



Cleanup of Toronto Harbour Leads to Waterfront Revitalization

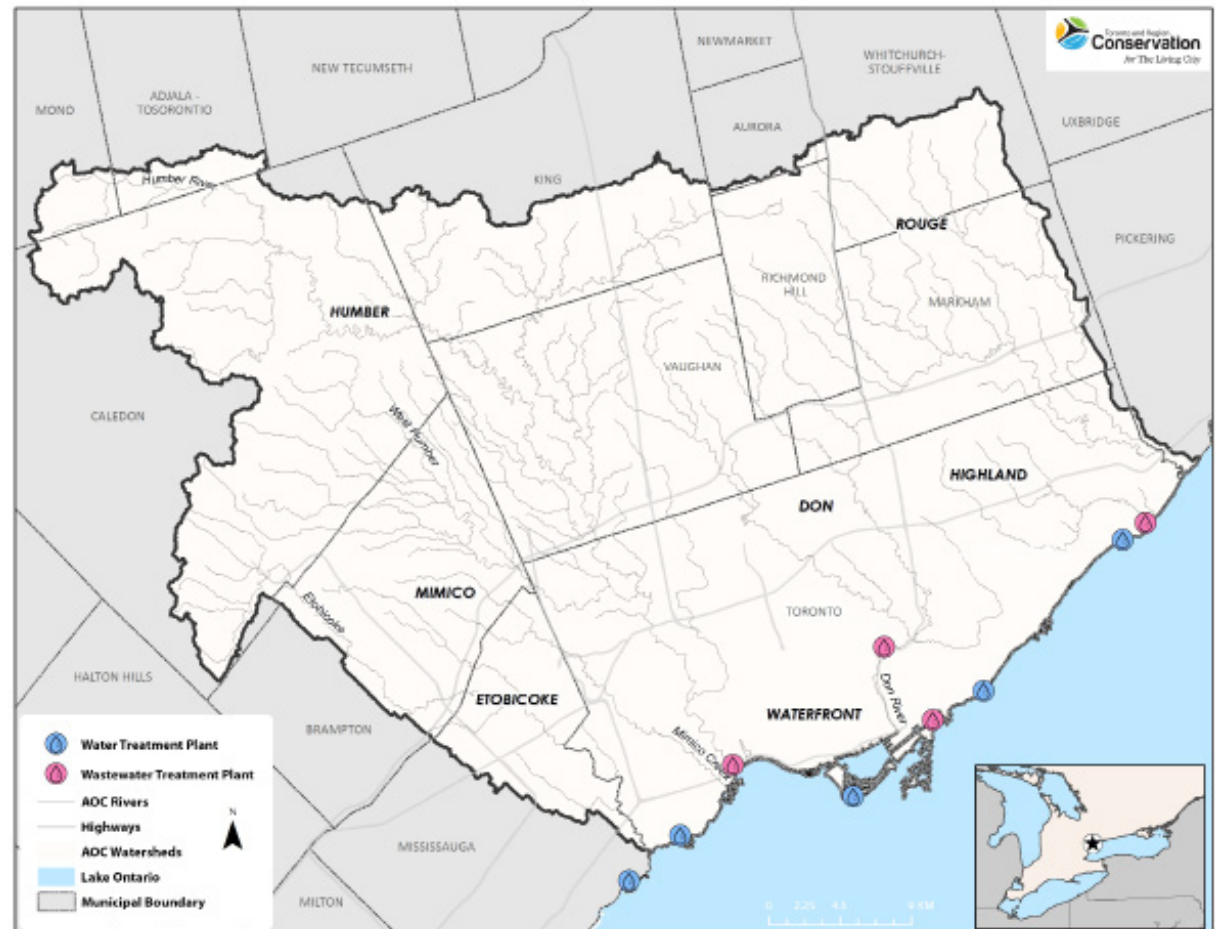
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By Valerie Francella, Toronto and Region Conservation Authority; with input from Michael Wolfe, Waterfront Toronto

Situated on the northern shore of Lake Ontario, Toronto has grown into Canada's largest city and a key hub of the nation's commercial, financial, industrial, and cultural life. In 1985, the International Joint Commission (IJC) identified Toronto and Region as one of 42 Areas of Concern (AOC) in the Great Lakes where water quality and other ecosystem functions were badly impaired. The AOC extends from Etobicoke Creek in the west to the Rouge River in the east and includes six major watersheds that drain into Lake Ontario (see map). These include Etobicoke Creek, Mimico Creek, the Humber River, the Don River, Highland Creek, and the Rouge River. These watersheds drain an area of 2,000 square kilometers (1,243 square miles) and include 42 kilometers (26 miles) of waterfront, 11 municipal jurisdictions, and more than 4 million people.

Toronto and Region Remedial Action Plan

In response to a 1985 recommendation of the IJC's Great Lakes Water Quality Board,



Map depicting the Toronto and Region Area of Concern, including its six major watersheds: Etobicoke Creek, Mimico Creek, Humber River, Don River, Highland Creek, and Rouge River. Credit: Toronto and Region Conservation Authority.

Environment Canada and the Ontario Ministry of the Environment (MOE) committed to developing and implementing a Remedial Action Plan (RAP) to clean up Toronto's harbor and restore all impaired beneficial uses using an ecosystem approach. A Stage 1 RAP (i.e., environmental conditions and problem definition) was completed in 1989 (MOE, 1989), followed by a Stage 2 RAP (i.e., actions to address problems) completed in 1994 (MOE, 1994). In 1989, eight beneficial use impairments (BUIs) were identified (i.e., restrictions on fish consumption, degradation of benthos, restrictions on dredging activities, eutrophication or undesirable algae, beach closings, degradation of aesthetics, degradation of fish and wildlife populations, and loss of fish and wildlife habitat) and three required further assessment (i.e., fish tumors or other deformities, bird or animal deformities or reproductive problems, and degradation of phytoplankton and zooplankton populations). The Toronto and Region RAP is managed by representatives from Environment and Climate Change Canada (ECCC), the Ontario Ministry of the Environment, Conservation, and Parks (MECP), the Ontario Ministry of Natural Resources and Forestry (MNR), Toronto Water, and the Toronto and Region Conservation Authority (TRCA). Since 2002, TRCA has led the

administration of the RAP under an agreement with ECCC and the MECP.

The Toronto RAP team works with partners to address BUIs to ultimately restore Toronto's waters and fish and wildlife habitats and populations. Implementation of remedial and restoration actions has led to significant and demonstrable improvements in the quality of water and sediment, the amount and condition of terrestrial and aquatic habitats, and the health of aquatic biota and aquatic communities (Kidd, 2015). Table 1 presents highlights of progress on key indicators. Although much has been accomplished, there is still work to be done to meet the Toronto and Region RAP goal of completing restoration actions by 2025 to then delist as an AOC. Additional highlights of achievements are presented below.

Pollution Control

Control of contaminants at their source has been a major priority through legislation, regulations, and voluntary, beyond-compliance initiatives. In addition, the City of Toronto has made significant progress in implementing the city's Wet Weather Flow Master Plan (WWFMP). Since adoption of the master plan in 2003, the city has invested approximately \$485 million in wet weather flow

management projects. These projects improve water quality in Toronto's watercourses and the shoreline along Lake Ontario, build resilience to reduce basement flooding risks associated with extreme storms, and restore and protect watercourses from future erosion, which supports ecosystem health. Toronto Water's 10-Year Capital Plan (2016-2025) identifies almost \$2.8 billion for the implementation of WWFMP projects over the next ten years.

The city completed an environmental assessment study for the Don River and Central Waterfront Project in 2012 to address recommendations from the WWFMP related to management of combined sewer overflows (CSOs). The project integrates wet weather flow management systems to capture and treat stormwater discharges and CSOs from all the combined sewer outfalls to the Lower Don River, Taylor-Massey Creek (a tributary to the Don River), and Toronto's Inner Harbour (Snodgrass et al., in press, 2018). The project consists of three integrated tunnels (22 kilometers [14 miles] in total) connected to 12 underground vertical storage shafts, 27 connections to outfalls, seven off-line storage tanks, an integrated pumping station at the Ashbridges Bay Wastewater Treatment Plant, and a new wet weather flow, high-rate treatment facility to be built on a future

INDICATOR	STATUS	INDICATOR	STATUS
BUIs	Since 2007, assessments on four of the 11 original beneficial uses deemed impaired or requiring further assessment have been redesignated as "not impaired," including bird or animal deformities or reproductive problems, degradation of benthos, fish tumors or other deformities, and restrictions on dredging activities.	Benthic communities	Overall, there has been an increase in diversity of benthic organisms, reflecting improved conditions of bottom sediments along the waterfront.
Phosphorus	Spring total phosphorus concentrations in the Inner and Outer Harbour now reflect mesotrophic conditions (moderate phosphorus enrichment). Watershed levels continue to improve.	Habitat – natural cover	The lowest percentage and the poorest quality is in urbanized areas. Amount of natural cover is relatively stable, but quality has declined over time.
Bacteria	Overall steady improvement in bacterial pollution of beaches. Eight of 11 beaches now meet Blue Flag criteria (high water quality). Levels at three waterfront beaches adjacent to watercourses do not meet the RAP target.	Habitat – wetlands	Continued losses partly offset by wetland creation.
Heavy metals	In the watersheds, levels of metals are not an issue at most sites. Some improvements have been observed in copper and lead concentrations in tributaries since 1999.	Habitat – riparian vegetation	Possible slight increase due to restoration efforts and regulations that protect the floodplain from development.
Persistent organic compounds	In the watersheds, levels of compounds such as PCBs and PAHs are typical of streams in urban areas, are strongly related to the amount of urbanization, and tend to be higher in wet weather conditions.	Aquatic habitat	In the watersheds, aquatic habitat is greatly influenced by the degree of urbanization. Along the waterfront, the extent and quality of aquatic habitat has been improved through habitat creation and restoration.
Chlorides	Levels continue to increase in the watersheds. In some places, elevated concentrations are becoming a year-round issue. Increase in levels in Lake Ontario.	Fish communities	Decrease in native species and increase in degradation-tolerant species in the watersheds. Along the waterfront, populations are dominated by degradation-tolerant species, Index of Biotic Integrity is "fair," and proportion of piscivores generally reflects a "healthy" classification.
Aesthetics	No longer an issue in the watersheds and waterfront of the Toronto RAP area, and is in the process of being re-designated to "not impaired."	Contaminants in fish	Levels of PCBs and mercury have declined substantially over the last 30 years. Consumption of many resident fish is unrestricted. Consumption of most migratory fish species, as well as common carp and white sucker, are still restricted for certain sizes of fish.
Bottom sediments	Overall, concentrations of metals and organic compounds in sediments in the Inner Harbour and Humber Bay continue to decrease. Elevated concentrations of some metals are found only in some of the slips in the Central Waterfront. Implementation of key wet weather flow projects will further improve conditions.	Wildlife communities	Targets were met suggesting that bird and frog populations within Toronto & Region AOC are within the normal range of variability expected from bird and frog populations within a reference watershed, the Duffins Creek.

Table 1. Highlights of progress in key indicators of the Toronto and Region RAP. Credit: Kidd, 2015.

landform project south of Ashbridges Bay. The project will also help service future growth and provide redundancy for the Coxwell Sanitary Trunk Sewer.

This \$2 billion project is being implemented in stages over 25 years. Once it has been fully implemented, it will virtually eliminate the release of CSO discharges into the Don River, Taylor Massey Creek, and Toronto's Inner Harbour, as well as reduce polluted stormwater discharges. It will also reduce the associated loadings of nutrients, suspended solids, and associated heavy metals. The ultimate impact of this project on improved water quality in these waterbodies will be significant and will also contribute to improved aquatic recreational uses and fish habitat. Progress on this project includes completion of preliminary design for the system of tunnels, shafts, and off-line storage tanks in 2015. Construction of the first phase, the Coxwell Bypass, has started in 2018 and will take seven years to complete.

Habitat Restoration

Habitat rehabilitation and enhancement has been a long-standing priority of the Toronto and Region RAP with more than \$80 million invested since 1987. In the last 10 years alone, more than 823 hectares (2,030 acres) of habitat and 57

kilometers (35 miles) of shoreline were created or restored in the Toronto and Region AOC through TRCA-led projects.

In 2000, the federal, provincial, and municipal governments announced \$1.5 billion to revitalize the Toronto waterfront and establish the Toronto Waterfront Revitalization Corporation (now called Waterfront Toronto) to guide its development. It was immediately evident that an aquatic habitat restoration strategy was needed to ensure sustainable development in a cost-effective manner that met the needs of the development

industry, while achieving the mandates and objectives of the many resource management agencies.

In 2003, the Toronto Waterfront Aquatic Habitat Strategy was developed to guide aquatic habitat restoration efforts for the RAP in support of waterfront revitalization. Since that time, this strategy has guided the restoration of coastal wetlands and sheltered embayments for warm and coolwater fishes, open-coast habitat for populations of coldwater fishes, and river mouths and freshwater estuaries for resident and

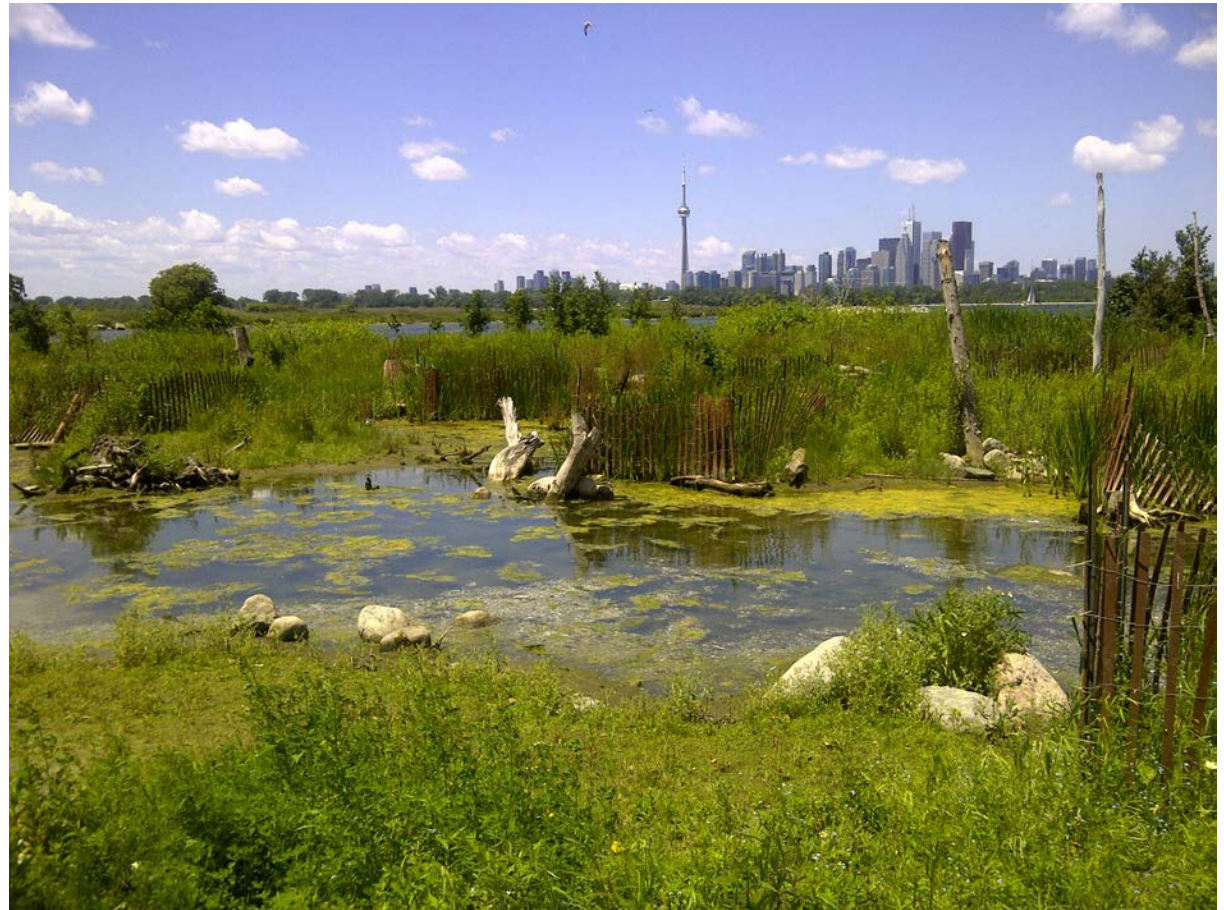


Construction of wetland at Embayment D, Tommy Thompson Park. Credit: Toronto and Region Conservation Authority.

migratory fishes. Aquatic Habitat Toronto (AHT) is a committee established to coordinate the implementation of the strategy. Representatives from Fisheries and Oceans Canada (DFO), ECCC, TRCA, MNRF, City of Toronto, Ports Toronto, and Waterfront Toronto comprise the committee.

AHT ensures that all waterfront projects incorporate opportunities to improve aquatic habitat and support sustainable aquatic ecosystems as envisioned in the strategy. AHT works with proponents of waterfront projects at the early planning stages to facilitate the approvals process. It also provides essential information to help decision makers, designers, and regulatory authorities restore aquatic habitat to create a more livable city and to delist Toronto and Region as an AOC. Electrofishing, trap netting, hydroacoustic surveys, trawling, and fish acoustic telemetry provide an assessment of the health of the fish community and aquatic habitat. AHT coordinates monitoring and research efforts undertaken by DFO, TRCA, MNRF, Carleton University, and the University of Toronto to inform habitat design and restoration efforts and to assess the success of restoration projects in improving fish and wildlife habitat and populations.

Major habitat restoration projects completed under this strategy restored 23.8 hectares (56 acres) of coastal wetlands; 4.5 kilometers (2.8



View of downtown Toronto through constructed habitat at Tommy Thompson Park. Credit: Toronto and Region Conservation Authority.

miles) of open-coast shoreline; 2.5 hectares (6 acres) of sheltered embayments; and 1.9 kilometers (1.2 miles) of river shoreline. These efforts were carried out at Tommy Thompson Park, Toronto Island Wetlands, Port Union shoreline, Mimico Linear Waterfront Park, Humber Marshes, Long Pond shoreline, Outer

Harbour shoreline, West Shore, and numerous central waterfront fish habitat creation projects.

In 2011, the federal government announced that Rouge Park was to become Canada's first national urban park. The Rouge Park is rich in natural, cultural, and agricultural features, including 1,700 species of plants and animals,

more than 10,000 years of human history, and some of the rarest and best remaining wetlands, forests, and agricultural lands in the Greater Toronto Area. It contains working farms, Carolinian forests, one of the region's largest wetlands, unspoiled beaches, kilometers of hiking trails, and the city's only campground. Once fully established, Rouge National Urban Park will be more than 79 square kilometers (30 square miles) in size—some 22 times the size of Central Park in New York—making it one of the largest and best-protected urban parks of its kind in the world. In 2015, the federal government announced it was committed to expanding the park by more than 36 percent with the addition of 21 square kilometers (8 square miles) of lands. Federal investment in Rouge National Park is projected to be \$100 million.

In 2017, federal, provincial, and municipal governments announced \$1.25 billion for the Port Lands Flood Protection and Don River Mouth Naturalization Project to revitalize Toronto's eastern waterfront. This effort adds to the flood protection landform completed in 2012. In the early 20th century, Toronto's Ashbridges Bay Marsh was filled to create the Port Lands, and the mouth of the Don River was straightened to form the Keating Channel. The loss of this 428-hectare (1,058-acre) coastal marsh negatively impacted flooding, aquatic habitat, and fish and wildlife diversity and abundance, contributing to Toronto being listed as an AOC.

This project will construct a new naturalized river mouth through the Port Lands, creating a new urban island neighborhood called Villiers Island. The river valley will add 16 hectares (40 acres) of new parkland, promenades, and riverfront open space. In addition, the river valley will have 14 hectares (39.5 acres) of new aquatic habitat and wetlands to improve biodiversity and water quality and to naturally moderate the effects of flooding and erosion. In addition to the social and environmental benefits derived from the project, an economic impact study (urbanMetrics, 2013) estimated that spending on construction would generate approximately



Aerial views of Port Union waterfront park upon completion of Phase 1 of construction (top), and Mimico Waterfront Park, Toronto, Ontario (bottom). Credit: Toronto and Region Conservation Authority.

- \$1.1 billion in value to the Canadian economy,
- 10,829 person-years of employment, and
- \$373 million in tax revenues to all levels of government.

In addition to the projects above, many of the improvements in the Toronto and Region AOC are attributable to the implementation of larger programs that support RAP objectives. Many of these programs are long-term, multi-agency, and strategic, working on a prioritized implementation basis. A few examples are TRCA's waterfront development program and erosion control and risk management program; long-term water quality monitoring programs of the ECCC, MECP, TRCA and city; as well as the city's ravine, parklands, and biodiversity strategies that aim to showcase and improve public literacy around urban biodiversity.

Economic Benefits of Toronto Waterfront Revitalization

Historically, Toronto's waterfront was underused and unappreciated; however, it is rapidly becoming a priceless public asset accessible to everyone. Through an inclusive process, Waterfront Toronto is rethinking, reimagining,



The Simcoe Wavedeck next to the Martin Goodman Trail and Queens Quay Boulevard. Credit: Waterfront Toronto.

and redefining what its waterfront should be. It believes that revitalizing Toronto's waterfront represents an unparalleled opportunity to reestablish positive, meaningful relationships with Lake Ontario and to transform underused lands into vibrant public and cultural spaces for all Torontonians. Waterfront Toronto's mandate is to deliver a revitalized waterfront that brings together the most innovative approaches to

sustainable urban development, excellence in urban design, real estate development, and leading technology infrastructure.

Working with the community and with public- and private-sector partners, Waterfront Toronto creates complete neighborhoods anchored by parks and public spaces; and diverse, sustainable, mixed-use communities that offer a high quality of life for residents,



employees, and visitors alike. This waterfront transformation is being undertaken for the use and enjoyment of the people of Toronto and across Canada, to foster economic growth and to redefine how the city, province, and country are perceived by the world. Waterfront Toronto has worked synergistically with the Toronto and Region RAP to restore and sustain a vibrant

ecosystem that provides environmental, social, and economic benefits to local communities and visitors.

As part of an effort to measure economic effectiveness, Waterfront Toronto commissioned urbanMetrics (2013) to undertake extensive analyses of the economic and fiscal benefits stimulated by the organization's investment in Toronto's

Revitalized Queens Quay Boulevard along Toronto's waterfront. Credit: Waterfront Toronto.

waterfront and an update for its 2018 Corporate Social Responsibility & Sustainability Report. As part of these analyses, urbanMetrics quantified that Waterfront Toronto invested \$1.6 billion on waterfront planning and implementation since the organization's inception in 2001 through March 2017. A review of Waterfront Toronto's

historic expenditure patterns was undertaken, based on the 2007 North American Industrial Classification System. Once classified, the \$1.6 billion of investments were analyzed using an urbanMetrics Input-Output model, which simulates the flow of Waterfront Toronto's initial expenditures through the economy. This model

has been specifically designed to provide a reliable measure of the impact of the organization's expenditures on job creation, incomes, value added to the economy, and taxes and other government revenues.

When adjusted for inflation, Waterfront Toronto's \$1.6 billion investment equals



Water park – Corktown Common in the West Don Lands. Credit: Waterfront Toronto.

approximately \$1.9 billion in 2016 dollars. This investment will:

- Generate approximately 14,100 full-time years of employment, of which approximately 88.5 percent are in the City of Toronto (the majority of the jobs created are in the construction sector, the finance, insurance, real estate, and renting and leasing sector, and the professional, scientific, and technical services sector);
- Stimulate \$4.1 billion in total economic output to the Canadian economy (the majority of this economic growth will accrue in the City of Toronto); and
- Generate total government revenues of approximately \$848 million, with \$394 million to the federal government, \$243 million to the provincial government, and \$162 million to the City of Toronto.

Although Toronto Waterfront's expenditures are significant, they are relatively small compared to the recurring benefits that result. These include permanent jobs, property taxes, income taxes, and tourism spending that will be experienced with the continued development of new office, residential, retail/service commercial, cultural, and entertainment uses along the city's waterfront, which would not occur without the initial investments by Waterfront Toronto.

Clearly, Waterfront Toronto has played a significant role in creating economic value in the Toronto waterfront. Interviews with Toronto's development community confirmed that if it were not for the planning, land assembly, remediation, and infrastructure improvements by Waterfront Toronto, many parts of the waterfront would continue to languish as vacant and underutilized brownfield sites (urbanMetrics, 2013). Whereas the above impacts related to Waterfront Toronto's direct spending on planning and infrastructure, urbanMetrics also quantified benefits accruing to private- and public-sector real estate projects both on lands controlled by Waterfront Toronto and other privately-owned land on the waterfront.

For example, the combined development on East Bayfront and West Don lands, and the adjoining neighborhoods, will generate nearly 207,900 years of employment, add \$13.8 billion to the Canadian economy, and provide \$7.5 billion in tax revenues to the three levels of government (Table 2).

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Project Category	Value Added to Economy	Years of Employment	Labor Income	Tax Revenue *
East Bayfront and West Don Lands (public lands controlled by Waterfront Toronto)	\$3.4 billion	35,100	\$2.3 billion	\$1.3 billion
Privately held development projects in waterfront precincts and neighborhoods	\$16.8 billion	172,800	\$11.5 billion	\$6.2 billion
Total	\$20.2 billion	207,900	\$13.8 billion	\$7.5 billion

Table 2. A summary of economic benefits of construction projects located on public lands controlled by Waterfront Toronto in the East Bayfront and West Don areas, and privately-owned lands in adjoining neighborhoods. Credit: urbanMetrics, 2013.

* Tax revenue to federal, provincial, and local governments

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Cover photo shows Toronto's waterfront with Toronto Islands in the foreground. Credit: Waterfront Toronto.

All monetary amounts are in Canadian dollars.

Contacts

Valerie Francella
Project Manager
Toronto and Region Conservation
Authority
valerie.francella@trca.on.ca

John Hartig
Great Lakes Science-Policy Advisor
International Association for Great Lakes
Research; Visiting Scholar, Great Lakes
Institute for Environmental Research,
University of Windsor
johnhartig1@gmail.com



The Toronto and Region case study is part of a larger project to evaluate achievements and lessons learned from 32 years of efforts to clean up Great Lakes AOCs. Case studies will be used to help sustain support for cleaning up AOCs and to inspire and motivate others to restore other degraded aquatic ecosystems.

Funding was provided by the Fred A. and Barbara M. Erb Family Foundation to the International Association for Great Lakes Research, which administers and oversees the project. The Erb Family Foundation is a philanthropic organization that nurtures environmentally healthy and culturally vibrant communities in metro Detroit and supports initiatives to restore the Great Lakes ecosystem.

The International Association for Great Lakes Research is a scientific organization made up of researchers studying the Laurentian Great Lakes, other large lakes of the world, and their watersheds, as well as those with an interest in such research. With its mission to promote all aspects of large lakes research and communicate research findings, IAGLR is uniquely positioned to foster the connection between science and policy, a connection vital for effective management and protection of the world's large lakes.

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