

Wetland Restoration Backgrounder

(More about Project Paradise)



Marsh Stressors

Between 1820 and 1990 several human-induced stresses caused the loss of the Cootes Paradise and Grindstone Marsh and associated fish and wildlife. The human-induced marsh stresses are grouped as follows:

- High nutrient levels (hypereutrophic)
- Excessive inflowing sediment
- Uprooting of plants and mudding of water by introduced carp
- Lake Ontario water level regulation
- Ditching of rivers and isolation of habitats

The sum total of these resulted in hypereutrophic plantless muddy waters, with key water column measures of total phosphorus over 300ug/l and total suspended sediment averaging 65ug/l. The wetland restoration is integrated into the Hamilton Harbour Remedial Action Plan (HHRAP) initiated in 1985.

Restoration Goal

The *long term goal* is the recovery of water quantity and quality conditions, to promote the natural regeneration and the sustainability of wetland ecosystem. This includes river and lake water cycles that match natural patterns, and water quality that meets the provincial guidelines for aquatic life. The critical plans for recovering these are the watershed plans of Halton, and Hamilton Conservation Authorities, the City of Hamilton Stormwater and Wastewater Master Plans, and the St Lawrence Board of Control Water Level Regulation Plan. The *short term goals*, are to manage the non-native species that came to dominance in these altered conditions, re-establish the marsh river channels, and engage the community in various through various events. Several technical targets related to vegetation coverage and water quality are used to measure progress.

History of Cootes Paradise Marsh

Prior to the 20th century, the nutrient-rich, shallow waters of Cootes Paradise Marsh thrived as a coastal freshwater marsh habitat. Almost 100 percent of the wetland was covered with meadow marsh, emergent aquatic plants like wild rice and submergent plants like wild celery, providing food, shelter and migration stop-overs for a variety of birds, mammals, reptiles, amphibians and insects. The lush wetland also provided ideal spawning, nursery and adult habitat for many fish like bass, perch, pike, herring and trout. This led to its protection, first as a fish sanctuary in the 1870's, and then as a wildlife preserve in 1927, and finally through the properties addition to the Royal Botanical Gardens in 1942.

The plentiful flora and fauna of Great Lakes coastal marshes did not go unnoticed by settlers in the 1800s. Cootes Paradise Marsh and its surrounding natural habitats offered abundant fishing and hunting opportunities, fertile farmland and convenient access to water. However, human settlement of Hamilton Harbour and its surrounding natural lands brought with it several stressors that, over time, had a cumulative impact on the natural abundance of Cootes Paradise and Grindstone Creek marshes. Throughout the watersheds, agricultural practices and residential, commercial and industrial development contaminated connecting creeks with sewage effluent, eroded soil and sediment and chemical runoff and destabilized flow patterns. In 1852 the Desjardins Canal, a shipping channel bisecting the marsh was recut through the centre of Burlington Heights directly connecting the marsh to the lake water levels. The original

outflow was filled in two locations to allow for two rail lines, disconnecting it from the Grindstone Marsh. In 1957 the lake water level became regulated with the construction of the St. Lawrence Seaway and construction of the Moses Saunders Dam, further disrupting marsh water cycles.

As human pressures on the watersheds increased, the decline in the health and biodiversity of Cootes Paradise became markedly visible. By the 1930s Cootes Paradise Marsh experienced a 15% permanent reduction in wetland vegetation, and by 1985 the level of plant loss reached 85% of its original coverage. This loss of vegetation matched the regularly flooded portion of the wetland emphasizing the water based stressors. In addition a large portion of the marsh at the mouth of Chedoke Creek was being infilled as a city landfill. This permanent loss of aquatic flora had a direct negative impact on water quality and the fish and wildlife inhabitants and economies of Lake Ontario. Since its dramatic decline began the Garden's has been focused on restoring Cootes Paradise Marsh. Carp removal first attempted in the 1950's, along with requests to the provincial government to improve sewage treatment.

Concerns over Great Lakes environmental degradation led the International Joint Commission to designate Hamilton Harbour as one of 42 Areas of Concern in the Great Lakes. In 1986, the Hamilton Harbour Remedial Action Plan (HHRAP) was initiated to address this environmental degradation in the Harbour and key remaining areas like Cootes Paradise and Grindstone Marsh. Under this plan, a variety of restoration projects and monitoring programs have been implemented stakeholders to control pollution, restore and improve fish and wildlife habitat and communicate the health status of the wetlands.

Nutrient Issues

The nutrient levels (phosphorus and nitrogen) in the wetlands reflect the waters that flow into them. While the very high nutrient levels are improving as of 2010 they are still extreme (hyper eutrophic), resulting in ongoing algae blooms. Water sources include several urban storm drains and sewer overflows, a wastewater treatment plant (King St, Dundas) and 25 creeks draining just over 400km² of land. None of these sources meet Provincial Water Quality Guidelines (PWQG) for Aquatic Life on a consistent basis. However, the largest creek, Spencer Creek, is the healthiest, originating 25km to the north above Beverly Swamp, and entering the western end of Cootes Paradise, and with 95% of its watershed within the provincial Greenbelt.

The waste water plant located at the western tip of Cootes Paradise has undergone numerous upgrades over the past 40 years. Currently it flows at approximately 200 litres/second and operates as tertiary treatment plant (1985), with an overflow tank to stabilize and optimize its treatment ability (2005). The plant removes essentially all particulate, >95% of the phosphorus, but releases very high levels of nitrate (>15mg/l). Despite the significant phosphorus removal, the levels are still 7 times those found in natural waters, and are only exceeded by urban runoff as a source of phosphorus to the marsh, generating thick rafts of algae in the area it discharges.

While rural areas continue to improve practices to retain agricultural fertilizers on the land, the urban areas continue to expand. The rain water runoff from urban areas is surprisingly high in nutrients, and after rains provides concentrations poorer than that of the waste water treatment plant effluent. Due to the size of the urban areas in Ancaster, Hamilton, Dundas and Waterdown, this stormwater often overwhelms the marshlands, particularly after summer thunderstorms. Considerable improvements to inflowing water from the older portions of the City of Hamilton have been made through the construction of multiple sewer overflow tanks. This includes two on Chedoke Creek, one on Ancaster Creek, and one at the head of Westdale Creek. These now capture over 1 billion litres of water per year, diverting these waters to the main waste water treatment plant, and reducing sewer overflows by 95%.

Sediment contamination with nutrients has resulted from the above issues. Sediment samples have been taken on an ongoing basis since the 1970's. These initial samples showed nutrient levels averaging 5 times that of natural sediments. However with ongoing improvements to inflowing waters the nutrients levels have healed significantly, and as of 2006 averaged only 50% higher than natural levels.

Sediment Issues

Sedimentation rates and suspended sediment levels in the water continue to be dramatically higher than natural, although much improved. These issues result in buried plants and habitats, choking of aquatic life, and prevent light from reaching plants on the marsh bottom. In natural waters suspended sediment levels generally consisting of clay, and decomposing organic material exist at levels <5mg/l. In Cootes Paradise Marsh, prior to the onset of the restoration they averaged 65 mg/l and ranged as high as 1000mg/l. The sources are urban and rural areas upstream of the marshes, with the resulting fine sediments maintained in suspension by the feeding and spawning behaviour of the common carp. With the exclusion of carp, average levels have dropped dramatically and often meet HHRAP targets (<25mg/), although still spike up dramatically after rainstorms. This is most notable in association with Grindstone Creek.

Sedimentation rates, a reflection of the "bedload" fraction of the inflowing sediment, are measured using long term changes in water depths. These measurements, first taken in the 1940's, and updated in 1998, and 2005 indicate that the marshes are infilling at a rate of between 0.5 and 1cm per year. Many marsh locations in proximity to the main river mouths have more than 100cm of sediment accumulated since 1949. Overall, this is equivalent to approximately 15,000 m³/ year of new sediment, mostly in the form of sand and silt and many times natural rates. While the sedimentation is infilling the marshes they are not expected to become completely filled, as isostatic rebound is counteracting this issue and providing some deepening of the wetlands. [Isostatic](#) rebound is the gradual rising of the land historically depressed by the weight of glaciers. In the case of the Lake Ontario area, the east end is rising slightly faster than the western end (~1-3 mm/yr). This rebound thus raises the water at the west end of the lake and results in the technical name for wetlands that occur there, "drowned river mouth wetlands".