Appendix C: The Urban Land Classification System
(Excerpt from CVC 2007; Updated 2011)

What is the Urban Land Classification system?
The ability to describe the diversity, proportion and distribution of natural and urban land uses within a city is integral to identifying opportunities for restoration and enhancement at the landscape scale. In Mississauga and in the southern portion of the Credit River watershed in general, urban land uses dominate. Much of the land base is devoted to residential, commercial, industrial and intuitional usage as well as the infrastructure (i.e.: road networks) that support them. Urban development often occurs at the expense of natural areas and those that remain intact are often isolated, fragmented and disturbed.

The CVC has previously mapped land use in its entire watershed based on the Ecological Land Classification (ELC) system for Southern Ontario. This system only maps the natural vegetation communities (such as forests, swamps, marshes) and cultural features (such as meadows, thickets and woodlands) (Lee et al., 1998). Areas that have been developed and converted into urban land uses are identified only as "urban" and not further described (Credit Valley Conservation, 1998).

The Urban Land Classification is a mapping tool developed by the CVC to provide a level of detail to urban areas within the watershed and the City of Mississauga. It involves classifying non-natural and non-cultural land uses into 5 distinct new classes, itemized in Table 1. The mapping reflects *actual* land use, and in cases may not correspond to the zoning or designation in the municipal Official Plan (for instance open spaces are separated from their commercial, institutional or other use).

Table 1: Urban Land Classifications

Transportation	Commercial / Industrial / Institutional
• Highway	• Commercial / Industrial
• Regional Road	• Educational / Institutional
• Collector	
• Railways	**Construction**
• Airport	• Construction
Urban Residential	**Manicured Open Space**
• Low Density Residential	• Institutional Open Space
• Medium Density Residential	• Recreational Open Space
• High Density Residential	• Residential (Private) Open Space
• High Rise Residential	• Commercial / Industrial Open Space
• Mixed Residential	• Major Trail
• Residential Estate	• Other Open Space
• Rural Development	

Source: (Credit Valley Conservation, 2007)

Landscape Scale Analysis of the City of Mississauga
Natural and Semi-Natural Habitats and Opportunities for Enhancement
Final Technical Report – 2012

How was it developed?
In 2007 the CVC initiated an update of its mapping in the City of Mississauga to add detail to the urban layer. Table 1 details the classifications used to add detail to the mapping.

The Urban Land Classification system builds on previous work done by the CVC for its Integrated Watershed Monitoring Program and Water Quality Strategy which uses land use analysis to determine and capture changes in land use and imperviousness of *specific* areas within the Credit River watershed. The Urban Land Classification system is meant to harmonize these classifications and provide a standard classification that could be applied to all areas of the watershed and specifically the City of Mississauga.

The digitization and classification of urban land uses was performed as a desk-top activity, using ortho-rectified aerial imagery for the city of Mississauga from 2005. These images had a resolution of 20 cm cells (ground resolution), which allows small features to be viewed, but the spatial accuracy of the photo is only accurate to 1:10 000 scale due to the ortho-rectification process. Some of the natural and urban features are small enough not to be visible at a scale of 1:10 000, however, they are considered important and mapped to the best extent possible. Generally, the smallest size of polygons within the Urban Land Classification is 0.5 hectare in order to account for scale issues and be consistent with mapping of natural features described by ELC.

Land use mapping was completed for the entire City of Mississauga, even for those portions outside of the Credit River Watershed. Data for the areas in Mississauga but outside of the Credit River watershed were provided by the Toronto and Region Conservation Authority in a compatible format for the analyses. Land use was also mapped in a two-kilometre radius outside of the City of Mississauga in order to be consistent with the Landscape Scale Analysis methodology. In some areas outside of the Credit River Watershed, this mapping was incomplete or was in a different format than prescribed by the Urban Land Classification or the ELC; in these cases the data were manipulated into a compatible format in order to incorporate this information into the analysis.

Quality checking of the Urban Land Classification mapping was accomplished with the aide of several tools:
- field checks where necessary to determine accurate land use;
- mapping of the "existing landuse codes" provided by the City of Mississauga;
- 2006 aerial photography available from the interactive Mississauga E-maps tool: http://www.mississauga.ca/portal/services/maps;
- 2007 aerial photography (only available late in the classification process) was used to document and revise the mapping because of new developments

Quality checking was unavailable in some areas outside the city boundary due to a lack of available imagery.

Landscape Scale Analysis of the City of Mississauga
Natural and Semi-Natural Habitats and Opportunities for Enhancement
Final Technical Report – 2012

The mapping of the "existing landuse codes" by the City of Mississauga is parcel-level data, where individual properties within the city were coded to a single use (i.e.: residential detached, general retail commercial, Open Space/Cultural *etc.*); however, multiple uses on one parcel were not captured (for example, manicured open space on a commercial property). By breaking out multiple land uses on single parcels the Urban Land Classification mapping provided by CVC more accurately reflects the true land use of the entire city.

Identifying Restoration Opportunities:
How is the Urban Land Classification useful?
Ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed (Society for Ecological Restoration, 2004). It can take on various forms depending on what the causes of the degradation / damage are and what the target recovery goal is. Determining the state of the ecological features and functions of an area and the pressures they face is a necessary step in restoration priority setting in any landscape-scale analysis.

The Urban Land Classification system is one tool allowing natural resource managers, policy makers and researchers to more accurately describe and understand the ecological features and functions found in the landscape. By knowing the diversity and spatial arrangement of land uses (both natural, cultural and urban) a better understanding of the threats to natural features and opportunities for their protection is afforded.

Urban land uses can have varying impacts depending on the ecological feature or function under study. For example, some urban land uses can supply, degrade or limit wildlife habitat and affect the ability of species to survive, reproduce and/or move through the matrix of urban land uses. Some areas that have been developed or disturbed by humans - such as rough areas in golf courses and manicured parks - can provide opportunities for species to survive, and offer unique opportunities for stewardship, restoration and naturalization. Urban development also increases impervious surfaces and alters water infiltration and runoff and can influence the quality and quantity of water entering rivers, creeks and our source of drinking water: Lake Ontario.

The following points describe how the Urban Land Classification has aided the landscape scale analysis process and documents how it can potential be used in future work or analyses.

General:
• Help in setting realistic landscape or city-wide targets and limits to restoration by documenting the area available for things like naturalization or tree planting.
• It is in an easy-to-use and searchable GIS format and can be used to map potential restoration sites.

Connectivity Function:

Landscape Scale Analysis of the City of Mississauga
Natural and Semi-Natural Habitats and Opportunities for Enhancement
Final Technical Report – 2012

- Informs the connectivity function (and thus matrix influence) in the landscape scale analysis by more accurately refining urban and natural boundaries.
- Identifies possible connections between natural areas through semi-natural, modified, and human disturbed ecosystems. Some of these areas are the last remaining possible land-based routes for connection – i.e.: trails through neighbourhoods, golf-courses, highway rights-of-way, and utility corridors.

Restoring Open Spaces:
- Identifies the matrix of land uses – especially the variety of open space - that surrounds natural areas or that is within desired linkage areas so that these areas can be prioritized for restoration. Some of the possible areas for restoration that can be highlighted by the Urban Land Classification are:
  - Open spaces associated with schools and parks that may offer more opportunities for naturalization, community involvement and volunteer stewardship.
  - Open space within hazard lands (high slope or within flood plain). Since development is limited in these areas there would be fewer competing land use interests.
  - Open space in commercial, industrial, institutional, and residential areas to target for greening and restoration projects.
- The Urban Land Classification will also identify commercial/industrial areas with large surface parking lots and high imperviousness so that these could be explored in the future for retrofitting opportunities to improve the water quality and quantity entering creeks, rivers and Lake Ontario.

Monitoring:
- With regular updates, the Urban Land Classification mapping can help to monitor land use change, imperviousness and the success of restoration efforts (i.e.: how many hectares converted from urban land uses to natural land uses) at either a landscape scale or a site scale.
- Where species data is available for individual natural features the land use matrix surrounding the patches can be examined to understand how these species may be impacted by existing adjoining or proposed urban development. In the future it can help identify barriers and permeability of the environment to species movement and possible avenues for improvement.
- The mapping and characterization of urban land uses reflects a truer representation of the land use than existing parcel-level data and could be incorporated to future studies or monitoring (for example, urban tree canopy studies).

References
Credit Valley Conservation. 1998. Credit Watershed Natural Heritage Project Detailed Methodology: Identifying, Mapping and Collecting Field Data at Watershed and Subwatershed Scales Version 3.

Landscape Scale Analysis of the City of Mississauga
Natural and Semi-Natural Habitats and Opportunities for Enhancement
Final Technical Report – 2012

Credit Valley Conservation, 2007. Urban Land Classification. Internal Technical Document.

Lee, H.T., W.D. Bakowsky, J. Riley, J. Bowles, M. Puddister, P. Uhlig and S. McMurray. 1998. Ecological Land Classification for Southern Ontario: First Approximation and its Application. Ontario Ministry of Natural Resources, Southcentral Science Section, Science Development and Transfer Branch. SCSS Field Guide FG-02.

Society for Ecological Restoration International Science & Policy Working Group. 2004. The SER Interantional Primer on Ecological Restoration. www.ser.gor & Tucson: Society for Ecological Restoration International.