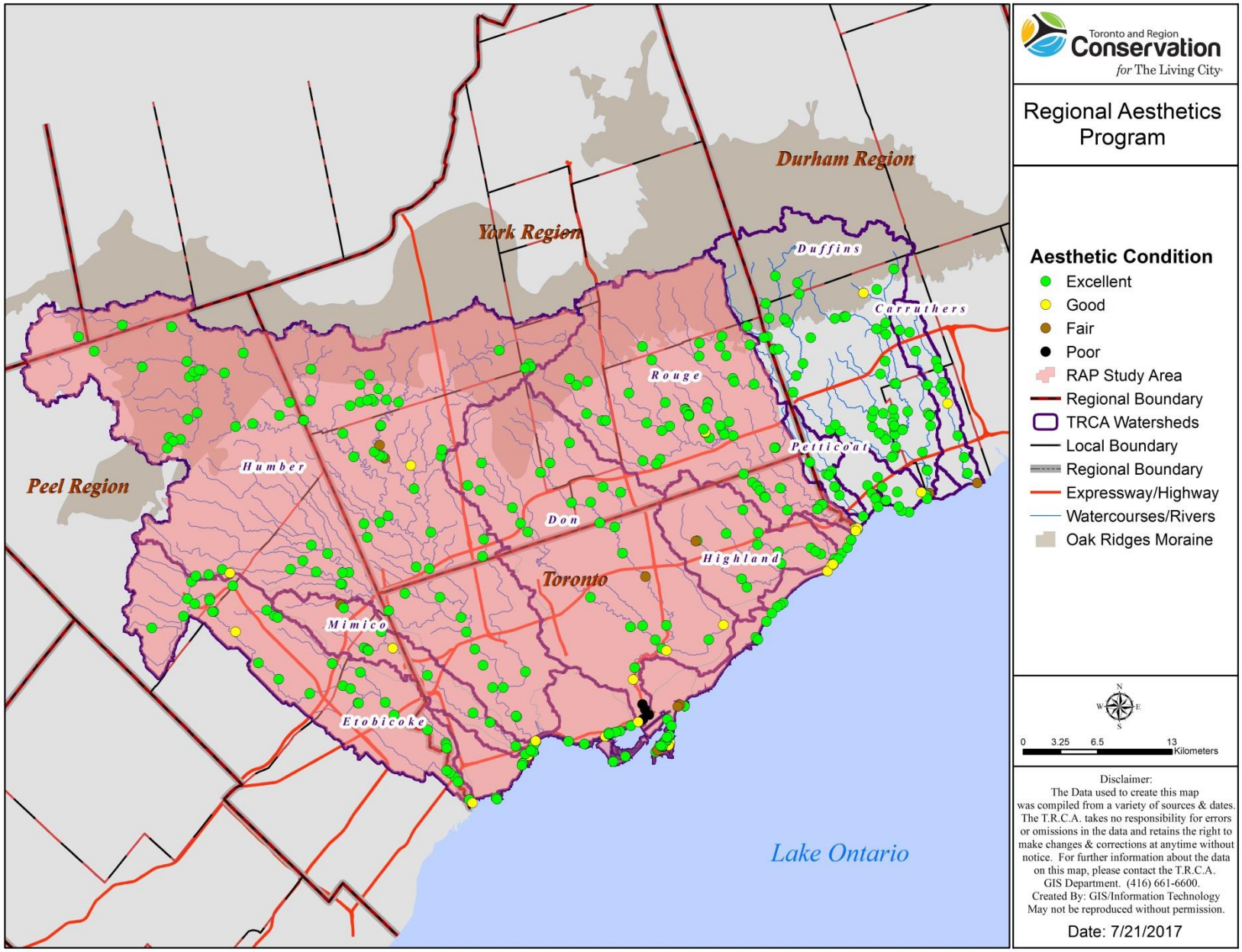

Figure 2 Aesthetic condition (excellent, good, fair, poor) for sites located in RAP (shaded) and Non-RAP (unshaded) watersheds, represented as median Aesthetic Quality Index (AQI) score over the study period (2012, 2013, and 2015).

A total of 20 samples (1% of observations) from the RAP area were assessed as having poor (i.e., unacceptable) aesthetic condition over the three years of sampling (Figure 1), with the majority of poor samples observed during 2012 (Table 4). The 11 sites within the RAP area where poor aesthetics were observed tended to be located near the mouth of a river or along the waterfront, with the majority of observations at sites in the lower Don River. Of the poor samples from the Don River watershed 7 out of 13 total samples were from the Keating Channel sampling site, where a log boom is maintained by Ports Toronto to collect and dispose of debris that is swept downstream, preventing it from entering the harbor where it could become a potential navigational hazard.

AQI values reported for each site were assessed against the BUI re-designation criteria to determine whether poor aesthetic conditions were persistent – defined as occurring on multiple occasions over at least 2 years of sampling – in the RAP area. Analysis of a subset of monitoring sites that were assessed for aesthetic impairment during all three years of monitoring (2012, 2013, and 2015), and that were sampled at least five times per year, indicated that there was only one occasion in which a sample was assessed as having a poor aesthetic condition (i.e., AQI < 6). The poor AQI score obtained at this site, located in a highly urbanized portion of the Don River watershed, was attributed to opaque, brown water with a musty odour. A number of environmental factors, such as increased runoff following precipitation, may have contributed to the degraded aesthetic condition during the time of sampling in July 2012; The poor aesthetics did not appear to be due to an oil slick, surface scum, or unnatural foam. Further, over the three year period of this study 91% of observations at this site were indicative of excellent aesthetic condition, therefore it was not considered to have a persistent poor aesthetic condition.

Conclusion

The AQI provides an inexpensive framework for characterizing aesthetic condition that is easy to integrate with existing TRCA monitoring programs while allowing for adaptation to account for variability in local watershed conditions and assessment or program goals, as demonstrated by its application for assessing the status of the Degradation of Aesthetics BUI in the Toronto and Region AOC.

Overall, the majority of samples collected throughout the RAP and Non-RAP areas had excellent aesthetic condition during 2012, 2013, and 2015. A number of observations throughout the monitoring period were indicative of poor aesthetic condition at sites in the lower Don River, however these were not considered persistent or indicative of an impaired beneficial use.

BUI Status Assessment: Degradation of Aesthetics

Comparison of AOC Conditions to BUI Re-Designation Criteria

Over three years of aesthetic monitoring, 1667 samples collected from 320 sites throughout the Toronto and Region AOC indicated that within the RAP area:

Re-Designation Criteria
Waters are free of any substance that produces a persistent objectionable deposit, unnatural colour or turbidity, or unnatural odour

- 94% of observations were assessed as having excellent or good aesthetic condition.
- 80% of observations were indicative of water that was clear, colourless, and odourless, with no excess debris present at the sampling site.
- 1% of observations (20 samples) were assessed as having poor (i.e., unacceptable) aesthetic condition. Of the sites assessed as poor on one or more occasion, none were considered to have persistent, objectionable aesthetic issues.

Have the BUI Re-Designation Criteria been met?

Yes

Waters are free of any substance that produces a persistent objectionable deposit, unnatural colour or turbidity, or objectionable odour.

Recommended Status of the Beneficial Use

Not Impaired

It is recommended that the Degradation of Aesthetics beneficial use be considered not impaired for the Toronto and Region AOC.

Ongoing Actions

Don Mouth Naturalization

The Don Mouth Naturalization and Port Lands Flood Protection Project will transform the mouth of the Don River, including the Keating Channel, into a healthier, more naturalized river outlet. Completion of this project will lead to improved aesthetic conditions along the Toronto waterfront and will create: over 1,000 m of new river channel; 13 hectares of new coastal wetland, with a 2 hectare wetland patch adjacent to the Don Roadway connecting to the Ship Channel; and 4 hectares of terrestrial habitat located within the constructed valley system with additional greenspaces anticipated outside the valley system.

Wastewater Infrastructure Improvements

Improvements to the City of Toronto's wastewater infrastructure have included construction of the Western Beaches Storage Tunnel, which captures and treats stormwater and combined sewer overflows, and the development and ongoing implementation of the 2003 Wet Weather Flow Master Plan to further improve the management of sewage and stormwater, especially under wet weather conditions.

Ongoing infrastructure projects such as the Don and Central waterfront project and the proposed new Ashbridges Bay Wastewater Treatment Plan outfall will greatly contribute to reducing nutrient loadings, and improvement of the overall aesthetic quality of the water in local streams and along the waterfront.

Great Canadian Shoreline Cleanup

The Great Canadian Shoreline Cleanup is a national conservation initiative that provides Canadians the opportunity to take action in their communities wherever water meets land. Cleanup events are organized every year throughout the Toronto Region by local residents and conservation groups.

Great Lakes Guardian Community Fund

The Great Lakes Guardian Community Fund supports community-based restoration and clean-up projects throughout the Great Lakes and St. Lawrence River Basin.

Yellow Fish Road

The Yellow Fish Road community outreach program helps to raise awareness about storm water pollution and encourage residents to take actions to help protect local watersheds.

Recommendations

Future Monitoring or Actions Required

- Toronto and Region RAP partners continue to work together to implement watershed management plans to address the causes of urban impacts on waterways, and improve water quality and aesthetics of local streams and the Toronto waterfront.

- The three levels of government work together to support and implement the City of Toronto's Wet Weather Flow Master Plan to eliminate discharges from combined sewer overflows and improve stream and waterfront water quality.

- Toronto and Region RAP partners continue to coordinate biological, sediment, and water quality monitoring programs. Monitoring programs should be able to identify and report on unacceptable aesthetic conditions to ensure conditions do not decline within the Toronto and Region AOC.

- TRCA continue to implement the Regional Watershed Monitoring Network to provide long-term data to track improvements in water quality and aesthetic condition.

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Appendix A

Method to Assess Beneficial Use Impairment (BUI) Degradation of Aesthetics (Toronto)

Appendix B

Degradation of Aesthetics Beneficial Use Technical Summary Report 2012–2015