Answer Guide for Water Quality Trends

Extracted from Reddick D. & Theÿsmeÿer T. 2012. 20 Year Trends in Water Quality, Cootes Paradise and Grindstone Marsh. Royal Botanical Gardens. Burlington, Ontario.

Cootes Paradise Delisting Site

Site Description: Open water, mid-marsh location, near the outflow located at the East end of the marsh. The bulk of the water flowing through Cootes' Paradise mixes before passing this site.

Purpose: The water sampled at this site represents the overall state of water quality with the various inflowing waters mixed, as well reflects the water entering Hamilton Harbour from the marsh

***Summary*:** Overall this site demonstrates the water quality of Cootes Paradise is much improved and is improving on an ongoing basis. The exclusion of carp from Cootes Paradise, along with the infrastructure upgrades to the sewer overflow system is leading to better water quality at this site. Water clarity has more than doubled although needs to more than double again to reach the target. Carp exclusion is the most significant factor to date. The total suspended sediment levels are approaching the objective, although continues to limit water clarity and affect phosphorus concentrations. Phosphorus, while now less than half of what is was 20 years ago, is still high and reflective of a hypereutrophic environment, and needs to be reduced by half again. A hypertrophic environment is one in which algae outgrows and suppress other forms of plant growth.

It is important to note that strong winds continue to periodically impact water clarity levels by re-suspending bottom sediment, and will continue to do so until wetland plants dominant again and break the waves. During storm events water flowing in from Chedoke creek rarely reaches this delisting station. This water flows along the eastern shore, exiting directly into the harbour. A significant highlight is that many of the more sheltered inlets have improved to the point where the marsh bottom is often visible.

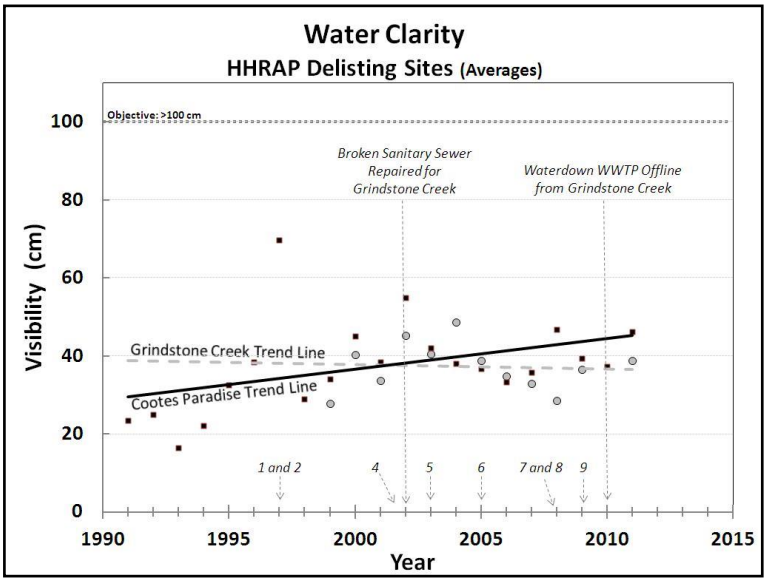
Grindstone Marsh Delisting Site

Site Description: Open water site, located at the mouth of Grindstone creek within Carroll's Bay Marsh

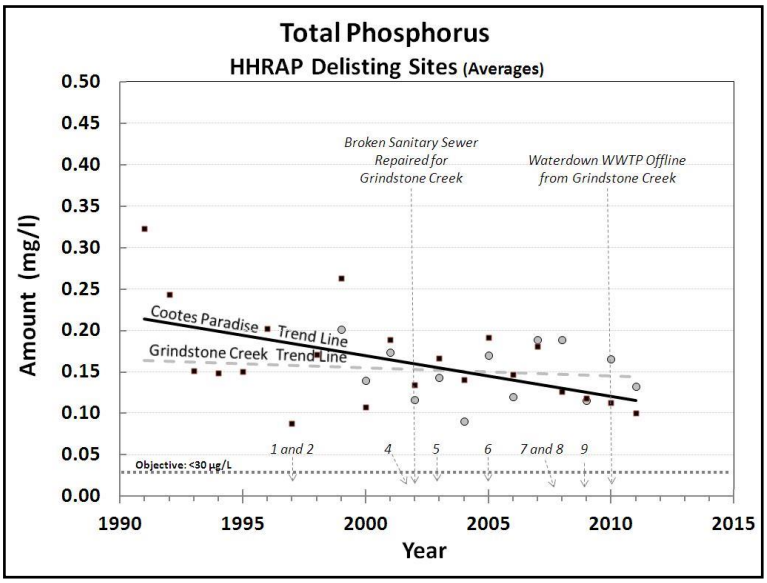
Purpose: The water sampled at this site represents the oval quality of water in the Grindstone Marsh area, and reflects the water entering Hamilton Harbour from this watershed.

***Summary*:** Grindstone Marsh has a watershed of approximately 1/3 that of Cootes Paradise, with this monitoring site having no direct carp exclusion. As a result this location serves as both a delisting site and comparison site for improvements at Cootes Paradise. To date the infrastructure improvements related to this marsh have had no measurable impact on the water quality at the site. The improved water quality in Cootes Paradise is now better than at this location. The information illustrates that suspended sediment is controlling both water clarity and phosphorus levels. The two infrastructure improvements so far completed in the Grindstone watershed; the repair of a broken sewer in 2002, and the 2010 removal of the Waterdown WWTP are expected to result in a gradual decline in the phosphorus levels over several years. In Grindstone Marsh rehabilitation areas (data not shown here) the water regularly has visibility to the bottom, as inflowing sediments are restricted and the excluded carp are not able to re-suspend the sediment. Twenty hectares of the 60 hectares of this marsh is under rehabilitation.

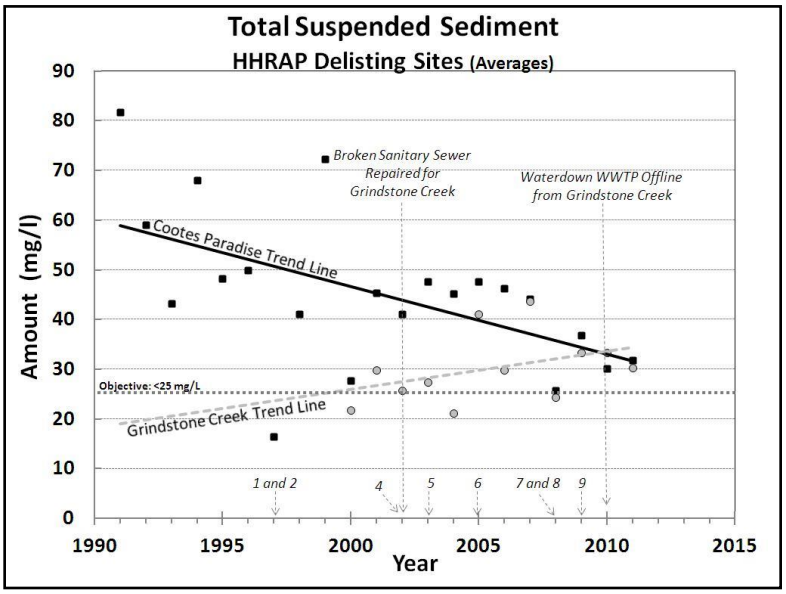
Water Quality: Note the improving visibility of the water in Cootes Paradise, while Grindstone marsh remains fairly consistent. The exclusion of carp from Cootes Paradise, along with the infrastructure upgrades to the sewer overflow system is leading to better water quality at this site. Water clarity has more than doubled although needs to more than double again to reach the target. To date the infrastructure improvements related to this marsh have had no measurable impact on the water quality in Grindstone. The improved water quality in Cootes Paradise is now better than at this location.



Total Phosphorus: Note the decreasing trends in Cootes Paradise, especially since 2008. Cootes Paradise is moving towards the water quality objective, whereas Grindstone marsh has remained consistently high with some fluctuations. Phosphorus, while now less than half of what is was 20 years ago, is still high and reflective of a hypereutrophic environment, and needs to be reduced by half again. A hypertrophic environment is one in which algae outgrows and suppress other forms of plant growth. The two infrastructure improvements so far completed in the Grindstone watershed (the repair of a broken sewer in 2002, and the 2010 removal of the Waterdown WWTP) are expected to result in a gradual decline in the phosphorus levels over several years.



Total Suspended Sediment: The average total suspended sediment amount from each summer of water quality sampling. Note the consistent decline in the Cootes Paradise levels since the carp barrier became operational and the infrastructure upgrades have been made. The suspended sediment levels in Grindstone marsh are not showing improvement. It is important to note that strong winds continue to periodically impact water clarity levels in Cootes by re-suspending bottom sediment, and will



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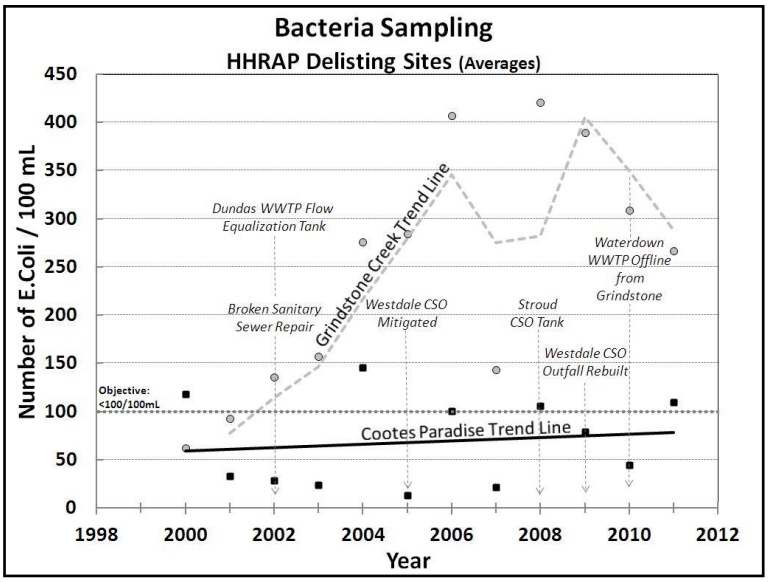
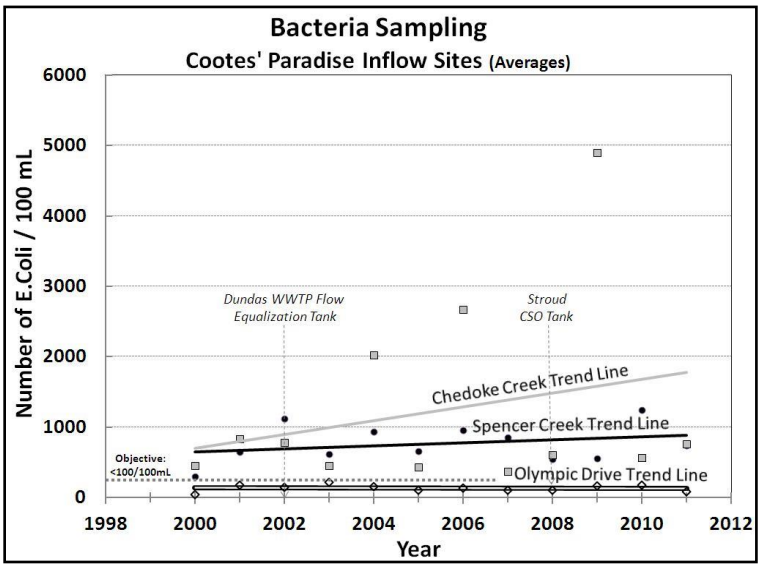
continue to do so until wetland plants dominant again and break the waves. Suspended sediment is controlling both water clarity and phosphorus levels. In Grindstone Marsh rehabilitation areas (data not shown here) the water regularly has visibility to the bottom, as inflowing sediments are restricted and the excluded carp are not able to re-suspend the sediment.

Average ***E.coli*** **bacteria** levels within the marsh have not shown an improvement over the duration of monitoring despite the projects that have been undertaken. Bacteria objectives are not part of the HHRAP delisting criteria for the marsh areas. Recreational use of water as a delisting criteria is measured at the designated beaches of the harbour.





At the Cootes Paradise Marsh site, average bacteria levels were generally not poorer than the recreational guidelines and have not declined despite the increasing frequency of heavier rain events (Figure 1), demonstrating that the overflow tanks are improving the conditions. Also influencing this monitoring site is the sewer overflow on Spencer Creek (Ancaster tributary). The holding tank for this site began construction in 2009 and is expected to be operational in 2012. The annual pattern of bacteria levels in the marsh reflects the pattern of rain events and intensity, and the need to complete the tank.

In the case of Grindstone Marsh, conditions have worsened during the period with conditions often poorer than would be recommended for swimming. No CSO sites are part of the watershed, and like Cootes Paradise Marsh, the variable pattern of concentrations is reflective of the pattern of increasing rain events of higher intensity.

The student activity addresses Ontario Curriculum Grade 8 Science Water Systems specific expectations 1.3, 2.2, and 2.4