3.0 DESCRIPTION OF THE POTENTIALLY AFFECTED ENVIRONMENT

The purpose of Chapter 3 is to present an overview of the environment potentially affected by the proposed LWC Project. This will create familiarity with issues to be addressed and the complexity of the environment likely to be affected by the LWC Project. All aspects of the environment within the LWC Regional and Project Study Areas (see Figures 3.1 and 3.2) have been described in this chapter. The chapter is divided into three sections which capture different components of the environment. The first section describes the coastal and fluvial characteristics, including aquatic habitat, which will influence the development of 'Alternative Methods'. This information has been separated from the remaining description of the natural environment so that emphasis can be given to those aspects of the existing environment that are driving the LWC Project. The second section describes the remaining components of the natural environment: terrestrial vegetation and wildlife, and soils and geology. The third section describes socioeconomic components: existing and planned land use, land ownership, archaeology, cultural heritage, recreation and Aboriginal interests.

The description of the existing environment is primarily based on the information from two existing studies including the Feasibility Study (CVC and TRCA, 2012), and reports prepared for CVC's LOISS (Aquafor Beech, 2011a; 2011b). Additional field studies were undertaken where appropriate. Other documents and studies used in the preparation of the information are referenced in the appropriate sections.

3.1 SHORELINE & RIVER PROCESSES & CONDITIONS

3.1.1 Geomorphology

Geomorphology is the study of the composition and configuration of landforms, the forces acting upon them (e.g. streamflow, wind, wave), and the physical response of landforms to those processes (e.g. erosion, deposition). These dynamic process-response systems have an impact on terrestrial and aquatic habitat, infrastructure, water quality, recreation, and many other components of the environment. In the context of the LWC Project, an understanding of baseline geomorphology is critical to designing a stable, functional and sustainable landform and aquatic system.

3.1.1.1 Shoreline Processes & Conditions

Current shoreline conditions within the LWC Regional and Project Study Areas are a function of natural coastal process and modifications that have occurred over time as the area has been urbanized. Baseline shoreline conditions provide insight into potential shoreline configurations that will be proposed as LWC Project 'Alternative Methods'.

LWC Regional Study Area

Within the City of Mississauga city, approximately 80% of the shoreline has been modified (LOISS 2011). The City of Toronto portion of the LWC Regional Study Area consists of approximately 175 m of sand beach shoreline on the east side of Etobicoke Creek plus approximately 3,100 m of artificial shoreline, including the headlands at Colonel Samuel Smith Park (see Figure 3.1).

The nearshore bottom within the LWC Regional Study Area is composed mainly of shale bedrock, overlain with erodible cohesive tills varying from low plains to low and moderate height bluffs. Extensive filling has created a number of reaches that are characterized as artificial shores (LOISS 2011).

Examples of artificial and natural beaches (sand and cobble) within the LWC Regional Study Area are found at Rattray Marsh, Lakeside Park (artificial clay cobble) and Fusion Park; and sand beaches at Richard's Memorial Park, Lorne Park Estates, Jack Darling Park, Suncor Energy and on either side of the mouth of Etobicoke Creek. Strictly speaking the beaches on either side of the mouth of Etobicoke Creek, within Marie Curtis Park (East and West) are naturally a sand/gravel beach. The City of Toronto has had to nourish Marie Curtis Park beach on an as needed basis and not as part of routine maintenance operations, primarily focused on the east side of Etobicoke Creek. In response to recent storm events and to ensure safety and to provide access for permitted uses such as volleyball, beach nourishment is now occurring (on an as needed basis) on the west side of Etobicoke Creek as well.

LWC Project Study Area

Within the LWC Project Study Area (see Figure 3.2), approximately 55% of the shoreline is hardened, with the remaining 45% being thin sandy beaches. Historic lakefilling that has occurred in front of the WWTF's ash lagoons are examples of hardened shores (revetment). The sand beach between those two sections of artificial shore is a remnant of previous lakefilling and is a thin sand deposit overlying the cohesive shore and bedrock substrate. The beach fronting Marie Curtis Park is natural and is backed by a low cohesive plain and overlays a bedrock substrate. The length of sand beach fronting Marie Curtis Park west of Etobicoke Creek is 505 m.

The mouth of Etobicoke Creek was redirected and piers were installed between 1946 and 1954 which fixed the creek mouth in its current location and created a partial barrier to long shore sediment transport. Air photo analysis indicates that shoreline recession rates have been stabilized since 1978 (Geomorphic Solutions, 2012). Given these stable conditions, the beach no longer meets the province's definition for classification as a dynamic beach[2] (GHD 2013).

[2] Beach material is moved over time by shoreline erosional processes.

Figure 3.1 Features within the LWC Regional Study Area

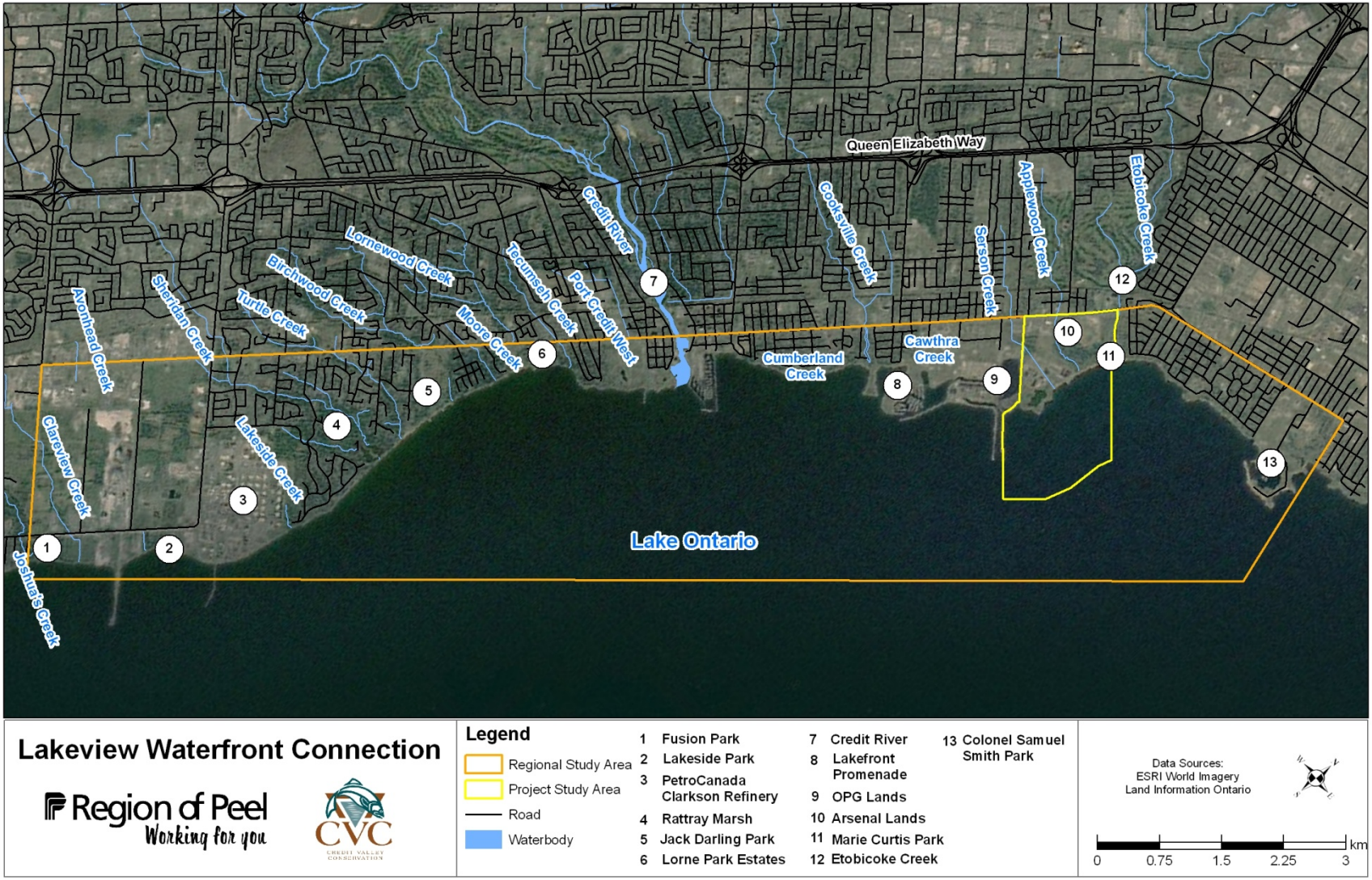


Figure 3.2 Features within the LWC Project Study Area

3.1.1.2 River Processes & Conditions

Creeks provide hydraulic, organic and sediment inputs to natural features such as wetlands and will inform the potential locations of wetland features that are created as part of the LWC Project. Baseline creek conditions will also inform the design of new reaches through the LWC Project footprint. Understanding historical and contemporary trends in creek morphology will be used in the generation of LWC 'Alternative Methods' and the detailed assessment of the Preferred Alternative.

LWC Regional Study Area

Creeks within the LWC Regional Study Area vary in size from small catchments with headwaters just north of the QEW (e.g. Applewood and Serson) to large systems with catchments extending to northern parts of the Region of Peel (e.g. Credit River, Etobicoke and Cooksville). The drainage areas of the lower Credit River and the smaller Lake Ontario tributaries are primarily urban land use with some woodlots and open spaces (golf courses, hydro corridors, etc.). Depending on their geographic extent, these creeks flow over/through glacial till, glaciolacustrine sands, alluvial (river) deposits, and soft bedrock of the Queenston Shale. The impervious surfaces of urban systems coupled with storm drainage create flash flood responses of greater magnitude in comparison to more natural systems. These floods pass through these creeks rapidly, posing potential hazards from flooding, erosion and deposition.

LWC Project Study Area

The LWC Project Study Area contains two creeks, Applewood and Serson (Figure 3.2). These creeks have small drainage basins extending from south of the QEW and form part of CVC's Lake Ontario East Shoreline Subwatershed. The lower portions of the creeks flow southeast between Lakeshore Road and Lake Ontario. As part of the LWC Project, the creeks will be extended from the existing shoreline to a proposed shoreline. The extension will be roughly 200 m into Lake Ontario, which is expected to be integrated into the waterfront design with the creeks' natural integrity.

Serson and Applewood Creeks are located in urbanized watersheds with large areas of impervious surfaces, meaning that the creeks respond rapidly to rainfall events (CVC & TRCA, 2012). Generally speaking, the area downstream of Lakeshore Road is considered to be a depositional zone due to a combination of backwater effects from Lake Ontario and shallow channel gradients; however, sediment accumulations may be removed under erosive flow conditions when lake levels are low (CVC & TRCA, 2012).

Serson Creek

The small Serson Creek watershed drains 270 ha (CVC & TRCA, 2012). Baseflows from Serson Creek currently travel through a wooded, open channel north of the WWTF, before being diverted underneath the WWTF and through a culvert to Lake Ontario. During storm events, flood flows are split between the baseflow culvert and a straight, stormwater channel located between the WWTF and OPG's Lakeview site. The current flow splitting conditions impairs ecological functions within the westerly flood conveyance channel and precludes any ability to establish a functioning coastal wetland at the mouth of Serson Creek (CVC & TRCA, 2012). Fieldwork undertaken in 2011 confirmed interaction between Serson Creek and Lake Ontario to be minimal (Aquafor Beech, 2011a).

An erosion assessment conducted for the flood conveyance channel of Serson Creek to the west of the WWTF included a field survey and detailed description of the channel (AECOM, 2008). The assessment noted that Serson Creek has undergone various changes in alignment since at least 1954 (the earliest aerial photographs available). The culvert beneath the WWTF and flood conveyance channel was constructed between 1964 and 1970. Much of the remaining channel is protected on the banks and bed with cobble riprap, of which the majority appears stable. Based on field observations completed at the time, an erosion rate of 0.05 m/yr is estimated. Regular monitoring, combined with localized bank restoration if necessary, was recommended as an appropriate method of managing future erosion risk along this channel (AECOM, 2008). Monitoring cross-sections were established and erosion pins were installed downstream of the rail line bridge/culvert by AECOM in 2008, to monitor possible effects of the removal of the culvert.

In 2009, the former rail line bridge/culvert located at the head of the flood conveyance channel was removed and a flood berm constructed. Based on erosion monitoring conducted between 2008 and 2010, no downstream geomorphic impacts have resulted from these works and the restored section is functioning as a riparian floodplain area. Erosion pin measurements found that the overall rate of change since establishment was a maximum of 0.03 m/yr (AECOM, 2010).

Rapid Geomorphological Assessment (RGA) and Rapid Stream Assessment Technique (RSAT) surveys were undertaken along the main channel of Serson Creek in 2011 as part of the LOISS (Aquafor Beech 2011a). A field survey was also undertaken in 2011 to support a scour assessment at Lakeshore Road. The findings of both surveys indicate that aggradation[3] is the dominant geomorphological process between Lakeshore Road and the culverted section under the WWTF, with low scour risk at the Lakeshore Road crossing. However, there is also

[3] Aggradation refers to increased creek bed elevation caused by deposition.

evidence that meanders are beginning to develop where the channel is actively adjusting and bank slumping is occurring. Although the channel currently remains in poor condition in terms of stream health, there is a good opportunity to rehabilitate the creek as part of the LWC Project.

Serson Creek has a low sediment supply from the surrounding land surface. The existing supply is sourced primarily from the channel bed and banks and a few tributary inputs. Sediment is comprised of mainly finer material (silts, sands and fine gravel), which are mobilized regularly. The existing channel configuration upstream of the WWTF and low gradient have created a depositional area upstream for over 200 m, noted by siltation on the bed.

Applewood Creek

Applewood Creek has a relatively larger drainage area than Serson Creek at 411 ha (CVC & TRCA 2012). The drainage area is less modified than Serson Creek, maintaining a natural open channel throughout the lower reaches. During field walks undertaken in 2011 the channel was observed to be wider at its downstream extent, with lower velocities and backwater conditions for a distance of 150 m upstream of Lake Ontario (Aquafor Beech 2011a).

A geomorphological assessment has already been undertaken for the downstream 472 m of Applewood Creek in the vicinity of the WWTF (Parish Geomorphic 2005). The creek flows within a well-defined valley with an irregular meander pattern because the meanders are partially confined by the shale valley wall adjacent to the WWTF. Average migration rates were calculated based on historical aerial photography as 0.12 m/yr with an average downstream migration of 0.16 m/yr (Parish Geomorphic, 2005). These are moderate rates and reflect meander development. RGA and RSAT surveys were also undertaken and indicate that the channel is adjusting through widening and aggradation. At the time of the survey, it was noted that debris (e.g. woody debris, municipal waste, etc.) were causing jams in the creek.

Similar to Serson Creek, field surveys were undertaken at Applewood Creek to inform a scour assessment at Lakeshore Road (Parish Geomorphic 2011). The watercourse upstream of Lakeshore Road is heavily modified with bed protection, aggraded material and some sections of exposed shale-bedrock. The banks are lined with armourstone (large limestone blocks) with gabion protection (stone filled wire baskets) towards the toe and top of bank. Downstream of Lakeshore Road, the channel banks consist of exposed bedrock due to deepening of the channel during the installation of the sanitary trunk sewer in the 1960s.

RGA and RSAT surveys were undertaken in the LWC Project Study Area as part of the LOISS study (Aquafor Beech, 2011a). The results indicate that, although the lower 150 m of Applewood Creek is backwatered, the channel is actively adjusting. Comparing the 2005 and 2011 survey results, it appears that the channel has continued to adjust by widening and planform

adjustment. Debris causing jams are noted in the LOISS study as an ongoing issue (Aquafor Beech, 2011b).

Similar findings were observed by Parish Geomorphic, and it was noted that aggradation, scour pools, and bar-formations occurred throughout this downstream reach. Such forms are indicative of sediment movement and storage within this backwater reach. Furthermore, debris jams will temporarily store sediment. These are temporary in nature as floods will mobilize fines stored around jams, and possibly remove/rework the structure itself.

The conditions and processes observed on each creek within the LWC Project Study Area will be used to develop 'Alternative Methods' and for the detailed assessment of the Preferred Alternative. Planform configurations and cross-section geometries for new reaches through the proposed LWC Project landform will be developed to reflect the current trends in each creek and, if possible, enhance stream function.

3.1.2 Bathymetry

Bathymetry refers to the underwater depth or topography of a lake, ocean or river. Baseline bathymetry is a critical component of the environmental assessment as it is considered in every aspect of coastal modeling, design, constructability assessment and cost estimates.

LWC Regional Study Area

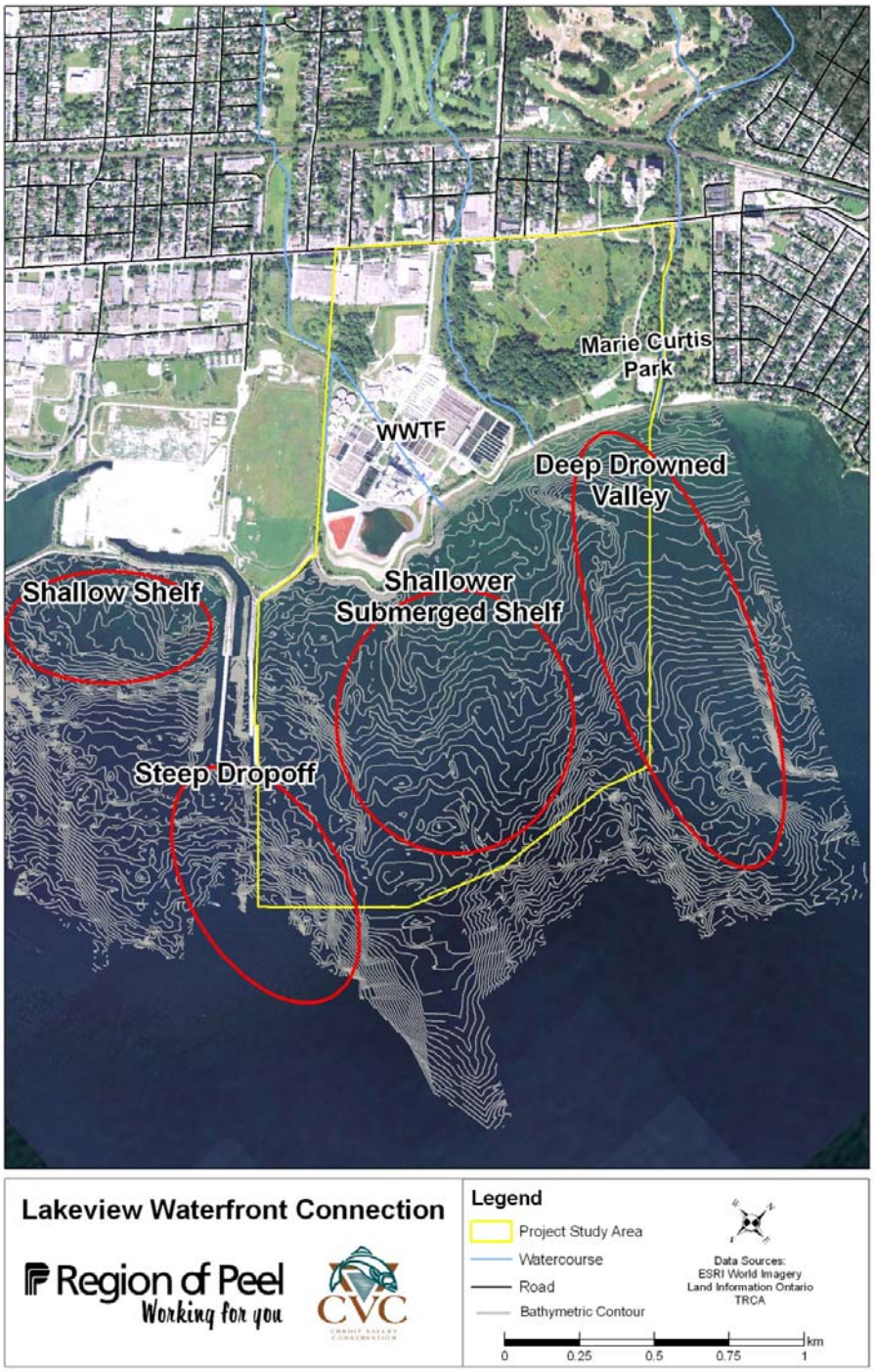
The LWC Regional Study Area extends offshore to approximately the 20 m depth contour (see Figure 3.3). Bathymetric data for the area is available in digital format from the Canadian Hydrographic Service. In addition, as part of LOISS, more detailed bathymetric data has been collected. The LWC Regional Study Area overlies the Etobicoke Shale Outcrop which consists of a thin till layer that originally covered the bedrock which has been scoured by glacial action leaving a prominent area of bedrock substrate that extends from the mouth of Mimico Creek westward to Burlington. This bedrock forms a convex shoreline profile consisting predominantly of broken shale boulders on top of bedrock extending into deep water (Aquatic Habitat Toronto 2013).

LWC Project Study Area

A detailed bathymetric survey of the LWC Project Study Area was completed in 2011 (Figure 3.3). Depths vary up to approximately 7 m along most of the outer edge; although, there is a steep drop-off approaching 10 m in the southwestern corner, fronting the edge of OPG's Lakeview site. There is a shelf-like feature fronting the WWTF resulting in nearshore bottom slopes that are flatter immediately in front of the WWTF than in front of Marie Curtis Park. Depths at the tip of OPG's Lakeview site breakwaters are in the order of 7 m. The existing

breakwaters at OPG's Lakeview site are expected to define the governing depth for nearshore processes due to their local influence on coastal processes (e.g., wave refraction, longshore sediment transport, etc.) and their proximity to the LWC Project Study Area.

Figure 3.3 Bathymetry within the LWC Project Study Area



3.1.3 Water Quality in Lakes and Creeks

In developing LWC 'Alternative Methods' and selecting a Preferred Alternative, it is important that water quality in the various creeks and Lake Ontario is not impaired at the intakes for the Regional water treatment facilities and along the nearshore areas. The following baseline water quality conditions will be used to assess potential changes in water quality that would result from the LWC Project.

LWC Regional Study Area

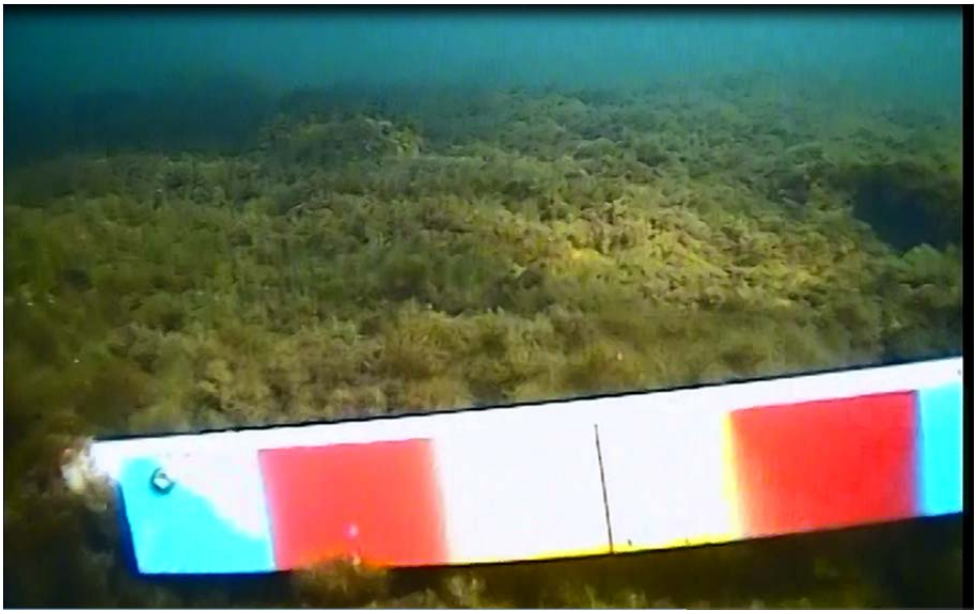
Generally speaking, storm sewer overflows and rivers are major sources of bacterial, nutrient, and total suspended solids (TSS) loadings along the LWC Regional and Project Study Areas. The Credit River is a significant source of nutrient loadings and is identified as 1 of 4 rivers that contribute more than 50,000 kg of phosphorous annually (LOISS 2011). The G.E. Booth WWTF and other WWTFs also contribute significant loadings of nutrients, particularly ammonia, as well as moderate loadings of TSS.

LWC Project Study Area

Sampling of Serson Creek identified exceedances for both Total Phosphorus and *E. Coli* when compared to Provincial Water Quality Objective (PWQO) targets. Chloride concentrations also exceeded Canadian Water Quality Guidelines (CWQG) targets. Although no target exists for Soluble Reactive Phosphorus, Serson Creek has been identified as problematic through field sampling at the mouth of the low flow channel. Despite these conditions there is no indication that these exceedances are limiting Serson Creek in supporting aquatic life. Sampling in Applewood Creek indicated parameters generally below PQWO targets for all parameters except *E. Coli*. Applewood Creek also exceeded CWQG targets for Chloride. These exceedances are not considered detrimental to aquatic life (CVC unpublished data, 2012). Benthic invertebrate sampling in 2011 indicated water quality was reflective of poor to fairly poor water quality with significant organic pollution in Applewood and Serson Creeks.

Large algal blooms are known to occur in the LWC Project Study Area due to high nutrient loads and the presence of mussels which increase the availability of soluble phosphorus and light penetration allowing algae to growth at increasing depths than previously. Underwater video collected within the LWC Project Study Area in 2012 depicted extensive areas of attached filamentous algae. During storms, filamentous algae can be detached and wash onshore where it decomposes adding to the unsightliness of the shoreline. Diver based benthic invertebrate sampling was conducted in 2012 in the vicinity of the WWTF to depths of 18 m (CVC unpublished data, 2012). The study indicated that benthic invertebrate densities were generally low and consisted generally of Quagga Mussels (*Dreissena bugensis)*, Tubificid worms, amphipods and Chironomids.

Figure 3.4 Screen Capture of Underwater Video of Filamentous Algae



Within the LWC Project Study Area, the beach at Marie Curtis Park is deemed unsafe for swimming more often than most of the beaches along Toronto's waterfront due to consistently high *E. Coli* levels given the beach's proximity to the mouth of Etobicoke Creek (Table 3.1). It is one of three beaches remaining in Toronto that have not reached Blue Flag status. The Etobicoke storm sewer overflows, and likely Cooksville Creek and the Humber River contribute to the high occurrence of beach postings at Marie Curtis Park. Table 3.1 provides a summary of beach closure postings at various Toronto beaches.

Table 3.1 Marie Curtis Park East Beach Closure Postings from 2007 to 2013 (Source: City of Toronto)

	Open	Closed	%open	%closed	total days
2007	63	29	68%	32%	92
2008	36	55	40%	60%	91
2009	17	42	29%	71%	59
2010	39	53	42%	58%	92
2011	71	21	77%	23%	92
2012	53	37	59%	41%	90
2013	55	36	60%	40%	91
Total	334	273	55%	45%	607

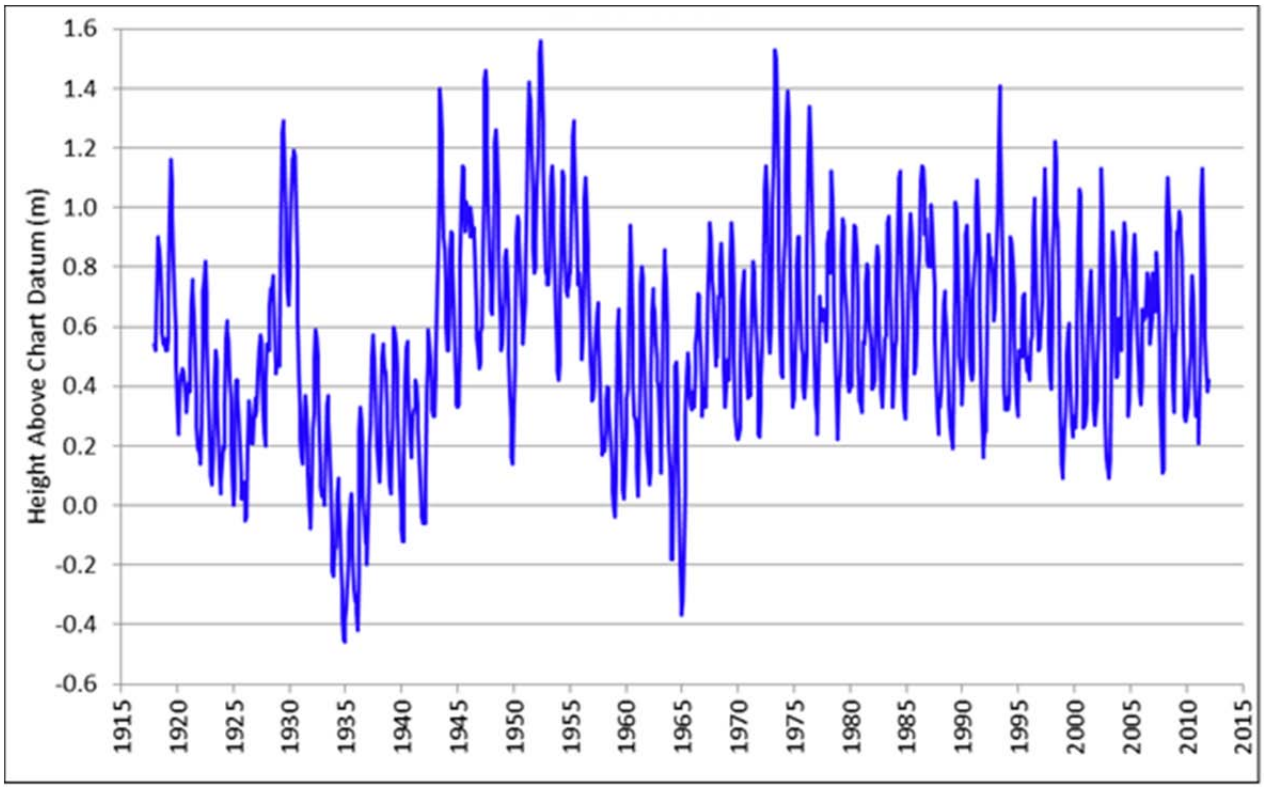
3.1.4 Lake Water Levels

Lake water level fluctuations alter the position of the shoreline and impact coastal wetland ecology, river channel hydraulics due to lake-backwater effects, the functioning of constructed infrastructure (such as culverts and water control gates), and all physical coastal processes. An understanding of water level fluctuations is important to the development of 'Alternative Methods' and the detailed assessment of the LWC Preferred Alternative.

LWC Regional and Project Study Areas

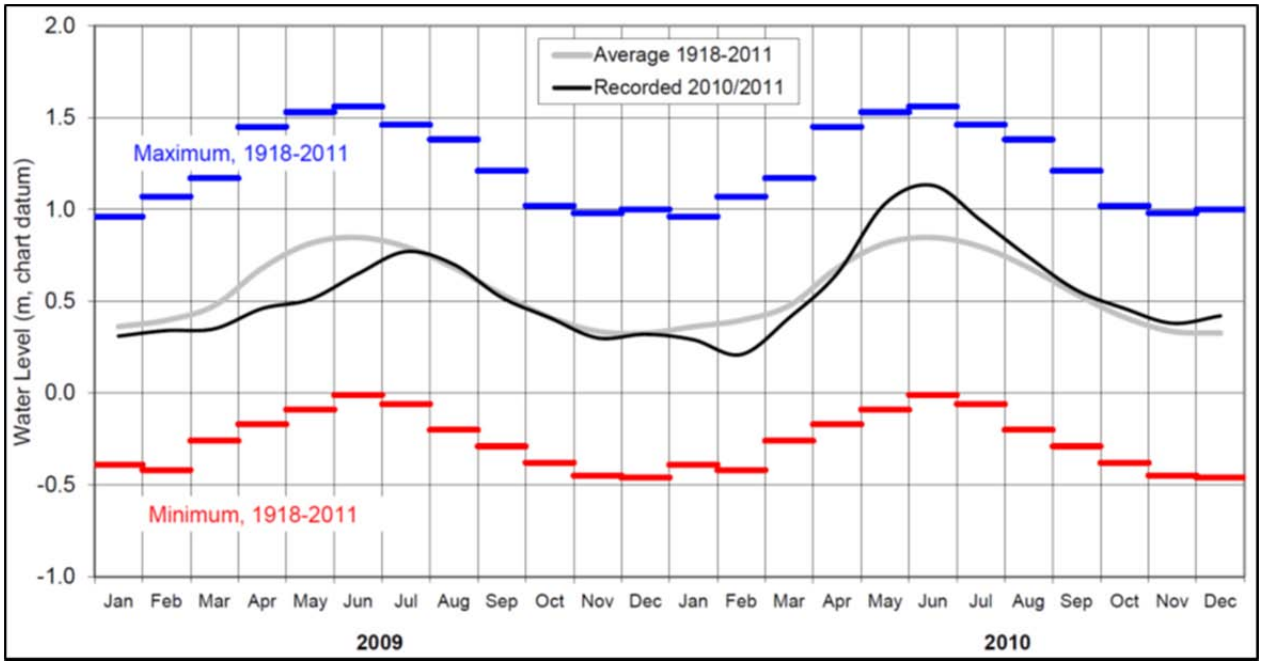
Water levels on Lake Ontario fluctuate in the short-term, seasonal and long-term (see Figures 3.5 and 3.6).

Figure 3.5 Lake Ontario Monthly Mean Water Levels (1918-2011)



Short-term fluctuations last from less than an hour up to several days and are caused by local and regional meteorological conditions. These fluctuations are most noticeable during storm events when barometric pressure differences and surface wind stresses cause temporary imbalances in water levels at different locations on the lake. These storm surges, or wind-setup, are most noticeable at the ends of Lake Ontario, particularly when the wind blows down the length of the Lake. Due to the depth of Lake Ontario, storm surge is not as severe as occurs elsewhere on the Great Lakes (such as in Lake Erie).

Figure 3.6 Lake Ontario Hydrograph, Mean Monthly Lake Levels



Seasonal fluctuations reflect the annual hydrologic cycle which is characterized by higher net basin supplies during the spring and early part of summer with lower supplies during the remainder of the year. Seasonal water levels generally peak in the summer (June; above 75.5 m) with the lowest water levels generally occurring in the winter (December; below 74 m). The average annual water level fluctuation is approximately 0.5 m, and tends to remain between 74 and 75.5 m. Although water levels below 74.2 m, which is chart datum[4] for Lake Ontario are rare, the lowest monthly mean on record is approximately 73.8 m below chart datum. Lake water level gauge data at (02HC048) Toronto indicates that the highest water level exceeded 75.8 m in 100 years of record.

Long-term water level fluctuations on the Great Lakes are the result of persistently high or low net basin supplies. More than a century of water level records show that there is variability in the average at seasonal, inter-annual and decadal scales, making it difficult to predict long-term water level fluctuations. Some climate change studies that examined the impact of global warming have suggested that long-term average water levels on the Great Lakes will be lower than they are today. Those studies have also shown that temporal lake level variability is anticipated to increase. Those changes, however, are expected to have a lesser impact on

[4] Chart datum is a vertical reference system that has been standardized to a reference point to which depths on nautical charts, tidal height predictions and water level measurements are referenced. The referenced chart datum on the Great Lakes is the International Great Lakes Datum (1985). It is generally set at a level below which the water level rarely falls.

average Lake Ontario water levels than on the upstream lakes because Lake Ontario water levels are regulated. Within the regulation scheme however, water levels can fluctuate by over 1 m. The International Joint Commission has been considering possible changes to the regulation of Lake Ontario but no final decision has been made at the time of writing this report. Currently, most approving agencies, including CVC and TRCA, require that the 100-year instantaneous water level, typically those determined by MNR, be used for the design and assessment of shoreline protection structures. Within the LWC Project Study Area, the instantaneous water level elevation is 75.8 m.

3.1.4.1 Wave Conditions

An assessment of wave conditions is required to understand littoral sediment transport (see Section 3.1.6), coastal erosion and deposition processes, and water movement. Wave information is also required for the design of shore protection structures related to sizing of materials, shoreline orientation and maximum elevations required.

LWC Regional and Project Study Areas

Measured wave data on Lake Ontario, as on most bodies of water, is very limited and generally covers only short periods of time. For this reason a procedure called hindcasting is used to produce long term wave climates based on measured wind data. Long term records of wind data are readily available for most locations. The hindcasting procedure uses well established formulations to create wave climate sets. The hindcasting models have been calibrated for use on Lake Ontario on previous projects.

A 36-year wave hindcast was carried out using Toronto Island wind data to produce deep water wave conditions offshore of the site. Wind data recorded from January 1, 1973 to December 31, 2008 was used to produce hourly estimates of the deep-water significant wave height, peak wave period and mean wave direction. Wind data prior to 1973 was not used due to the relatively high occurrence of missing data.

The deep-water wave climate offshore of the LWC Project Study Area has a bi-nodal distribution of the total wave power with predominant easterly and southwesterly peaks. Figure 3.7 shows the directional distribution of the highest hindcast wave heights and the total offshore wave power. Approximately, 72% of the total power comes from the east, approximately 22% comes from the southwest and the remaining 6% is distributed over all other directions. Figure 3.8 presents “all-directions” wave height and period exceedance curves which show the percentage of time a given wave height or period is exceeded. Figures 3.9 and 3.10, respectively, show the annual and monthly variation of the total offshore wave power from the 36-year hindcast.

Figure 3.7 Distribution of Highest Hindcast Wave Heights and Total Wave Power

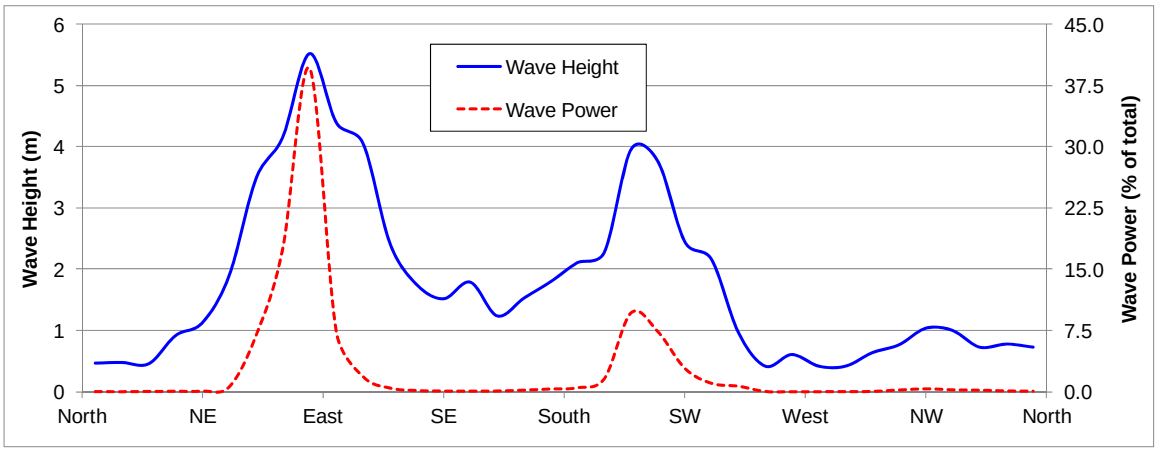


Figure 3.8 Wave Height and Period Exceedance Curves

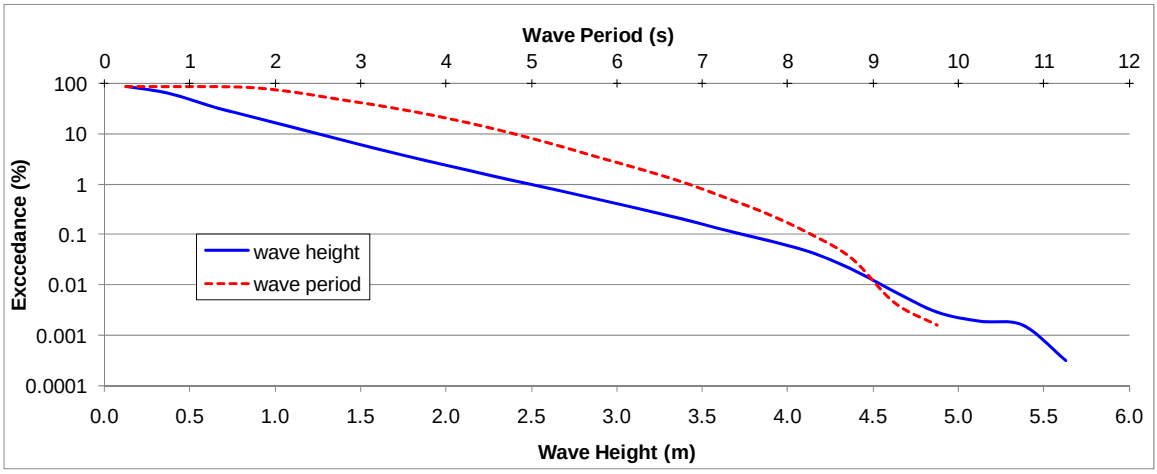


Figure 3.9 Monthly Distribution of Total Wave Power

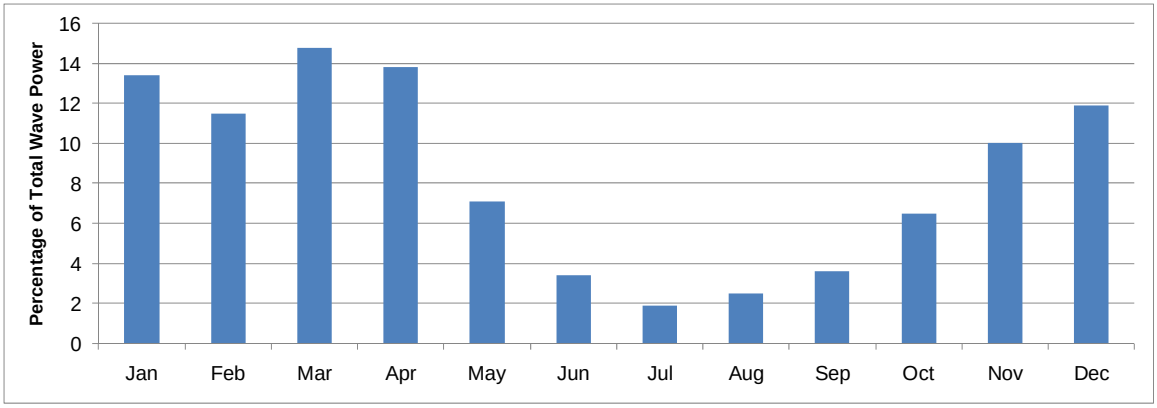


Figure 3.10 Annual Distribution of Total Wave Power

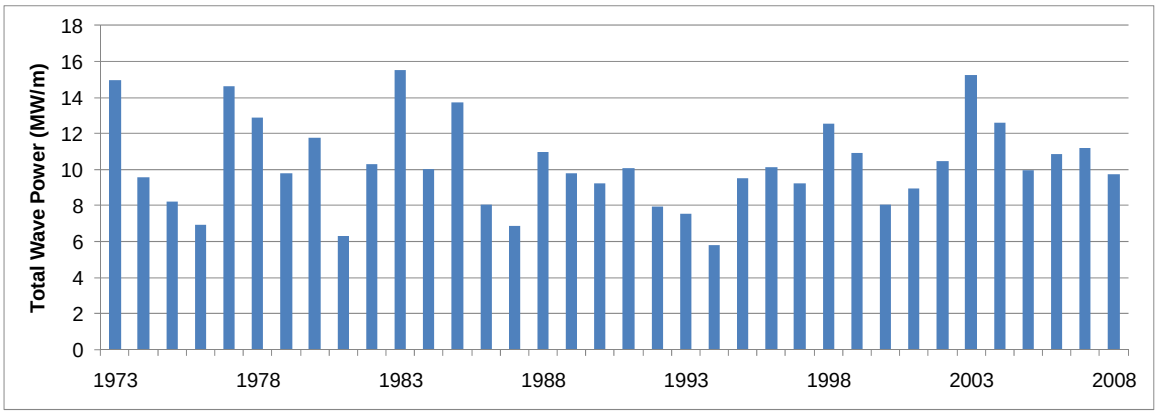


Figure 3.11 shows the results of an extreme value analysis of easterly storm events wave heights. The design 100-year return period wave condition has a wave height of 5.8 metres with a period of 10.5 seconds. A similar analysis of southwesterly storms yields a 100-year return period wave with a 4.5 m wave height and an 8 second wave period for waves coming from that sector.

Nearshore design wave heights and wave climates were determined by transferring the offshore wave conditions in to the site using a two-dimensional spectral wave model with energy dissipation and diffraction terms. The model simulates a steady-state spectral transformation of directional random waves co-existing with ambient currents in the coastal zone. It includes features such as wave generation, wave reflection, wave diffraction, and bottom frictional dissipation. Nearshore bathymetry in the wave model was synthesized from surveys conducted by the Canadian Hydrographic Service and the detailed bathymetric survey of the LWC Project Study Area described in Section 3.1.2.

Nearshore wave climates were produced by transferring a large number of representative offshore wave conditions and using the results of the transformations to interpolate nearshore waves for each wave in the 36-year hindcast. This produces nearshore waves at any location within the model grid.

Design wave conditions throughout the LWC Project Study Area were determined by transferring specific offshore wave conditions with the CMS-Wave numerical model. Figure 3.12 shows the 100-year offshore wave condition transferred inshore at the 100-year instantaneous water level. This represents the upper limit of design conditions usually considered in coastal applications. Extreme values of both offshore wave conditions and water levels are typically considered because both play a major role in determining the nearshore wave condition.

Figure 3.11 Peak-Over-Threshold Extreme Value Analysis (Easterly Storms)

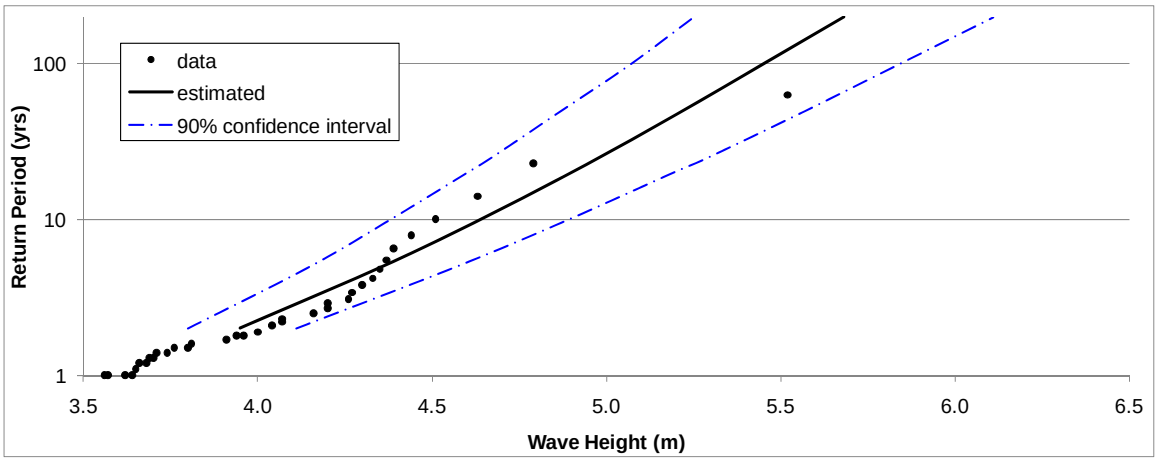
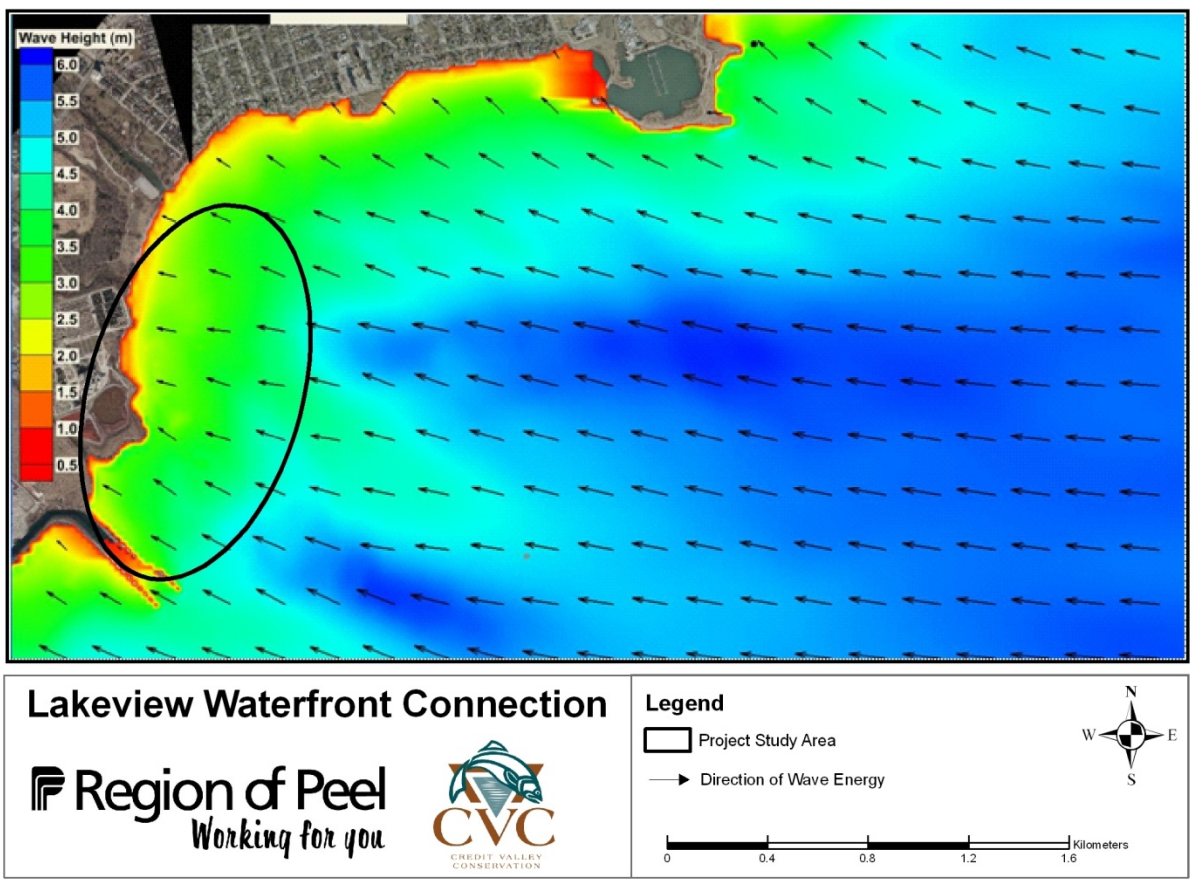


Figure 3.12 Design Wave (100-yr wave, 100-yr water level)



3.1.4.2 Flooding

In developing 'Alternative Methods' for the LWC Project, it is important to understand how different LWC Project activities could affect flooding. The following provides a baseline from which LWC 'Alternative Methods' and the Preferred Alternative can be evaluated.

LWC Regional Study Area

The LWC Project activities will not affect the flood plain of any watercourses within the LWC Regional Study Area; as such, no description of flooding within the LWC Regional Study Area is required.

LWC Project Study Area

Applewood and Serson Creeks are the only watercourses located within the LWC Project Study Area (Etobicoke Creek bounds the eastern side of the Project Study Area only).

Table 3.2 outlines the design flows for Applewood and Serson Creeks.

Table 3.2 Design Flows at Lake Ontario

Water Course	Regional	Return Period					
		100-yr (m^3/s)	50-yr (m^3/s)	25-yr (m^3/s)	10-yr (m^3/s)	5-yr (m^3/s)	2-yr (m^3/s)
Applewood	50.2	31.3	26.8	22.7	18.5	13.8	9.6
Serson	23.4	18.2	14.9	12.4	9.8	6.7	4.1

Analysis undertaken for Applewood Creek as part of floodplain mapping indicated that no structures are at risk south of Lakeshore Road. During one of the August 2009 storms, the Dixie underpass was partially filled with water from Applewood Creek and St. Mary's Avenue was inundated with floodwaters.

The flood prone area from Serson Creek in the WWTF has been eliminated with grading works done in recent years. The Lakeshore Road crossing of Serson Creek is undersized and results in upstream ponding under the Regulatory Flood.

The City of Mississauga is currently undertaking works to replace the Applewood and Serson Creek culverts at Lakeshore Road. Works are anticipated to be undertaken in 2014 and will enlarge the crossings to allow unrestricted conveyance of the Regional Storm. Re-establishing fish access upstream of the Lakeshore Road crossings is also being incorporated as part of the culvert upgrades.

3.1.5 Littoral Sediment Transport

Littoral sediment transport refers to the movement of sediments (e.g. sand, silt, clay) along a coastline resulting from the continual erosion and deposition of sediments resulting from swash and backwash in the littoral zone. This process will inform the generation of shoreline treatments for the development of 'Alternative Methods' and the detailed assessment of the Preferred Alternative.

LWC Regional and Project Study Area

The shoreline from Burlington to Toronto is generally referred to as a non-drift zone due to the lack of littoral (coastal) sediments. On many shores of the Great Lakes, littoral sediment supply originates from erosion of shoreline bluffs and the nearshore lakebed. Within both the LWC Project Study Area and the LWC Regional Study Area, the majority of the shoreline has been hardened, essentially eliminating bluff erosion, and the nearshore lakebed is erosion-resistant bedrock. Some sediment transport does take place because of nearshore bottom deposits, but there is no significant source of new littoral material. Sediment introduced via the watercourses (creeks, rivers, etc.) that discharge into Lake Ontario is typically fine grained and tends to deposit in deeper water offshore of the littoral zone. Therefore, the beach at Marie Curtis Park does not receive any substantive natural sources of sand or gravel; rather, the City of Toronto has had to nourish the Marie Curtis Park beach on both sides of Etobicoke Creek to ensure safety and to continue to provide access for permitted uses such as volleyball. This is completed on an as needed basis only and is not a part of routine maintenance operations.

A one-dimensional sediment transport model was used to evaluate the potential sediment transport rates for uniform shorelines within the LWC Regional Study Area. Potential transport is the transport that would be expected to occur if the transport rates were not limited by sediment supply. The model assumes that sediment is transported by uniform alongshore currents generated by breaking waves. However, the currents will not be uniform in the vicinity of structures extending offshore, so some interpretation of the predicted transport rates is required.

Figure 3.13 shows the cross-shore distribution of the predicted potential alongshore sediment transport rates for a sample profile extending out from Marie Curtis Park. By definition, sediment transport rates are positive for sediment moving from left to right past the beach (when facing offshore) and negative when moving from right to left. At this site, sediment moving from northeast to southwest is therefore defined as positive transport and sediment moving from southwest to northeast is defined as negative transport. The gross transport rate is the sum of the positive and negative transport rates and the net transport rate is the difference between the positive and negative transport rates. As the net transport for this profile is positive, it is from

northeast to southwest, or moving from Marie Curtis Park towards Port Credit.

Figure 3.13 Average Annual Potential Sediment Transport Rates, LWC Regional Study Area

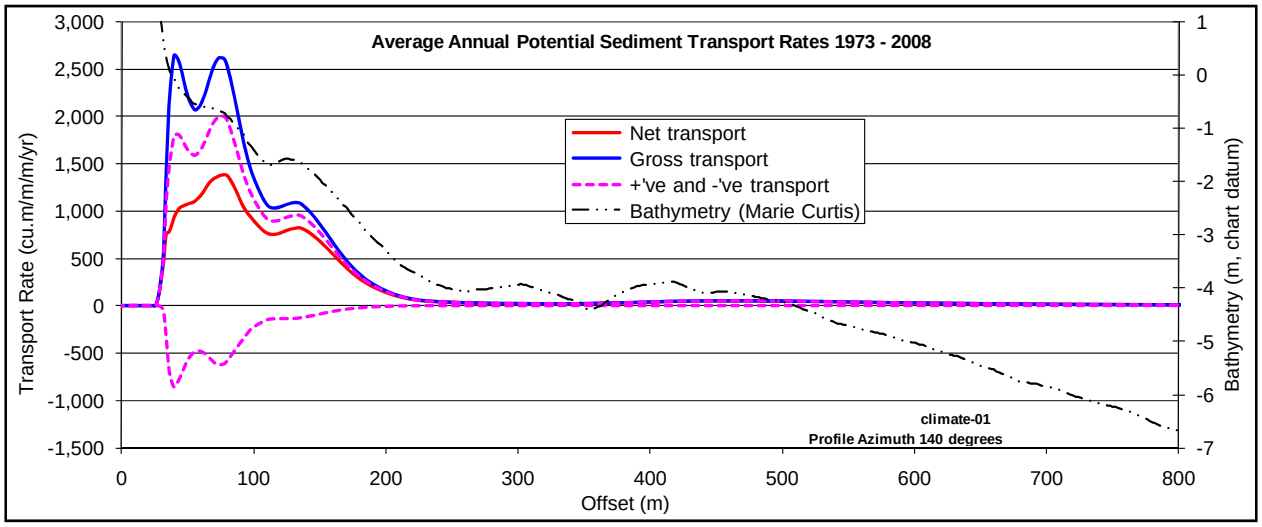


Figure 3.14 shows the gross and net transport rates from Figure 3.13, summed across the profile. Figure 3.15 shows the gross transport rate from Figure 3.14 expressed as a percentage of the total predicted gross potential transport rate.

Together, Figures 3.13 to 3.15 show where transport tends to take place across the nearshore profile. Less than 10% of the predicted potential sediment transport takes place in depths greater than 4 metres below datum, and only 1 to 2 % of the transport takes place in depths greater than 7 metres below datum.

Figure 3.14 Cumulative Sediment Transport Rates, LWC Regional Study Area

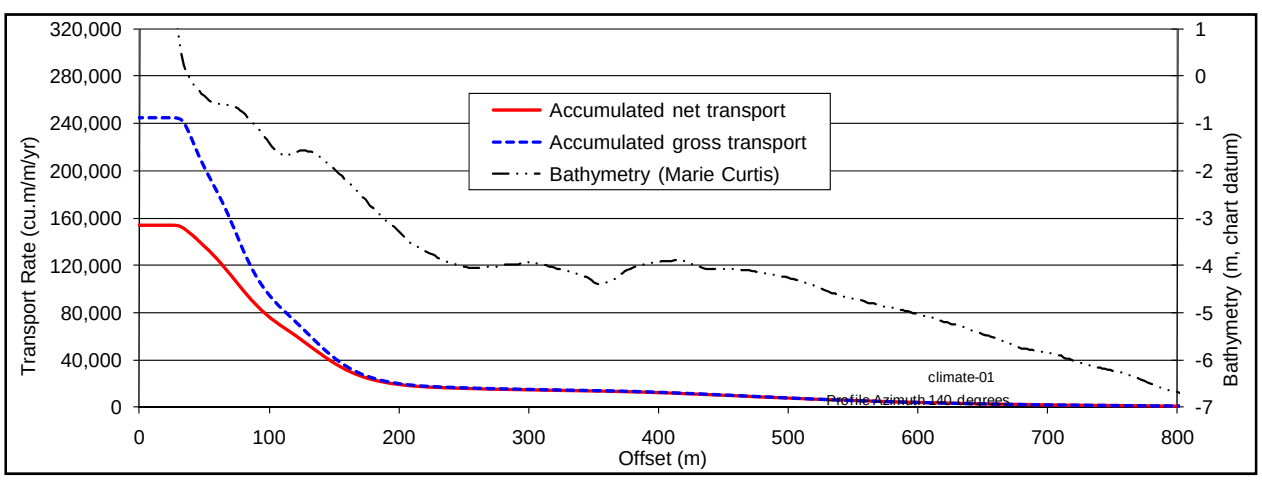
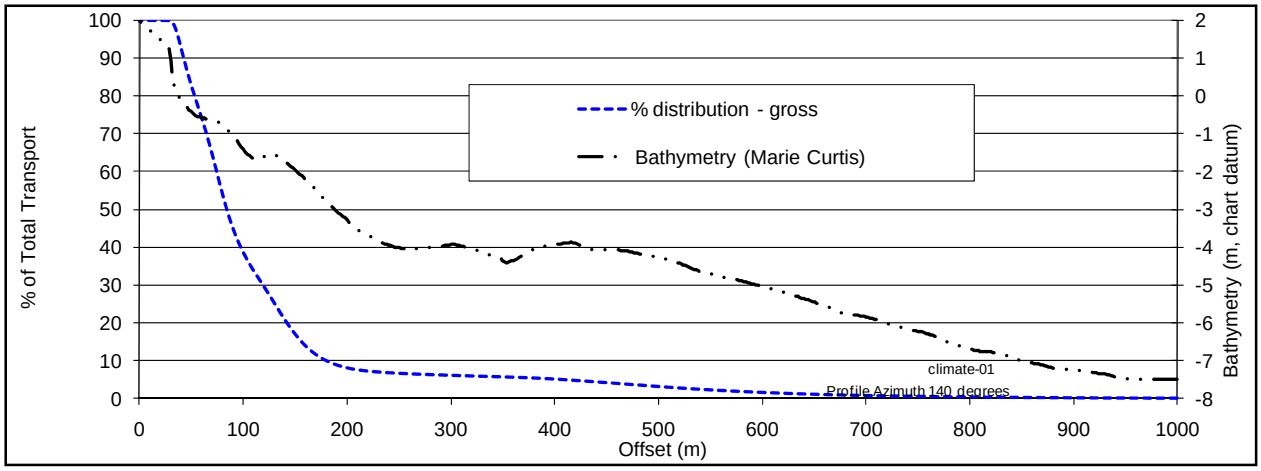


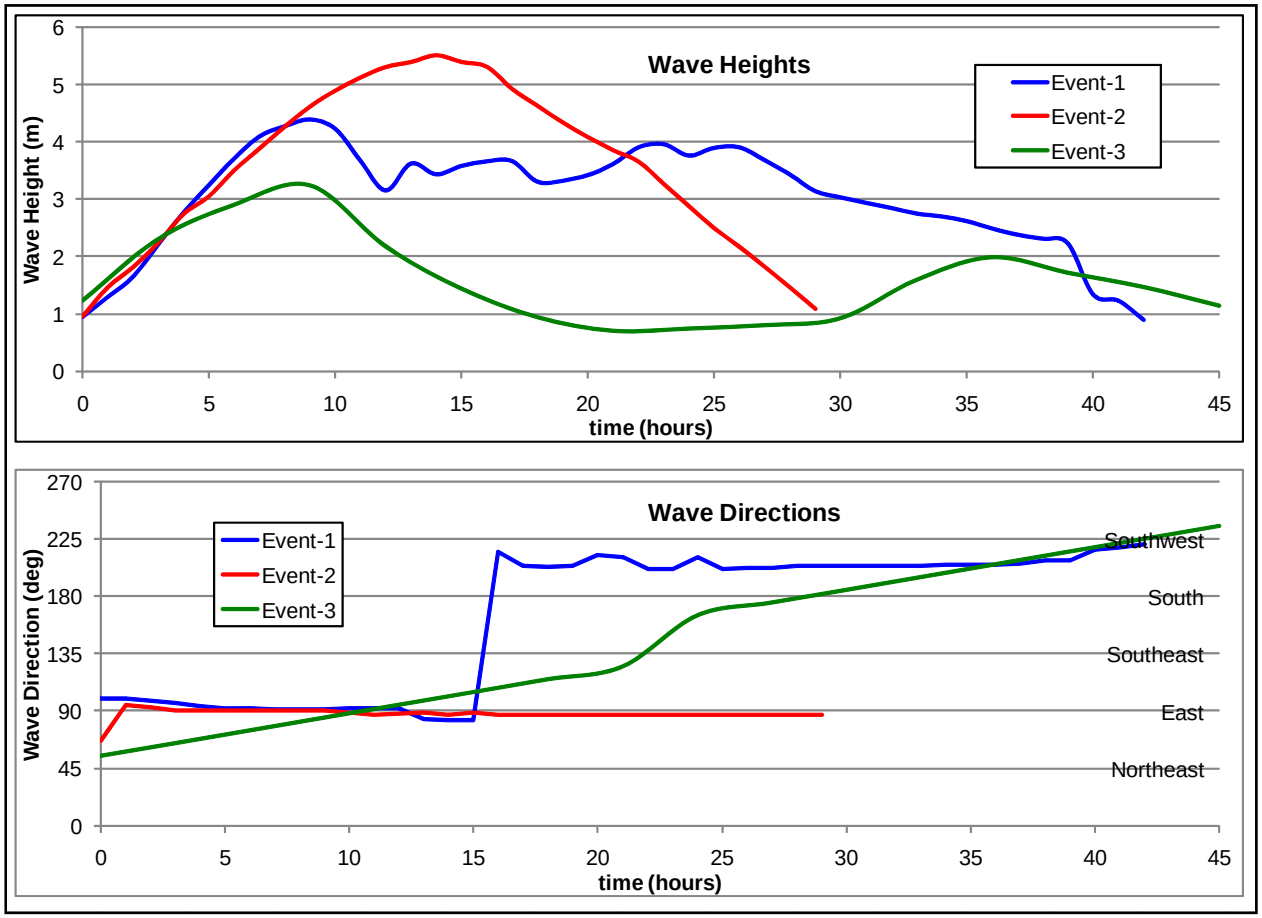
Figure 3.15 Percentage Distribution of Regional Potential Gross Sediment Transport Rate



Sediment transport conditions within the LWC Project Study Area were also investigated using a two-dimensional sediment transport model capable of considering the effects of local structures on the nearshore flow field. Baseline conditions for the analysis of the potential effects of the preferred alternative were established by modeling three representative storm conditions with separate runs of the 2D model. Event-1 was a typical major storm event passing the site. Waves originally come from the east then swing through the southwest as the storm front passes. Event-2 was the largest storm from the 36-year hindcast and consisted of easterly waves only. Event-3 was a "constructed" storm event consisting of the average of the highest annual wave height per direction sector from the 36-year hindcast, for 10-degree wide sectors. Events 1 and 2 represent major storm events and event 3 is representative of average annual storm conditions. Figure 3.16 shows time series plots of the wave heights and directions for the modeled events.

Results from the sediment transport modeling under existing conditions will be used as baseline conditions for the assessment of the potential impacts of the preferred alternative.

Figure 3.16 Storm Events for Sediment Transport Modeling



3.1.6 Ice and Debris

Ice formation and debris inputs can affect the created landform and its various ecological elements such as wetlands, streams and beaches. The following baseline information will inform the development of 'Alternative Methods' and the detailed assessment of the Preferred Alternative.

LWC Regional and Project Study Area

Under typical conditions Lake Ontario is considered to remain ice free, allowing wave generation throughout the year. Shore ice, which is ice that forms around the perimeter of the lake, can both protect and damage shorelines; however, development of shore ice is annually variable depending upon local climate conditions and storm event details.

Debris from watercourses and storm sewer systems is typically made up of urban refuse such as plastic bags, water bottles, yard waste, and take-out containers, as well as woody debris such as

sticks and logs. Woody debris is generally considered beneficial. Within the LWC Project Study Area, large volumes of urban debris are regularly observed along the beach at Marie Curtis Park and on the beach between the two WWTF headlands. This material comes from the Lake Ontario shoreline and Etobicoke, Serson and Applewood Creeks. Debris is widely scattered across beach shorelines during storm events and tends to collect against structures that extend out into the lake.

The City of Toronto Parks staff have confirmed that as a part of their regular maintenance operations the beaches at Marie Curtis Park east and west are mechanically raked up to the municipal boundary.

3.2 NATURAL ENVIRONMENT

The shoreline represents the interface between the aquatic and terrestrial ecosystems, with plants, animals, nutrients, resources and energy being cycled between the two environments. The interface is generally referred to as the 'riparian' zone with the character of the shoreline riparian zone being closely linked to its geomorphology, lakebed materials, and coastal processes. Lake Ontario has a moderating effect on local temperature and climate, and combined with the physiography of the Project Study Area, creates unique conditions for natural habitats that are reflective of the broader Deciduous Forest Region or Carolinian Life Zone.

An understanding of aquatic and terrestrial habitats will inform the development of 'Alternative Methods' and the detailed assessment of the Preferred Alternative.

3.2.1 Aquatic Habitat

Aquatic habitat refers to the natural and built features that are utilized by aquatic organisms to fulfill portions of their life cycle or other behaviours critical to their survival. A survey of existing habitat is a critical component of the EA as it is considered in the development of conceptual designs, evaluation criteria and the preferred alternative.

LWC Regional and Project Study Areas

Aquatic habitats within Ontario's Great Lakes including both the LWC Regional and Project Study Areas have undergone substantial change from their historical conditions:

- Up to 75% of historic wetlands within heavily settled Great Lakes environments have been lost to activities such as land use change, filling, dredging, and disturbance (Whillans 1982).
- The Lake Ontario shoreline within CVC's jurisdiction is almost completely hardened, with only 20% of the shoreline retaining some natural structure and function.

- Historical stonehooking activities along the Mississauga shoreline resulted in changes in, and destruction of, nearshore aquatic habitat through the removal of structure and shelter for fish, including the now extinct Lake Ontario population of Atlantic Salmon (Martin 2007). The loss of virtually all cobble substrates and the elimination of Lake Trout spawning reefs are also attributed to stonehooking (Whillans 1979), with estimates of as much as 4 million tonnes having been removed from the nearshore Regional Study Area (CVC unpublished).
- Past land creation and shoreline modifications associated with OPG's Lakeview site and the WWTF were undertaken to allow for the expansion and protection of industrial activities, and did not consider fish or wildlife habitat.

3.2.1.1 Lake Ontario

LWC Regional Study Area

The shoreline in the LWC Regional Study Area consists primarily of erosion protection structures, such as armourstone, revetments, concrete, rubble and rip rap, with approximately 80% of the shoreline west of the LWC Project Study Area hardened. Hardening the shoreline impedes the movement of species between upland and lake habitats; restricts the ability of vegetation to take hold; and in many cases eliminates the potential habitat and feeding areas for waterfowl, shorebirds, and aquatic organisms. The armoured shorelines within the LWC Regional Study Area were designed specifically to protect infrastructure, and provides limited aquatic habitat.

Within the entire LWC Regional Study Area, fifty-two species of fish have been observed. Appendix B, Table B-1 provides a list of all fish species recorded within the LWC Regional and Project Study Areas. Forty-three species of fish have been recorded to the west of the LWC Project Study Area since 2008, including Smallmouth Bass, Northern Pike, Pumpkinseed, Yellow Perch Emerald Shiner, Brown Trout and Brown Bullhead. Records also include the following species of note: American Eel (Endangered provincially and Special Concern federally); Atlantic Salmon; Walleye; Longnose Gar; Bowfin; and White Bass. While the diversity of species is relatively high, the abundance of fish captured in this area is low and is typical of a degraded environment (i.e., low availability of fish habitat).

To the east of the LWC Project Study Area (primarily around and within Colonel Sam Smith Park), 37 species of fish have been recorded along the open coast and embayment area, since 1989. White Sucker was the most numerous and consistently caught fish throughout the period of record, while Common Carp was also ubiquitous throughout the samples. American Eel and Brown Trout were frequently caught throughout the 1990s, but reduced to sporadic captures in the 2000s. American Eel are typically found within the embayment of Colonel Sam Smith Park,

but were last captured on the open coast side of Colonel Sam Smith Park in 1998. Conversely, the incidence of capture for Alewife, Emerald Shiner, Lake Chub, Northern Pike, Pumpkinseed, Rock Bass, Smallmouth Bass, Walleye, and Yellow Perch has increased over the last ten years.

American Eel is the only aquatic species with conservation status within the LWC Regional Study Area, but has not been captured in the LWC Project Study Area. There are eleven introduced and/or invasive species found within the LWC Regional Study Area, including Round Goby and Common Carp. In addition, Zebra Mussel (*Dreissena polymorpha*) and Quagga Mussel (*D. rostriformis bugensis*) populations have been found all along the Mississauga shoreline (Pollutech 2012) and likely exist along the length of much of the Lake Ontario shoreline.

LWC Project Study Area

Open coast habitat dominates the LWC Project Study Area. Substrates in this habitat are generally sands, rip-rap, or cobbles over shale. The associated shoreline types within the LWC Project Study Area range from a sand beach at Marie Curtis Park West; a remnant beach located south of the WWTF (which is bounded by two armoustone headlands); armourstone and revetment south of the WWTF; and concrete reinforced barges, used to create the eastern pier off OPG's Lakeview site. As the majority of the shoreline has been protected, the elimination of bluff erosion has resulted in sediment starved littoral conditions.

Nearshore forage habitat is important for spawning and feeding. However, the extensive shoreline hardening, and erosion-resistant bedrock within the nearshore lakebed (largely a result of historic stonehooking activities), provides for limited habitat diversity in the nearshore area. In addition, there is no submergent vegetation within the entire LWC Project Study Area.

Thirty six species of fish have been found in the LWC Project Study Area. Of these, 17 were found in the area most likely to be affected by the LWC Project. The fish community likely to be affected by the LWC Project consists of fish species typically found in this type of habitat, including common fish such as White Sucker, Common Carp, Alewife, Lake Chub, Longnose Dace, Emerald Shiner and the invasive Round Goby.

3.2.1.2 Creeks

The life cycle of several species living in Lake Ontario, especially fish, have critical stages of their life located upstream within adjoining watersheds or at the mouth of creeks feeding Lake Ontario. Creek mouths are typically associated with coastal wetlands. These areas provide the necessary habitat conditions for many fish species and life stages including reproduction, juvenile rearing, and end of life. Given the historic loss of the entire coastal wetlands that once

connected the mouths of Etobicoke, Serson and Applewood Creeks, and the complete isolation of the Serson Creek watershed from Lake Ontario, the LWC Project offers the opportunity to re-establish missing habitat that is critical for many life cycle stages for fish and other species.

LWC Regional Study Area

In total, 18 creeks discharge directly to Lake Ontario within the LWC Regional Study Area (Figure 3.1). Of these creeks, three (Lakeside, Moore, and Cumberland Creeks) either contain no fish (due to blockages near the shoreline or complete enclosure) or there is no data for these watercourses. Fish records in Avonhead, Clearview, Turtle, Birchwood, Tecumseh and Lornewood Creeks indicate tolerant warmwater communities typical of urban streams.

In total, thirty-two species of fish have been found in the streams and estuaries of creeks and rivers within the LWC Regional Study Area. Appendix B, Table B-1 provides a list of all fish species recorded within the LWC Regional and Project Study Areas including those found in the streams and creeks.

LWC Project Study Area

Within the LWC Project Study Area, three creeks discharge directly to Lake Ontario (from east to west): Etobicoke Creek (marking the eastern boundary of the LWC Project Study Area); Applewood Creek; and Serson Creek. Historically, these creeks played a significant role as spawning and nursery areas for numerous lake resident fish including a large coastal wetland that connected all three creeks at their mouths. Today, these are highly urbanized systems with poor quality fish habitat. Due to the enclosure of the low flow channel and blockage of the high flow channel, fish are currently unable to access Serson Creek from Lake Ontario.

Fish records for two Etobicoke Creek monitoring stations indicate that 31 species were recorded at the mouth of the creek and 16 species found upstream to Lakeshore Road. Seven of the upstream species were not previously identified at the mouth for a total of 35 unique species. The most consistent and numerous fish caught at the mouth of Etobicoke Creek are White Sucker and Common Carp. However, since 2003, Emerald Shiner and Alewife have been routinely captured in large numbers. Many of the species found in Lake Ontario are found in the lower reaches of Etobicoke Creek supporting the need for tributary access from the lake. This fish community depicts a fish population dominated by resilient, cool, and warmwater species.

While Applewood Creek is enclosed upstream of South Service Road, the confluence with Lake Ontario remains natural and fish are regularly able to access Applewood Creek. A total of six species have been recorded up to Lakeshore Road, including migratory White Sucker. No fish were caught upstream of Lakeshore Road. Lakeshore Road is currently identified as a barrier to fish migration, although the City of Mississauga is currently upgrading the culverts at Lakeshore

for both Serson and Applewood Creeks. CVC will continue to advise the City of Mississauga to provide conveyance up to the Regulatory Flood and enhanced fisheries access upstream as part of the culvert replacement works. The mouth of Applewood Creek provides habitat for a number of species such as Fathead Minnow and Lake Chub.

Serson Creek has undergone numerous diversions and currently splits upstream of the WWTF, with baseflows piped under the WWTF to Lake Ontario and high flows diverted through a straight, open channel, along the eastern boundary of the OPG Lakeview site (see also Section 3.1.1.2). No fish have been captured in sampling events in 2011 in Serson Creek above the diversion channel. The underground diversion prevents fish from entering the creek from the lake, while the higher flow channel is frequently dry and blocked with debris at the mouth; as such, sampling has not found any fish present in Serson Creek.

3.2.2 Terrestrial Habitat

Terrestrial habitat found within a few kilometres of the Lake Ontario shoreline serves an important role in supporting both resident and migratory species. With the limited natural cover that exists along the Lake Ontario shoreline, even small habitat patches in urban and urbanizing areas are of value and associated losses and/or gains have a much greater relative impact to overall ecosystem functions (CVC 2012; NSEL 2009; TRCA 2007).

LWC Regional Study Area

The natural cover within the LWC Regional Study Area is composed of forested and successional areas. Small wetland communities exist but are restricted to riparian areas along streams, the Credit River, and coastal embayments.

The majority of natural forest cover within the LWC Regional Study Area occurs in concentrated pockets isolated from one another by a matrix of urban land uses. These small forests occur along the shoreline, inland, and along the Credit River valley. The matrix of residential, commercial/industrial and institutional land that fills the spaces between natural areas is not devoid of vegetation, nor is it completely lacking in ecological activity. Because of the history of development in areas such as Port Credit, Mineola and Clarkson, many communities in the LWC Regional Study Area contain an urban forest composed of mature tree canopy and understories of both native and non-native vegetation.

The forests in the LWC Regional Study Area are similar to those in other heavily urbanized areas in that they contain a significant component of non-native vegetation. Human disturbances related to encroachments and off trail uses and intensive management are evident in many forests where reduced regeneration and forest understory structure are evident.

Successional communities in the LWC Regional Study Area include cultural meadows, cultural savannahs, cultural thickets, cultural woodlands and cultural hedgerows that are relatively spread out. They occur on both public and private lands and generally have been created or maintained as the result of human influences or other factors. Often the composition and function of the community is altered compared to communities that are less heavily human influenced. Within the LWC Regional Study Area successional communities make up a considerable portion of the non-urban land in the nearby OPG Lakeview site and are also clearly evident near Port Credit (the Imperial Oil lands) as well as in Marie Curtis Park and the associated Arsenal Lands.

Wetland communities within the LWC Regional Study Area make up less than 1% of the land cover, and only exist in isolated pockets. The largest wetlands occur at Rattray Marsh and the Credit River Marshes to the west of the LWC Project Study Area, and smaller wetland communities dot many of the urban creeks and creek mouths. The scarcity of wetland habitat in the LWC Regional Study Area echoes the state of wetlands across southern Ontario and the Greater Toronto Area where settlement, land conversion, and intensification have historically resulted in the especially high loss of wetland vegetation. Approximately, 50% of the wetlands along Ontario's Great Lakes have been lost; and up to 90% have been lost along the most urbanized shorelines (Governments of Canada and The United States of America, 2005). Land use change, filling, dredging, and disturbance are the most notable causes of the reduction.

Dynamic communities including beaches (including treed beach ridge) are restricted to shoreline areas. Within the LWC Regional Study Area only approximately 16% of the Mississauga shoreline is made up of natural beaches, bars, or short bluffs; other man-made beaches occur to the east at Colonel Sam Smith Park. Although beaches are difficult to classify with the mapping protocol for Ecological Land Classification due to their narrow linear shape and small size, based on our current mapping, there are less than 10-ha of beach habitat (open or treed, natural or created) within the LWC Regional Study Area.

LWC Project Study Area

The natural terrestrial habitats within the LWC Project Study Area are isolated from each other by industrial lands associated with the WWTF and the hardening of the shoreline. East-west connections along the shoreline and via offshore aquatic habitat may offer limited connectivity; however, uninterrupted terrestrial connections do not exist. North-south connections are limited to riparian habitat along the Serson, Applewood and Etobicoke Creeks. Opportunities to improve habitat connectivity through ecological restoration activities are noted as an enhancement opportunity in the Marie Curtis Park Terrestrial Biological Inventory and Assessment completed by TRCA (TRCA 2012).

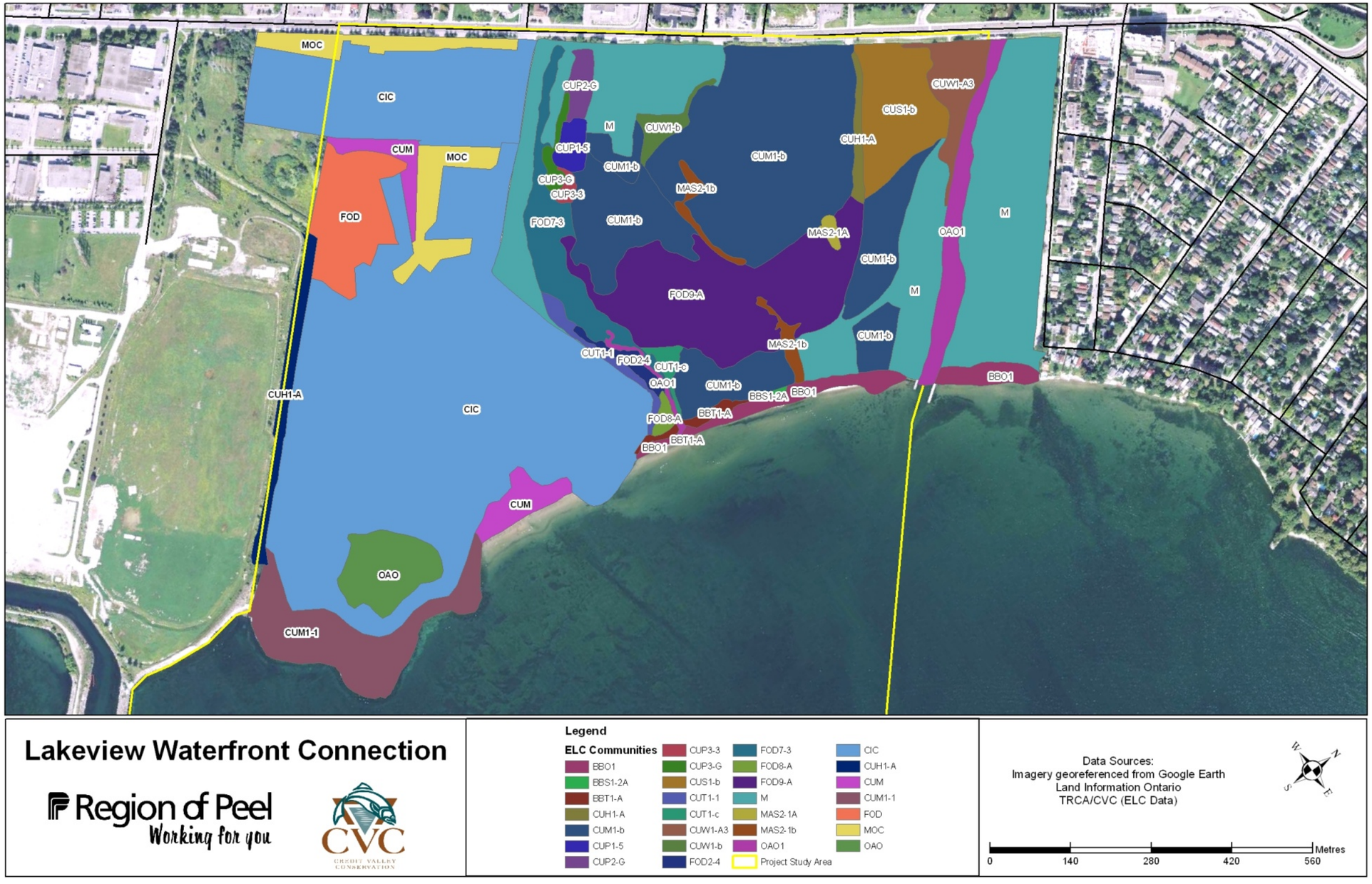
The vegetation communities within the LWC Project Study Area were delineated and identified to discrete vegetation types following the Ecological Land Classification (ELC) system for Southern Ontario (Lee *et al*., 1998). ELC is a tool developed by the Ontario Ministry of Natural Resources (MNR) which enables the interpretation of the diversity of vegetative community types within a natural area in a standardized manner. The vegetation communities within the LWC Project Study Area are shown in Figure 3.17. Table 3.3 summarizes these natural and semi-natural[5] communities.

Table 3.3 Summary of Vegetation Communities within the LWC Project Study Area

	Vegetation Community	Number of Vegetation Community Types	Area (hectares)
Natural	Deciduous Forest	5	13.2
	Beach with a Treed Beach Ridge	3	1.5
	Marsh	2	0.7
Semi-natural	Plantation	4	1.3
	Woodland	2	1.8
	Savannah	1	2.8
	Hedgerow	2	1.5
	Thicket	2	0.7
	Meadow	1	17.2

[5] Semi-natural communities are those that are, or have been, disturbed by human activities or development and are in various states of succession.

Figure 3.17 Vegetation Communities within the LWC Project Study Area



A total of twenty one unique vegetation community types are represented in the LWC Project Study Area. Nine of the twenty-one ELC communities within TRCA jurisdiction (i.e. the eastern half of the Project Study Area) are considered of conservation concern[6] (TRCA 2012) and one could potentially be considered a 'Rare Vegetation Community' according to the recommended criteria in the Region of Peel Significant Woodlands and Significant Wildlife Habitat Study (North-South Environmental *et al*. 2009). A complete list of all flora species observed in the LWC Project Study Area is provided in Appendix B, Table B-2.

3.2.2.1 Forest Habitat

LWC Regional Study Area

Forest is the dominant habitat type in Southern Ontario, and harbours much of the region's biological diversity, ranging in scale from genetic material to species and communities (Larson *et al.* 1999). In intensely urbanized parts of the region, including the LWC Regional Study Area, forests account for relatively little of the landscape; however, they can perform a number of ecological, economic, cultural and social services (MNR 1999).

LWC Project Study Area

There are approximately 13 ha of forest habitat within the LWC Project Study Area. These communities are associated with Marie Curtis Park, Arsenal Lands and the WWTF and comprise some of the only forested habitat within the Applewood Creek and Serson Creek watersheds.

The mosaic of natural forests within the LWC Project Study Area is described in Table 3.4 and included in Figure 3.17. The forests and beaches were primarily classified from field work conducted by TRCA (2003, 2005, 2010 and 2013) in areas for Marie Curtis Park, the Arsenal Lands, and the eastern section of the WWTF (TRCA, 2012). Surveys were also conducted for these same properties by the Mississauga Natural Areas Survey (City of Mississauga, 2011) and additionally for the small forest on the north-west section of the WWTF site (known as NAS site LV2).

The field surveys conducted by TRCA of the Arsenal Lands, Marie Curtis Park and the eastern section of the WWTF revealed populations of trees and ground vegetation consistent with Carolinian ecosystems. Some of these species include: Shagbark Hickory (*Carya ovata*), Butternut (*Juglans cinerea*), Glaucous Honeysuckle (*Lonicera dioica*), Wood Anemone (*Anemone quinquefolia*), Wild Geranium (*Geranium maculatum*) and Witch Hazel (*Hamamelis*

[6] TRCA assesses the quality of each habitat patch through an evaluation of size, shape and matrix influence. These criteria are weighted together to determine an average measure of habitat quality that corresponds to a 'local rank' or L-Rank ranging from L1 (the highest quality) to L5 (the poorest quality).

virginiana). Forests that exhibit southerly Carolinian woodland features are becoming increasingly rare within southern Ontario (TRCA, 2012).

A forest located on the Arsenal Lands was inventoried by TRCA forestry staff in 2005. At the present time the stand seems to be converting from a forest dominated by Red Oak (*Quercus rubra*) and Sugar Maple (*Acer saccharum*) to one composed of White Ash (*Fraxinus Americana*). Trampling and compaction by human traffic are likely affecting the ability of seedlings to germinate and establish. There is also little organic matter in much of the stand.

In addition to these remnant natural forests, treed/wooded communities exist where lands have been modified for human use, or where there has been disturbance and/or restoration in the past. In the LWC Project Study Area, there are approximately 1.3 ha of plantation and another 1.8 ha of cultural woodland[7].

Table 3.4 Natural Forest Communities within the LWC Project Study Area

Vegetation Type	ELC code	Ranking	Notes	Source
Fresh - moist lowland Deciduous Forest	FOD7-3	L5	Covers much of the central portion of Marie Curtis Park	TRCA, 2012
Dry-fresh Oak Hardwood Deciduous Forest	FOD2-4	L4		TRCA, 2012
Fresh - moist Popular Deciduous Forest	FOD8-1	L5	Only exists as an inclusion in a larger forested community.	TRCA, 2012
Fresh - moist Oak-Beech Deciduous Forest	FOD9-A	L3	Covers much of the central portion of Marie Curtis Park. FOD 9s could be considered a 'Foraging Area with Abundant Mast'[8]	TRCA, 2012
Fresh - moist Cottonwood Coastal Deciduous Forest	FOD8-A	L3	Area in transition and stabilizing as forest. Jack Poplar reaching end of life. Red Oak understory developing	TRCA, 2012/2013
Dry - fresh White Pine – Oak Mixed Forest	FOM2-1	L2	Only exists as a complex community and as such is not mapped. This vegetation type is considered a 'rare vegetation community' in the Region of Peel[9].	TRCA, 2012
Fresh - moist lowland Ash deciduous forest type	FOD7-2	n/a	Present on the north-west section of the WWTF.	City of Mississauga NAS – site LV2

[7] Cultural woodlands are treed communities with lower tree canopy cover than natural forests due to disturbance, management or being in an early state of succession.
[8] See recommended criteria in the Region of Peel guidelines for Significant Wildlife Habitat (North-South Environmental *et al*, 2009).
[9] Ibid.

3.2.2.2 Beach Community Habitat

LWC Regional and Project Study Areas

The beach communities are unique communities restricted to shoreline and riverine riparian areas.

Direct access to and from beach habitats is of importance to many wildlife species including waterfowl, molluscs, insects, reptiles, amphibians, and some mammals. Hardening the shoreline impedes the movement of species between upland and lake habitats, restricts the ability of vegetation to take hold, and in many cases eliminates the potential habitat and feeding areas for waterfowl, shorebirds, and aquatic organisms.

Beach habitats also support distinctive vegetation that require sandy sediments and can tolerate disturbance from wave action. Examples of this include Sandbar Willow (*Salix exigua*), and American Sea Rocket (*Cakile edentula*); both of which are found in Marie Curtis Park.

Approximately 1.3-ha of natural, but impaired, beaches are found along Marie Curtis Park and the WWTF. These communities are described in Table 3.5 and included in Figure 3.17.

Table 3.5 Dynamic Vegetation Communities (Beach) within the LWC Project Study Area

Vegetation Type	ELC Code	Ranking	Source
Mineral Open Beach	BBO1	L3	TRCA, 2012; and CVC field observations
Willow Shrub Beach	BBS1-2A	L4	TRCA, 2012
Treed Beach Ridge	BBT1-A (inclusion for BBO1)	n/a	TRCA, 2012; and CVC/TRCA field observations 2013

At the western end of the beach at Marie Curtis Park, a treed beach ridge was identified as part of the Mineral Open Beach feature (no existing ELC designation so BBT1-A "Mineral Treed Beach" is closest). The feature was assessed in 2003 and again in 2013. The vegetation type of this feature was originally classified as a Treed Sand Dune since this was the closest official designation at that time. However, it has since been redefined by additional field work as a Treed Beach Ridge since the substrate and coastal processes do not fit the definition of a dune.*

**Note: Based on the information available to CVC at the time of writing, it does not appear that the NHIC has assessed the rarity of Treed Beach communities in Ontario; however, beaches are considered to be rare to uncommon (S2-S3) by the NHIC.*

The feature occurs at the top of an open sand beach and roughly corresponds to the highest storm surge level of lake. This is not a dune as the sand is replenished by the City of Toronto and influenced by waves rather than being formed by wind. The feature is generally degraded, with significant amounts of refuse and trampling due to pedestrian activities, and the plant community is dominated by exotic species. The dominant tree is crack willow (*Salix x fragilis / Salix x rubens*), with some Manitoba maple (*Acer negundo*) and Siberian elm (*Ulmus pumila*). The shrub and sapling layer includes red ash (*Fraxinus pennsylvanica*), red-osier dogwood (*Cornus stolonifera*), and Japanese knotweed (*Fallopia japonica*). Geographically, it is a significant feature for the western part of Lake Ontario, but ecologically, it is quite low-quality. This feature does present significant restoration opportunities.

The Mineral Open Beach feature (BBO1-1) consists of one vegetation layer (5% or less cover, <0.5 m height), predominantly cocklebur (*Xanthium strumarium*) with smartweeds (*Persicaria lapathifolia, P. pensylvanica*), evening-primrose (*Oenothera biennis*) and silver-weed (*Potentilla anserina*). The beach is artificially augmented with sand by the City of Toronto. Excavation of the surface sand revealed a composition that was a mix of particle sizes, including sand, more-or-less fine gravel (0.5-3 cm), and shingle (mostly flat stones 3-10 cm) which indicates the natural substrate is a mix of cobbles, gravels and sand (TRCA and CVC field work 2013) (Figure 3.18).

Figure 3.18 Beach Profile and Particle Size at Marie Curtis Park West

3.2.2.3 Successional Community Habitats

Successional communities are those that are defined as cultural or old-field communities. In ELC descriptions they encompass cultural meadows, cultural savannahs, cultural thickets, and cultural woodlands. Generally, these are habitats which have been created or maintained as the result of human influences or other factors. As a result of human influences, often the composition and function of the community is altered compared to more naturally derived communities. Successional communities reflect the stage of natural succession from field (i.e., cultural meadow) to sparse forest (i.e., cultural woodland). These communities are important sources of food and shelter for wildlife.

Successional communities can be important habitat for many species of wildlife, e.g., migrant butterflies require areas with abundant wildflowers that are the source of their food. Open habitats including old fields and meadows can support species of raptors who hunt prey, and species of grassland birds that require large open spaces for breeding.

Meadows, shrub thickets and sparsely treed areas are often those that support a high abundance of fall fruit and seeds. These rich food resources are often important for migrating species of birds who use shoreline areas to rest and feed before embarking on their long migration southward in the fall.

LWC Regional Study Area

Successional communities are relatively spread out in the Regional Study Area occurring on both public and private lands. Successional communities make up a considerable portion of the non-urban land use in the area west of Southdown Road. They are also clearly evident near Port Credit (i.e. the Imperial Oil lands), Jack Darling Park, Richards Memorial Garden as well as in Marie Curtis Park / Arsenal Lands. The naturalizing areas associated with RK MacMillan / Lakefront Promenade Park are the closest successional communities to the west. Approximately, 11% of the LOISS area was reported to be composed of successional communities including meadows (CVC, 2011).

To the east, TRCA land use mapping available for the Etobicoke waterfront area reveal about 6% of the area consists of meadow and successional habitat, with the vast majority of the area centralized at Colonel Samuel Smith Park, and lesser amounts between the mouths of Mimico Creek and the Humber River. Studies conducted in Colonel Samuel Smith Park in 2009 by North-South Environmental Inc., indicated the presence of several meadow types.

LWC Project Study Area

There are approximately 24 ha of successional communities within the LWC Project Study Area; the majority of this is comprised of meadow habitat (17.2 ha). The remaining successional habitat is composed of communities in various states of regeneration from meadow to forest (cultural woodland, cultural savannah, cultural hedgerow, and cultural thicket).

The successional and meadow habitats are contained mainly within the Marie Curtis Park and Arsenal Lands section of the LWC Project Study Area. A small cultural meadow community exists along the shoreline at WWTF and a narrow Treed Hedgerow exists along Serson Creek at the west border of the WWTF and the OPG's Lakeview site.

A large proportion of the Arsenal Lands and Marie Curtis Park area consists of exotic old field meadows (CUM1-b) and cultural savannahs (CUS1-b). Despite an abundance of introduced and invasive meadow species within these areas, the extensive amount of open meadow likely support a wide range of birds and butterflies. In addition, the small cultural meadow at the WWTF contains a breeding season record of a Bobolink (*Dolichonyx oryzivorus*), a SAR that usually requires large expanses of open meadow or grassland to breed.

3.2.2.4 Wetland Habitats

Wetlands are areas where the water table is at or near the surface of the land for a portion of time. Wetland communities include swamps, marshes, fens and bogs; each of which provides unique habitat for wildlife and plants. Great Lakes Coastal Wetlands are unique ecosystems whose hydrology and ecology are dictated in part by the dynamics of the lake water levels.

Wetlands provide important ecological services and support the health of the entire watershed. They provide habitat for plants and animals that depend on wet areas for part or all of their life cycle, act as water filters for pollutants, nutrients and trapping sediments, influence groundwater recharge and discharge and are important stabilizers of shoreline areas. Wetlands and the wildlife they support are sensitive to surface water and groundwater pollution.

LWC Regional Study Area

Wetland habitat in southern Ontario is no longer common. Agricultural expansion, urban development, and human disturbance have significantly reduced wetland habitat. Coastal wetlands have especially been reduced in urbanized parts of the Great Lakes due to lake filling and other forms of development.

LWC Project Study Area

An historical air photo from 1945 suggests that a significant linear open water wetland that was protected by a long barrier beach along the shore of Lake Ontario likely connected the mouths of Etobicoke, Applewood and Serson Creeks (Figure 3.19). Air photos in the mid-1950s suggested that the mouth of Etobicoke Creek had breached across the barrier beach, and by the mid-1960s, the linear wetland connecting the mouths of Serson and Applewood Creeks was lost, possibly due to the infilling by municipal waste (Figure 3.20).

There is only 0.7 ha of wetland remaining within the LWC Project Study Area. Four isolated cattail shallow marshes exist within (or border) the old field community in the former Arsenal Lands and Marie Curtis Park. A Common Reed Mineral Marsh (MAM2-a) was also observed in 2010 within the meadow community and a Duckweed Floating-leaved Shallow Aquatic (SAF1-3) community also exists, though it is mapped as in inclusion in a larger marsh community. Though all the wetlands are small in size and relatively low in diversity, they do provide the only known habitat for breeding amphibians in the LWC Project Study Area. One wetland area is associated with a low, wet seepage area within the forested community at Marie Curtis Park and forms a small tributary that outlets to Lake Ontario through the beach between Etobicoke Creek and Applewood Creek. The recorded wetland vegetation communities are summarized in Table 3.6 and included in Figure 3.17.

Figure 3.19 Aerial Photograph of Mississauga Shoreline (OPG Lakeview Site to Etobicoke Creek), 1946

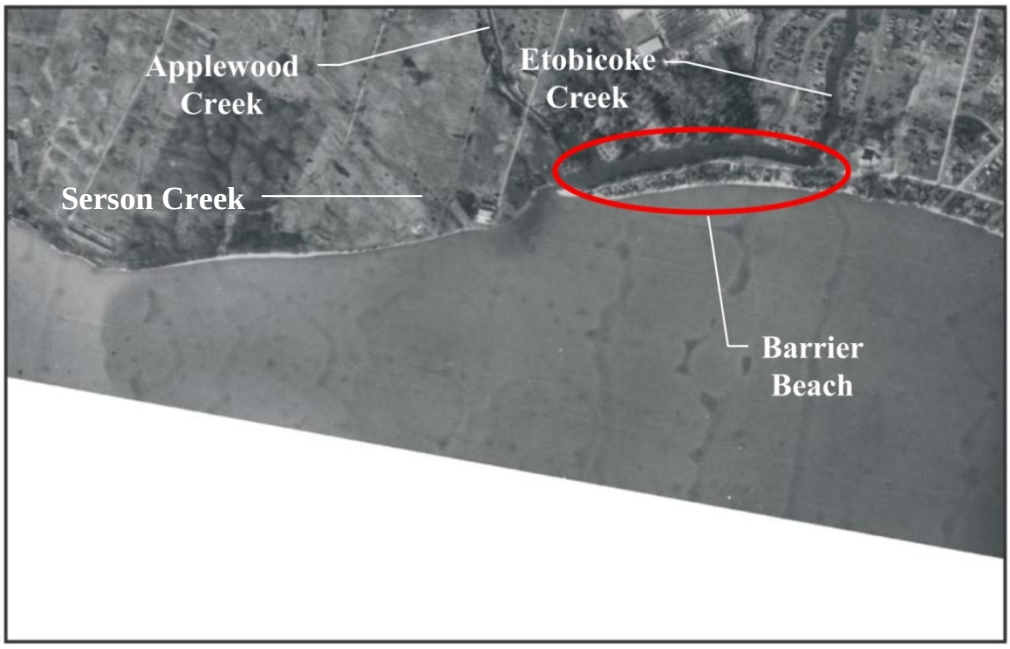


Figure 3.20 Aerial Photograph of Mississauga Shoreline (OPG Lakeview Site to Etobicoke Creek), 1954

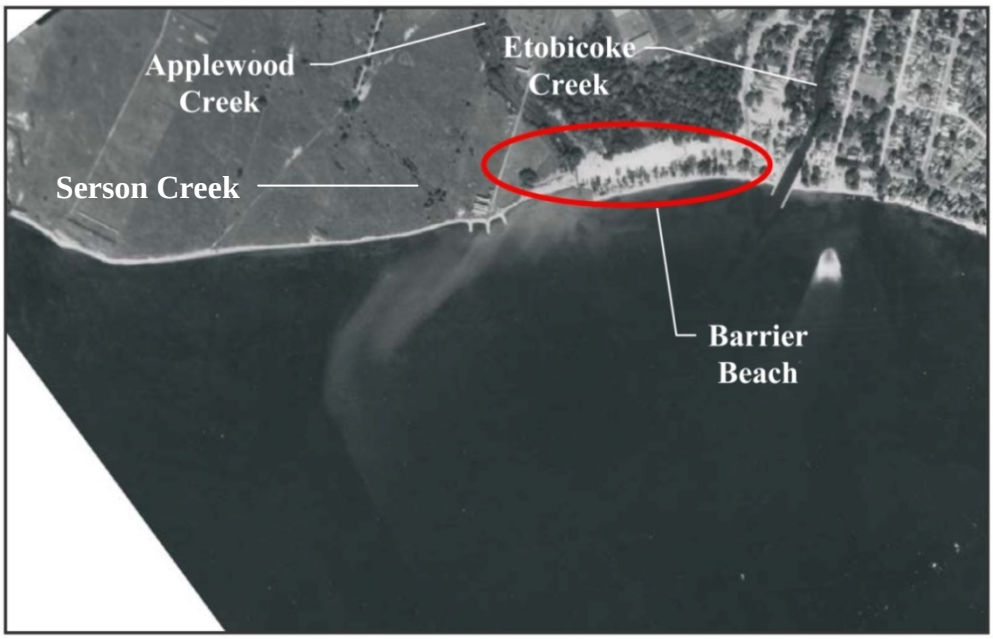


Table 3.6 Wetland Vegetation Community Types within the LWC Project Study Area

Vegetation Type	ELC code	TRCA Ranking[10]	Notes	Source
Narrow-leaved Cattail Mineral Shallow Marsh	MAS2-1B	L+		TRCA, 2012
Broad-leaved Cattail Mineral Shallow Marsh	MAS2-1A	L4		TRCA, 2012
Duckweed Floating-leaved Shallow Aquatic	SAF1-3	L4	Noted as an inclusion in a MAS2-1A community.	CVC 2010, unpublished
Common Red Mineral Meadow Marsh	MAM2-A	L+	Noted as an inclusion in a meadow community.	TRCA, 2012

In addition to the natural wetland communities, the WWTF currently contains three on-site settling ponds which may be acting as surrogate open water and wetland habitat. The largest and most easterly of the ponds includes a small willow thicket swamp. During the spring, migration has been known to support waterfowl and shorebirds which would otherwise require more natural wetland habitat to stopover, feed and rest.

[10] The only wetlands within the Project Study Area are within TRCA jurisdiction so only TRCA rankings are provided.

3.2.3 Designated Ecological Features

Designated ecological features are those areas within the Study Area that support key ecological features and functions, and/or have been identified for protection, conservation or management through various policies or programs. This category includes: Provincially Significant Wetlands, Areas of Natural and Scientific Interest, Environmentally Significant Areas and City of Mississauga Natural Area Survey Sites.

LWC Regional and Project Study Areas

Provincially Significant Wetlands

Provincially Significant Wetlands (PSWs) are wetlands identified by the Ministry of Natural Resources as being the most ecologically valuable in Ontario based on four broad categories: biological, social, hydrological and special features. Two PSW's are located in the LWC Regional Study Area (Rattray Marsh Wetland Complex and Credit River Marshes) although there are others that may meet the criteria for designation as provincially significant and these are being assessed as part of LOISS.

There are no PSWs located in the LWC Project Study Area.

Areas of Natural and Scientific Interest

Areas of Natural and Scientific Interest (ANSIs) are areas of land and water that represent significant geological (earth science) and biological (life science) features. Provincially significant ANSI's are identified by Ministry of Natural Resources (MNR) and are considered to have the highest value for conservation, scientific study and education. Two ANSI's are present in the LWC Regional Study Area (Rattray Coastal Marsh and Credit River Marshes).

There are no ANSIs located in the LWC Project Study Area.

Environmentally Significant Areas

The CVC has identified Environmentally Significant Areas (ESAs) within their jurisdiction based on their importance to ecological structure and function, and/or the value their geological features or native flora or fauna provide to society. One ESA is located within the LWC Regional Study Area (Rattray Marsh).

There are no ESAs in the LWC Project Study Area.

City of Mississauga Natural Area Survey Sites

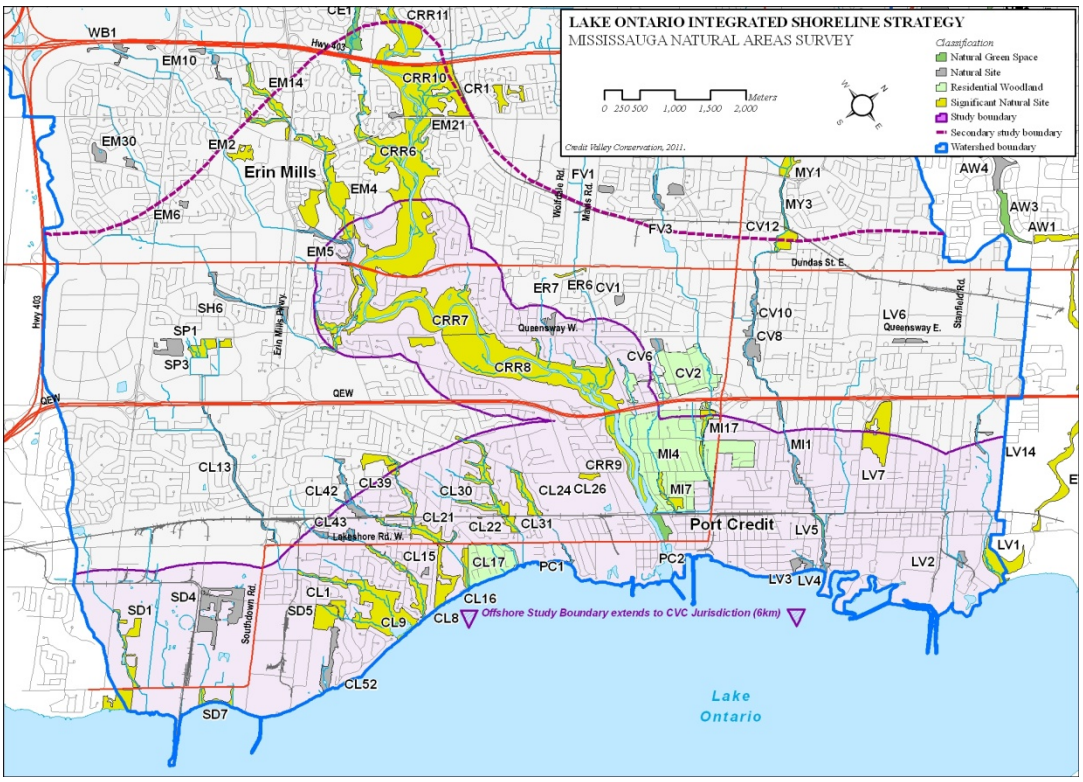
City of Mississauga Natural Area Survey (NAS) Sites are those that have been classified and evaluated by the City of Mississauga and have been shown to provide ecological functions (Figure 3.21). There are six designations under the NAS system, each of which has corresponding policies identified in the municipal official plan to encourage the protection and long term maintenance of the ecological functions they support. There is recognition that all remaining natural areas within the City of Mississauga are part of a system and that the degradation and loss of any natural area will have negative impacts on the entire system. Wherever possible, the protection and enhancement of natural areas is encouraged through land acquisition, restrictions on development, and the promotion of restoration and stewardship initiatives. The LWC Regional Study Area contains 17 NAS sites:

- Significant Natural Sites: SD1, SD7, CL1, SD5, CL9, CL8, CL16, LV1
- Natural Sites:SD4, CL52, CL15, LV3, LV2, LV4, PC1
- Natural Green Space: PC2
- Residential Woodlands: CL17

Two of these NAS Sites are located within the LWC Project Study Area:

- Site LV1 – an almost 13 ha site roughly corresponding to the portion of Marie Curtis Park, Arsenal Lands and the eastern section of the WWTF property that are within the City of Mississauga boundary. It is classified as a Significant Natural Site.
- Site LV2 – a 2.51 ha forest located at the northwest corner of the WWTF. This site is classified as a Natural Site.

Figure 3.21 City of Mississauga Natural Area Survey Sites



3.2.4 Wildlife & Wildlife Habitat

Areas identified as wildlife habitat are important functional areas for wildlife within the LWC Regional and Project Study Areas that require protection and enhancement for the species that depend on them. These areas include areas utilized by wildlife including seasonal concentration areas, rare vegetation communities or specialized habitats for wildlife, habitats for species of conservation concern and animal movement corridors.

3.2.4.1 Wildlife Corridors

Wildlife corridors are areas that are functionally or ecologically connected and provide important habitat and allow wildlife movement. Corridors can help to preserve populations of wildlife over the long term within a heavily urbanized landscape where natural communities are fragmented and dispersed.

Ensuring connectivity for all species is difficult in a fragmented landscape. However, it is essential to plan for local and regional connectivity to maintain healthy ecosystems that are resilient to disturbances. Generally, evidence suggests that habitats closer together improve the ability of the majority of species to disperse, feed, reproduce, and migrate.

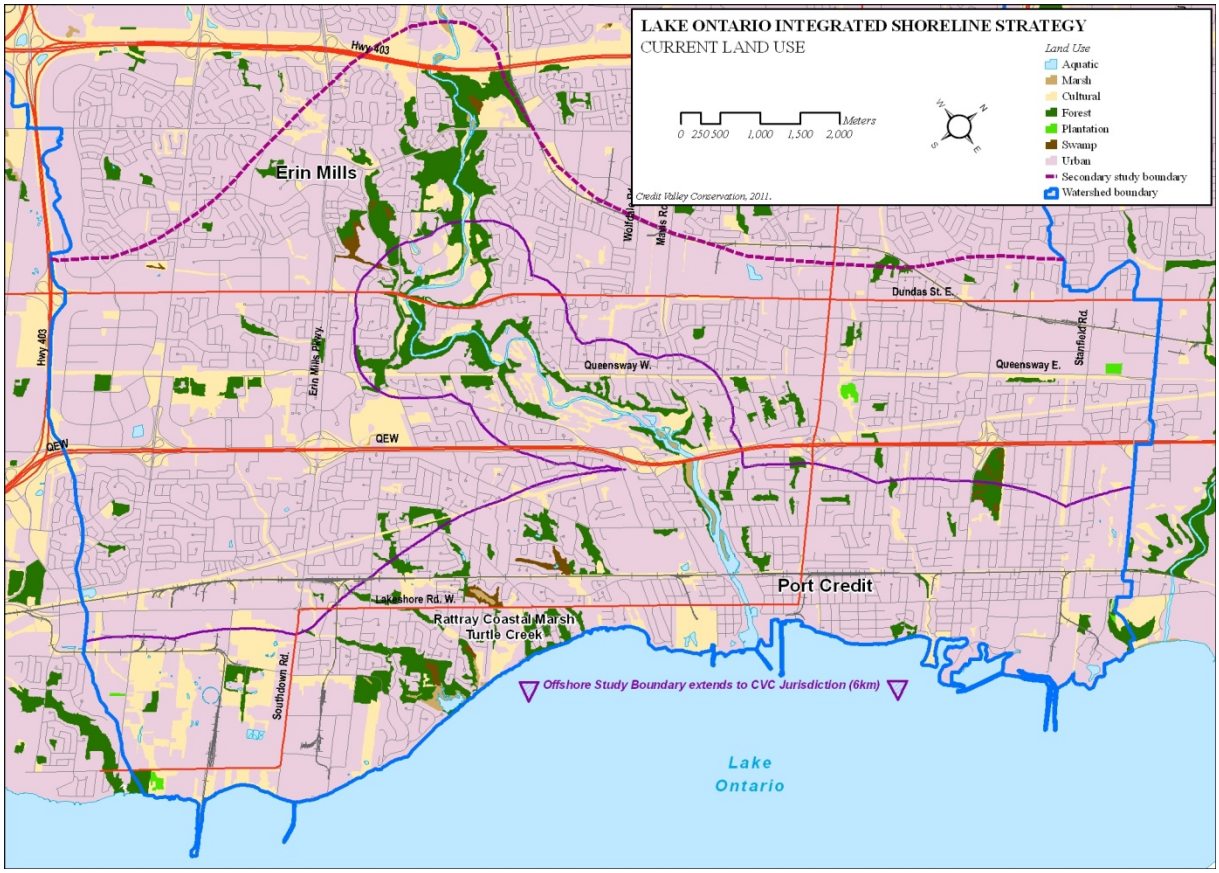
LWC Regional and Project Study Area

Wildlife migration within Mississauga and Toronto is highly dependent on critical linkages between the ravine systems and the Lake Ontario shoreline. Potential corridors and linkages in the LWC Regional Study Area have not been identified through LOISS but are expected in future stages (CVC, 2011). Many of the natural areas that exist in the LWC Regional Study Area are situated along creeks or the shoreline providing linkages for many species. Some natural areas link many different habitat types, and allow species to occupy and move between diverse habitats without many barriers. Historic (and current) disturbances to the shoreline can impact the long-term viability of fragmented populations and habitats, and can disrupt ecological connections between the terrestrial, nearshore and aquatic habitats.

Within the LWC Project Study Area, Etobicoke, Serson and Applewood Creeks and the Lake Ontario shoreline all create an essential migration corridor that facilitates the regional movement of wildlife to areas further upstream and in-land. This corridor provides important habitat for the movement of songbirds which rely on the vegetated shorelines and ravines when in need of rest, food or shelter from adverse weather conditions during migration. Additionally, this corridor offers important cover for the movement of mammalian, herpetofaunal and fisheries populations within the LWC Project Study Area.

Generally, corridors within the LWC Project Study Area are limited, and the remnant natural areas in Marie Curtis Park and at the WWTF are functionally isolated for many species of wildlife. To describe the potential for wildlife movement within the LWC Project Study Area, corridors have been categorized into several types: Riparian Corridors, Shoreline Corridors, Stepping Stone Habitat, Nearshore Corridors.

Figure 3.22 LWC Regional Study Area Land Use



Riparian Corridors

Serson Creek is highly engineered in its downstream reaches and has the potential, through restoration, to provide for a wider riparian/upland buffer to the creek linking Lake Ontario to the small woodland contained within the LWC Project Study Area. The corridor is currently highly altered and impaired.

Applewood Creek is the most naturally vegetated of the three creeks within the LWC Project Study Area; however, it lacks a significant connection beyond the LWC Project Study Area and upstream locations.

Within the Regional Study Area, the Credit River and Etobicoke Creek provide ravine systems that extend from Lake Ontario to the Oak Ridges Moraine. These corridors provide important habitat for the movement of songbirds which rely on the vegetated ravines when in need of rest, food, or shelter from adverse weather conditions during migration.

Shoreline Corridors

Shoreline corridors refer to natural features adjacent to the lake that largely consist of unhardened beaches and intact littoral zones. This provides an important east-west corridor linkage for wildlife movement, and provides stopover and staging habitat for migratory wildlife.

The remnant sandy beach south of the WWTF and beach at Marie Curtis Park provide some opportunities for wildlife movement along the shore as well as between the lake and upland areas; however, the remainder of the LWC Project Study Area shoreline is hardened, creating a barrier between terrestrial and nearshore habitats. The extensive use of fences along the shoreline of the WWTF creates further fragmentation along the shoreline corridors for both people and wildlife.

Stepping Stone Habitat

'Stepping stones' are isolated islands of natural habitat that provide landscape level connectivity to species and genetic material that can transcend the urban matrix. For many species of wildlife that cannot move through the urban matrix, these habitats are functionally isolated; however, some species of birds and mammals may be able to move over/through developed areas to other remnant natural areas. For example, the forests at Marie Curtis Park are functionally isolated from the small forest at the north-west corner of WWTF; however, many species of birds may be able to move between them.

Nearshore Corridors

Nearshore corridors are aquatic areas close to shore that provide habitat and food resources for species that move along the shore, up the river, or out to the deeper sections of Lake Ontario. With the extent of stonehooking in this portion of Lake Ontario, most of the nearshore habitat elements that may have provided this function are now absent from the LWC Project Study Area and much of the LWC Regional Study Area.

3.2.4.2 Wildlife

LWC Regional Study Area

Records of wildlife within the LWC Regional Study Area are limited, and have often been gathered incidentally rather than by directed surveys. The discussion of wildlife includes amphibians, reptiles, birds, and mammals. A total of 269 species of fauna were noted in the LWC Regional Study Area, though it is possible that many more use this area during portions of the year (i.e. migrant birds on their way to and from breeding/wintering sites) (CVC, 2011).

LWC Project Study Area

The composition of the faunal communities in the LWC Project Study Area has been assessed through the results of field surveys, observations and incidental reports of the various species groups. These wildlife observations are discussed in more detail below. In some cases the lack of consistent multi-year surveys precludes formal designations of 'significance' to be made; however, their presence indicates that inclusion is warranted.

The LWC Project Naturalization objective seeks to increase habitat and sustain diverse communities of native species.

3.2.4.3 Mammals

LWC Regional and Project Study Area

There has been no comprehensive study of mammal species in the LWC Regional or Project Study Areas. Various reports and incidental records have helped generate a list of 30 mammal species within the LWC Regional or Project Study Areas (CVC, 2011). Examples of common mammals are White-Tailed Deer (*Odocoileus virginianus*), Striped Skunk (*Mephitis mephitis*), Northern Raccoon (*Procyon lotor*) and Eastern Gray Squirrel (*Sciurus carolinensis*). Some not so common species such as Red Squirrel (*Tamiasciurus hudsonicus*) and Eastern Chipmunk (*Tamias striatus*) indicate that there are still some larger habitat patches supporting area-sensitive species. Other mammals such as American Mink (*Mustela vison*), Beaver (*Castor canadensis*) and Muskrat (*Ondatra zibethicus*) indicate the importance of the shoreline area to species that make use of both terrestrial and wetland communities. Natural areas along the lakeshore and Lake Ontario tributaries are important for the movement of these species and their ability to find adequate resources for food and shelter.

However, natural heritage surveys focused on other groups (e.g., plants, communities, birds, etc.) have revealed that there are potentially up to sixteen mammals making use of the habitat within the LWC Regional or Project Study Areas, for at least a portion of their life cycles. Appendix B, Table B-3 provides a list of the observed species, though others within the LWC Regional or Project Study Areas such as Striped Skunk can be expected. Information on mammals in the LWC Regional or Project Study Areas has been generated from:

- Terrestrial Biological Inventory and Assessment of Marie Curtis Park (TRCA field work 2003, 2011);
- Acoustic Bat Survey – WWTF (CVC field work 2011);
- City of Mississauga Natural Areas Survey Database sites LV1 and LV2 (updated 2008).

Larger mammals such as White Tailed Deer (*Odocoileus virginianus*) and Coyote (*Canis latrans*) are common visitors in the Marie Curtis Park area. These species are likely making use of natural areas within the LWC Regional and Project Study Area, particularly those along Applewood Creek and Etobicoke Creek to navigate through the urban matrix. MNR undertook tracking of coyotes within the LOISS study area and these data are being used to better understand use of the Regional Study Area by larger mammals (MNR 2012 unpublished).

Six bat species have been found within and surrounding the WWTF during a survey in 2011. There are only eight species of bats known from all of Ontario and within CVC's jurisdiction. Of the six species of bats observed, only two are particularly well adapted to urban environments: the Big Brown Bat (*Eptesicus fuscus*) and the Little Brown Bat (*Myotis lucifugus*). These species have even been known to roost in buildings during the summer and overwinter in houses or abandoned buildings.

Most bats rely on areas over open water to forage as these areas are important sources of the flying insects which make up the majority of their diet. For the insectivorous bats in Ontario, shoreline areas often provide abundant food resources in the form of invertebrates which rely on open water habitat to complete their life cycle. Sites that contain terrestrial and aquatic or wetland habitat are therefore valuable to bats.

Some bat species, like the Eastern Red Bat (*Lasiurus borealis*) and Big Brown Bat, prefer open woods and forest edges to feed. Deciduous forests with large trees are important to provide roosting/denning sites for bats like the Silver-haired Bat (*Lasionycteris noctivagans*). The LWC Project Study Area has forests, Lake Ontario and the sewage lagoons at WWTF, which provide good foraging habitat close to potential denning or roosting sites.

Three of the observed species of bats are known to be migrants to southern Ontario: Silver-haired Bat, Eastern Red Bat and Hoary Bat (*Lasiurus cinereus*). To these migrant species shoreline areas are especially important. Large bodies of water like Lake Ontario pose an impediment to migration, and bats will tend to congregate along shorelines before crossing or flying around them. Maintaining suitable habitat along shorelines will help to conserve and promote a healthy bat community.

3.2.4.4 Reptiles

LWC Regional and Project Study Area

Reptile populations in the larger Lake Ontario shoreline area have not been studied in depth. Snakes and turtles often fare poorly in urban environments due to loss of habitat. The lack of wetland habitat in the Regional Study Area and the high degree of shoreline hardening are

impediments to a robust turtle population. Restoration of shoreline areas to allow for permeable wildlife movement between aquatic and terrestrial habitats would greatly improve the potential for turtles to use the area.

Eastern Snapping Turtles (*Chelydra serpentina*) can be found in abundance in Rattray Marsh Conservation Area and along the Credit River Marshes. Observations of Northern Map Turtles (*Graptemys geographica*) have been made in the Credit River near Port Credit but the opportunity for them to disperse and use the lake as habitat has not been assessed.

The extent and viability of snake populations in the Regional Study Area is also unstudied. Incidental reports compiled in the City of Mississauga Natural Areas Survey (2011) and the TRCA (unpublished data) form the basis of the analysis. A list of the thirteen reptile species using the LOISS study area for a portion of their lifecycle is provided in Appendix B, Table B-4. There are five known turtle species (one species only exists as a historic record) and eight species of snakes (though the records for five snake species are historic).

There have been no targeted, comprehensive surveys for reptiles within the LWC Project Study Area. Incidental observations by CVC staff in 2012 indicated only one species of reptile within the LWC Project Study Area: the Midland Painted Turtle (*Chrysemys picta marginata*) using the wetland communities within Marie Curtis Park. The lack of wetland habitat in the LWC Project Study Area and the high degree of shoreline hardening are impediments to a robust turtle population.

The lack of reptile observations for the LWC Project Study Area is not surprising as reptiles often fare poorly in urban environments, where loss of habitat and conflict with humans is high. However, Gregory (2001) indicated that Eastern Garter snakes (*Thamnophis sirtalis sirtalis*) are found regularly on OPG's Lakeview site, adjacent to the LWC Project Study Area and within the LWC Regional Study Area.

3.2.4.5 Amphibians

Amphibians are key indicators of ecosystem health as most spend a portion of their life in both aquatic and terrestrial habitats. Because of this dependency on multiple habitats, amphibians are sensitive to ecological stressors and the quality of the ambient environment. Human disturbance (e.g., urban development, noise, incidental kill etc.), habitat destruction, pollution (e.g., water contamination), climate change, and alterations to the hydrologic cycle from development can have an impact on population size and health. However, some species are more resilient than others when faced with urban stresses. American Toads (*Bufo americanus*), Green Frogs (*Rana*

clamitans) and Northern Leopard Frogs (*Rana pipiens*) can generally make do with the limited and lower quality habitat and resources that is often available in urban areas.

LWC Regional Study Area

Observations made over the last 20 years indicate that the natural areas along Lake Ontario Shoreline in CVC jurisdiction and the western portion of TRCA's jurisdiction appear to only harbour seven species of frogs and toads (Appendix B, Tables B-4 and B5).

Salamander diversity and abundance within the broader Lake Ontario shoreline in CVC's jurisdiction are low. The most common salamander species is the Red-backed salamander (*Plethodon cinereus*) which has current records at 8 City of Mississauga NAS sites and historical records for another two locations. Other salamanders found in the area are the Spotted Salamander (*Ambystoma maculatum*) which occurs at two sites (one other site with a historical record). The Eastern Newt (*Notophthalmus viridescens viridescens*) is also known from one site, and has a historical record for one more area.

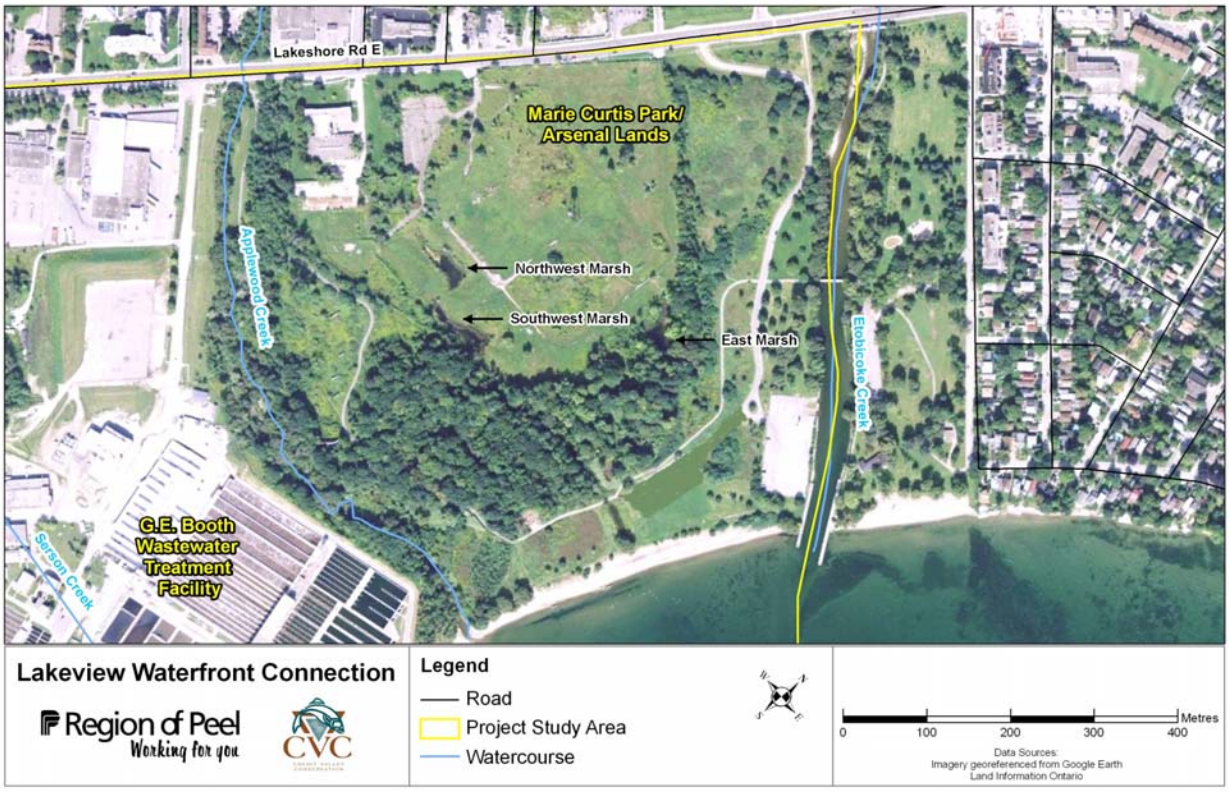
LWC Project Study Area

Suitable breeding habitat for forest and wetland breeding amphibians is limited in the LWC Project Study Area. Three small cattail marshes in Marie Curtis Park support the known breeding amphibian populations (Figure 3.23). Surveys conducted by TRCA in 2003, 2007 and 2011 and by CVC in 2009 and 2011 documented Green Frog, American Toad, Northern Leopard Frog and Gray Treefrog[11] (*Hyla versicolor*) in the 3 small cattail marshes in Marie Curtis Park, within the LWC Project Study Area. Results of these studies have been summarized in Appendix B, Table B-5. It is likely that these populations are small as only a few individuals of each species were heard on any given sampling occasion (TRCA 2012). The presence of Northern Leopard Frog is considered unique based on the urban land use that surrounds the site.

Given its size and composition, the forested habitat at Marie Curtis Park is also a potential place for forest breeding amphibians such as the Redback Salamander (*Plethodon cinereus*). Though no surveys were undertaken to determine if they are present, the disturbance caused by ad-hoc trails, mountain biking and other human impacts would likely degrade the quality of potential habitat for this species.

[11] Only one call of the Gray Treefrog was heard in 2011 by CVC staff members.

Figure 3.23 Amphibian Breeding Habitat within the LWC Project Study Area



3.2.4.6 Birds

The ecological needs of bird species differ depending on their behaviour and life history characteristics. For many groups of birds the specific habitat requirements can be readily identified and conserved based on these differences. Generally, birds can be grouped into five categories based on their ecological requirements:

- Year-round residents;
- Spring Migrants (passing through to summer territories);
- Fall migrants (passing through to winter territories);
- Breeding migrants (migrants that stay in the area to breed); and
- Wintering birds (birds that migrate from further north).

For example, migrating birds that pass through during a short window in the spring and/or fall require habitat with high concentrations of food while resident birds tend to inhabit larger territories with dispersed food sources. The protection of breeding and migratory habitat is an important consideration for the LWC Project.

Different bird groups (or guilds) use different areas of the shoreline, nearshore and in-land habitat preferentially and therefore, each must be investigated to determine how significant they may be to the local bird community:

- **Waterfowl:** prefer permanent open water making wetlands, watercourses key habitat. However, even temporarily flooded areas can play a supportive role especially during the migratory period. Upland or riparian communities play an important role for feeding, nesting and shelter. Waterfront areas are also home to species of wintering waterfowl especially where water remains open;
- **Shorebirds:** prefer to use exposed mudflats, shorelines and beaches for feeding and resting making wetland and beach habitats important. During the spring and fall, migratory species require these open areas for resting and staging;
- **Landbirds:** large, undisturbed natural forests, fields and wetlands provide the most useful habitat for these species; however, especially during migration period, smaller, marginal and less optimal habitat especially along the shoreline is often used. Manicured spaces providing adequate vegetation cover can also act as habitat for landbird migrants; and
- **Migrant:** intact riparian areas along small creeks act as corridors or funnels across the otherwise urbanized landscape. By providing continuous vegetated cover along these creeks we can help allow birds to migrate short and long distances.

LWC Regional Study Area

A comprehensive waterfowl survey was completed for the LWC Regional Study Area (CVC 2011). The LWC Regional Study Area is included in the Southwest subregion of Lower Great Lakes/St. Lawrence Plain North American Bird Conservation Region 13 (ON BCR13) (Ontario Partners in Flight, 2005). Recognizing the important habitat that exists in this region for landbirds, the ON BCR13 plan aims to guide conservation efforts for priority species of landbirds within the area, with a particular focus on forest habitats, grasslands, agricultural habitats, shrub and early successional habitats. ON BCR13 is of particular importance to the conservation of twenty Species of Continental Importance that were identified by the Ontario Partners in Flight (Ontario Partners in Flight, 2005).

Waterfront parks in the Mississauga and Toronto areas are known to play an important role in sustaining migratory bird populations. The LWC Regional Study Area is located within an important migratory zone, which encompasses both the Atlantic and Mississippi flyways. LOISS highlights the importance of the LWC Regional Study Area to migratory bird populations, and Marie Curtis Park has been identified in the Toronto Bird Flyways and Sanctuaries Project (City of Toronto, 2012).

The LWC Regional Study Area is recognized as an ecologically unique area for birds and with the identification of the Western Lake Ontario Important Bird Area (Canada's Important Bird Areas Program, 2013).

During winter months, areas with direct access to open water typically support waterfowl in the Regional Study Area (McIlveen 2009). A survey in the winter of 2008-2009 at twelve locations in the LOISS Study Area found that a great number of waterfowl are present and particularly attracted to the nearshore areas that remained ice-free. The four species present in highest numbers during the survey period were Greater Scaup, Canada Goose, Ring-billed Gull and Mallard. Other winter resident species present in relatively high numbers included Long-tailed Duck, Bufflehead, and Common Goldeneye. Of the other species encountered, the list appears to be relatively consistent with the species commonly encountered during the annual Christmas Bird Census (McIlveen 2009). Additional waterfowl surveys have been conducted by CVC as part of LOISS within both the Regional and Project Study Areas.

LWC Project Study Area

In an effort to document the birds that use the LWC Project Study Area for at least part of their life cycle, all bird observations have been combined. Records include breeding bird observations (Marie Curtis Park 2003 and 2011), migratory bird observations (Marie Curtis Park and WWTF 2011 and 2012) and other incidental observations made by TRCA or CVC during wildlife or vegetation surveys. Within the LWC Project Study Area, 157 species of birds have been observed. Of these species, six are listed as Species at Risk (Appendix B, Table B-6).

The relatively extensive forest cover within Marie Curtis Park allows for the persistence of a few area-sensitive species that require larger blocks of forest habitat. These include American Redstart (*Setophaga ruticilla*), Blue-gray gnatcatcher (*Polioptila caerulea*), Great-crested Flycatcher (*Myiarchus crinitus*), and Cooper's Hawk (*Accipiter cooperii*). Eastern Screech-owl (*Megascops asio*) was also noted by TRCA, and observations in 2011 and 2012 by CVC indicate that American Kestrels (*Falco sparverius*) may be nesting within the park. Unfortunately, due to the heavy prevalence of recreation and off-trail use, many of the birds that nest on the ground or in the understory have been impacted.

The meadows and successional areas of Marie Curtis Park support species that rely on open areas to breed; some of which are sensitive to disturbance. TRCA (2012) noted that in 2003 the community of ground-nesting birds in the open meadows included the Bobolink (*Dolichonyx oryzivorus*), and Savannah Sparrow (*Passerculus sandwichensis*); however these species have not been documented to breed since. The loss of this community of birds likely indicates a heavy level of disturbance (e.g., dog walkers within an otherwise restricted area of the park). Though it may not be currently breeding at Marie Curtis Park, records of Bobolink (SAR) from

2011 and Eastern Meadowlark (SAR) from 2012 indicate that they are still present and breeding elsewhere in the LWC Project Study Area.

Marie Curtis Park encompasses a variety of habitats (forest, meadow and beach lake front) that attracts a diverse population of birds especially during migration. The mature forest community hosts a population of woodland warblers. Uncommon birds such as Wilson's Warbler (*Wilsonia pusilla*), Blackpoll Warbler (*Dendroica striata*) and Yellow-bellied Flycatcher (*Empidonax flaviventris*) were common during the 2011 spring migration period. The Blue-Gray Gnatcatcher (*Polioptila caerulea*) was confirmed breeding in the forest. Along the beach front Red-necked Grebes (*Podiceps grisegena*) flock and forage offshore. The open meadow with shrub cover features an old water tower from which a Red-tail Hawk (*Buteo jamaicensis*) and an American Kestrel have been observed perching. Willow flycatchers, Tree Swallows and Eastern Kingbirds (*Tyrannus tyrannus*) have been seen foraging over the ponds. Maintaining the diversity in vegetation communities at this site will help to conserve the local bird community.

The sewage lagoons of the WWTF attract a variety of bird guilds. A small Bank Swallow (*Riparia riparia*) breeding colony of approximately 22 burrows was located within the eroding bank of the fly-ash material on the easternmost settling pod (Figure 3.24). This colony was one of only two known Bank Swallow colonies within Mississauga confirmed in 2011 as part of a CVC survey; however, observations in 2013 determined that this bank has since become overgrown with vegetation and is no longer occupied by bank swallows. Although the location of the colony and the material in which the burrows were made was not ideal, this feature is unique.

Figure 3.24 Bank Swallow Burrows in Fly-ash Material, WWTF
Photo: K. Vande Sompel, CVC

As observed during CVC's 2011 and 2012 surveys, the WWTF lagoons also host an array of resident waterfowl including nesting Trumpeter Swans (*Cygnus buccinator*) and a pair of Northern Shovelers (*Anas clypeata*). A variety of migratory and resident shorebirds have been observed along the lagoons mud flats. Several visits to the lagoon have revealed a breeding pair of Spotted Sandpiper (*Actitis macularius*), flocks of migratory Least Sandpipers (*Calidris minutilla*), Dunlins (*Calidris alpina*) and Pectoral Sandpipers (*Calidris melanotos*). A few uncommon transient species were also observed, including Ruddy Turnstone, Baird's Sandpiper and Wilson's Phalarope.

During the 2011 and 2012 spring and migration period, the forest in the northwest corner of the WWTF also was also surveyed and found to host a diversity of birds (72 species) many of which were migrants, including an array of woodland warblers (15 species) and other songbirds. Its proximity to the shoreline and key migratory bird corridors likely means that many species of birds use this area as a stopover ground to rest and wait out inclement conditions.

The cultural meadow that exists on the berm between Lake Ontario and the WWTF sewage lagoons hosts a variety of birds: Bobolinks, Savannah and Vesper Sparrows, Willow Flycatcher (*Empidonax traillii*), and other grassland bird species.

The WWTF buildings and structures provide plenty of opportunities for urban birds to nest. Barn Swallows (*Hirundo rustica*), a threatened species of insectivorous bird, were observed frequenting the grounds of the WWTF foraging and roosting. No visible nests were detected but evidence of breeding activity (i.e., carrying food and the presence of fecal sacs) was observed.

3.2.4.7 Butterflies and Odonates

LWC Regional Study Area

Over 100 species of butterfly have been observed in the Greater Toronto Area (Harrison 2007), which may be found in the Regional Study Area. The majority of these species are residents who live, breed and over-winter in the GTA. Approximately eleven species are known to be 'seasonal colonists' immigrating to the area in the spring to breed. Other species also have migratory tendencies and the GTA is occasionally visited by 'accidental' migrants. In the fall, other species of butterflies make the journey from southern Ontario to areas further south. The most familiar of these is the Monarch (*Danaus plexippus*); however, other common migrants include: Painted Lady (*Vanessa cardui*); American Lady (*Vanessa virginiensis*); Red Admiral (*Vanessa atalanta*); Mourning Cloak (*Nymphalis antiopa*), and Question Mark (*Polygonia interrogationis*).

The size of Lake Ontario presents an obstacle to butterfly and odonate migration. As a result, migratory species tend to congregate in shoreline areas to rest, feed, and engage in activities pertaining to migration either before their flight over/around Lake Ontario or thereafter. The habitat quality and available resources of sites along Lake Ontario are important factors in maintaining a viable population of resident and migrant butterflies and odonates. Butterfly and odonate surveys were conducted as part of LOISS.

LWC Project Study Area

Marie Curtis Park showed the highest diversity of butterflies (nine species) out of twenty survey locations (McIlveen 2010). Marie Curtis Park also supported the highest numbers of observed Monarch butterflies, likely because of the large patches of Common Milkweed (*Asclepias syriaca*), Goldenrods (*Solidago spp.*), Asters (*Symphyotrichum spp.*) and Thistles (*Carduus spp.*) (McIlveen 2009).

Incidental observations have noted that there are at least sixteen species of butterflies and eleven species of odonates observed in the LWC Project Study Area. Odonate and Lepidoteran surveys were completed in 2013 at WWTF and found several migratory species including monarch butterflies (*Danaus plexippus*), black saddlebags (*Tramea lacerate*), and green darners (*Anax junius*). Some are migrants, others breed in the area and these are listed in Appendix B, Table B-7.

3.2.4.8 Species of Concern

Species of Concern include plants and animals identified in provincial and federal species at risk legislation and through regional and municipal natural heritage strategies as Species of Concern.

LWC Regional and Project Study Area

Species of Concern have not been documented comprehensively across the entire study area. However, the LOISS background study documented Species of Conservation Concern which has a considerable overlap with the Regional Study Area. Wildlife records indicate that 128 Species of Concern were recorded (CVC, 2012). Of these species of conservation concern, there are 25 faunal species at risk known to occur in the Study Area either currently or historically. For the purposes of conservation and protection of these species at risk the specific locations in which they are found have not been recorded. Floral records indicated 265 Species of Concern were recorded.

Thirteen species at risk have been observed within the LWC Project Study Area (Appendix B, Table B-8).

3.2.4.9 Invasive Species

LWC Regional and Project Study Area

A thorough survey of all natural features in the Regional and Project Study Areas has not been undertaken. However, as with many highly disturbed urban natural areas, invasive species are common in the Regional and Project Study Areas.

Information on the presence, abundance and impacts of invasive species was drawn from terrestrial natural heritage studies conducted on the Arsenal Lands (2005) and Marie Curtis Park (2003 & 2010) by TRCA staff, and the Mississauga NAS and the Credit Valley Conservation Terrestrial Ecological Land Classification report (NRSI 2009).

Forested areas in Marie Curtis Park are dominated by Garlic Mustard (*Alliaria petiolata*), Japanese Knotweed (*Polygonum cuspidatum*), and Tartarian Honeysuckle (*Lonicera tartarica*). The beach component of Marie Curtis Park is predominantly devoid of vegetation; however, vegetation is dominated by non-native Crack Willows (*Salix fragilis*), Manitoba Maple (*Acer negundo*) and Black Locust (*Robinia pseudoacacia*). The exotic old field meadows found in Arsenal Lands and Marie Curtis Park also contain populations of Dog-strangling Vine (*Cynanchum rossicum*). Moist areas include Narrow-leaved Cattail (*Typha angustifolia*) and Common Reed (*Phragmites australis*) which can out-compete native species ultimately reducing native biodiversity and altering the community structure.

The forest on the north-western part of WWTF also contains populations of invasive species including Garlic Mustard, Buckthorn (*Rhamnus cathartica*), and Tartarian Honeysuckle.

3.2.5 Geology and Soils

The ground under which the LWC Project Study Area lies will influence the physical, chemical and hydrological characteristics of the Project as follows:

- Physical – impacts the stability and erodability of the shoreline, river banks and availability of sediment sources for transport within the area; impacts the underlying cohesiveness of the nearshore substrates and table lands as it relates to slope stability, development of foundations and structural key-ins.
- Chemical – identifies whether contaminants are present and available in the context of impacts on biota current and anticipated; identifies the soil constituents that are appropriate for establishing potential vegetation communities.
- Hydrological – identifies the mobility of groundwater through the surficial layers and discharges to created habitats to determine volumes and quality.

An environmental investigation was conducted to obtain current information on the environmental conditions of the soil and groundwater adjacent to the proposed development area located south of the WWTF. Sampling locations are shown in Figure 3.25. The results of the investigation have been used in the EA to inform assessment of Alternative LWC Project Configurations ('Alternative Methods') as well as the detailed assessment of the Preferred Alternative.

Figure 3.25 Sampling Locations for Soil and Groundwater Investigation

3.2.5.1 Geological and Hydrogeological Setting

LWC Regional and Project Study Areas

Both the LWC Project Study Area and LWC Regional Study Area are underlain by shale bedrock of the Georgian Bay Formation. The uppermost weathered zone of the shale bedrock was encountered within the supplementary environmental investigation at depths of 5.94 and 12.81 metres below ground surface (mbgs) corresponding to elevations of 70.98 to 71.17 metres. The Georgian Bay Formation is grey shale that is up to 175 m thick, with fracturing limited to the upper few metres of the Formation.

Approximately, 9 ha of the WWTF consists of land created in the late 1950s to expand the site southward into Lake Ontario to accommodate the construction of additional sewage lagoons as well as a much smaller area at the southeast corner to accommodate the inclusion of additional treatment tanks. Based on the stratigraphic information collected during the supplementary environmental investigation, the near shore soils comprise a combination of lakefill and fill soils that comprised sand and gravel and silty sand to sandy silt for thicknesses of 2.4 to 4.3 mbgs. Silt and sand were identified on a very local scale. The majority of the fill was devoid of material inclusions such as concrete, asphalt, wood, metal and glass except for very localized instances of asphalt fragments. No staining, odours or sheens were associated with the fill materials except for a presence of a petroleum hydrocarbon odour identified in two instances.

Within the western-most part of the near shore environment, substantially greater thicknesses of fill (8.5 to 10.3 m) were reported, the majority of which was represented by a reddish, powdery ash, generated from the WWTF incinerator process that forms a pronounced ridge.

Farther inland in the vicinity of the proposed Serson Creek realignment, lesser thicknesses of fill were encountered ranging from 0.61 to 1.83 mbgs, comprising sandy silt to sand and gravel. The greater thicknesses of fill were reported where the bedding material of a former rail spur occurs at the western end of proposed Serson Creek realignment route. No evidence of environmental impacts was reported in the fill in this area of the LWC Project Area except for a faint septic odour identified in one location in sandy silt fill.

The native soil underlying the LWC Project Study area, as identified through the supplementary environmental investigation, ranged from sandy silt to sand and gravel and layers of silt to sandy silt till. No evidence of environmental impacts was reported in the native soils.

Groundwater levels in both the LWC Project Study Area and LWC Regional Study Area are influenced by the close proximity of Lake Ontario and fluctuations in lake levels with the effects being most apparent with closer distances to the lake. Based on groundwater measurements

collected in early August 2013, groundwater flows toward the lake with a relatively modest lateral gradient of 0.027. Depths to groundwater ranged from 1.36 to 8.08 mbgs m near the lakeshore and 4.99 to 6.39 mbgs further to the north within the proposed Serson Creek realignment (a distance of 400 to 700 m from the lake).

Marie Curtis Park includes approximately 13.4 ha of municipal refuse under a thin veneer of topsoil. Although the landfill is located east of proposed in-water works of the LWC Project, depending on the nature of the tie-in approach and location of the eastern limit of the land creation, there may be geoenvironmental or geotechnical considerations to be accounted for in the design of the LWC Project.

It does not appear that significant infilling has occurred on the Arsenal Lands. The soils are expected to comprise mostly native silty clay and clayey silt tills (MNR, 1980). An extensive soil remediation program was completed in the 1990s, with the clean-up completed to meet the provincial generic standards for residential/parkland land use in effect at that time. A Record of Site Condition for the remediated property was filed on the MOE's Environmental Site Registry June 12, 2002 with further information provided on October 23, 2002. MOE provided acknowledgement of the RSC on November 8, 2002. MOE submitted acknowledgement of Filing of the Transition Notice on June 12, 2007.

3.2.5.2 Soils Testing

Soil samples were collected at each borehole and groundwater monitoring well location and tested for a selection of potential contaminants including inorganic substances, petroleum hydrocarbon compounds (PHCs), volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs).

The results of the testing of fill and native soil along the shoreline adjacent to the LWC Project Area identified a number of instances where the soils did not meet the applicable Ministry of the Environment (MOE) Site Condition Standards (SCS). These results were largely represented by metals along with electrical conductivity (EC) and sodium absorption ratio (SAR) reported in fill. Very localized concentrations of PHCs and PAHs were also reported. The source of these soil impacts is attributed to the environmental condition of the fill used for land creation to accommodate the past expansion to the WWTF. It is understood that land creation and construction of the naturalization features will not involve the disturbance of any of the existing land mass beyond the possible removal of armour stones where it is installed along portions of the existing shoreline.

No reported concentrations of inorganic parameters, PHCs, PAHs or VOCs were reported in soils analyzed from boreholes MW12-11 to MW12-16 except for a reported concentration of cadmium reported in fill at MW12-14 (Figure 2.25). The extent of this one instance has not been delineated but, based on the balance of the results reported, is not a significant concern to the proposed habitat creation.

3.2.5.3 Groundwater Testing

Groundwater samples were collected at each borehole and groundwater monitoring well location and tested for inorganic substances, PHCs, VOCs, PAHs and PCBs. The primary concern with regards to the development of new terrestrial and wetland habitat is the potential for the migration of contaminated groundwater discharging into these areas, whether the source of the groundwater contamination is from the near shore soil conditions or from some other sources further upgradient.

Testing of groundwater from the wells installed along the shoreline did not report any concentrations of analytes that exceeded the applicable generic MOE SCS for groundwater within 30 m of an open water body (Table 9 SCS) except for one instance of F3 PHCs (530 µg/L versus 500 µg/L) reported in one well installed at the western end of the LWC Project Study Area. The MOE SCS for F3 PHCs in groundwater is not an ecological-derived or human health-derived risk-based value. The MOE SCS has been established based upon the relatively low solubility of F3 PHCs in groundwater and thus the potential for the formation of non-aqueous phase liquid (NAPL). It should be noted that no evidence of a NAPL was identified within the LWC Project Study Area and thus, the result reported is not considered to be a significant concern warranting further remedial or mitigative action.

Groundwater testing of the monitoring wells located within the proposed Serson Creek realignment did not report any concerns with all analysis meeting the applicable MOE SCS.

3.3 SOCIO-ECONOMIC ENVIRONMENT

3.3.1 Land Use

The land use descriptions in this section are based on the existing Mississauga Plan (City of Mississauga, 2003) and the Toronto Official Plan (2002, consolidated in December 2010). However, the policy review for Lakeview and Port Credit within the City of Mississauga is currently underway and will involve formulating Official Plan policies for the Lakeview and Port Credit Communities and the preparation of zoning by-law amendments, urban design guidelines, and special site policies. A draft version of the Port Credit Local Area Plan is available, and information from this document has been included as appropriate.

3.3.1.1 Planned Land Use

Planned land use describes the land use designations which are included in the Mississauga Official Plan (MOP 2012) (City of Mississauga, 2012) and the Toronto Official Plan (2002, consolidated in December 2010). Some sections of the MOP (2012) are currently being appealed at the Ontario Municipal Board and the Mississauga Plan (2003) remains in effect for those areas under appeal. This section does not include land uses envisioned by other planning initiatives such as Inspiration Lakeview and Inspiration Port Credit. A description of these initiatives is provided in Section 3.3.1.3 (Future Land Uses).

LWC Regional Study Area

According to the Mississauga Official Plan (City of Mississauga, 2012), land use and development within the City is guided by the various elements of the City Structure. These elements include:

- Downtown;
- Major Nodes;
- Community Nodes;
- Corporate Centres;
- Neighbourhoods;
- Employment Areas; and
- Special Purpose Areas.

Elements that are within the LWC Regional Study Area include three community nodes (Clarkson Village, Port Credit and Lakeview), three neighbourhoods (Clarkson-Lorne Park, Port Credit, and Lakeview), and two employment areas (Southdown and Lakeview).

Land use designations in Southdown include large Utility and Business Development areas, Utility, and areas of Public Open Space/Greenbelt along the waterfront and adjoining watercourses.

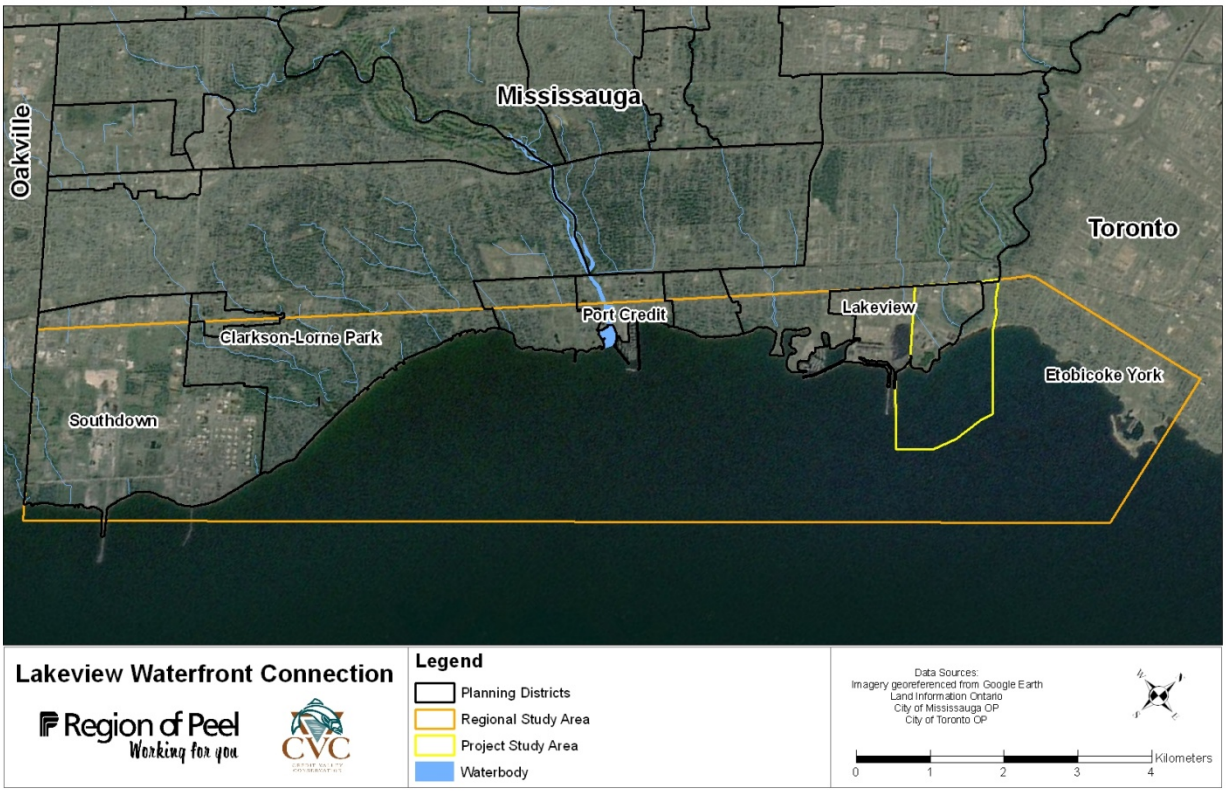
Clarkson-Lorne Park is largely Low and Medium Density Residential, with various amounts of Public Open Space/Greenbelt and Commercial. A sizeable area south of the QEW, between Winston Churchill Boulevard and Southdown Road is designated Business Employment.

Port Credit, centred around Lakeshore Road West, is designated as a mix of Low, Medium and High Density Residential, Commercial, and Public Open Space/Greenbelt. A few parcels of land adjacent to the CN Railway along Queen Street and Queen Street West are designated Business Employment. The Port Credit Local Area Plan describes the future development of Port Credit as an “urban waterfront village”, based on the principles of a mixture of land uses, a variety of

densities, pedestrian and cycling friendly infrastructure, transit and supportive urban forms, a significant public realm, and public access to the waterfront.

Lakeview is largely Low and Medium Density Residential, with large areas of Public and Private Open Space/Greenbelt and Utility (OPG's Lakeview site and Lakeview Water Treatment Plant). Land along Lakeshore Road West is mostly designated Commercial and Business Employment.

Figure 3.26 Planning Districts in the LWC Regional Study Area



In November, 2007, the City of Mississauga initiated a review of the Lakeview and Port Credit District Policies, culminating in the "Lakeview and Port Credit District Policies Review and Public Engagement Process – Directions Report" in November, 2008. This resulted in the Port Credit Local Area Plan and Built Form Guide which is currently being finalized by the City of Mississauga's Policy Planning Division and the preparation of the Lakeview Local Area Plan (2012). Policy recommendations resulting from these plans will be incorporated into the new Port Credit and Lakeview Local Area Plans which will form part of the Mississauga Official Plan (2012).

The eastern portion of the LWC Regional Study Area falls within the Etobicoke York District in the City of Toronto (Figure 3.26). The dominant land use designation is "Neighbourhoods" with "Parks" representing the second most dominant land use. A small strip of land buffering Etobicoke Creek is designated as a "Regeneration Area" and two adjoining areas in the far eastern portion of the LWC Regional Study Area are designated as "Institutional Areas " and "Other Open Space Areas (such as Golf Courses, Cemeteries, Public Utilities)".

LWC Project Study Area

The LWC Project Study Area includes lands within both the City of Mississauga and the City of Toronto. Within the City of Mississauga, the WWTF land is designated Utility, with the area north of the WWTF designated Business Employment. The Arsenal Lands are designated Public Open Space, while the lands along Serson and Applewood Creeks are Greenbelt (Figure 3.27). Within the City of Toronto, Marie Curtis Park is designated Park.

According to the City of Mississauga's Zoning By-law and the City of Toronto Official Plan, land within the LWC Project Study Area is zoned as shown in Table 3.7, with permitted uses.

Figure 3.27 Designated Land Use within the LWC Project Study Area

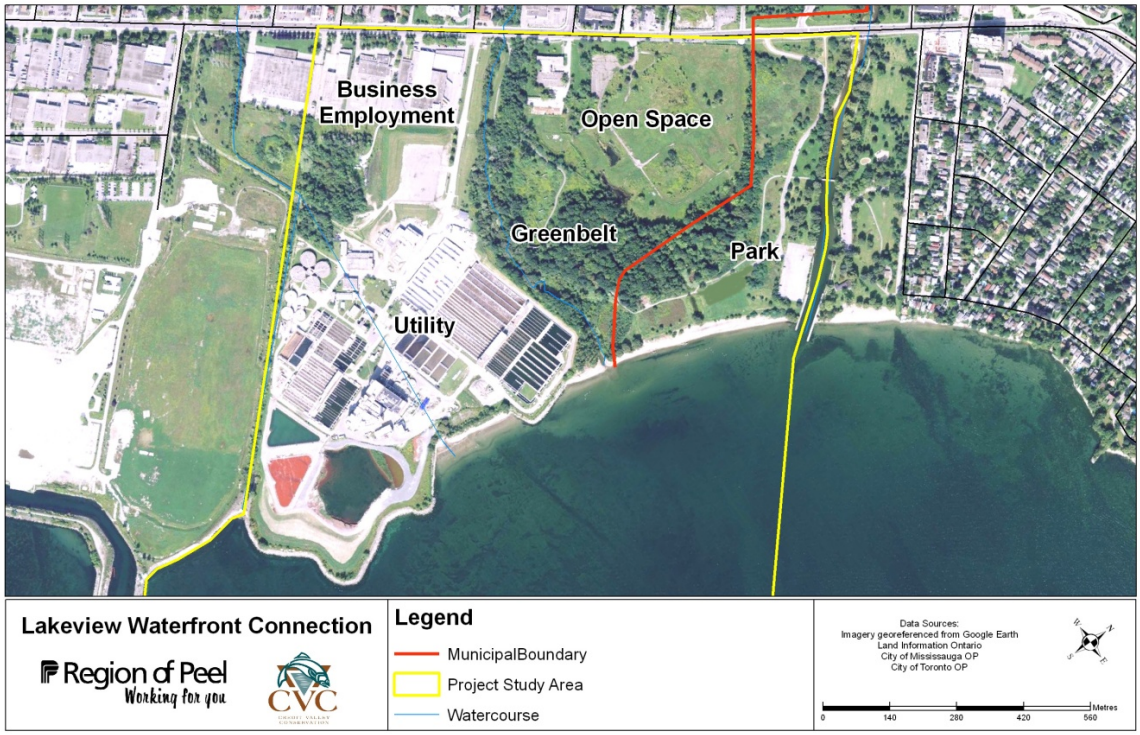


Table 3.7 LWC Project Study Area Zoning

Area	Zoning Codes (Meanings)	Permitted Uses
WWTF	U-1 (Utility Zone - 1) – City of Mississauga	Passive recreational use; utility building; water treatment facility, sewage treatment plant; electric transformer and distribution facility; power generating facility and associated outdoor storage
	G2 (Greenbelt – Natural Features) – City of Mississauga	Natural protection area; natural heritage features and areas conservation
Marie Curtis Park/Arsenal Lands	G1 (Greenbelt – Natural Hazards) – City of Mississauga	Flood control; stormwater management; erosion management; natural heritage features and areas conservation
	OS2 (Open Space – City Park) – City of Mississauga	Passive and active recreational use; stormwater management facility
	Parks – City of Toronto	To be maintained in a primarily natural state while allowing for compatible recreational, cultural and educational uses and facilities that minimize adverse effects on natural features and functions; and conservation projects, public transit, public works and utilities for which no reasonable alternatives are available, and that are designed to have only minimal adverse impacts on natural features and functions
Commercial area	E2-21 (Employment) – City of Mississauga	A variety of office uses, business activities, and commercial facilities. Uses that are not permitted include power generating facility, waste processing facility, motor vehicle repair facility, composting facility, night club, adult entertainment establishment, etc.
Serson and Applewood Creeks	G1 (Greenbelt – Natural Hazards) – City of Mississauga	Flood control; stormwater management; erosion management; natural heritage features and areas conservation

3.3.1.2 Existing Land Use

LWC Regional Study Area

Existing land uses within the LWC Regional Study Area are residential, commercial, industrial, institutional, open space/greenbelt, vacant lands (City of Mississauga, 2012), and parks (City of Toronto, 2002). Communities within the LWC Regional Study Area include Clarkson-Lorne Park, Port Credit and Lakeview in Mississauga (City of Mississauga, 2012), and Long Branch and New Toronto in Toronto (City of Toronto, n.d.). Population statistics for these communities are shown in Table 3.8, as reported in the 2001 and 2006 censuses and summarized by the Cities of Mississauga and Toronto.

Table 3.8 Population Statistics for Communities in the LWC Regional Study Area

Neighbourhood	Population (2001)	Population (2006)	% Change in Population (2001-2006)	% of Municipal Population in 2006 (Mississauga or Toronto)
Clarkson-Lorne Park	39,250	39,080	-0.4%	5.9%
Port Credit	10,260	10,535	2.7%	1.6%
Lakeview	22,045	21,370	-3.1%	1.4%
Long Branch	10,385	9,625	-7.3%	0.4%
New Toronto	11,280	10,655	-5.5%	0.4%

Sources: City of Mississauga, n.d.b.; City of Toronto, 2006a, 2006b.

It is noted from the population changes presented in the table above that the communities within the LWC Regional Study Area are generally stable or slowly losing population. This population loss is likely attributable to aging families creating empty nests. The following community descriptions are based on the divisions defined by the Cities of Mississauga and Toronto.

Clarkson-Lorne Park - Clarkson-Lorne Park is a stable residential community with two distinct Character Areas - the east and west sides of Southdown Road. Lands east of Southdown Road are developed largely for detached dwellings, predominately one storey (more recent construction is generally two storeys) in height on large lots with low lot coverage and generous setbacks, resulting in a low density development pattern. The lands west of Southdown Road contain a broad range and mix of housing built on a road pattern dominated by crescents and culs-de-sac. The Clarkson Village commercial area provides a focus for the community with a mixture of street related shops, strip retail commercial/residential plazas, and a traditional shopping centre. Also, a combination of apartments and townhouses has developed in the vicinity of the GO Transit station. The community is also served by a mixture of retail commercial concentrations, including those at Lorne Park Road, Clarkson Road and Truscott Drive. The area also includes some commercial and light industrial uses south of the QEW between Winston Churchill Boulevard and Southdown Road.

Port Credit - Port Credit is generally a stable area with a distinct community identity within the City of Mississauga, with a focus on the Lake Ontario waterfront, the harbour and its heritage. The community is anchored by established residential areas at the eastern and western parts, and is served primarily by a commercial corridor along Lakeshore Road. Port Credit's heritage can be found in the unique buildings in and around the harbour area and the Lakeshore Road commercial areas. Port Credit's location makes the community a focal point of residential, commercial, open space and tourism and recreation activity on the Mississauga waterfront.

Residential development consists of a combination of dwelling types and forms comprising a high density area centrally located near the Port Credit GO Transit Station, medium and high density development along Lakeshore Road, as well as low density areas characterized by tree-lined streets in grid patterns. As it passes through Port Credit, Lakeshore Road has a "mainstreet" commercial character, and is flanked by on-street parking and spacious sidewalks accommodating active pedestrian use. The street is framed by one- to two-storey buildings with small storefront shops. Small-scale industrial and commercial uses exist south of the Canadian National Railway tracks along Queen Street and Queen Street West. Most of the lands in the area are developed with the exception of the vacant Imperial Oil (formerly Texaco) lands west of Mississauga Road South. Several commercial areas are located along Queen Street and Queen Street West, just south of the CN Railway.

Other uses along the Port Credit waterfront include a working harbour, fishing, boating and marine services.

Lakeview - Existing residential land uses in Lakeview are a combination of low density detached and semi-detached units, medium density townhouses and high density apartments. The high density development is primarily located south of the Canadian National Railway right-of-way along Lakeshore Road East. A large portion of the existing commercial facilities are concentrated along Lakeshore Road East. OPG's Lakeview site and the Lakeview Water Treatment Plant, situated south of Lakeshore Road East, comprise a major portion of the Lake Ontario shoreline within Lakeview. An unused north-south hydroelectric power corridor (between OPG's former Lakeview site to areas north of the QEW) is the other primary industrial use in the area.

Long Branch and New Toronto - Long Branch and New Toronto are located at the southwestern portion of the City of Toronto, along Lake Ontario. The communities are defined by their proximity to the lake, and include a number of waterfront parks, as well as shopping districts along Lakeshore Boulevard. Both communities are in transition: many new home developments are being built along Lakeshore Boulevard in Long Branch, and an industrial corridor in northern New Toronto has been rezoned to residential as industry gradually moves out of the area. Within New Toronto, the City of Toronto has a Water Treatment Plant at Colonel Samuel Smith Park.

Waterfront parks within the LWC Regional Study Area include: Colonel Samuel Smith, Lakefront Promenade, Jack Darling Memorial, J.C. Saddington, AE Crookes, Douglas Kennedy, the Adamson Estate, Lakeside, and Watersedge. These parks provide a number of amenities including baseball diamonds, picnic areas, soccer fields, washrooms, concession stands, splash pads and boat launch and yacht club facilities. Many of these parks are connected by the

Waterfront Trail, which weaves along the Lake Ontario waterfront from Niagara to the Quebec border.

LWC Project Study Area

Land uses within the LWC Project Study area include the WWTF in the southwest, Marie Curtis Park and the Arsenal Lands in the east, and a Business Employment Area in the northwest, while the LWC Project Study Area is within the Lakeview District (which includes residential communities), there are no existing residential uses within the LWC Project Study Area itself (see Figure 3.25).

The Arsenal Lands and Marie Curtis Park are owned by TRCA. The Arsenal Lands site was long used for a variety of manufacturing activities, including small arms and munitions production during the Second World War. It has also been used for offices, storage, ordnance, a canteen, a Provincial weigh scale, and a firing range. It was purchased by TRCA and the Province of Ontario, City of Toronto and the Region of Peel in 1992 with ownership being transferred to TRCA for the intent of expanding Marie Curtis Park. Remediation activities were completed in 2002, though the lands remain mostly fenced off from the public. Marie Curtis Park was formerly the site of barracks and farming activities.

Conceptual master park plans for Marie Curtis Park and the Arsenal Lands indicate that the Arsenal Lands will include ponds, picnic areas, splash pad/playground, parking lots, forest regeneration zones, and other amenities. Marie Curtis Park currently has a number of recreational amenities, including a children's playground area, wading pool, baseball diamond, and beach. Redevelopment of Marie Curtis Park will include picnic areas, beach volleyball courts, a dog park, an extended trail system, and many other amenities.

The WWTF covers an area of approximately 47 ha. The plant is owned by the Region of Peel and processes the wastewater from residential and employment areas in Bolton, Brampton and the eastern parts of Mississauga as well as York Region. The WWTF has the total daily capacity of 448,000 cubic metres of wastewater. The outfall currently extends approximately 1.6 km offshore and consists of a 7' diameter pipe. Any works along the waterfront must ensure that access to the outfall be retained in perpetuity for long-term maintenance and repair.

The existing Business Employment Area includes 84 businesses, which include:

- Service providers – Oasis Convention Centre, ACA Immigration Inc., Avenue Moving and Storage Ltd., Ingersoll Rand Security and Safety Inc., Xtreme Tire Garage, McKenna Logistics Centres, Twinkle Coin Car Wash, Shomi Inc., SCA Oplenac, Richards-Wilcox Door Systems Ltd., Ontario Clean Water Agency, Nova Insurance Agency Ltd., Pippi's

World, H&R Block, Lakefront Graphix Technology, Lakefront Pet Vet Hospital, Long Branch Rental, MNF Financial and Accounting Services Inc., Money Max, Canada Post, Ecstasy Limos, Empire Group, Evergreen Health Centre Skin and Body Care, Focused on Food;

- Manufacturers – Boltron Bookbinding Ltd., Northstar Composites Inc., Long Branch Foundry Inc.; Plasterform Inc., Interior Manufacturing Group Inc., Stratos Industries Inc., Select Overhead Door Service Inc., Lakefront Manufacturing Inc., C/S Construction Specialties Company Inc., C/S Construction Specialties Company Inc., Ilsco of Canada Ltd., Toronto Fabricating & Manufacturing Company, ABC Fire Doors Testing and Manufacturing Ltd., Cintube Ltd., Filamat Composites Inc., Four Four Four Ltd., Triton Sails Ltd.;
- Suppliers – Gaspard and Sons Ltd., Specialty Gaskets Inc., Genco Marine Ltd., Kotyck Brothers Ltd.; Cosway Supplies, Metagenics Canada Inc., Wonderland Food and Equipment Inc.;
- Wholesalers and warehouses – Grohe Canada Inc., National Bait Inc., AJ Lanzarotta Wholesale Fruit and Vegetable Ltd., Canadian Food for Children, Casino Auto Wholesale Ltd., Chantler Packaging Inc., Four Four Four Ltd., Illy Caffe, Meaty Meats;
- Retail – Cango, Softcom Cell Phone Accessories;
- Restaurants – Tim Hortons, Lily's Restaurant, Lotus Island Vietnamese;
- Institutions – Peel Alternative School South; and
- Accommodations – The Ivy Motel, Green Acres Motel.

3.3.1.3 Future Land Use

LWC Regional and Project Study Areas

This section describes planning initiatives relating to the LWC Regional Study Area and Project Study Area that are currently underway. These initiatives propose redevelopment but have not been approved as part of *Planning Act* applications. These initiatives will inform and will be informed by the LWC Project planning process.

Inspiration Lakeview is a visioning process which was undertaken by the City of Mississauga, with the purpose of developing a Visionary Concept Plan to guide future development at the OPG's Lakeview site and adjacent employment lands along the Mississauga waterfront. The process included visioning sessions and presentations, with residents and key stakeholders from all over Mississauga sharing their ideas for the waterfront.

The final report outlined a vision for the water's edge, green space, cultural attractions, and urban design. This vision included creating space for Serson Creek to flow above ground and new water channels through OPG's Lakeview site; allowing for a variety of recreational

activities along the waterfront; creating both north-south and east-west green corridors; developing cultural spaces for the arts and community events; commemorating the cultural history of the area; and designing the urban landscape to support the elements described above. The full report was presented to the City of Mississauga's Planning and Development Committee on April 18, 2011, and was unanimously accepted as a key step in developing this part of the Mississauga waterfront.

Similar to Inspiration Lakeview, Inspiration Port Credit (IPC) is a process whereby the City of Mississauga is working with landowners, residents and other stakeholders on a master plan and an implementation guide for the waterfront sites. The lands being considered are the Port Credit Harbour Marina lands and the Imperial Oil Limited (formerly Texaco) lands. The process will help guide the City towards the realization of the full potential of these waterfront sites. The process was launched on May 9, 2012 by City Council, and options were presented to the community for comment and feedback on March 26th, 2013. A final community meeting is planned for the spring 2014 before the plan is submitted to City Council.

The City of Mississauga initiated the Lakeview and Port Credit District Policies Review in response to changing local circumstances and recent provincial planning initiatives. The goal of these reviews is to provide for intensification of the areas in a manner which continues to make the Lakeview and Port Credit communities desirable places to live and work. These district policies, once approved, will become part of Mississauga's Official Plan.

The Port Credit Local Area Plan describes the future development of Port Credit as an "urban waterfront village", based on the principles of a mixture of land uses, a variety of densities, pedestrian and cycling friendly infrastructure, transit and supportive urban forms, a significant public realm, and public access to the waterfront. The Lakeview District Policy Review is currently under way and a report on the draft Lakeview Local Area Plan will initiate the public consultation process in 2014.

The Canada Lands Company created a demonstration plan for the redevelopment of 1 Port Street (Port Credit Harbour Marina), an area of land and water on the Mississauga waterfront immediately to the east of the Credit River. This plan is being peer reviewed by the City as part of Inspiration Port Credit. The draft Port Credit Local Area Plan identified the site as having potential as a mixed use, water-related development that takes advantage of the site's location in downtown Port Credit and on the lake. The master plan process will involve the creation of a detailed vision for the 1 Port Street site that will ultimately set out permitted uses, densities, heights and building forms.

While the focus of Inspiration Lakeview is on OPG's Lakeview site, the process identified the LWC Project Study Area as key towards creating ecological and public linkages to and along the waterfront. The redevelopment envisioned an extension of the lands at the WWTF into the lake, to allow for the creation of a "green water's edge" which would connect the Arsenal Lands to Lakefront Promenade Park.

On the City of Toronto side of the LWC Regional and Project Study Areas, the Arsenal Lands/Marie Curtis Park West Master Plan Addendum (2007) is an update of the Arsenal Lands Park and Site Remediation Master Plan (1998). The Arsenal Lands/Marie Curtis Park West is a 15.7 ha property located south of Lakeshore Road East on the City of Toronto's eastern border with the City of Mississauga within the LWC Project Study Area. The purpose of the Addendum is to provide an overall plan which reflects the current site conditions, meets the needs of regional and local park users, addresses potential and existing safety concerns, and provides specific recommendations to direct park management and operation. Elements of the Marie Curtis Park Master Plan have been implemented in 2011, 2012 and 2013 including removal of the western most parking lot near the lake, reconfiguration of the boat launch area, resurfacing of the Waterfront Trail, installation of beach volleyball courts, installation of the "dogs-off-leash" area, installation of the water-play and kid-play areas on the east side of Etobicoke Creek, and reforestation efforts. City of Toronto is exploring the potential for establishing a bike skills park in Marie Curtis Park in 2013.

Plans by the City of Mississauga and TRCA to provide a further update to the Arsenal Lands Park Master Plan have been indefinitely postponed in 2012. TRCA is proceeding with building upgrades in the Small Arms Building in the Arsenal Lands following receipt of funding from the Region of Peel.

3.3.2 Land Ownership

LWC Regional Study Area

The majority of the LWC Regional Study Area is under the jurisdiction of the CVC. Within its jurisdiction, CVC owns approximately 26% of the Lake Ontario shoreline. The entire shoreline within CVC's jurisdiction is comprised of public lands (43%) and private lands (57%), with public lands being owned by the CVC, City of Mississauga, Region of Peel, MNR, OPG, MOE and DFO.

The eastern portion of the LWC Regional Study Area is within TRCA's jurisdiction including the Arsenal Lands within the City of Mississauga and Marie Curtis Park West in the City of Toronto. East of Etobicoke creek, the communities of New Toronto and Long Branch are predominantly residential neighbourhoods made up of privately owned land.

LWC Project Study Area

Most of the lands within the LWC Project Study Area are publicly owned by the Region of Peel (City of Mississauga side of the municipal boundary) and TRCA (City of Mississauga and City of Toronto side of the municipal boundary). The Region of Peel also leases the WWTF and a 9.12 ha of waterlot immediately south of the existing shoreline, including the WWTF outfall, from the MOE. OPG owns the waterlot east of the eastern pier as illustrated on Figure 2.4. The remaining lake within the LWC Project Study Area is considered unalienated Crown land which has not been surveyed into waterlots. Use of the unalienated Crown Land waterlots requires that they be purchased from MNR.

3.3.3 Recreation

3.3.3.1 Land Based

LWC Regional Study Area

A number of waterfront parks are located within the LWC Regional Study Area, with larger parks including Jack Darling Memorial, Saddington, and Lakefront Promenade. Public access to the Lake for recreation purposes was a significant driver of the original development by CVC of Lakefront Promenade Park beyond OPG's Lakeview site. Lakefront Promenade Park was created through lakefilling conducted by CVC and was completed in 1988 to facilitate recreation and conservation purposes, which included public and private marinas, beaches, trails and parkland area. This park, while a significant waterfront amenity, did not address connectivity along the waterfront either eastward or westward. OPG provides a recreational license for approximately 16 hectares of parkland to the City of Mississauga and a waterfront trail license for the connection of the Waterfront Trail between Lakefront Promenade Park and lands to the east of the former OPG Lakeview site. On the City of Toronto side of the LWC Regional Study Area is Marie Curtis Park east and Colonel Sam Smith Park. Both parks and surrounding areas in the LWC Regional Study Area offer recreational opportunities including walking, cycling, beach, sports fields, boat ramps, charter boats, sailing, jet skiing, paddlesports and fishing. Colonel Sam Smith Park is one of Toronto's largest waterfront parks located at the far east end on the LWC Regional Study Area.

The Waterfront Trail extends throughout the LWC Regional Study Area, either on-road or off-road.

LWC Project Study Area

Recreational opportunities within the LWC Project Study Area include: beach, walking, fishing, cycling, public boat launching, kite boarding/wind surfing, sea kayaking, nature appreciation, beach volleyball and dogs-off leash areas. The beach at Marie Curtis Park west is unofficially

used by kite boarders and wind surfers. Recent park improvements to this area have added permitting for beach volleyball from May to October. The westerly limit of this beach is also used for socially unacceptable activities.

The entire shoreline within the LWC Project Study Area is in public ownership. However, public access to and along the Lake Ontario waterfront is impeded by industrial activities of the WWTF. The WWTF is considered critical public infrastructure and operations extend to the water's edge. As such, public access across the property along the shore is restricted for security reasons.

At the eastern part of the LWC Project Study Area within the City of Toronto, Marie Curtis Park west provides public access to the waterfront for recreation. However, no connectivity exists along the shoreline between Marie Curtis Park and amenities to the west of the LWC Project Study Area (including Lakefront Promenade Park).

Lakefront Promenade Park and Marie Curtis Park are connected only by the Waterfront Trail; however the trail is forced to bypass much of the actual waterfront within the LWC Project Study Area, and includes a 650 m stretch of dedicated trail running adjacent to Lakeshore Road East between Hydro Road and the Arsenal Lands. The Waterfront Trail continues east running south of the Arsenal Lands and then through Marie Curtis Park to Etobicoke Creek. A spur trail connects the Waterfront Trail with Lakefront Promenade.

Currently, land-based "open lake views" (or vistas) from the LWC Project Study Area to Lake Ontario are limited as public access to the LWC Project Study Area is restricted.

3.3.3.2 Marine

LWC Regional and Project Study Areas

The LWC Project Study Area is adjacent to one of the largest and busiest of Mississauga's waterfront park complexes, which is comprised of five parks, including Lakeview Park, Lakefront Promenade Park, Douglas Kennedy Park, A.E. Crookes Park and R.K. McMillan Park. Due to its diverse shoreline and direct access to the lake, this area is a prime location for boating. Currently there are four marinas along the waterfront in Mississauga, with two located at Lakefront Promenade and the other two at the mouth of the Credit River. Marine uses within the Lakefront Promenade Marina area include motor boating, boat launching, shoreline and boat-based fishing, canoeing and kayaking. During the summer, the Lakefront Promenade Marina is often densely populated with residents and tourists.

At the eastern limit of the LWC Regional Study Area is Colonel Samuel Smith Park in the City of Toronto. This is a waterfront park that was constructed at the base of the former Lakeshore Psychiatric Hospital and adjacent to the RL Clark Filtration Plant. The waterfront park is a lakefill park that consists of shingle beaches, and naturalized areas, but also provides a large boat basin and fishing opportunities.

The sand beaches at Marie Curtis Park are regularly covered with large volumes of debris and the waters are regularly deemed unsafe for bathing due to high *E. Coli* levels (among the highest levels of all the Toronto beaches), given the proximity of Etobicoke Creek. Out of Toronto's eleven public beaches, Marie Curtis Park is one of three beaches that does not qualify for Blue Flag Beach status. Toronto Parks mechanically rakes the beaches at Marie Curtis Park 2 to 3 times a week. Sand is added to the beaches by City Staff on an as needed basis only and is not a part of routine maintenance operations. Parks staff notes that large rocks underlie the sand at a very shallow depth. A public boat launch is available on the west side of Etobicoke Creek near the lake.

Despite the water quality issues at Marie Curtis Park, the beaches are used as launching and landing points for windsurfers and kite boarders. A website dedicated to the windsurfing community (www.windsurfcanada.com) identifies Marie Curtis Park East (east of Etobicoke Creek) as the preferred location for launching and landing at Marie Curtis Park. Users on the winsurfcanada.com forum identify the south end of Forty Second Street as the ideal parking location providing a short walk to the launch site. Users of this website indicate through the forum section that Marie Curtis Park is recommended for experienced since the area is prone to large waves and numerous hazards.

The kiteboarding community has a similar website (www.localkitespots.com) that identifies Marie Curtis Park as a kiteboarding location. Unlike the Windsurf Canada site, the point location for kiteboarding within Marie Curtis Park is on the western beach near the mouth of Etobicoke Creek. This is likely due to the longer length of the western beach leaving more area for kiteboarders to lay out their lines. Localkitespots.com rates locations based on the degree of difficulty and rates Marie Curtis Park as "advanced". User comments on the site indicate that it is a very difficult beach to launch from due to numerous hazards including rocks and nearshore trees and that other locations in the area such as Cherry Beach or Frenchman's Bay are better options for less experienced riders.

3.3.4 Archaeology

3.3.4.1 Land Based

TRCA archaeologists conducted a Stage 1 Archaeological Assessment in 2012 and 2013 for the LWC Project to provide a general history of land use within the region, and to specifically document the LWC Project Study Area's archaeological and land use history and present condition in order to evaluate the property's archaeological potential. Based on the results of the Stage 1 Study, more detailed in-field Stage 2 assessments were conducted where recommended by the Stage 1 Study.

LWC Regional Area

The Background study was undertaken following the Standards and Guidelines for Consultant Archaeologists set by the Ministry of Tourism, Culture and Sport. The following research information and sources were visited to undertake this assessment:

- the most current list of archaeological sites from the Ministry of Tourism, Culture and Sport's archaeological sites database for the presence of sites in the project area and sites within a 1 km radius of the project area;
- reports of previous archaeological field work within a radius of 50 m around the property;
- topographic maps at 1:10,000 (recent and historical) or the most detailed scale available;
- historic settlement maps and atlases;
- known archaeological management plans or other archaeological potential mapping;
- aerial photography (both recent and historical);
- title deeds and other land registry documents;
- historical land use and ownership records including assessment rolls, census records and commercial directories;
- organizations with oral or written information about the land use of the property and area; and
- secondary historical document sources such as local and regional histories and academic research.

The LWC Regional Study Area has undergone extensive change since the end of the last Ice Age, approximately 12,000 BP. The existing shoreline is located on what is known as the Iroquois Plain physiographic region (Chapman and Putnam 1984), a lake-submerged landscape of the former Glacial Lake Iroquois. The shoreline of Lake Iroquois was situated approximately 3.8 km inland of the existing Lake Ontario shoreline. The terrain would have been similar to the tundra currently found in the eastern sub-arctic. It is thought that the entire population of

Ontario ranged between 100 and 200 people. These PalaeoIndians lived in small family groups and presumably subsisted on caribou and other colder weather animal species.

At the start of the Archaic Period (10,000 to 2,800 BP) lake levels dropped precipitously following the establishment of the St. Lawrence River outlet around 11,400 BP. With water levels 10-20 m lower than current conditions, the shoreline of Lake Ontario would have been much further offshore at that time. Climatic changes occurred during this period resulting in milder winters and long dry summers, and changed the landscape from tundra to spruce forests (Karrow and Warner 1990). This resulted in substantial changes in wildlife in the area, and a corresponding change in the technologies and subsistence strategies incorporated by the Archaic peoples of this time.

Between 10,000 BP and 7,500 years ago, gradual changes in climate resulted in the establishment of our modern climate and vegetation communities, consisting of mixed coniferous-deciduous forest in the region. Water levels in Lake Ontario raised moderately to levels approximating where they are today.

Wood and stone tools underwent technological changes during this time, including the use of native copper that would have been mined from the Lake Superior region. Evidence of native copper from Lake Superior suggests extensive trade routes.

The Initial Woodland Period (2,800 BP to A.D. 700) marked the point when clay pots began to be created, allowing for the storage and transport of food, which helped reduce the hardships faced during winter. It also marked the beginning of the bow and arrow, which revolutionized hunting and warfare. By 2,000 BP, populations became larger, with the establishment of camps and villages with more permanent structures. Trade networks began to extend further to the west in Ohio and to the Atlantic.

The Late Woodland Period (A.D. 700 to 1650) marked the period when maize was introduced to southern Ontario from the south. This provided the basis for horticulture to establish, and a tremendous increase in population, and establishment of permanent villages. However, after centuries of occupation along the north shore of Lake Ontario which involved small-scale warfare and gradual resource depletion (loss of soil nutrients), the Late Woodland groups moved northwards towards Georgian Bay. These groups gradually evolved into the Petun and Huron Nations that were observed by European explorers and missionaries. By A.D. 1650, their populations had dwindled due to disease and through adoption / relocation as a result of continued warfare with the League Iroquois from New York State.

Post-Contact Period (A.D. 1650 to 1805), also known as the Early Historic Period, marks the arrival of small numbers of Europeans interested in exploration, trade and establishment of missions. This marks the gradual adoption of European materials by First Nations peoples. In terms of culture, it is difficult to differentiate between *Haudenosaunee*, *Anishinaabe*, *Métis* and colonial settler campsites given the large-scale interaction and adoption of each other's material goods and subsistence strategies. These permeable boundaries continued until the Crown started to establish segregated reserves in the 18th and 19th centuries in order to grant lands to European settlers. French explorers and fur traders began exploring Lake Ontario and the north shore land, following a centuries-old route well-established up the Humber River (Toronto Carrying Place Trail) and eastern branch of the Rouge River to the Holland River. It is at this time, the Métis culture developed.

The Late Post-Contact Period/Settlement Period (1805-1900), started with the purchase of the southern portion of the Mississauga Tract by the British Crown in 1805. It is at this time Peel County was established, named after Sir Robert Peel, a past Prime Minister of England. From this initial purchase, lands were made available for settlers and the development of villages, towns along the north shore of Lake Ontario in the LWC Regional Study Area.

Given this long history of occupation by First Nation and Metis peoples, and given the importance of the nearshore area of Lake Ontario, and the proximity of the Etobicoke Creek and Credit River, the background report indicated that there is potential for archaeological resources to be found within the LWC Project Study Area. As such, recommendations were made to undertake Stage 2 assessments in the LWC Project Study Area where specific physical works are anticipated as a result of the LWC Project, where past soil disturbances have not already been documented.

The early nineteenth century settler families in this area would have encountered thriving forests filled with plenty of hardwood trees important for building homes and fuelling fires. Families were fortunate if their land had a substantial water source, such as a stream, creek or spring that would attract game animals, provide fish and be a source of drinking water. Clearing the land would have been a tedious, painstaking task but of high importance. The planting, growing and harvesting of crops was vital if the pioneer families were to survive through the harsh winter months. Early accounts of the area indicate that Etobicoke Creek suggested that parts of the creek amounted to little more than a seasonal stream, sometimes dissipating to isolated pools during the summer months. This affected the ability of the water to consistently power mills for flour and lumber. Milling became an unattractive business with the lack of a steady flow and periodic flooding. Only a small handful of water powered mills were able to operate during the nineteenth century.

The Atlas of Peel County provides a wealth of historical information including discussions of population, geography, road, soil, stock, water power, settlement, agriculture and individual villages. Noted is the Niagara Escarpment, dividing the area into upper and lower regions. The study area, being in the lower region, is recorded as being slightly undulating, with a gradual but continual ascent from the lake to the base of the escarpment. The soil, being of loamy clay and sandy loam, was unsuitable for growing wheat, but excelled in crops such as peas, barley, oats, rye, corn and all root vegetables.

The alignment of the mouth of the Etobicoke Creek has changed dramatically over the past 200 years, as has the shoreline of Lake Ontario, based on surveyor's maps and twentieth century aerial photography. Slight errors are not unusual for the nineteenth century maps, but it is reasonable to expect that the course of the creek has changed due to the effects of erosion and storm events during the past 200 years, and engineering works during the last 60 to 100 years. Additionally, an early depiction of Applewood Creek is located in an 1851 surveyed map (Map 6) found in the Township Papers at the Peel Archives of Lots 4, 5 and 6 Concession III SDS. It is illustrated as a long narrow inlet west of the mouth of the "Etobicoke River".

Four Ontario Heritage Plaques were identified in the LWC Regional Study Area: three were located to the west of the LWC Project Study Area; and one immediately east of the LWC Project Study Area:

- Commemorates the loss of life and destruction to property resulting from Hurricane Hazel in1954 at the mouth of Etobicoke Creek. This plaque is located on the east side of Etobicoke Creek in Marie Curtis Park East;
- Commemorates the presence of a nearby Credit Indian Village of 1826;
- Commemorates Government Inn 1798-1861; and
- Commemorates Canada's First Aerodrome. This last plaque is located on the former Lakeview Power Generation Site.

LWC Project Study Area

The Stage 1 Assessment identified three features of note within the LWC Project Study Area: the Arsenal Lands; Long Branch Rifle Range; and Marie Curtis Park.

The Arsenal Lands played an extensive role in the military history of Canada between 1910 and the post-World War Two era. The lands provided extensive factory space to produce munitions and small weapons. The lands were eventually purchased by Canada Post and most recently by TRCA in the early 1990s. Existing structures on the property include the water tower and Small Arms Building. This site will eventually be transformed into public park space bordering the western side of Marie Curtis Park.

The Long Branch Rifle Range was used by the Ontario Rifle Association to train the local militia in 1891. It was used as the training ground by the Department of National Defense during WWII and administration offices for the Royal Canadian Air Force. The Rifle Range closed its doors in 1957. The majority of the Rifle Range is west of the LWC Project Study Area, however, a portion of the earthen-filled wooden baffles and concrete backstop remain south of the Small Arms Building. These lands are owned by the Region of Peel.

Marie Curtis Park was formed after Hurricane Hazel following the destruction of many homes and the relocation of several hundred people. The local government petitioned the Province and Federal government to purchase these properties around the mouth of Etobicoke Creek which formed the basis for Marie Curtis Park East and West. The Park is currently owned by TRCA and maintained by Toronto Parks.

A map was produced indicating areas of higher archaeological potential within the LWC Project Study Area that would require Stage 2 assessments in the event that the project would overlie those areas.

Based on assumptions for construction access routes and proposed channelization works associated with Serson Creek, Stage 2 assessments were conducted in areas of the Arsenal Lands, Region of Peel-owned lands associated with the Long Branch Rifle Range, and lands north of the WWTF near the confluence of the Serson Creek baseflow and stormwater channel. All archaeological surveys indicated that that underlying soils were highly disturbed and that there is low potential for any remaining archaeological resources.

The study does recommend the implementation of standard guidelines pertaining to the construction site operation and management in the event that deeply buried archaeological finds and/or remains are unearthed during the implementation of the LWC Project.

3.3.4.2 Marine

The broad waters of Lake Ontario were and continue to be critical in the development of past and current societies in South Ontario. The water and shorelines of Lake Ontario provide transportation, food, drinking water, materials to build communities, medicine, recreation, and contribute to spirituality, to name but a few elements. Evidence can be found along the shores and in the nearshore areas to provide evidence of human occupation and use of the Lake in more distant times. As the majority of the LWC Project Study Area involves land creation activities within Lake Ontario, it is important to ensure that evidence pointing to that past marine heritage is not lost.

A marine archaeologist was retained in 2012 to undertake background studies to assess the potential for marine archaeological resources within the LWC Regional Study Area, and detailed surveys to explore specific marine archaeological resources at the LWC Project Study Area. A series of reports were generated in 2012 outlining the results of those studies (see Janusas August 2012 and Janusas September 2012).

LWC Regional Area

Background research involved desktop research of existing records and reports of marine and archaeological sites for the entire LWC Regional Study Area. This research came up with extensive information about the recent marine heritage of the Port Credit area, which was a major hub for the past stone-hooking industry of the 1800s and early 1900s. Associated with the stone-hooking activities, a surge in ship construction also occurred in the Port Credit area. A substantial deepwater gill net fishing fleet was also based out of Port Credit.

Stone-hooking involved the removal of aggregate and sheets of bedrock from the lakebed to be used in the burgeoning construction business in Toronto in the 1800s. The nearshore area between Port Credit and Etobicoke Creek would have been a prime area for material extraction that had many noticeable consequences, even in the 1850s. Unrestricted lake mining resulted in the loss of lakefront properties do to the removal of materials and corresponding increase in shoreline erosion as increased wave energy hit the shore. The removal of these materials also removed the elements that provided fish habitat along the nearshore areas of the Lake, which would have impacted many fish communities. This is an impact still felt today.

Prior to the 1800s, First Nations and Metis would have used the waters of Lake Ontario and their access to the Hinterland via river mouths, such as the Credit River, for trade and transportation, fishing, trapping and hunting, as well as the collection of plant materials for food, medicine and spiritual needs. Communities were frequently located near the mouths of major rivers on the Lake Ontario shoreline.

In addition, records indicate numerous shipwrecks in the Port Credit area, west of the OPG piers.

LWC Project Study Area

At the LWC Project Study Area, much more detailed surveys were conducted to ensure that there were no marine archaeological concerns. These studies included:

- Side-scan sonar mapping;
- Magnetometer surveys;
- Visual surveys;
- Remote operated vehicle (ROV) surveys of any “hits” using the above technologies; and

- Pit surveys on the beaches and nearshore area.

Background research also identified that in 1968, three steel barges were sunk to extend the eastern pier at the Lakeview Power Generation site. These barges were:

- Bryn Mawr, built in Chicago in 1900 (the middle barge); and
- The John Fritz and The John R. Roebling, both out of West Bay City, Michigan in 1989.

Following the extensive field surveys conducted throughout 2012, many hits were recorded but following detailed video, visual and pit surveys, it was determined that the hits were deemed modern day refuse. No significant marine archaeological resources were found in the LWC Project Study Area.

3.3.5 Cultural Heritage

LWC Regional and Project Study Areas

The waterfront within the LWC Regional and Project Study Areas has a long history, which dates from the time of the First Nations peoples and continued through the French and British regimes with extensive documentation and maps dating from the 18th Century onwards. In the 20th century, large areas of lake were infilled for Lakefront Promenade Park, the Lakeview Generating Station, and the WWTF. The WWTF site was the location of Canada's first aerodrome and flying school.

The LWC Project Study Area has a strong link with Canadian wartime history, including the Boer War, the Great War, and World War II. Within the LWC Project Study Area, a number of properties are recognized for their direct association with this history (Figure 3.28).

The Arsenal Lands, located at 1400 Lakeshore Road East, are identified as a unique cultural heritage landscape within the City of Mississauga's Cultural Heritage Landscape Inventory (Site No. L-IND-3), based on direct association with Canadian wartime history. Although the Arsenal Lands are not designated under the *Ontario Heritage Act*, the features within the property are to be considered as potential to be listed.

The Small Arms Building and Water Tower, located at 1352 Lakeshore Road East within the Arsenal Lands, have "direct associations with the federal government, World War II, the corresponding Canadian war industry, and the World War II influx of working women. The Water Tower also has direct associations with World War I rifle training." The Small Arms Building and Water Tower are designated under Section 29 of the *Ontario Heritage Act* (By-law No. 0258-2009) as being of cultural heritage value or interest. Key heritage attributes which

reflect the contextual value of the Small Arms Building and Water Tower include the row of deciduous trees to the west of the Small Arms Building and a woodlot of 5-6 trees located to the southwest of the Small Arms Building.

The Long Branch Indoor Rifle Range, located at 1300A Lakeshore Road East on the WWTF property, has "direct associations with WWII, training for WWII, the Long Branch Rifle Ranges, the Department of National Defense, and City of Toronto Emergency Housing. The Indoor Rifle Range yields, or has the potential to yield, information that contributes to an understanding of national defense, particularly WWII militia training." The Long Branch Indoor Rifle Range is designated under Section 29 of the *Ontario Heritage Act* (By-law No. 0170-2012) for its historical/associative, contextual, and physical value.

The Outdoor Firing Range, located at 1300 Lakeshore Road East within the Arsenal Lands, has "direct associations with training for the Boer War, the Great War and World War II, the Department of National Defense, and City of Toronto Emergency Housing. The Outdoor Firing Range yields, or has the potential to yield, information that contributes to an understanding of national defense, particularly militia training since 1891." Key heritage attributes include the concrete backstops and the wooden baffles. A Notice of Intention to Designate the Outdoor Firing Range under the *Ontario Heritage Act* was issued by the City of Mississauga on December 11, 2013.

Figure 3.28 Cultural Heritage Features within the LWC Project Study Area

3.3.6 Aboriginal Interests

LWC Regional and Project Study Areas

There are no recognized Aboriginal reserves or communities currently located within the LWC Regional or Project Study Areas. First Nations and Métis communities with known or suspected historical occupation of the LWC Regional and Project Study Areas are:

- Alderville First Nation (Williams Treaty First Nation);
- Anishnabek Nation/Union of Ontario Indians, Nipissing First Nation;
- Beausoleil First Nation (Williams Treaty First Nation);
- Chippewas of Georgina Island (Williams Treaty First Nation);
- Chippewas of Mnjikaning/Chippewas of Rama (Williams Treaty First Nation);
- Credit River Métis Council;
- Curve Lake First Nation (Williams Treaty First Nation);
- Fort William First Nation;
- Haudenosaunee Confederacy Council;
- Hiawatha First Nation (Williams Treaty First Nation);
- Huron-Wendat First Nation;
- Kawartha Nishnawabe;
- Métis Nation of Ontario;
- Métis National Council;
- Mississaugas of the New Credit First Nation;
- Mississaugas of the Scugog Island (Williams Treaty First Nation);
- Mohawks of the Bay of Quinte;
- Moose Deer Point First Nation;
- Nishnawabe Aski Nation;
- Peel Aboriginal Network; and
- Six Nations of the Grand River.

Although the lands in the LWC Project and Regional Study Areas are not currently used by First Nations or Métis communities for traditional purposes or otherwise, the area is included as part of a larger land claim (Toronto Purchase) by the Mississaugas of the New Credit First Nation which was negotiated to resolution in 2010. It is also noteworthy that the Mississaugas of the New Credit were never approached to sign the 1923 Williams Treaty covering areas in Toronto east to the Bay of Quinte because they had relocated in 1847 to lands adjacent to the Six Nations Reserve southeast of Brantford.

In discussions with the Mississaugas of the New Credit First Nation, CVC and Region of Peel have been advised that the Mississaugas were contemplating the submission of a Claim to the Government of Canada for the loss of riparian rights one mile on either side of the Credit River, and for a one mile area along the Lake Ontario shoreline in the City of Mississauga. The Credit River claim falls within the LWC Regional Study Area, and the Lake Ontario shoreline claim falls within the LWC Project Study Area.

Currently, there are no known culturally significant riparian uses within the LWC Project Study Area. However, in our discussions with the Mississaugas of the New Credit First Nation, they have expressed a strong spiritual attachment to the water and a desire for increased access to the Lake and streams in the area. The Mississaugas of the New Credit First Nation have also expressed an interest in the potential for the collection of medicine and ceremonial activities within the LWC Project Study Area and for some form of commemoration of their use of the area, and where they are now, following implementation of the works. The Mississaugas of the New Credit First Nation have also offered to assist us in the supply of native vegetation from their local nursery in the implementation of the LWC Project. Please see Section 10.7 for a description of engagement activities with Aboriginal communities and a list of the communities contacted.