Date: _____ Name: _____

Water Quality Trends in Cootes Paradise Marsh and Grindstone Creek

adapted from the 2012 report by Dave Reddick and Tys Theysmeyer

The watershed of Hamilton Harbour drains over 500 square kilometers, with approximately 75% of this first passing through the wetland systems under RBG management. The main rivers of this system are Spencer Creek draining to Cootes Paradise Marsh, and Grindstone Creek draining to Grindstone Marsh.

These wetlands are damaged by many factors, including changes to land use, fertilizer and sediment runoff, ditching of tributaries, poorly treated sewage, and arrival of non-native species. By 1990, virtually no wetland plants or related species existed in the regularly flooded portion of the local coastal wetlands. Water clarity averaged less than 30 cm, and Carp (*Cyprinus carpio*) was the dominant species. Like many of the wetlands in the lower Great Lakes regions, nearly 80% of wetlands was either lost or degraded.

Fifty percent of the water entering Hamilton Harbour is from rain. The other 50% is from Lake Ontario water that cycles through the city and is released through four Waste Water Treatment Plants (WWTP) that service Burlington and Hamilton and combined sewer overflows (CSOs).

The Hamilton Harbour Remedial Action Plan Rehabilitation includes improving the 400 hectares of rivermouth wetlands of Cootes Paradise and Grindstone Marshes within Royal Botanical Gardens Nature Reserves. Over the last 20 years, City of Hamilton infrastructure projects to the sewer system have been a major part of improving the quality of water flowing into these wetlands.

Using the data on the next few pages, assess how well the projects have improved the quality of water flowing into RBG wetlands.

BIG QUESTION: Have they been rehabilitated?

Precipitation significantly affects the quality and quantity of the waters through sewer overflows, urban and agricultural runoff, and creek flows. Before sewer overflow tanks were built, even minor rain events (less than 5mm) caused sewers to overflow into local waters. Sewer overflow tanks are designed to contain all sewage in rain events of up to about 25mm, and overall reduce overflows by 90%, capturing about 1.5 million litres annually. A trend of increasing frequency of large rains has occurred.

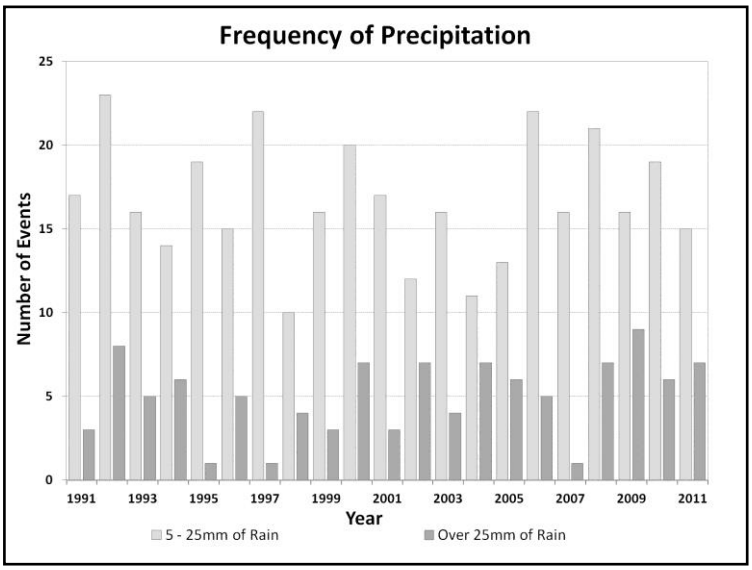

Figure 1: Summary of annual rain events based on level of intensity of the rain. Data summarized from the Hamilton Airport Environment Canada Weather Station.

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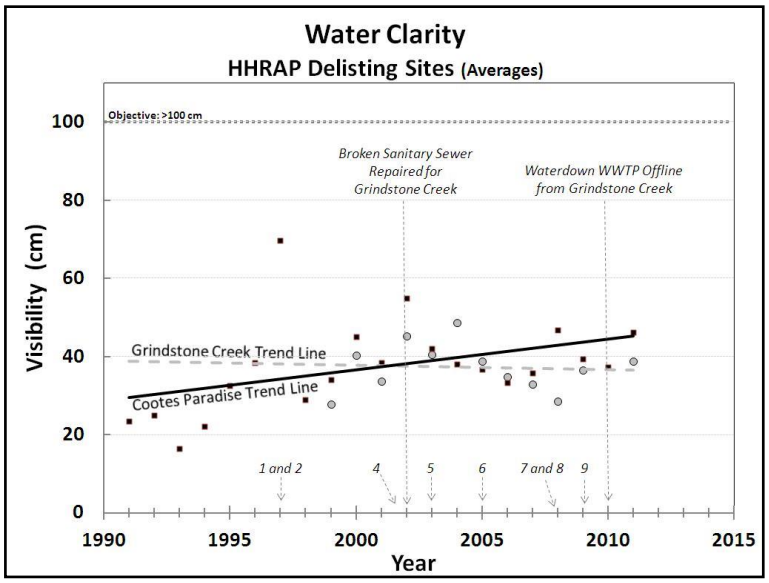
The following table indicates what event happened for the number listed on the graphs in next pages.

Table 1: Major infrastructure upgrades improving water quality in Cootes' Paradise and Grindstone

Year	Watershed	City Infrastructure Upgrades for RBG marshes	Graph ID
1997	Cootes Paradise	Main King CSO (Combined Sewer Overflow) Tank Operational - Chedoke Cr	1
1997	Cootes Paradise	Carp Exclusion Barrier Operational	2
2002	Cootes Paradise	Dundas WWTP Flow Equalization Tank Operational	4
2003	Cootes Paradise	Spencer Creek Flood Plain Connected to West Pond	5
2005	Cootes Paradise	CSO Mitigated for Westdale Creek	6
2008	Cootes Paradise	Stroud CSO Tank Operational for Chedoke Creek	7
2008	Cootes Paradise	Kaydrage Landfill Leachate Containment for Chedoke Creek Operational	8
2009	Cootes Paradise	CSO Outfall Rebuilt for Westdale Creek	9
2000	Grindstone Marsh	Carp exclusion operational in upper marshes	11
2002	Grindstone Marsh	Broken Sanitary Sewer at Long Pond Repaired	3
2010	Grindstone Marsh	Waterdown WWTP Offline from Grindstone Creek	10

Figure 2: The average water clarity from each season of water quality sampling. *(The numbers near the bottom of the graph represent the Cootes Paradise infrastructure upgrades. See Table 1, "Graph ID" column for the improvement associated with the number).*



Water Clarity **-** Water clarity represents how far light can penetrate into the water column. The remediation goal is consistent clarity to the bottom in the deepest areas of the marshes = 150cm.

QUESTION 1:

a) What is the trend in water quality in Cootes Paradise and in Grindstone Creek?

b) Which infrastructure upgrade might be responsible for the change (if any)?

c) Does water quality meet the remediation goal?

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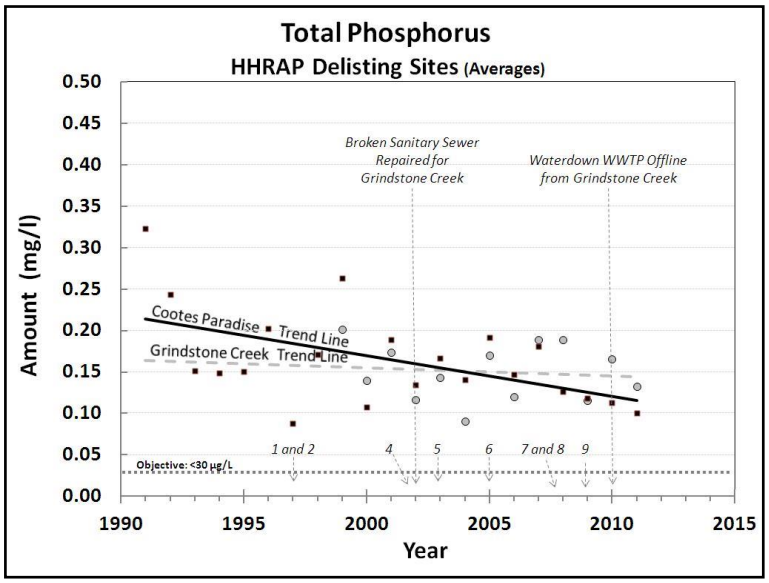
Figure 3: The average total phosphorus amount from each summer of water quality sampling. *(The numbers near the bottom of the graph represent the Cootes Paradise infrastructure upgrades. See Table 1, "Graph ID" column for the improvement associated with the number).*



Total Phosphorus **-** Phosphorus is the primary nutrient limiting aquatic plant growth in fresh water. Excess phosphorus causes algal to outgrow and smother other species. The Provincial Water Quality Objective for Aquatic Life is < 30µg/L. Sources; human and animal waste and fertilizers.

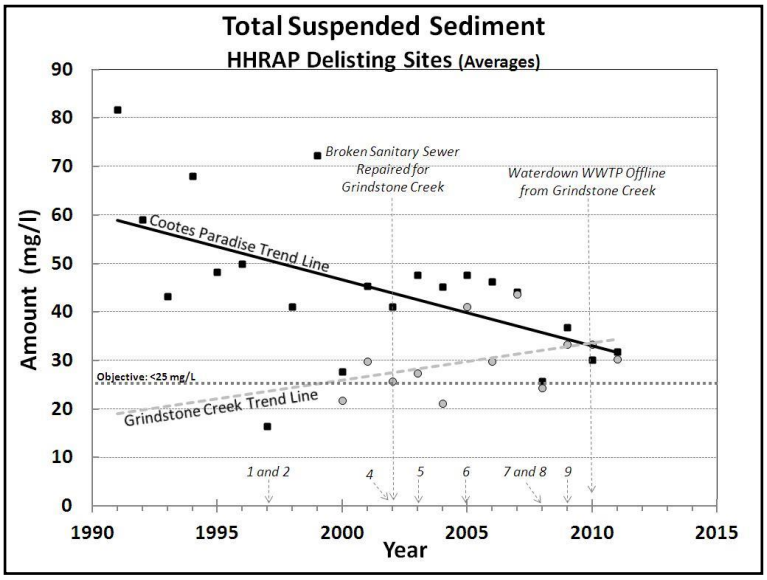
QUESTION 2:

a) What is the trend in total phosphorus in Cootes Paradise and in Grindstone Creek?

b) Which infrastructure upgrade might be responsible for the change (if any)?

c) Does total phosphorus meet the remediation goal?

Figure 4: The average total suspended sediment amount from each summer of water quality sampling. *(The numbers near the bottom of the graph represent the Cootes Paradise infrastructure upgrades. See Table 1, "Graph ID" column for the improvement associated with the number).*



Total Suspended Sediment **-** Suspended sediment represents particulates that do not immediately settle out of the water such as silt, clay, and organic particles (i.e. plant fragments). The goal is levels < 25mg/l. Sources; urban and agriculture runoff, and in marsh re-suspension by waves or carp foraging.

QUESTION 3:

a) What is the trend in total suspended sediment in Cootes Paradise and in Grindstone Creek?

b) Which infrastructure upgrade might be responsible for the change (if any)?

c) Does total suspended sediment meet the remediation goal?

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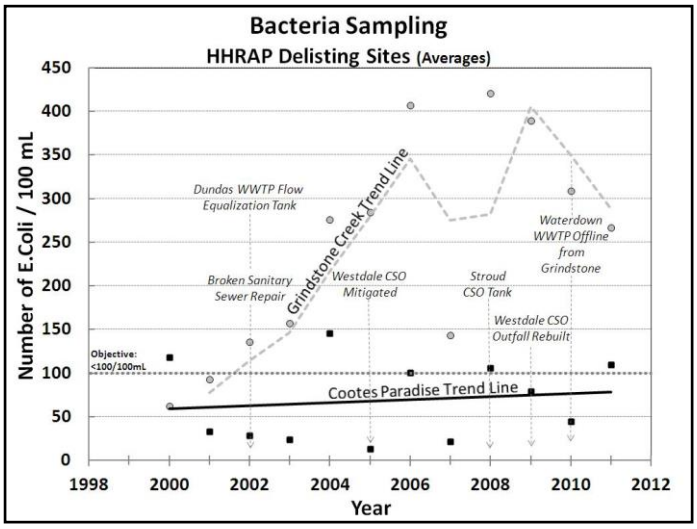
Figure 5: *E.coli* bacteria – Average amount of *E.coli* present at the two delisting site. An indicator of untreated sewage or agriculture runoff. Recreational guidelines for water are less than 100 *E.coli*/100ml (provincial), and a 200 *E.coli* /100ml (federal).



QUESTION 4:

a) What is the trend in bacteria in Cootes Paradise and in Grindstone Creek?

b) Would you recommend to the city that they could open Cootes Paradise or Grindstone Creek as recreational swimming spots?

c) Looking at the graph of Bacteria Sampling at Cootes Paradise Inflow Sites, which creek might be contributing the most bacteria to Cootes Paradise?

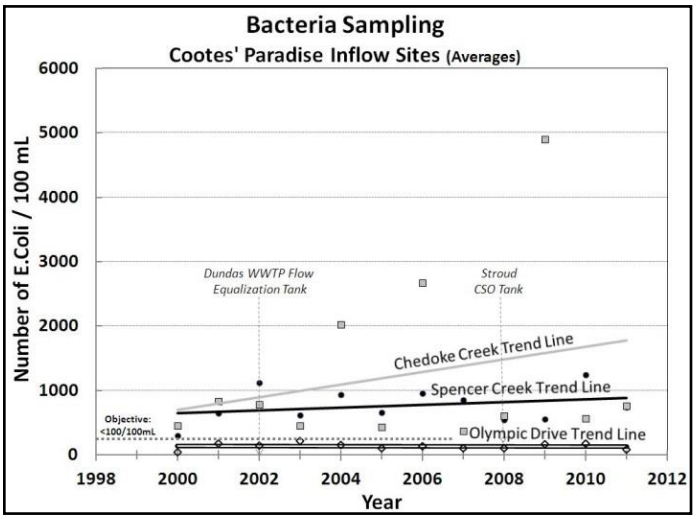


Figure 6: Average amount of *E.Coli* bacteria present in the water quality samples from the inflowing sites.

QUESTION 5:

Review your answers to questions 1-4.

a) In a paragraph, summarize the trends and quality of water in Cootes Paradise Marsh. Identify which improvements (listed in Table 1) have been beneficial (if any). Make recommendations for next steps in rehabilitating the marsh.

b) Write a paragraph summarizing the trends and quality of water in Grindstone Creek. Indentify which improvements (listed in Table 1) have been beneficial (if any). Make recommendations for next steps in rehabilitating the creek.