

Marshroots: The Reclaiming of Precedent on Toronto's Waterfront

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The success behind architecture is in its incompleteness. Thus its role is not to dictate, but to encourage and nurture. It is dangerous to pre-suppose program, as this curtails the possibility for future growth. The site at Maple Leaf Quay is symptomatic of this kind of stagnation; public furniture is peppered around the harbor in a slipshod manner with no real attraction. In the harbor itself, organic debris drifts haplessly, degrading the aesthetic value of the Toronto waterfront. Programmatically, Maple Leaf Quay has reached a stalemate; the site is currently devoid of any pedestrian and natural activity. Intervention requires a return to precedent: historically, the Toronto waterfront consisted of diverse plant and animal communities, though these communities have been compromised in favor of human development. Maple Leaf Quay's proximity to the systems of the Don Valley River and Lake Ontario, minimal cultural attraction, and deteriorating program give credence to the idea that a marsh can occupy the vacant harbor. A marsh, once self-sustaining, will continue to thrive after its initial implementation while serving the public via the devices required to facilitate its existence.

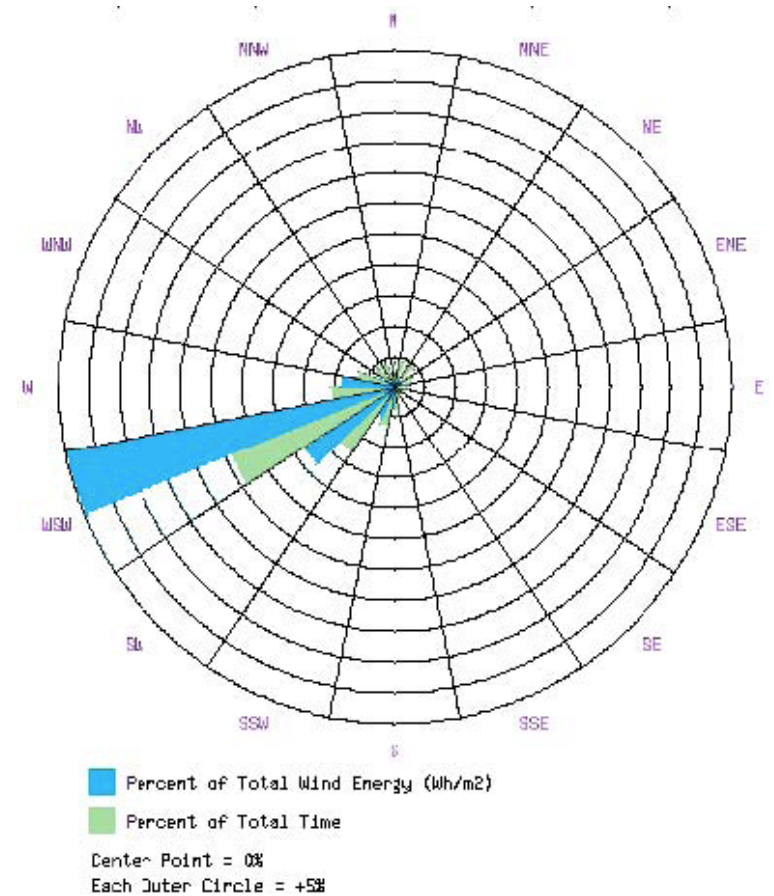
Given that the geographic history of Toronto is abundant with aquatic habitats and their corresponding wildlife, the choice to revert to this ecology as precedent for a future development on Toronto's waterfront is a natural and unobtrusive decision. If posed as a problem of creating an ecosystem, the solution simplifies the variables by which the new habitat is to be designed. Essentially, the ecosystem problem condenses the understanding of a space to "everything is related to everything else." Thus the relationship between humans and all other living organisms is summarized by a basic symbiosis.



Source: "Environment & Energy - Living In Toronto | City of Toronto." Environment & Energy - Living In Toronto | City of Toronto. N.p., n.d. Web. 20 July 2014. <<http://www1.toronto.ca/wps/portal/co ntentonly?vgnextoid=fid95ba2ae8b1e310VgnVCM10000071d60f89RCRD>>.

Because the habitats of the shoreline have been displaced by extensive development, the re-introduction of a marsh both restores the natural habitat and enhances the quality and attractiveness of human communities. Human use is a vital part of Toronto's waterfront, and so it is imperative for the re-design of Maple Leaf Quay to incorporate social activity whilst prioritizing the generation of a self-sustaining marsh. This action must be accompanied by remedial measures to provide the right biological, ecological, and chemical conditions for marsh growth. Growth is influenced primarily by meteorological, wave, and sediment activity. As the geography of Toronto's waterfront is predisposed to promote favorable conditions for the sustenance of a marsh, these factors need only be amplified with devices that augment wind and wave energy.

Along the Toronto harbor, wave energy is predominantly determined by prevailing winds. A high percentage of lake currents and near-shore waves are determined by wind direction; winds are generally from the West, although longer eastern fetches, fetches being the length of water over which a given wind has blown, produce more wave energy.¹ The wave energy that is the result of winds and ambient lake currents is the primary means by which sediment is transported.



Source: "NAV CANADA." NAV CANADA. N.p., n.d. Web. 16 July 2014. <<http://www.navcanada.ca/>>.

1 "Aquatic Habitat Toronto." Aquatic Habitat Toronto. N.p., n.d. Web. 5 July 2014. <<http://www.aquatichabitat.ca/>>.

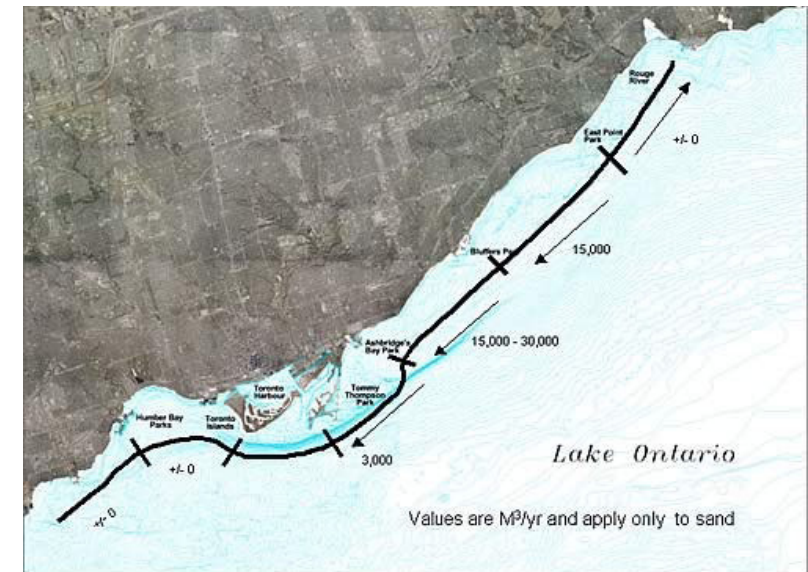
The movement of sediment--littoral drift--is heavily applicable to the design of a marsh on the waterfront as it is the mechanism for the emergence of the Toronto Islands. The sediment transport pertaining to the area surrounding Maple Leaf Quay is much less a factor of erosion of northeastern shorelines and more so one traceable from the Don Valley River.² From the marsh implementation perspective, this is where necessity evinces itself. Toronto Bay is a depositional area that contains suspended sediment loads from the Don River, and current aquatic revitalization projects are focusing on flood protection from the Lower Don. Alterations to Toronto Bay and growth in the Distillery District beginning in the early 1900s caused the Don River to become severely polluted. Runoff and erosion from upstream in the Don River bring up to 40,000 cubic meters of sediment into Toronto Harbor every year; sediment generally moves east-to-west, and is made up of depositional muds and clay.³ Restoration techniques that focus on the growth of emergent vegetation rely on the mitigation and optimization of wind and wave energy, and littoral transport to promote marsh growth.

2 "Sediment quality on the Toronto waterfront." *Sediment quality on the Toronto waterfront*. N.p., n.d. Web. 16 July 2014. <<https://archive.org/stream/SEDIMENTQUALITYO00WILK09231.ome/SEDIMENTQUALITYO00WILK09231#page/n0/mode/2up>>.

3 "Environment & Energy - Living In Toronto | City of Toronto." *Environment & Energy - Living In Toronto | City of Toronto*. N.p., n.d. Web. 20 July 2014. <<http://www1.toronto.ca/wps/portal/contentonly?vgnextoid=f495ba2ae8b1e310VgnVCM10000071d60f89RCRD>>.

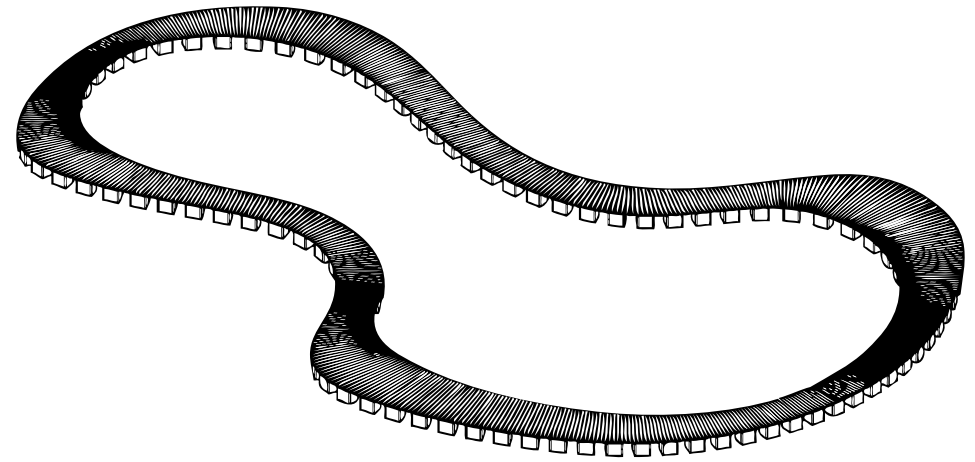


Source: "Aquatic Habitat Toronto." *Aquatic Habitat Toronto*. N.p., n.d. Web. 5 July 2014. <<http://www.aquatichabitat.ca/>>.

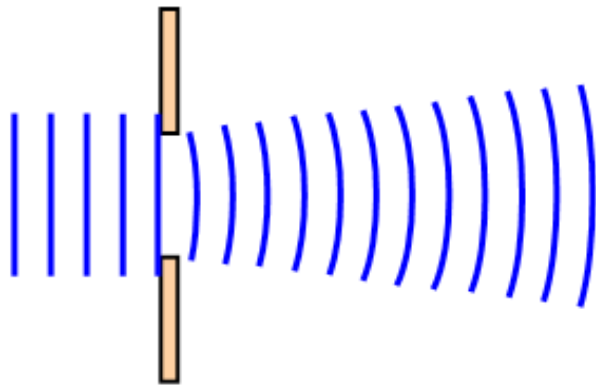


Source: "Aquatic Habitat Toronto." *Aquatic Habitat Toronto*. N.p., n.d. Web. 5 July 2014. <<http://www.aquatichabitat.ca/>>.

Restoration techniques for marsh growth each correspond to a target for ecologic enhancement. While each adds to the integrity of a habitat, the greatest elements to consider are wave attenuation and sediment collection. Wave effects, especially those of Toronto Harbor's eastern fetches, accumulate, and can reflect and diffract, depending on what kinds of obstacles exist. In addition, waves change their behavior as they impact shallow water. Therefore, the design of a wave attenuator to break up wave action and generate the stability needed for a marsh is very site-specific. A wave attenuator that consists of decking on a floatation device permits the passage of silt while significantly decreasing disturbances in the water.⁴



The breakwater on pontoons at Maple Leaf Quay



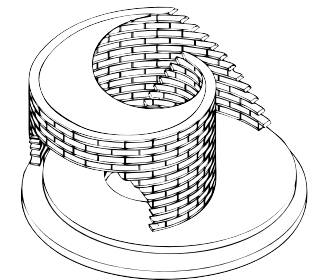
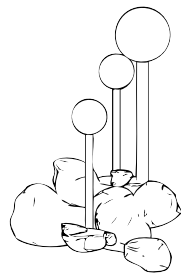
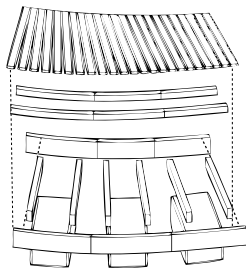
Wide gap – small diffraction effect

Figure 1

This breakwater strategy is optimal in that it simultaneously acts as a venue for human recreation. The boardwalk/decking format limits the invasiveness of the project while protecting its contents from both wind and wave energy. After close examination of the site at Maple Leaf Quay, it has been observed that waves coming from the East enter the inner harbor in a broad, fan-shaped pattern caused by diffraction at the harbor opening (see figure 1).

To dampen the effect of these incoming waves, the floating breakwater used in the Maple Leaf Quay design must have some orientation around the mouth of the site so as to interfere with the east-to-west lake currents. Structural habitat features for newly emerging vegetation will be deployed accordingly with respect to the sculpted floating dock, as incoming sediment channeled at the mouth of the harbor determines future growth patterns. The vertical seawall condition at Maple Leaf Quay can be improved with a mixture of stone and aggregates (rip-rap and gravel) to not only provide structure for an aquatic habitat, but also catch incoming sediment and begin the accumulation process. Forage areas for terrestrial and underwater species are thusly introduced to increase primary production in the swamp and enhance habitat diversity.⁵ In the context of Maple Leaf Quay, the concept of using rubble to bolster aquatic habitats can be advanced through the use of log piles. With regard to the ecosystem approach, vertical log piles, in this case synthetic, are positioned in a further application of rubble/gravel to once again furnish the site with underwater structural elements, and also anchor the aforementioned floating breakwater in a stable position. Culturally, synthetic log piles behave as lighting elements as part of the human program, giving the project a distinct aesthetic and attractive presence.

From left to right: A section of the floating dock, synthetic log piles, rubble, floating pavilion



Once these measures have been implemented, it is anticipated that the sediment of the Don Valley River will accumulate to the point where shallower waters will become conducive to flourishing emergent vegetation. In doing so, Maple Leaf Quay will effectively transform into a riparian zone (the interface between the Don Valley River and Toronto Harbor) and begin the cycle of self-sustenance. Floating plant rafts, introduced as an intermediate measure to initiate marsh development, are expected to reach the point where their roots extend down to the silt collected by various substrates, yielding an ecosystem as a result. Riparian vegetation protects aquatic environments from excessive sedimentation, provides shelter for wildlife habitats, and filters pollutants from incoming waters.⁶ Water flow and sediment are detained naturally, and in the case of the Don Valley River, larger pieces of debris that flow downstream in the event of heavy rainfall are captured and used for further filtration.

5 "Exploring Nature Educational Resource." -- Exploring Nature Educational Resource. N.p., n.d. Web. 16 July 2014. <<http://www.exploringnature.org/db/detail.php?dbID=44&detID=591>>.

5 "Exploring Nature Educational Resource." -- Exploring Nature Educational Resource. N.p., n.d. Web. 16 July 2014. <<http://www.exploringnature.org/db/detail.php?dbID=44&detID=591>>.

The decision to design a marsh as a part of public infrastructure is one that considers the role of Lake Ontario as a biological centre of organization. Lake Ontario performs as a wetland habitat for avian and fish communities during all stages of life, a migratory corridor, and as a seasonally dependent environment for transient species. A self-sustaining habitat like a marsh has the ability to host a diverse number of species that depend on each other for nourishment; however, due to the degradation of the Toronto waterfront, the occurrence of fish, bird, and plant life has suffered. A productive, resilient habitat like a marsh can greatly improve the integrity of coastal life in its presence as an emergent biological structure.⁷ The symbiosis between species, and thus the necessity of the proposal, is enhanced by the design of the Maple Leaf Quay marsh through its introduction of secondary human programming in the form of floating pavilions. The pavilions themselves incorporate a small area for the growth of gardens, which are supported by the aquatic life in the marsh.



A floating plant raft that initiates marsh growth

Source: "Exploring Nature Educational Resource." -- Exploring Nature Educational Resource. N.p., n.d. Web. 16 July 2014. <<http://www.exploringnature.org/db/detail.php?dbID=44&detID=591>>.

The perpetual nature of the biological processes that pertain to Toronto Harbor and the Don Valley River attest to the evolutionary character of the marsh at Maple Leaf Quay. The marsh will continue to produce life and purify water after its completion, therefore serving as an asset for the city both respect to its ecological and cultural longevity. Meteorological and biological conditions required as prerequisites for this design are extant to the site, whereas suffering cultural attractions demand this caliber of transformation. Ultimately, the project's merit is attributed to its effort to restore and intervene in a manner that serendipitously produces a lush cultural waterscape.

⁷ *"Aquatic Habitat Toronto." Aquatic Habitat Toronto. N.p., n.d. Web. 5 July 2014. <<http://www.aquatichabitat.ca/>>.*

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