Southern Ontario Wetland Conversion Analysis

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Table of Contents

Appendices

Tables

Figures

Executive Summary

Although wetlands are being restored and protected on the southern Ontario landscape, the trend of wetland loss continues. In order to assess the status of wetlands and enhance our understanding of the impacts of human activities on wetlands, as well as the effectiveness of stewardship efforts within the Great Lakes Basin and across Southern Ontario, we need to understand wetland distribution, conversion rates and trends over time.

Prior to the Environment Canada study in 1987 wetland information was fragmented and inconsistent. The 1987 study provided the best measure of wetland status and trends across southern Ontario up to 1982. The Southern Ontario Wetland Conversion Analysis has converted the original study methodology into a Geographic Information Systems (GIS) methodology. Building on the 1987 study, which assessed wetland extent across 3 points in time, this analysis has extended the estimates of wetland status and trends in large wetlands (> 10 ha) across southern Ontario to the year 2002, thus becoming the "Fourth Approximation".

Soil, quaternary geology, Digital Elevation Model (DEM) and net balance ground water flow surface data were used to map the pre-settlement wetland area/extent. Three land use datasets, 1967 Canada Land Inventory (CLI) Present Land Use, 1982 Land Systems, and 2002 SOLRIS, were used to map the extent of wetlands and wetland conversion in southern Ontario. The current analysis revealed that prior to European settlement (c.1800), 2,026,591 ha of wetland were widely distributed throughout Southern Ontario. By 2002, 560,844 ha remained, an overall reduction of approximately 1.4 million ha or 72% of the pre-settlement wetlands. The decline in wetlands since settlement has been most drastic in south western Ontario, parts of eastern Ontario, Niagara and the Toronto area, where over 85% of the original wetlands have been converted to other uses. Between 1982 and 2002, an additional 3.5% (70,854 ha) of the pre-settlement wetlands in the study area were lost, an average loss of 3,543 ha per year. This is equivalent to the loss of approximately 354 large 10 ha wetlands per year for the last 20 years. Conversion to agricultural lands, including field and forage crops, specialty crops, nurseries, rural properties and idle lands, urban brown fields, hydro right-of ways, edge of transportation corridors and clearings within forests accounted for the most losses in all areas. Built-up lands, impervious and pervious, were the significant factor in the loss of wetlands within the Golden Horseshoe. The extent and loss trends provided only apply to large wetlands (>10 ha) and are therefore a conservative estimate of wetland loss. If wetlands less than 10 ha in size were included in these estimates, the annual loss would be even more significant.

The findings from this analysis will help raise public awareness of the status of wetlands, inform our conservation, policy and planning initiatives and serve as a springboard to further examine trends across the landscape using new data that becomes available.

1.0 Introduction

As part of the Canada Land Use Monitoring Program, Environment Canada's Inland Waters and Lands Directorate conducted an analysis of wetland conversion across southern Ontario. The project was published as a working paper titled Wetland Distribution and Conversion in Southern Ontario (Snell, 1987) and as a series of 1:50,000 scale maps known as the Wetland Mapping Series. The project replaced a variety of fragmented and inconsistent studies and provided the Province with a consistent and defensible measure of wetland conversion trends in the Mixedwood Plains ecozone. It developed and applied a methodology for estimating the proportion of wetland conversion since European settlement, the converted land uses and mapping for the remaining wetlands as of 1982. It also provided a base for monitoring future wetland change.

The original project methodology was developed before the widespread use of Geographic Information Systems (GIS) and the availability of geospatial datasets, relying instead on hard copy maps and transparent mylar to record and transfer information. The approach overlaid maps of circa 1967 natural land cover on maps of poorly and very poorly drained soil. Areas of coincidence were considered wetland while areas of poorly and very poorly drained soil without natural cover were considered converted wetland. These features were traced onto the mylar and changes over time were assessed by laying the mylar on an updated 1982 land use map and sketching the changes. The resulting features were then measured using a planimeter and summarized by municipality. This methodology made use of provincial datasets and provided a consistent estimate of wetland status for pre-settlement, 1967 and 1982, thus enabling municipal and regional trends to be measured and compared across the Mixedwood Plains ecozone. It also recognized the inherent limitations of using provincial scale datasets when comparing wetlands which are naturally dynamic and commonly under-represented in mapping products. To overcome these challenges, it focused on the larger wetlands and removed features that were below ten hectares, considered the Minimum Mapping Unit (MMU) of the input data.

The alarming findings of the study became the Province's best measure of wetland status and have been used repeatedly to guide policy and conservation planning activities. These results remain in the literature as the reference for status and trends in wetland conversion (OMMA & OMNR, 1992, OMNR, 1989). This original Environment Canada study is over 20 years old and a new estimate of wetland conversion is required to assess current trends and status and to evaluate efforts made in wetland conservation over the last two decades. How has wetland abundance changed across the southern Ontario landscape since the original study? Are we gaining more wetlands through conservation and restoration efforts? Are we losing them faster than we are able to conserve them? What land use threats are having the most impact on wetland numbers? These are all questions that are critical for helping researchers evaluate previous wetland conservation work and to plan future programs and projects.

Fortunately, Geographic Information Systems (GIS) technology has evolved to make a new estimate less laborious than the first study. It is now much easier to superimpose maps and quantify wetland changes. Many of the hard copy maps from the 1960s and 1980s have also been digitized for use in a GIS

environment and an updated land cover dataset has been completed as part of the Southern Ontario Land Resource Information System (SOLRIS). SOLRIS a seamless GIS layer of land cover/land use, circa 2000-2002, covers the Lake Manitoulin-Lake Simcoe and St Lawrence lowlands ecoregions (6E) and the Lake Erie Lowland ecoregion (7E), which comprise the Mixedwood Plains ecozone in southern Ontario. The SOLRIS land cover product has mapped significantly more wetland features than any exhaustive large area mapping effort in southern Ontario and was the main catalyst for an update to the original study.

The purpose of this project was to translate the original project methodology into a GIS approach, enhancing the original study with improved technology and datasets whenever possible and to create a new estimate of wetland conversion since 1982 using the SOLRIS land cover dataset. Original estimates (i.e. wetland conversion between pre-settlement, 1967 and 1982) were recreated to ensure consistency when measuring trends from pre-settlement to 2002.

This report presents the methodology and the results of the project to recreate the original conversion estimates using GIS and to update the estimate of wetland conversion for southern Ontario. It also identifies the types of land cover/land use which wetlands have been converted to as well as the wetland types (e.g. swamp, marsh, bog or fen) which were excluded from the study due to project methodology. A validation of the updated wetland conversion estimates was also presented.

2.0 Study Area

The study area for this update analysis is similar to the original Environment Canada study, covering southern Ontario's Mixedwood Plains ecozone. The Mixedwood Plains ecozone contains a large portion of the country's population and is one of the most human dominated ecozones. For this reason it has experienced increased industrial, commercial, transportation, residential development and agricultural pressures. Wetlands as well as other natural areas often cannot compete economically with these other land uses and as a result there has been a significant decline in wetland areas within this ecozone through the industrial revolution to current day. Wetlands, however, provide a wide variety of ecosystem services that benefit people and the environment. These include flood control/attenuation, shoreline stabilization, water purification and groundwater recharge and discharge, recreation, education and tourism opportunities. Wetlands also help limit greenhouse gases in the atmosphere by acting as carbon sinks and stabilizing climate conditions. When wetlands are lost or destroyed the important ecosystem services they provide are also lost.

Since 1982, the Ontario Wetland Evaluation System (OWES) has been developed jointly by the federal and provincial government to rank the value of 'significant wetlands' and 'significant wetlands' are now referenced in the Provincial Policy Statement (2005) under the *Ontario Planning Act* (amended 2009). Other regional legislation, acts and regulations have been developed such as Greenbelt Plan (2005), Oak Ridges Moraine Conservation Plan (2002) and Conservation Authorities Act – Section 28 Regulations (amended 2006) which all include some level of protection for wetlands. Even though these and other

regional initiatives represent important progress in wetland conservation, wetlands continue to be lost in this ecozone.

Within the study area data were summarized for all years based on the pre-amalgamation township boundaries that were used in the original study. Figure 1 displays the coverage area for 1967, 1982 and 2002 datasets. For the purposes of reporting, counties and regional municipalities have been collectively referred to as counties. Likewise townships and municipalities have been referred to as townships. Haliburton and Renfrew, included in the original study, were not included in this update as there was insufficient coverage by one or more datasets. Muskoka also had insufficient 1982 and 2002 coverage however pre-settlement and 1967 summaries have been included for this county. East York and Toronto (unassessed areas in Metro Toronto) were not included in the original study and have not been included in this update and can assume that wetland loss is underestimated in these areas. This analysis also did not include coastline areas i.e. Long Point in the analysis as these features were not captured in the land use datasets. Summaries for 350 townships within 40 counties have been provided.
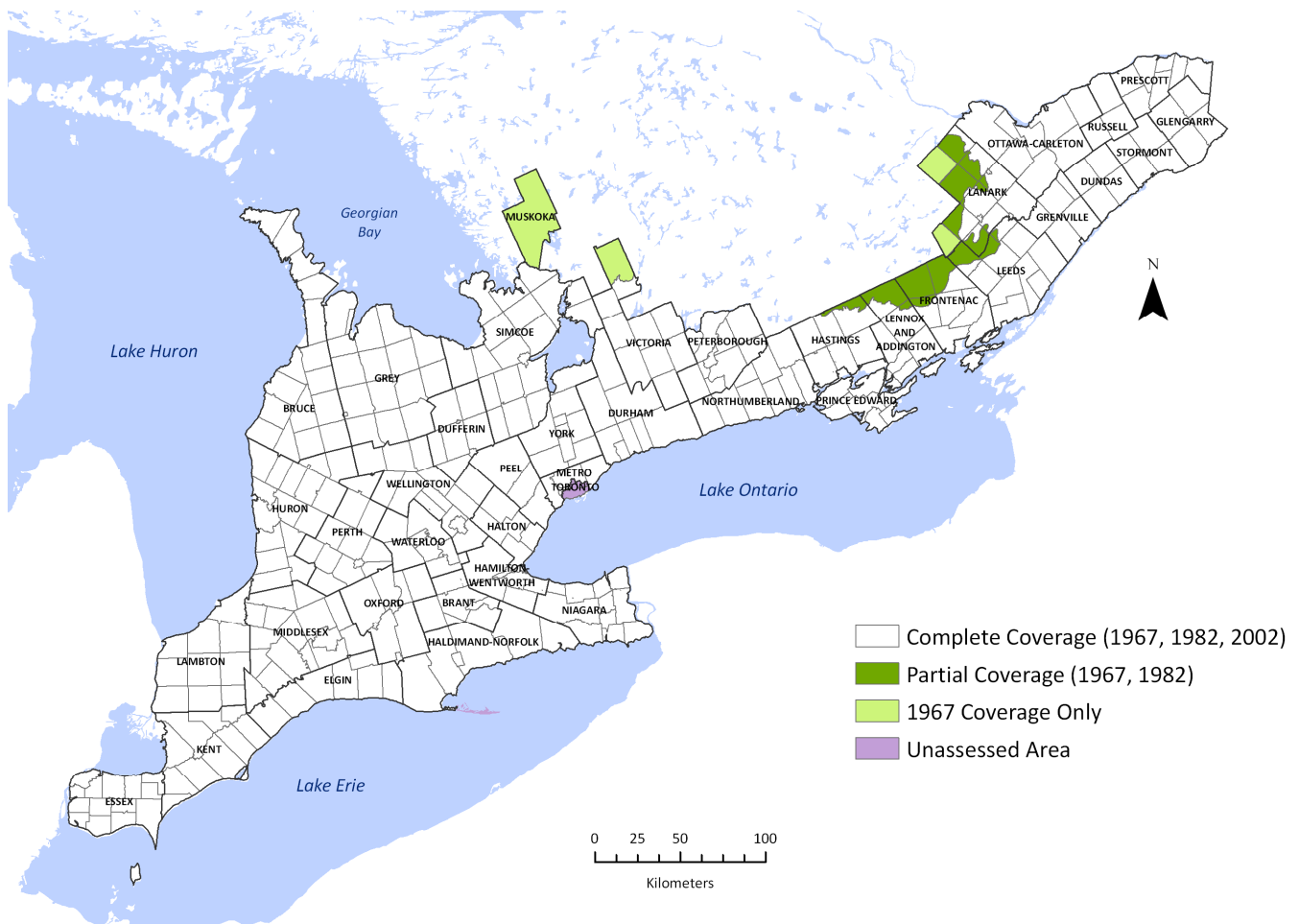
Figure 1: Southern Ontario study area

3.0 Methodology Development

The following wetland definition was used during both the original analysis and this update. Wetlands are 'land having the water table at, near or above the land surface or [land] which is saturated for a long enough period to promote wetland or aquatic processes as indicated by hydric soils, hydrophilic vegetation and various kinds of biological activity which are adapted to the wet environment' (Tarnocai, 1980). According to the original study, the methodology and selection of data were based on two principles derived from this definition:

1. that wetlands occur where near-permanent saturated soils support natural vegetation; and
2. that "converted wetlands" occur where soil was once saturated but no longer has a natural vegetation cover.

The principles underlying the original methodology and selection of datasets did not change during the update, however, it was noted that near-permanent soil saturation in the first principle is not necessarily required for wetlands to exist. In most cases, the translation of the methods into GIS routines followed the original study very closely.

Three distinct methodologies were created. The first dealt with recreating the historic wetland coverage, herein called "pre-settlement wetland", the second prepared and standardized the three land cover datasets to enable comparisons between years and the third compared, using an overlay analysis, pre-settlement wetland and land cover to determine wetland conversion. Each methodology is described along with background on the original approach where applicable. The GIS process flow chart and the specific GIS tools and parameters are provided in Appendix C and D respectively.

3.1 Creation of Pre-Settlement Wetland Extent

The original study used soil type and soil drainage to identify historic wetland areas. Whereas land cover can change quickly, soil is a better indicator of past conditions because its characteristics remain static for a longer period of time (Wilson, E. personal communications, January 9, 2008). When relying on soil surveys, organic soils, poorly and very poorly drained mineral soils indicate terrestrial areas (i.e. non coastal nor within inland water bodies) that are likely to have supported wetlands.

To determine soil characteristics, the original study relied on 1:50,000 Canada Land Inventory (CLI) Agricultural Capability maps that were derived from Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) County Soil Surveys. The soil surveys were published in a variety of scales and thus less adaptable to manual overlay on 1:50,000 land cover maps. National Topographic Series (NTS) 1:50,000 maps were used to add current wetlands associated with water bodies as well as current small wetlands beyond soil data resolution.

The updated analysis of wetland conversion also used soil characteristics to predict historic wetland areas. However, instead of relying on the CLI Agricultural Capability maps and NTS marshes, the OMAFRA County Soil Surveys were combined with areas dominated by organic accumulation from the

Ontario Ministry of Northern Development Mines (OMNDM) quaternary geology classes. The soil surveys were used because a number of the surveys have been updated since 1982 and all the surveys have recently had their attributes edited and standardized by OMAFRA. Using the surveys also avoided errors introduced during earlier hand-transposition from the soil maps to the CLI Agricultural Capability maps (Snell, E. personal communications, January 19, 2006). Combining soil surveys with the quaternary geology also enhanced the consistency of pre-settlement wetland coverage for regional comparisons because the soil surveys vary in scale from 1:20,000 to 1:63,360 while the quaternary geology is a 1:50,000 scale dataset across the province.

Attempts were made to include all bottomland features in the pre-settlement wetland because of their topographic position, proximity to a source of water and the precedent set by SOLRIS which relied on these characteristics to identify wetlands. However the soil surveys classification of bottomland drainage was variable and in some counties bottomland resolution was poor. In the soil survey of York County bottomland features are defined as 'areas subject to periodic flooding with vegetation consisting of willow, elm, cedar, bulrushes, sedges and marsh grasses' (Hoffman and Richards, 1955). It was discovered that the digital soil polygon boundaries were not always spatially correct due to the original soil survey resolution and to a number of difficulties when converting the legacy paper soil maps to digital versions. It was noted, that when the bottomland polygons were draped over a digital elevation model, it was not unusual to observe polygons shifted by as much as 200 m, resulting in polygons extending well onto valley hillsides. Attempts were made to correct this problem using rubber sheeting techniques but shifts were not always uniform and correcting a bottomland polygon often resulted in a misalignment of other polygons elsewhere on the map. Soil map re-digitization using the most up-to-date base maps was deemed too costly. As a result, segments of bottomlands were included in the pre-settlement wetland only when they transected or ran adjacent to wetland forming soils. An estimated 82% (140,433 hectares) of the total mapped bottomland features were excluded from the analysis. Selecting only these bottomland features kept with the conservative estimates of the original methodology.

A final step in the creation of pre-settlement wetland was to remove portions that were unlikely to be wetland due to their topographic position. Using OMNR's Provincial Digital Elevation Model (DEM) (1:10,000) and a net balance groundwater flow surface derived from MRI- DARCY (Baker et al., 2001), areas of negative net groundwater balance were identified and removed from the pre-settlement wetland as probable upland inclusions. This approach was tested in OMNR's Southern Ontario Land Resource Information System (SOLRIS) project and has proven useful where topographic relief is adequate. SOLRIS found that relief was not suitable in south western Ontario as the subtle topographic undulations that define wetland features were not captured by the 5 metre contour data used as input into the Provincial DEM. These steps, concluding with the removal of upland inclusions with the net groundwater balance model produced the historic or pre-settlement wetland extent.

3.2 Preparation and Standardization of Land Cover Datasets

3.2.1 Data Preparation for 1967 and 1982 Datasets

Incomplete digital land cover datasets were identified as one of the key data issues which needed to be addressed in the beginning phases of this project specifically the digitization of the circa 1967 Canada Land Inventory (CLI) Present Land Use maps and the digitization of Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) circa 1982 Land Systems maps.

The digitization of the circa 1967 CLI Present Land Use, was the driving force behind the data preparation phase. It was initiated in order to locate and digitize the remaining 1:50,000 map sheets for Southern Ontario before proceeding with the implementation. Large portions of the circa 1967 CLI Present Land Use dataset had not been digitized and consequently, were not usable in the GIS methodology. There were sixty-two Present Land Use maps to be scanned, georeferenced and digitized. Seven maps corresponding to the Niagara Escarpment Commission (NEC) were digitized first as a trial in order to further refine the digitizing specifications. The remaining fifty-five maps were then digitized using the refined specifications. Once the remaining sixty-two map sheets had been georeferenced, digitized, and quality assured (QA), they were integrated (i.e. edge matched) with previously digital existing maps downloaded from GeoGratis[1]. During the QA process it was noted, on the digitally available maps downloaded from GeoGratis, that all water features were missing and that large polygons were incorrectly delineated and had invalid codes. These water features were added into those sheets and the large polygons were corrected, to ensure consistency across all map sheets. Quickbird[2], SWOOP[3] and GTA2002[4] orthoimagery were used to feature match all features along the 1:50,000 National Topographic System (NTS) boundaries. During the feature matching process a feature shift issue was identified. Upon completion of feature matching, an overall assessment of the final digital dataset was conducted. Random feature shifts greater than 60m were identified, with the majority of these located on the GeoGratis map sheets. Shifts were found to occur in portions of the map sheet or across the entire map sheet and could be either large interlocking features, small islands of features or single features. Shifts greater than 80m were manually adjusted using Quickbird, SWOOP and GTA2002 orthoimagery.

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[1] Natural Resources Canada, *GeoGratis*, http://geogratis.cgdi.gc.ca/geogratis/en/index.html (March 2009)

[2] Ministry of Natural Resources, Land Information Ontario, *Quickbird Project*, http://www.mnr.gov.on.ca/en/Business/LIO/2ColumnSubPage/STEL02_168243.html (December 2009)

[3] Ministry of Natural Resources, Land Information Ontario, *South western Ontario Orthophotography Project (SWOOP),* http://www.mnr.gov.on.ca/en/Business/LIO/2ColumnSubPage/STEL02_168247.html (November 2009)

[4] Ministry of Natural Resources, Land Information Ontario, *Greater Toronto Area Orthophotography Projects*, http://www.mnr.gov.on.ca/en/Business/LIO/2ColumnSubPage/STEL02_168240.html (November 2009)

The OMAFRA circa 1982 Land Systems maps were also digitized, however the effort was much less laborious. Maps were digitized on a lower tier municipality basis and then edge matching was completed using the OMNR lot and Ministry of Municipal Affairs and Housing (MAH) municipal boundary layers. The upper tier and lower tier municipality borders along with Quickbird, SWOOP and GTA orthoimagery were used to feature match all features that represented "woodland", "water", and "swamp, marsh or bog". During the preparation phase some road features were identified in eastern Ontario and either dissolved into adjacent classes or removed from the dataset.

The overall steps involved in the data preparation, for the 1967 and 1982 datasets are provided in Appendix D, section D-2 (Part 1). The digitizing specifications for the 1967 dataset can be found in the document titled Southern Ontario Wetland Conversion Analysis: Interim DRAFT Final Report (DUC, 2009).

3.2.2 Standardization of 1967, 1982 and 2002 Datasets

The inclusion of the 1:10,000 scale SOLRIS presented a challenge because it was created at a scale that captured many small features that were missed by the other two 1:50,000 scale land cover datasets, making direct comparisons misleading. When validating results with aerial photography, it was noted that this was particularly true when comparing the 1982 Land Systems land cover to SOLRIS due to the Land System's focus on agricultural land use and the use of ownership parcels to delineate features on the ground.

Two steps were taken to rectify this. First, land use categories in all three datasets were standardized by collapsing related classes together. Forest classes were collapsed into a single wooded class in both the 1967 CLI Present Land Use and the 1982 Land Systems datasets. In the CLI, the productive woodland and non-productive woodland classes were merged together. Woodland and pastured woodland classes were merged in the Land Systems dataset. In SOLRIS, forest classes were merged into a wooded class, wetland classes were merged into a wetland class and open tallgrass prairie and tallgrass savannah into a tallgrass class. The transportation class was removed in SOLRIS, because transportation classes were not present in the other sources of land cover mapping, by dissolving features into the adjacent classes.

Secondly, all natural features below 10 hectares were removed from all three datasets by placing them into a converted category prior to the overlay analysis. This was to be consistent with the spatial accuracy constraints of the data and original methodology, recognizing the estimates would be conservative and expecting that wetland extents would be underestimated, but necessary for the spatial standardization of all datasets.

3.3 Overlay Analysis

The original study assessed conversion for two points in time using the CLI Present Land Use and OMAFRA Land Systems maps from circa 1967 and circa 1982, respectively. To reflect the two principles derived from the wetland definition (Section 3.0) each land cover dataset was reclassified into either natural or converted cover and overlaid on maps of pre-settlement wetland. Where natural cover

coincided with the pre-settlement wetland, the area was considered an existing wetland; where land cover was converted, the wetland was considered lost. Areas of recent gain were also noted where regeneration on pre-settlement wetland had occurred in the interval between the two maps (1967 and 1982). Since map overlays can create erroneous sliver polygons (where the precision and/or accuracy of mapped boundaries cause spatial misalignments), rules were developed to remove these instances from the analysis. Remnant wetlands (i.e. small wetlands resulting from the overlay of soils and land cover) that were along the margin of a historic wetland block and less than 10 hectares in size, or within the historic wetland block and less than 5 hectares in size, were dropped from the analysis (Snell, E. personal communications. 5 Oct 2007). These rules reflected the fact that the Minimum Mapping Unit (MMU) of soils maps was about 10 hectares and "that a derived overlay [could] be no more accurate" (Snell, 1987). Furthermore, the 1982 Land Systems maps were repeatedly shifted during the overlay with other maps in order to align concession roads due to distortion in the paper maps (Snell, 1987).

In this update, standardized classes of the 1967 CLI Present Land Use, 1982 Land Systems and 2002 SOLRIS maps were reclassified into three categories: natural cover, converted cover or no data (unmapped, water features) based on the category definitions of the original study. The reclassified maps were then intersected with the pre-settlement wetland. Features from the overlay that were below 10 hectares were flagged as slivers and placed into a converted category. The data were then summarized by municipality resulting in four categories for each municipality: converted wetland, existing wetland, wetland below MMU (slivers) and no data (areas where either the pre-settlement wetland or land cover data were classified as No Data).

4.0 Wetland Distribution and Conversion since Pre-Settlement

The following sections present the final results of the analysis summarized by both county and township in the Mixedwood Plains. Similar to the original study discussion of the results has been focused mainly at the county scale however township scale is discussed and results are presented in figures by township where applicable. County groupings by regional area and township summaries are provided in Appendix A and B respectively.

4.1 Distribution of Wetlands

It was estimated that there were approximately 2,026,591 hectares of wetland before European settlement within the southern Ontario study area which is equivalent to 25% of the total area (Table 1, Figure 2a). During that time period the highest concentration of wetlands (of that 25%) occurred in counties of south western and eastern Ontario with 50 – 85% of their total area covered by wetland. Essex had the greatest wetland coverage in south western Ontario at 83%, followed by Kent and Lambton with wetland coverage of 56% and 50% respectively. In eastern Ontario, Prescott had the greatest wetland coverage (51%). Smaller concentrations of wetlands (20 – 40%) existed in the counties surrounding Lake Erie, along the shore of Lake Huron, the Kawartha Lakes (Victoria County) and several

of the eastern Ontario counties. Wetland areas within central Ontario and the counties surrounding Lake Ontario (Golden Horseshoe) were found in lower concentrations covering only 5 – 20% of the total area. These lower estimates in the Golden Horseshoe may be attributed to the fact that the estimates do not include the original Humber or Don River mouth wetlands, or the coastal wetlands (e.g. East York was not assessed).

The extent of wetlands on the southern Ontario landscape declined drastically by 1967 and continued to decline with only 560,844 hectares of pre-settlement wetlands remaining by 2002, representing 7% of the total 25% pre-settlement wetland area (Table 1, Figure2b). In south western Ontario, counties have less than 5% of their total area remaining as wetland, almost a complete reversal of the pre-settlement coverage (Figure 2a). This lower coverage of wetlands could also be seen in the eastern Ontario counties of Frontenac and Russell as well as the four Golden Horseshoe counties, Toronto, Peel, Halton and Hamilton-Wentworth. The majority of the other counties in the study area only have 5 – 20% wetlands remaining by 2002 and it is only in Grenville where more than 20% of the wetland coverage remains.

The original and 2002 wetland distributions by township are displayed in Figures 3 and 4 respectively.

Table 1: County wetland area statistics for c. 1800, 1967, 1982 and 2002

County	Pre-Settlement (c. 1800) Wetland Area		1967 Wetland Area		1982 Wetland Area		2002 Wetland Area	
	Ha	% of County	Ha	% of County	Ha	% of County	Ha	% of County
Brant	9,455	8.2%	1,514	1.3%	650	0.6%	1,159	1.0%
Bruce	84,251	20.9%	31,419	7.8%	30,949	7.7%	29,929	7.4%
Dufferin	30,939	20.5%	13,459	8.9%	11,531	7.7%	12,136	8.1%
Dundas	53,433	51.4%	14,950	14.4%	16,916	16.3%	13,843	13.3%
Durham	32,796	12.6%	21,364	8.2%	22,078	8.5%	20,276	7.8%
Elgin	17,553	9.2%	4,138	2.2%	3,967	2.1%	2,673	1.4%
Essex	155,779	83.4%	4,345	2.3%	2,384	1.3%	3,068	1.6%
Frontenac*	29,910	14.6%	12,695	6.2%	14,236	6.9%	9,078	4.4%
Glengarry	55,379	44.0%	14,802	11.8%	16,490	13.1%	12,011	9.5%
Grenville	46,552	38.6%	25,312	21.0%	30,074	24.9%	27,703	23.0%
Grey	85,812	18.9%	55,102	12.2%	53,395	11.8%	50,729	11.2%
Haldimand-Norfolk	87,232	30.0%	19,629	6.8%	17,838	6.1%	15,572	5.4%
Halton	12,392	12.6%	4,382	4.5%	4,556	4.6%	3,807	3.9%
Hamilton-Wentworth	15,023	13.0%	5,394	4.7%	4,995	4.3%	5,621	4.9%
Hastings*	33,117	18.9%	15,719	9.0%	17,908	10.2%	15,502	8.9%
Huron	69,346	20.3%	18,836	5.5%	17,140	5.0%	16,358	4.8%
Kent	140,818	56.4%	5,451	2.2%	3,007	1.2%	2,123	0.8%
Lambton	144,237	50.1%	17,927	6.2%	12,918	4.5%	5,092	1.8%
Lanark*	82,436	31.2%	49,947	18.9%	47,867	18.1%	31,682	12.0%
Leeds*	56,278	23.8%	24,335	10.3%	24,868	10.5%	23,017	9.7%
Lennox and Addington*	38,365	24.3%	12,031	7.6%	14,145	9.0%	11,033	7.0%
Metro Toronto	1,379	2.7%	115	0.2%	0	0.0%	45	0.1%
Middlesex	41,115	12.2%	8,992	2.7%	6,922	2.1%	4,512	1.3%
Muskoka*	10,092	10.0%	1,202	1.2%	N/A	N/A	N/A	N/A
Niagara	68,929	36.7%	11,169	5.9%	15,679	8.3%	10,269	5.5%
Northumberland	28,471	12.9%	15,299	7.0%	16,579	7.5%	16,215	7.4%
Ottawa-Carleton	131,679	47.2%	37,051	13.3%	38,730	13.9%	37,113	13.3%
Oxford	17,615	8.5%	6,519	3.1%	6,349	3.1%	5,920	2.9%
Peel	9,528	7.6%	2,550	2.0%	2,524	2.0%	2,053	1.6%
Perth	33,617	15.2%	6,074	2.7%	5,620	2.5%	3,837	1.7%
Peterborough	40,109	22.2%	24,906	13.8%	25,042	13.9%	24,889	13.8%
Prescott	63,221	50.8%	10,265	8.2%	10,991	8.8%	8,836	7.1%
Prince Edward	18,468	17.1%	10,300	9.5%	11,315	10.5%	12,426	11.5%
Russell	22,175	28.8%	2,308	3.0%	2,443	3.2%	2,093	2.7%
Simcoe*	79,167	16.5%	42,116	8.8%	40,286	8.4%	39,075	8.2%
Stormont	41,685	40.8%	16,433	16.1%	19,246	18.8%	15,368	15.0%
Victoria	54,475	20.1%	31,838	11.8%	29,150	10.8%	30,714	11.3%
Waterloo	19,363	13.9%	4,661	3.4%	4,772	3.4%	4,959	3.6%
Wellington	37,071	13.8%	20,107	7.5%	15,559	5.8%	18,804	7.0%
York	27,330	15.4%	12,362	7.0%	12,583	7.1%	11,305	6.4%
Full Study Area	2,026,591	24.8%	637,020	7.8%	631,699	7.7%	560,844	6.8%

*Study area includes only part of the county, for extent see Figure 1

a) Pre-Settlement (c. 1800)

b) In 2002

Percentage

0 - 5	40.1 - 60
5.1 - 20	> 60
20.1 - 40	Unassessed Area
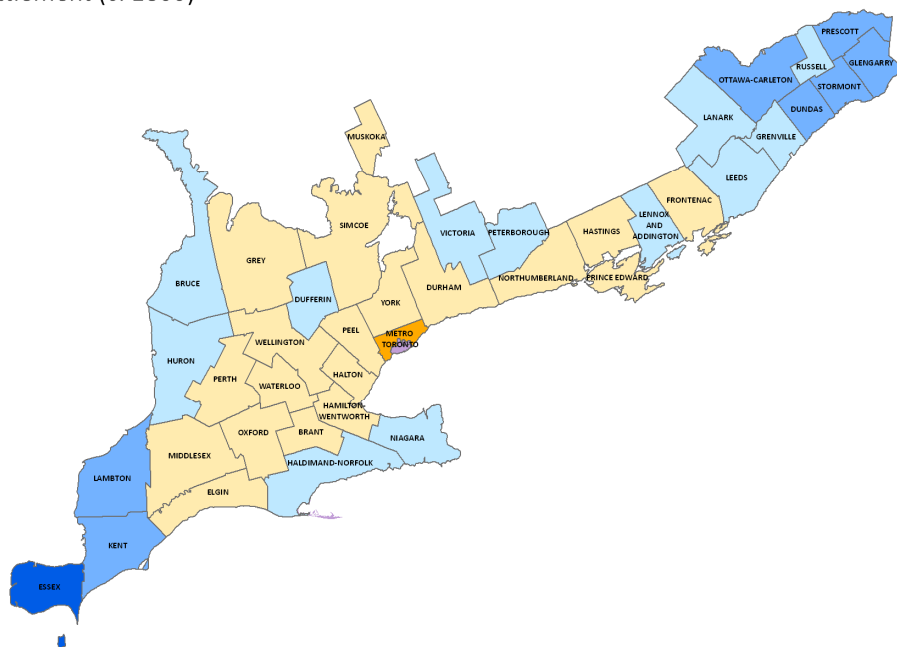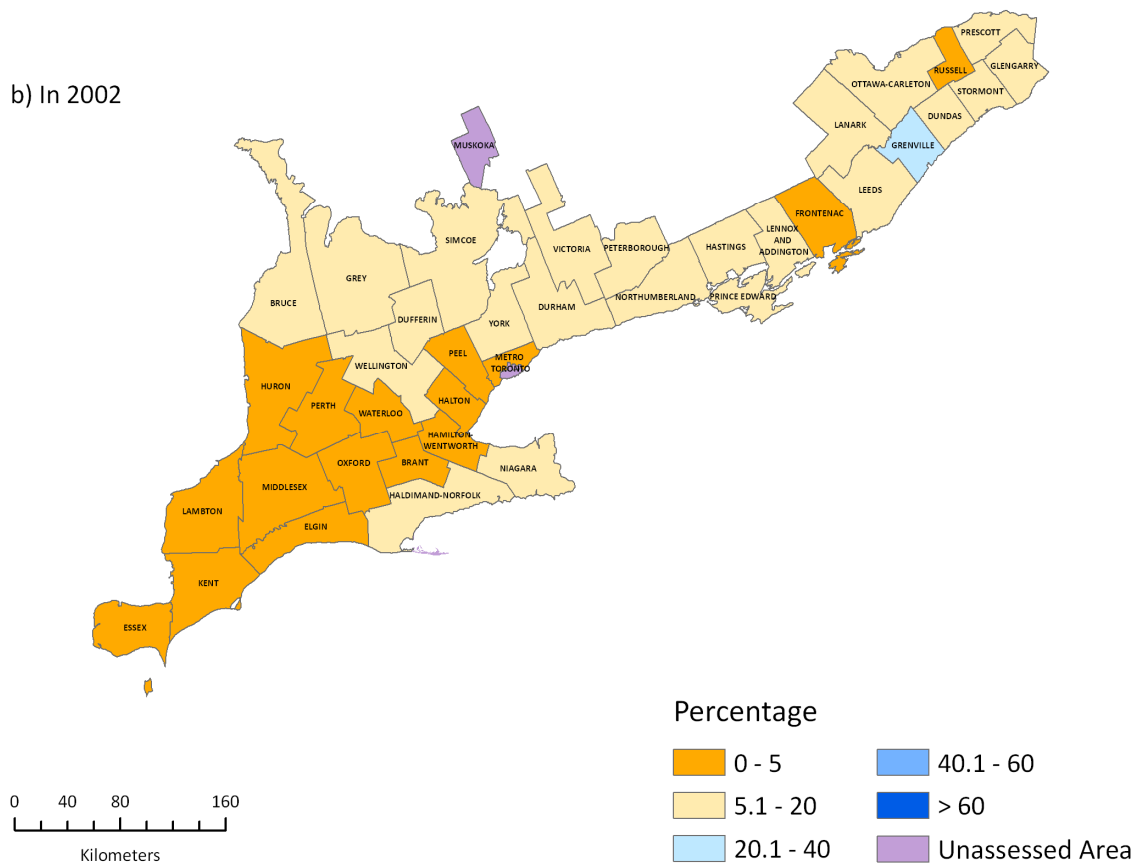
Figure 2: Percentage of county as wetland
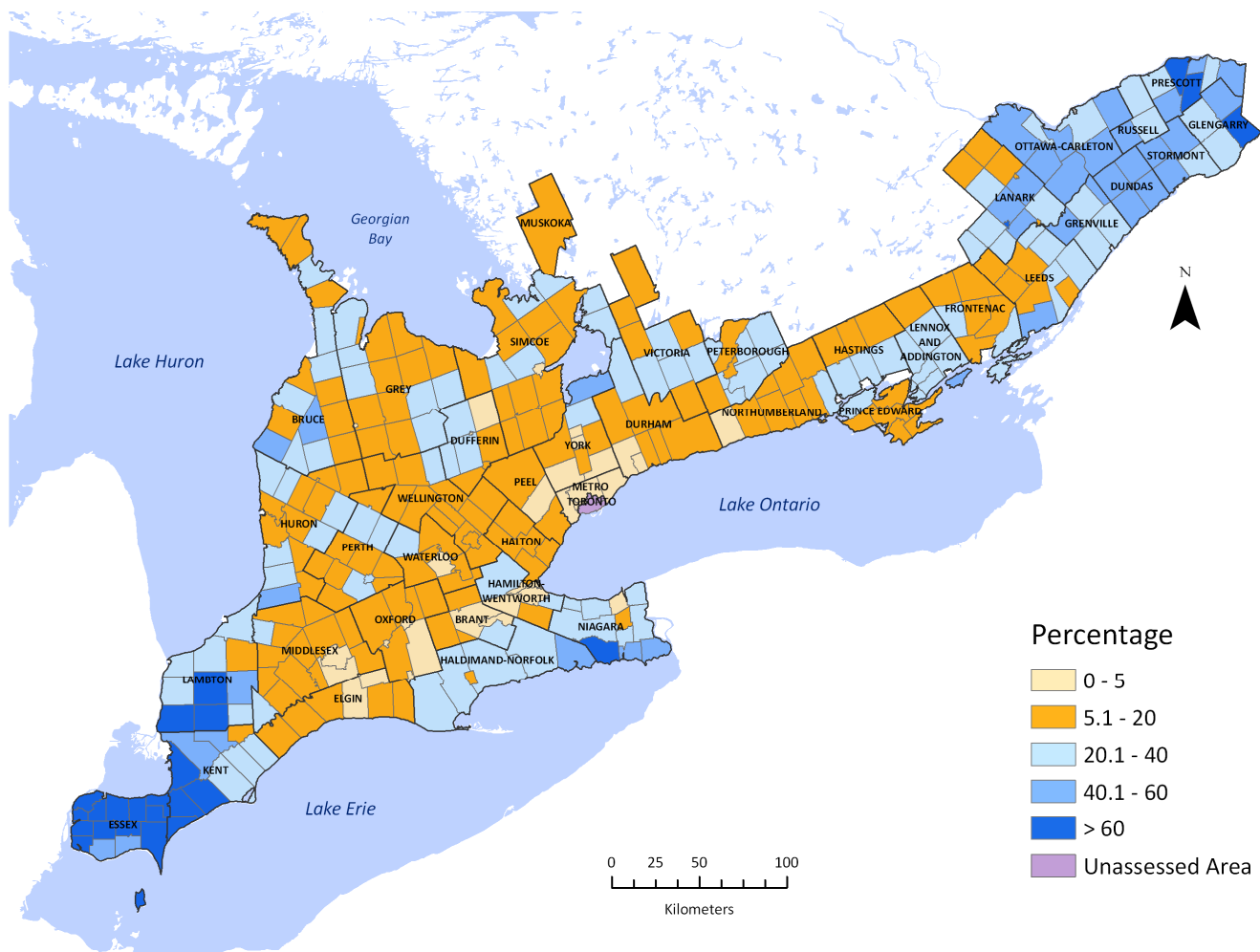
Figure 3: Percentage of township as wetland pre-settlement (c.1800)

Legend — Percentage:
- 0 - 5
- 5.1 - 20
- 20.1 - 40
- 40.1 - 60
- > 60
- Unassessed Area
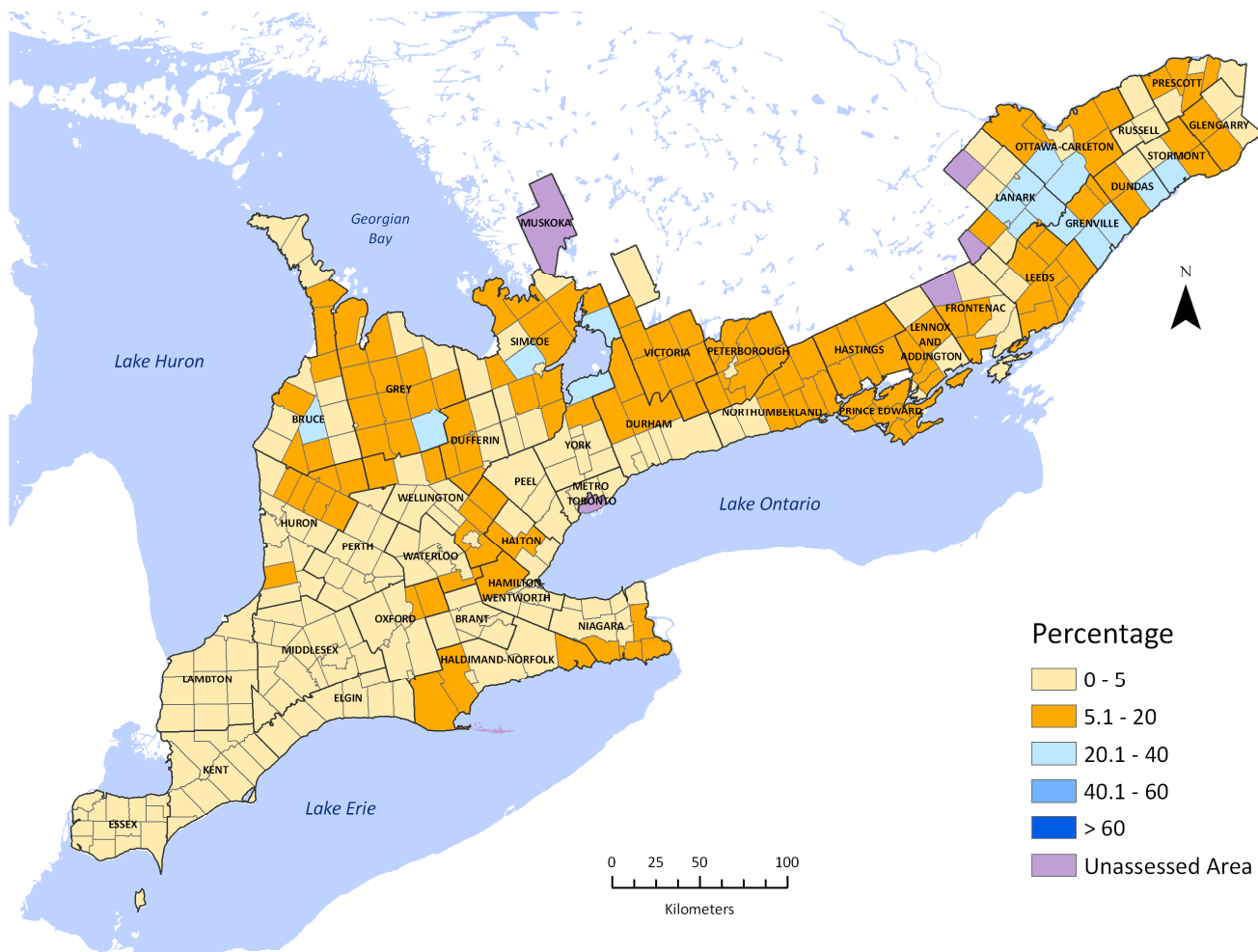
Figure 4: Percentage of township as wetland in 2002

4.2 Wetland Conversion Pre-Settlement (c.1800) to 2002

Prior to 2002, the wetland area in southern Ontario was estimated to have been reduced by approximately 1,465,747 hectares or 72% of the total pre-settlement wetland area (Table 2). The largest losses of wetlands have occurred in the counties that had the greatest concentrations of wetlands pre-settlement (south western Ontario and parts of eastern Ontario). The counties of Essex, Kent and Lambton underwent wetland losses greater than 90% followed closely by the counties of Russell and Prescott, with losses of 89% and 84% respectively. Metro Toronto (specifically Etobicoke, North York, Scarborough and York), Middlesex and Perth all underwent sizeable losses as well. The sizable loss noted in Metro Toronto was associated with Etobicoke, North York, Scarborough and York, as these were the only townships assessed in this county. Counties that had fewer than 50,000 hectares of wetlands in the pre-settlement coverage experienced less loss (< 35%), with the smallest losses occurring in Durham, Peterborough, Northumberland, Prince Edward and Grenville. Grey County also experienced a moderate loss. Greater than 60% of wetlands have been lost in the counties west and north west of Waterloo; east and south east of Ottawa- Carlton; and in Frontenac and Lennox and Addington. All other counties show losses of 20-40%.

The 1967 and 1982 conversion estimates have similar trends to the 2002 estimates. In some counties however there is less conversion from pre-settlement to 2002 then there was from pre-settlement to 1982. For example, Hamilton-Wentworth experienced a loss of 10,028 hectares by 1982, and by 2002 there was only a loss of 9,402 hectares. Multiple factors could be playing a role. Since 1982 there has been an increase in wetland protection through wetland evaluations and legislation to protect 'significant wetlands', this protection along with more conservation programs aimed at protecting and restoring wetlands could be helping to replace wetlands on the landscape. Alternatively, these increases may be a side effect of the data; simply more wetland area was mapped by the 2002 SOLRIS dataset than the 1982 Land Systems dataset, which appears to be the case in the townships of Flamborough, Dundas and Glenbrook. The scale and the methods of the 2002 SOLRIS dataset definitely make it better at mapping wetland areas. In townships such as Onondaga and Tuscorora, which contain First nation reservation lands, wetland areas were not mapped by the 1982 dataset. A limitation in the 1982 dataset was that it did not map certain county areas, such as First Nation reservations. Wetland features were also not mapped by the 1982 dataset in a few city centers such as Brantford and downtown Toronto.

Wetland conversion by county and township are displayed in Figures 5 and 6 respectively.

Table 2: Wetland conversion statistics by county for 1967, 1982 and 2002

County	Amount of Pre-Settlement Wetland					
	Lost by 1967		Lost by 1982		Lost by 2002	
	Ha	%	Ha	%	Ha	%
Brant	7,941	84.0%	8,805	93.1%	8,296	87.7%
Bruce	52,832	62.7%	53,302	63.3%	54,322	64.5%
Dufferin	17,480	56.5%	19,408	62.7%	18,802	60.8%
Dundas	38,483	72.0%	36,517	68.3%	39,590	74.1%
Durham	11,433	34.9%	10,718	32.7%	12,520	38.2%
Elgin	13,414	76.4%	13,586	77.4%	14,880	84.8%
Essex	151,434	97.2%	153,395	98.5%	152,711	98.0%
Frontenac*	17,215	57.6%	15,674	52.4%	20,832	69.7%
Glengarry	40,577	73.3%	38,889	70.2%	43,368	78.3%
Grenville	21,240	45.6%	16,478	35.4%	18,849	40.5%
Grey	30,710	35.8%	32,417	37.8%	35,083	40.9%
Haldimand-Norfolk	67,603	77.5%	69,394	79.6%	71,661	82.1%
Halton	8,010	64.6%	7,837	63.2%	8,586	69.3%
Hamilton-Wentworth	9,628	64.1%	10,028	66.8%	9,402	62.6%
Hastings*	17,397	52.5%	15,209	45.9%	17,615	53.2%
Huron	50,509	72.8%	52,206	75.3%	52,987	76.4%
Kent	135,367	96.1%	137,811	97.9%	138,695	98.5%
Lambton	126,310	87.6%	131,318	91.0%	139,145	96.5%
Lanark*	32,489	39.4%	34,570	41.9%	50,754	61.6%
Leeds*	31,943	56.8%	31,409	55.8%	33,261	59.1%
Lennox and Addington*	26,334	68.6%	24,220	63.1%	27,333	71.2%
Metro Toronto	1,264	91.7%	1,379	100.0%	1,334	96.7%
Middlesex	32,123	78.1%	34,193	83.2%	36,603	89.0%
Muskoka*	8,890	88.1%	N/A	N/A	N/A	N/A
Niagara	57,760	83.8%	53,249	77.3%	58,659	85.1%
Northumberland	13,172	46.3%	11,892	41.8%	12,256	43.0%
Ottawa-Carleton	94,629	71.9%	92,950	70.6%	94,566	71.8%
Oxford	11,095	63.0%	11,266	64.0%	11,695	66.4%
Peel	6,978	73.2%	7,004	73.5%	7,475	78.4%
Perth	27,543	81.9%	27,997	83.3%	29,780	88.6%
Peterborough	15,203	37.9%	15,067	37.6%	15,220	37.9%
Prescott	52,956	83.8%	52,230	82.6%	54,385	86.0%
Prince Edward	8,168	44.2%	7,153	38.7%	6,042	32.7%
Russell	19,866	89.6%	19,732	89.0%	20,081	90.6%
Simcoe*	37,050	46.8%	38,881	49.1%	40,091	50.6%
Stormont	25,252	60.6%	22,439	53.8%	26,317	63.1%
Victoria	22,637	41.6%	25,325	46.5%	23,761	43.6%
Waterloo	14,702	75.9%	14,591	75.4%	14,405	74.4%
Wellington	16,964	45.8%	21,512	58.0%	18,267	49.3%
York	14,968	54.8%	14,748	54.0%	16,026	58.6%
Full Study Area	1,389,571	68.6%	1,394,893	68.8%	1,465,747	72.3%

*Study area includes only part of the county, for extent see Figure 1
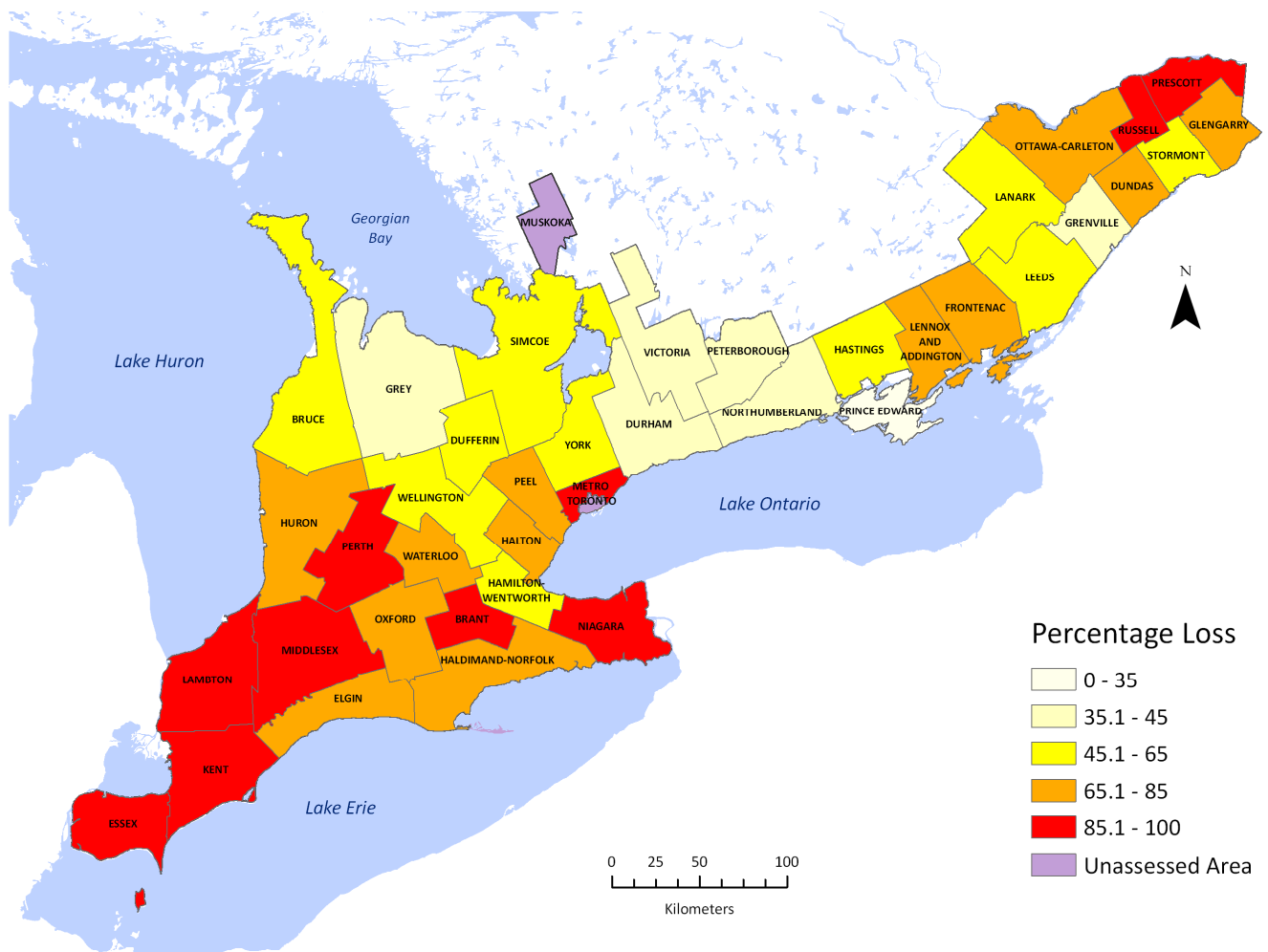
Figure 5: Conversion of original wetland area by County, c. 1800 – 2002
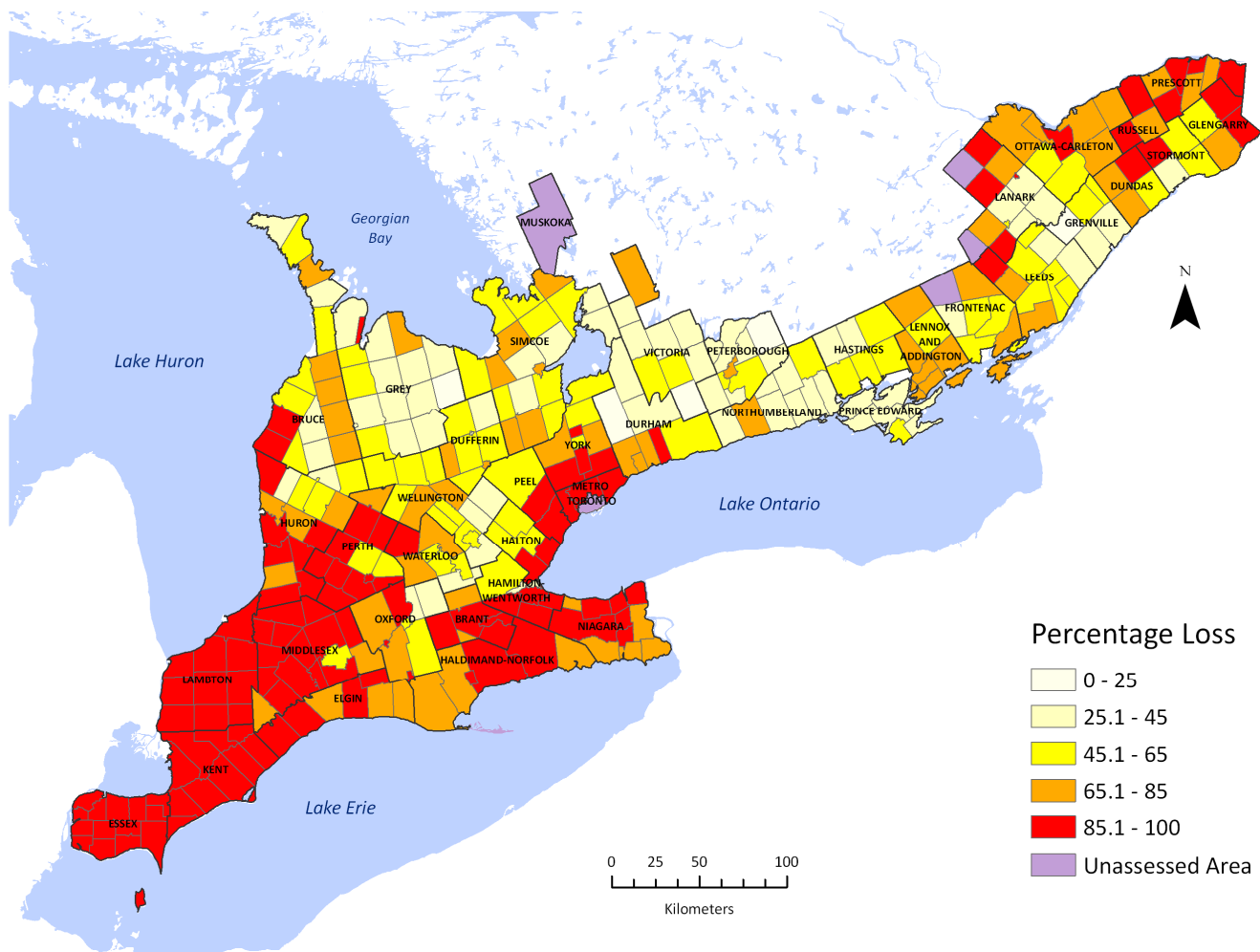
Figure 6: Conversion of pre-settlement wetland area by township, c. 1800 – 2002

4.3 Land Cover of Converted Wetlands

In the original study the classification for converted wetland uses included: intensive agriculture, low intensity agriculture (hay, pasture and grazing), idle land (abandoned less than 10 years), reforestation, built-up uses, extractive uses and recreation. Unlike the original study, intensive agriculture, low intensity agriculture and idle land classes could not be identified separately, rather they are included in an undifferentiated class. The undifferentiated class, in SOLRIS, represents the remaining areas that were restricted to the other SOLRIS classes, including all agricultural lands, urban brown fields, hydro right-of ways, the edge of transportation corridors and clearings within forests (OMNR, 2008a). Using the Southern Ontario Interim Land Cover (SIL) to reclassify the SOLRIS undifferentiated class it was determined that approximately 90% of the class was associated with agricultural uses outside of the Golden Horseshoe, with the exception of Niagara as it was included in the SIL coverage area. Additional work would need to be conducted to delineate features within the undifferentiated class in order to assess these uses separately. All other classes are similar to the original classification, with the exception of the recreation class as it was not a classification in the 2002 SOLRIS dataset. Summaries have only been provided by county for this section.

4.3.1 Land cover of wetland converted since pre-settlement

A total of 1,147,172 hectares of wetland, larger than 10 hectares, were converted to alternative uses between pre-settlement and 2002. Table 3 summarizes the area and percent total change for each of the converted land uses within the study area.

The primary land use associated with converted wetlands between pre-settlement and 2002 was the undifferentiated class. This class accounted for 94.3% (1,081,495 hectares) of the converted wetland area and was the primary class in all counties except Metro Toronto and Peel. These Golden Horseshoe counties had less than 45% of their converted wetlands associated with the undifferentiated class. Halton, Hamilton-Wentworth and York, also Golden Horseshoe counties, had 68-78% of converted wetlands associated with the undifferentiated class. In all other counties more than 85% of converted wetlands were mapped as undifferentiated lands by 2002.

Built-up areas accounted for a total of 4.2% (48,875 hectares) of the converted wetlands, 1.1% (12,962 hectares) to built–up pervious uses and 3.1% (35,913 hectares) to built-up impervious uses. Essex and Ottawa-Carleton had the greatest area associated with both built-up pervious and built-up impervious cover. With respect to total converted area for the county, Metro Toronto and Peel had more than 50% converted wetlands associated with built-up impervious cover. Many of these built-up areas are associated with residential and commercial development, both high and low density.

Tree cultivated plantations and hedge rows accounted for 1.3% of the converted wetland area. The most significant of these conversions was noted in Ottawa-Carleton for tree cultivated plantations and Essex for hedge rows.

The remaining 0.1% (1,507 hectares) of wetland converted were mapped as extractive, a very small amount of the total converted wetland area. There were some counties however where extraction represented a more significant impact such as Essex, Haldimand-Norfolk and Ottawa-Carleton.

Table 3: Land cover of converted pre-settlement wetlands by 2002

County	Plantations - Tree Cultivated		Hedge Rows		Extraction		Built-up Areas Pervious		Built-up Areas Impervious		Undifferentiated	
	Ha	%	Ha	%	Ha	%	Ha	%	Ha	%	Ha	%
Brant	22	0.4%	33	0.6%	1	0.0%	37	0.7%	26	0.5%	5,130	97.7%
Bruce	116	0.3%	48	0.1%	45	0.1%	270	0.6%	191	0.5%	41,278	98.4%
Dufferin	227	1.5%	39	0.3%	14	0.1%	21	0.1%	152	1.0%	14,471	97.0%
Dundas	120	0.3%	334	0.9%	34	0.1%	114	0.3%	154	0.4%	34,569	97.9%
Durham	23	0.4%	46	0.9%	31	0.6%	99	1.8%	632	11.8%	4,527	84.5%
Elgin	49	0.4%	79	0.6%	1	0.0%	33	0.3%	89	0.7%	11,876	97.9%
Essex	198	0.1%	1,611	1.1%	294	0.2%	3,957	2.7%	12,377	8.4%	128,710	87.5%
Frontenac*	17	0.2%	69	0.9%	1	0.0%	174	2.2%	241	3.0%	7,509	93.7%
Glengarry	623	1.7%	381	1.0%	16	0.0%	110	0.3%	335	0.9%	35,522	96.0%
Grenville	159	1.2%	279	2.2%	12	0.1%	43	0.3%	175	1.4%	12,132	94.8%
Grey	263	1.5%	116	0.6%	8	0.0%	103	0.6%	253	1.4%	17,081	95.8%
Haldimand-Norfolk	361	0.6%	571	1.0%	219	0.4%	905	1.6%	653	1.2%	53,034	95.1%
Halton	47	0.9%	53	1.1%	45	0.9%	228	4.6%	1,192	24.2%	3,365	68.3%
Hamilton-Wentworth	65	1.1%	46	0.8%	54	0.9%	258	4.5%	853	14.8%	4,501	77.9%
Hastings*	41	0.4%	356	3.7%	1	0.0%	355	3.7%	80	0.8%	8,667	91.2%
Huron	457	1.1%	183	0.4%	12	0.0%	178	0.4%	427	1.0%	41,939	97.1%
Kent	43	0.0%	795	0.6%	10	0.0%	184	0.1%	864	0.6%	133,548	98.6%
Lambton	73	0.1%	374	0.3%	75	0.1%	787	0.6%	2,340	1.8%	124,621	97.2%
Lanark*	116	0.9%	261	2.1%	5	0.0%	108	0.9%	320	2.5%	11,737	93.5%
Leeds*	58	0.3%	193	0.9%	16	0.1%	187	0.9%	352	1.7%	19,680	96.1%
Lennox and Addington*	0	0.0%	55	0.3%	9	0.0%	149	0.8%	291	1.5%	18,517	97.3%
Metro Toronto	0	0.0%	4	0.3%	20	1.7%	62	5.2%	790	66.9%	306	25.9%
Middlesex	109	0.4%	165	0.6%	23	0.1%	146	0.5%	155	0.5%	28,908	98.0%
Niagara	334	0.7%	371	0.8%	44	0.1%	738	1.6%	1,005	2.2%	42,947	94.5%
Northumberland	28	0.7%	21	0.5%	17	0.4%	64	1.6%	273	6.8%	3,623	90.0%
Ottawa-Carleton	1,331	1.6%	851	1.0%	169	0.2%	1,878	2.3%	3,236	3.9%	74,794	90.9%
Oxford	93	1.1%	53	0.6%	0	0.0%	40	0.5%	18	0.2%	7,917	97.5%
Peel	31	0.6%	15	0.3%	4	0.1%	190	3.7%	2,790	54.7%	2,074	40.6%
Perth	42	0.2%	30	0.1%	9	0.0%	108	0.4%	293	1.2%	24,833	98.1%
Peterborough	22	0.3%	28	0.4%	15	0.2%	77	1.1%	230	3.4%	6,339	94.5%
Prescott	419	0.8%	265	0.5%	15	0.0%	118	0.2%	467	0.9%	48,874	97.4%
Prince Edward	0	0.0%	81	2.2%	0	0.0%	17	0.5%	1	0.0%	3,607	97.3%
Russell	198	1.1%	141	0.8%	100	0.5%	54	0.3%	427	2.3%	17,821	95.1%
Simcoe*	484	1.7%	105	0.4%	39	0.1%	335	1.2%	1,031	3.7%	25,795	92.8%
Stormont	333	1.5%	172	0.8%	39	0.2%	58	0.3%	269	1.2%	20,809	96.0%
Victoria	10	0.1%	43	0.4%	64	0.5%	100	0.8%	220	1.9%	11,408	96.3%
Waterloo	61	0.5%	46	0.4%	17	0.1%	147	1.3%	257	2.3%	10,778	95.3%
Wellington	170	1.7%	43	0.4%	12	0.1%	102	1.0%	241	2.4%	9,389	94.3%
York	99	0.8%	103	0.9%	18	0.2%	428	3.7%	2,212	18.9%	8,859	75.6%
Full Study Area	6,842	0.6%	8,453	0.7%	1,507	0.1%	12,962	1.1%	35,913	3.1%	1,081,495	94.3%

*Study area includes only part of the county, for extent see Figure 1

4.4 Wetland Area Less than the Minimum Mapping Unit (MMU)

The purpose of this analysis was to recreate and update the trends in wetland conversion reported by Snell, 1987. A fundamental component of the original methodology was to focus on wetlands greater than 10 hectares in size, (MMU of the input data). There were 2 steps during the analysis where features were removed due to size: a) during the standardization; and b) after the overlay analysis, both have been reported in Table 4 however this discussion only focuses on features removed after the overlays.

As a result a total of 441,587 hectares of smaller wetland were removed from the analysis after the overlays; 154,352 hectares in 1967, 130,963 hectares in 1982 and 156,271hectares in 2002 (Table 4). The removal of smaller wetlands was fairly consistent between datasets, however it is important to note that more than half of the smaller wetlands were removed in the standardization step for the 2002 dataset. Natural cover in the 1967 and 1982 datasets accounts for 40% of the total area removed, and in the 2002 dataset the natural area removed accounts for 47%. The amount of natural cover removed from each county is displayed by dataset in Figure7. In almost all counties the natural area removed from the analysis is greatest in 2002. Bruce, Grey, Leeds and Simcoe all had more than 3,000 hectares removed from the analysis across all years. Lanark also had substantial area removed from all years. Less than 500 hectares were removed due to project methodology in Essex, Elgin and Metro Toronto and the area removed from all other counties ranged between 800 – 2,500 hectares.

Table 4: Area of land removed from the analysis due to project methodology

Cover Type	1967 CLI Present Land Use	1982 Land Systems	2002 SOLRIS
Removed During Standardization	(30,244.14)	(24,763.41)	(91,443.45)
Natural Cover	62,055.34	52,158.87	73,880.21
Converted Cover	87,657.56	72,263.93	72,289.38
No Data	4,639.53	6,539.90	10,102.10
Total Area Removed	154, 352.43 (184,596.57)	130,962.70 (155,726.11)	156,271.69 (247,715.14)

Note: Total area removed in brackets includes the area removed during standardization

In 2002, the total natural cover removed due to methodology was 73,880 hectares which consisted of 36,651 hectares of wetlands (swamp, fen, bog and marsh) and 37,166 hectares of forest. The other natural features (tallgrass, shoreline, alvar) only accounted for 63 hectares. Table 5 displays the wetland type by county removed from the analysis. Of the wetlands removed 87.8% were swamp, 12.1% marsh, 0.1% bog and 0.0% bog.

In all counties, swamp area was the primary wetland type removed from the analysis and it is the most prominent wetland type in the Mixedwood Plains ecozone. In most cases the swamp area removed from

each of the counties was greater than 100 hectares. The only exceptions were Metro Toronto and Essex County. The greatest area of swamp removed was in Grey County, a total of 2,826 hectares. Sizable amounts of swamp area were also removed from the other north western counties (Bruce, Dufferin, Simcoe), more than 500 hectares in each county. Marsh area was the second most common wetland type removed from the analysis. Simcoe County had the greatest amount of marsh area removed, 648 hectares. Bruce, another north western Ontario county, had a sizeable amount of marsh area removed as well. Generally all counties had some marsh area removed. Fens and bogs were less prominent on the landscape and as a result fewer hectares were removed due to project methodology. York had the most bog area removed (10 hectares) and Bruce had the most fen area removed (5 hectares).
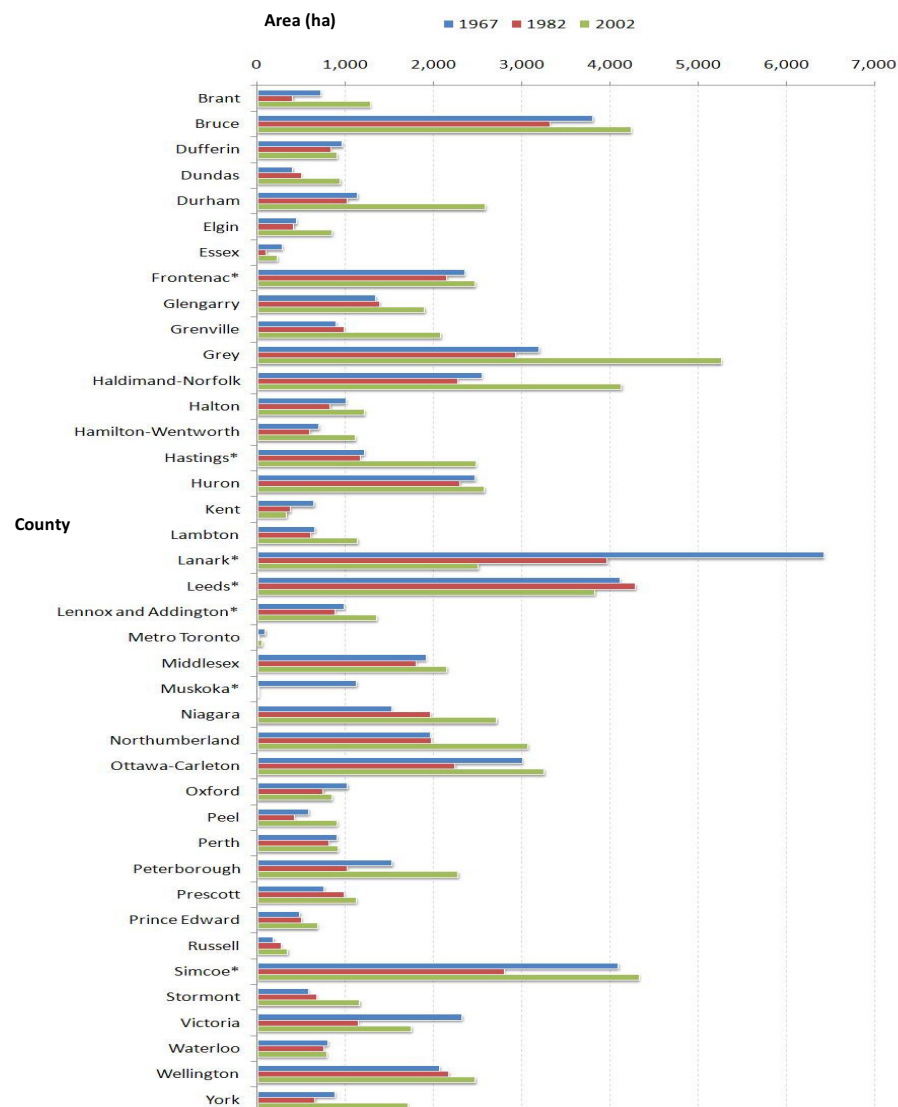
Figure 7: Natural area removed from the analysis due to methodology by County, by Dataset

Table 5: 2002 wetland types by county removed by project methodology

County	Total Wetland Area	Swamp		Fen		Bog		Marsh	
		Ha	%	Ha	%	Ha	%	Ha	%
Brant	784.69	733.81	93.5%	0.00	0.0%	0.00	0.0%	50.88	6.5%
Bruce	2,117.14	1,691.96	79.9%	5.33	0.3%	0.51	0.0%	419.35	19.8%
Dufferin	612.95	566.18	92.4%	0.00	0.0%	0.00	0.0%	46.77	7.6%
Dundas	311.69	308.28	98.9%	0.00	0.0%	0.00	0.0%	3.41	1.1%
Durham	1,090.77	1,018.85	93.4%	2.06	0.2%	0.00	0.0%	69.87	6.4%
Elgin	338.66	323.42	95.5%	0.00	0.0%	0.00	0.0%	15.25	4.5%
Essex	91.35	67.09	73.4%	0.00	0.0%	0.00	0.0%	24.26	26.6%
Frontenac*	1,208.57	789.95	65.4%	2.23	0.2%	0.08	0.0%	416.31	34.4%
Glengarry	704.38	661.90	94.0%	0.00	0.0%	0.90	0.1%	41.58	5.9%
Grenville	723.39	690.99	95.5%	0.00	0.0%	0.16	0.0%	32.24	4.5%
Grey	2,998.89	2,825.96	94.2%	0.00	0.0%	0.00	0.0%	172.93	5.8%
Haldimand-Norfolk	1,618.14	1,510.48	93.3%	0.00	0.0%	0.00	0.0%	107.66	6.7%
Halton	425.37	394.77	92.8%	1.38	0.3%	0.00	0.0%	29.21	6.9%
Hamilton-Wentworth	644.05	574.78	89.2%	0.06	0.0%	0.00	0.0%	69.21	10.7%
Hastings*	1,053.53	922.26	87.5%	1.62	0.2%	0.03	0.0%	129.62	12.3%
Huron	1,671.13	1,632.37	97.7%	0.04	0.0%	0.00	0.0%	38.72	2.3%
Kent	204.46	150.33	73.5%	0.00	0.0%	0.00	0.0%	54.13	26.5%
Lambton	366.45	339.21	92.6%	0.00	0.0%	0.00	0.0%	27.24	7.4%
Lanark*	1,188.40	1,119.94	94.2%	0.00	0.0%	0.00	0.0%	68.46	5.8%
Leeds*	1,917.44	1,461.79	76.2%	0.00	0.0%	2.17	0.1%	453.48	23.7%
Lennox and Addington*	641.32	458.34	71.5%	0.00	0.0%	0.00	0.0%	182.98	28.5%
Metro Toronto	35.45	30.59	86.3%	0.00	0.0%	0.00	0.0%	4.85	13.7%
Middlesex	1,055.80	1,019.82	96.6%	0.00	0.0%	0.00	0.0%	35.97	3.4%
Muskoka*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Niagara	1,300.04	1,105.33	85.0%	0.00	0.0%	0.00	0.0%	194.71	15.0%
Northumberland	1,662.16	1,475.47	88.8%	0.00	0.0%	0.00	0.0%	186.69	11.2%
Ottawa-Carleton	1,485.28	1,351.64	91.0%	1.34	0.1%	2.02	0.1%	130.27	8.8%
Oxford	526.91	492.76	93.5%	0.00	0.0%	0.00	0.0%	34.15	6.5%
Peel	445.45	384.42	86.3%	1.07	0.2%	0.32	0.1%	59.64	13.4%
Perth	551.13	536.79	97.4%	0.00	0.0%	0.00	0.0%	14.34	2.6%
Peterborough	1,156.45	1,031.82	89.2%	0.00	0.0%	0.03	0.0%	124.59	10.8%
Prescott	392.64	375.14	95.5%	0.00	0.0%	5.81	1.5%	11.70	3.0%
Prince Edward	374.98	279.29	74.5%	0.00	0.0%	0.00	0.0%	95.69	25.5%
Russell	135.35	128.94	95.3%	0.00	0.0%	0.00	0.0%	6.41	4.7%
Simcoe*	2,039.02	1,391.22	68.2%	0.00	0.0%	0.02	0.0%	647.78	31.8%
Stormont	494.56	473.43	95.7%	0.00	0.0%	0.00	0.0%	21.13	4.3%
Victoria	1,084.71	893.83	82.4%	0.00	0.0%	0.73	0.1%	190.15	17.5%
Waterloo	500.87	426.50	85.2%	0.00	0.0%	0.00	0.0%	74.37	14.8%
Wellington	1,924.45	1,863.29	96.8%	0.00	0.0%	2.35	0.1%	58.81	3.1%
York	773.17	688.90	89.1%	1.00	0.1%	10.36	1.3%	72.91	9.4%
Full Study Area	36,651.18	32,191.81	87.8%	16.14	0.0%	25.49	0.1%	4,417.74	12.1%

*Study area includes only part of the county, for extent see Figure 1

4.5 Validation of Wetland Conversion Estimates for 2002

An accuracy assessment was preformed on the 2002 SOLRIS wetland extent by comparing 126 randomly sampled wetland features, with the equivalent locations in the reference datasets, Quickbird; SWOOP; GTA2002; and DRAPE[5]. These reference datasets were chosen as they were independent, of a precision three times greater than that used to create the mapping, and representative of the conditions and features of interest. Assessment was conducted at a 95% confidence interval with a 10% precision. Table 6 shows that of the 7410 hectares 6928 were wetland yielding an overall accuracy of 93.5%. It was noted that 45% of these mapped wetlands were associated with a Provincially Significant Wetland (PSW). The remaining 6.5% was mapped as forest (1.0%), partially wetland and partially forest (5.2%), or non-wetland (0.3%). The areas mapped as forest or partial forest may in actual fact have been swamps, as swamps are extremely difficult to validate on orthoimagery when not using stereo pairs. The feature mapped as a non-wetland was actually a partial wetland with a small portion of area converted to dewatering ponds for an extraction operation.

Table 6: Confusion matrix for 2002 wetland and converted extents, units in hectares

		Reference Imagery				
		Wetland	Forest	Wetland & Forest	Non-Wetland	
2002 Wetland Extent	Wetland	6928	74	383	25	
	Total	6928	74	383	25	7410

In addition to sampling the wetland features, a small sample of 32 converted features were validated to ensure that wetland features were not being categorized as converted. Of the 32 features (650 hectares), 28 (599 hectares) were converted features, and 4 features (51 hectares) were shift and interpretation errors, natural features classified as converted. Of the converted features 400 hectares were associated with intensive agriculture, 58 hectares were associated with idle pasture and woodlands, and the remaining 141 hectares were associated with residential or commercial development.

A full validation of the 1967 CLI Present Land Use and 1982 Land Systems wetland extents was not completed. However, these datasets were examined using Ontario Base Mapping (OBM) and the reference datasets used to validate the 2002 SOLRIS wetland extents. The OBM data was used only for historical context as well as an additional verification that image interpretation was correct. As a result, mapped wetlands aligned to wetland areas within both datasets.

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[5] Ministry of Natural Resources, Land Information Ontario, *Digital Raster Acquisition Project for the East (DRAPE) Project*, http://www.mnr.gov.on.ca/en/Business/LIO/2ColumnSubPage/STEL02_168249.html (November 2009)

5.0 Wetland Conversion Estimates between years

Comparisons between the 1967 and 2002 and the 1982 and 2002 datasets were used to attempt to measure precise changes over recent years. The 1967 wetland and converted extents, generated during the overlay analysis with pre-settlement wetland (section 4.0), were intersected with 2002 SOLRIS maps. Areas that were no longer natural in 1967 were considered converted or lost and areas of gain were those which were converted or lost in 1967 and natural in 2002. The same analysis was conducted for the 1982-2002 time period.

The following sections present the results of these between year comparisons. The validation of the conversion estimates between years is presented first to define the level of confidence in these between year estimates and to emphasize what the results suggest with respect to future comparisons between 1967-1982-2002 data in a GIS environment. The 2 main findings were: a) comparison analysis between years using datasets from different organizations created using dissimilar methods yield poor accuracies; and b) these poor accuracies limit the ability to understand these precise changes.

Based on these findings, the between year analysis did not effectively measure precise changes in wetland features over the short 35 year (1967-2002) or the 20 year (1982-2002) time periods. The validation and analysis results for the between year analysis have still been included in this report to provide an understanding of the complexities around tracking precise changes in wetland conversion between years over short time frames.

5.1 Validation of Wetland Conversion Estimates between years

To evaluate the validity of the wetland conversion estimates and identify type of change occurring between years an accuracy assessment was conducted. The assessment examined both loss and gain features larger than 10 hectares, the MMU of the study. A valid occurrence of a loss was a feature under natural cover in the 1967 or 1982 data and converted cover in the 2002 data. A valid occurrence of a gain was a feature under converted cover in 1967 or 1982 data, which was under natural cover in the 2002 data.

Randomly sampled gain and loss features were selected from both the 1967-2002 period and the 1982-2002 period across the study area based on the total number of loss and gain features within those periods gaining a representative sampling from the total population. Features were overlain on top of spring 2002-2008 1:20,000 scale orthoimagery in ArcGIS and then compared with the either summer 1954 1:50,000, spring 1978 FRI 1:15,000 or spring 1982/83 OBM 1:10,000 scale air photos. Since the air photos were not digital, features were located and estimated using vegetative, anthropogenic and hydrologic features existing on both air photos and orthoimagery. Loss and gain features were deemed either complete (100% change) or partial based on the amount of change observed within the feature. Rules defined for accuracy assessment in SOLRIS (OMNR, 2004) were used. Features were deemed valid only if 50% or more of the feature being verified matched the thematic category being examined. Occurrences were considered to be partially valid if the % change was < 50%. Loss and gain features that

were placed in the partial category or where there were no changes detected were considered error. Errors were classified into one of 4 categories:

a) *class discrepancy* - occurring when the class definition did not conclusively indicate a natural or converted cover. For example, the recreation class in the 1982 Land Systems dataset which included parks and conservation areas along with campgrounds and drive-in theatres OR the undifferentiated class in the 2002 SOLRIS dataset which included idle lands and open clearings in forests along with intensive agriculture and urban brown fields;

b) *interpretation error* - occurring when the class assigned to the polygon was incorrect or could not be confirmed using aerial photography;

c) *scale error* - occurring when a gain feature was not separated into its own feature instead it was an inclusion in a larger land use feature in the 1982 Land Systems data OR when a feature was mapped at a scale smaller than the study's MMU (< 10 hectares) and was removed due to method; or

d) *shift error* – occurring when a feature was shifted in one dataset and did not align with the feature to which it was being compared.

In this validation, features lost between 1967 and 1982 were not sampled as those were sampled in one of the earlier phases of this project, findings can be found in the document titled*Wetland Conversion Analysis: A Validation* (OMNR, 2008a).

5.1.1 Loss & Gain Evaluation – 1967 to 2002

An initial validation was conducted which yielded results similar to those outlined in section 5.1.2 and 5.1.3. Further investigation would be required to do a complete accuracy assessment for this period.

5.1.2 Loss & Gain Evaluation – 1982 to 2002

Sixty loss samples were assessed interpretively to evaluate the correctness of the loss events generated through the wetland conversion analysis method. Nineteen were valid losses and 47 were attributed to error, either class discrepancy (34); scale (12); or interpretive error (1). Using the same standards as SOLRIS, the 50% polygon accuracy evaluation rule, these results yielded an overall accuracy of 16.5% ± 10% with a 90% confidence (Table7).

Table 7: Summary of loss samples showing total valid and breakdown of associated error

	Frequency	Area (Ha)	% Area
Valid - 100% change	13	194	16.5%
Class discrepancy	34	684	58.1%
Scale	12	280	23.8%
Interpretive error	1	19	1.6%
Total	60	1,177	

Valid loss features were verified interpretively as having all or part (> 50%) of an existing wetland converted to an alternative anthropogenic use by 2002. Six of the features were converted to accommodate residential development, 1 feature was lost to residential development with an infrastructure expansion, 1 feature was lost to aggregate expansion, 4 features were lost to agriculture, and the final feature was lost as a result of a pond creation. Wetland lost to residential development occurred mostly in the Golden Horseshoe, eastern Ontario and north western Ontario. Figure 8 displays a loss to residential development in eastern Ontario. This figure is also an excellent example of agricultural land being lost to development. Loss to agricultural practice occurred only in western Ontario, both south and north.

a) in 1978   b) by 2002

Figure 8: Example of a loss event to residential development and infrastructure

Using the 50% polygon accuracy evaluation rule accuracies for loss events were unexpectedly low. Upon investigation two primary reasons were deemed responsible. These included class discrepancies and a large MMU.

Class discrepancies were responsible for 58% of the loss error and were largely attributed to the natural areas defined by the 1982 Land Systems data. A misunderstanding of class definitions (what each class included) and erroneous feature inclusions all contributed to this error. The most common example included features that were mapped as natural in 1982 Land System data; either pastured woodland or idle agricultural land (over 10 years). These features were thought to be commonly associated with forest and wetland areas so they were categorized as natural features for the analysis. During the validation it became apparent that many of these features were associated with the undifferentiated class in the 2002 data. The undifferentiated class includes pastured woodlands and idle lands (farmland not in production) as well as productive agricultural lands and other converted feature types therefore

this class was not included as a natural class. As a result these types of natural features identified in the 1982 Land Systems data were identified as a loss in 2002. In most cases there was no change on the landscape between the years and in some cases the area identified was not a wetland feature. These kinds of error were encountered during the pilot assessment to a lesser extent (OMNR, 2008b). The dramatic jump in error in this assessment was likely due the incorporation of data from all of Southern Ontario and suggests that varying interpretations and data qualities exist across the study area.

 MMU was responsible for 24% of the error. Generally the MMU defined for the least precise data included in any analysis is selected as a study's MMU. There was much debate within the technical working group about an acceptable MMU for both the 1982 Land Systems and soils data, and an MMU of 5 hectares, 8 hectares and 10 hectares were suggested as possible options. After attempting analysis with all three MMU's it became clear that each size was problematic and selecting an appropriate MMU became an effort in determining the one which would introduce the least error. In the end 10 hectares was recommended. This 10 hectare limitation led to a large portion of features mapped as natural in the 2002 SOLRIS data being omitted as a result of the MMU and thus being classed as converted when in actuality natural features still remained on the landscape. This type of error was the most prevalent error prior to the removal of features which were originally natural and smaller than the MMU and placed into the converted category during the standardization step of this analysis. These features were not included in this assessment. By removing these features the amount of error associated with the MMU was reduced considerably. Errors attributed to MMU are consistent with the pilot accuracy assessment.

The one and only interpretive error was a result of a wetland area being classed as undifferentiated in the 2002 SOLRIS dataset and thus becoming a loss event, although it was classified as natural in the 1982 Land Systems dataset. This loss feature was associated with a road feature that bisected a provincially significant wetland and was collapsed into an undifferentiated polygon during the standardization step of the analysis. Only 40% of this area was actually converted to infrastructure the remaining area was still wetland.

Eighty gain samples were assessed interpretively to evaluate the correctness of the gain events generated through the wetland conversion analysis method. Twelve valid gains were verified, the remaining 68 features were attributed to error. Table 8 summarizes the results. The overall gain accuracy was 11.8% ± 5% with an 80% confidence.

Table 8: Summary of gain samples showing total valid and breakdown of associated error

	Frequency	Area (Ha)	% Area
Valid	12	200	11.8%
Class discrepancy	12	303	17.9%
Scale	53	1,143	67.6%
Shift	2	30	1.8%
Interpretive error	1	15	0.9%
	80	1,691	

Valid gain features were verified interpretively as having all or part (> 50%) of an existing wetland returned to a natural use. Agricultural lands being left fallow and returning to more natural uses accounted for more than 50% of the valid gains, 7 features. The remaining 5 gain features were the result of increased vegetation as a result of successional change, one of which was actually within a recreational area. Gains as a result of farming practice change occurred mostly in the Golden Horseshoe and Central Ontario.

During the assessment a number of gain features (> 5%) were found to be associated with Ducks Unlimited Canada conservation programs. Figure 9 is an example of a gain feature associated with a Ducks Unlimited Canada project in Erin Township that was completed in 1988. Other conservation programs and organizations in Ontario have also likely contributed to these gains including (not limited to) Ontario Soil and Crop Improvement Association's Environmental Farm Plan (EFP) and Conservation Authority programs. Further investigation should be conducted to determine which other wetland restoration programs in southern Ontario are contributing to these gains.
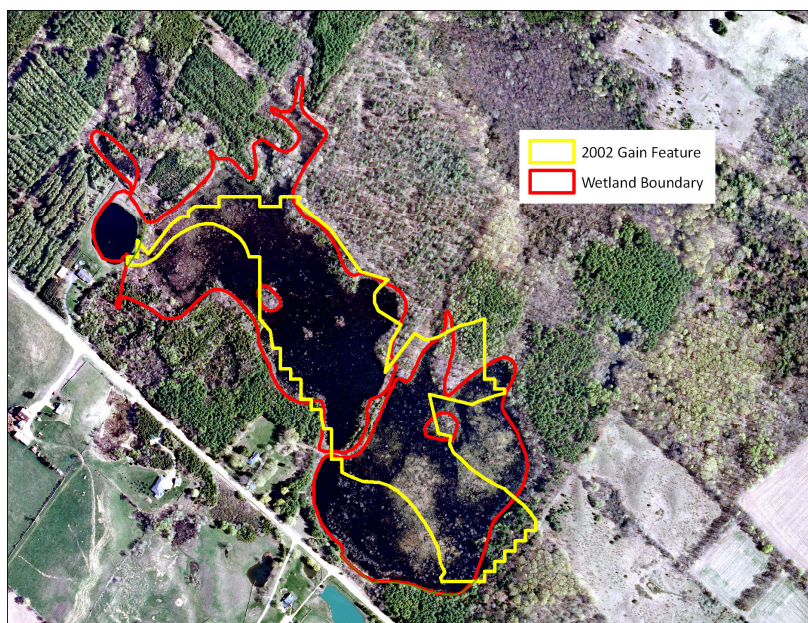
Figure 9: Example of a 2002 gain feature associated with a Ducks Unlimited Project, Erin Township.

Again using the 50% polygon accuracy evaluation rule accuracies for gain events were unexpectedly low. As noted with the loss events, the primary reasons for these low gain numbers were associated with class discrepancies and scale errors. Spatial shifting errors associated with both historical layers and interpretive errors were also noted.

Class discrepancies were responsible for 18% of the gain error and were largely attributed to the natural areas not defined by the 1982 Land Systems data. Examples include areas in the 1982 Land Systems data that were identified as abandoned farmland, idle lands (5 – 10 years), grazing lands, recreation or reforestation, all converted classes, however, each of these classes contain natural features which are identified in the more detailed 2002 SOLRIS data as natural. As a result these events are incorrectly identified as gains when in fact there had been no change on landscape between those years. This was a particular problem within natural parks or recreational areas where the majority of the landscape was natural with the exception of the campground facilities or idle lands where degraded systems had started the successional trajectory towards natural or wetland areas. The recreation class contributed to 3,821 hectares of the total gains by 2002. Unfortunately, these classes also contain converted features so including all features as natural was not possible. Again the dramatic increase in error was likely due the incorporation of data from all of Southern Ontario and suggests that varying interpretations and data qualities exist across the study area.

Scale was responsible for the majority of the gain error, 68% of the error. Much of the scale error associated with gains was a result of the original purpose and creation of the 1982 Land System data. The 1982 Land System data is noisy; it was created with a focus on agricultural land use and utilized ownership parcels to delineate features. As a result many of the natural features on the landscape in 1982 were included in larger land use polygons and often associated with converted classes. In the 2002 SOLRIS data however, these natural features are identified individually thus creating gains on the landscape where they did not exist. Gain errors attributed to scale are consistent with the pilot accuracy assessment.

Upon comparing gain events with historical air photos and current orthoimagery it became apparent some of the error was due to simple spatial shifting of historical data layers. This problem existed in both the 1982 Land Systems data and the soils data and accounted for 2% of the error. This error was caused when the less spatially accurate and precise 1982 Land Systems and soils data were overlain with the more accurate SOLRIS data. It is important to note that this particular problem was expected and is primarily a reflection of the technological limitations under which the data was created. Errors attributed to spatial shifting are consistent with the pilot accuracy assessment. In this assessment spatial shifting was less frequent than expected however if the scale error had not been so significant, spatial shifts may have been more prominent in the gains and identified in the losses.

5.1.3 Relaxed Gain and Loss Evaluation – 1982 to 2002

Based on the section 5.1.2 results it is clear that this process is not an effective measure of area change in wetland features between the years of 1982 and 2002. The 1982 data is a different scale than the 2002 data, even after the standardization of the datasets, so as a result there are discrepancies for

identifying these areal changes. The original nature of the datasets also contribute to these discrepancies, 1982 land systems dataset was created with an agricultural focus while the 2002 SOLRIS dataset was created as an ecological based inventory. Consequently an additional assessment was calculated with relaxed accuracy rules. In this assessment a loss or gain was considered correct if any portion of a polygon identified through the analysis contained a lost or gain. Thought this kind of assessment limits reporting to events rather than areas it was hoped that results would be usable.

Table 9 shows that 28 of the 60 samples can now be classified as valid loss events, increasing the accuracy to 46.7% ± 1% with a 90% confidence. This increases the overall accuracy by 31%. These results are still lower than expected, however are explained by the error previously mentioned.

Table 9: Summary of loss events based on a relaxed accuracy assessment

Events	Frequency	
Valid	28	46.7%
Not Valid	32	53.3%
	60	

Using the relaxed assessment valid events now include partial losses with changes less than 50% identified within the feature. The partial loss events were similar to those identified as valid features. Again a large portion of the features exhibited partial losses to residential development, infrastructure expansion, and agriculture changes. The majority of the partial losses verified were either outer edge loss of the wetland area where development, infrastructure and agricultural practices were starting to encroach and remove the edges of the wetland area. There was one partial loss, where there was an expansion of a marina into the coastal wetland area in the north western Ontario along Lake Huron. The partial losses experienced were between 5 and 40%.

Similarly to the losses, using relaxed accuracy rules 26 of the 80 samples could be classified as valid gain events, increasing the accuracy to 32.5% ± 5% with an 80% confidence, an overall increase of 21% (Table 10). Again these results are lower than expected, however are explained by the error previously mentioned.

Table 10: Summary of gain events based on a relaxed accuracy assessment

Events	Frequency	
Valid	26	32.5%
Not Valid	54	67.5%
	80	

Using the relaxed assessment valid gain events now include partial gains with changes less than 50% identified within the feature. The partial gain events were similar to those identified as valid features.

Again a large portion of the features exhibited partial gains as a result of farming practice changes, successional vegetative increases and increases in open water area. The partial gains experienced were between 5 and 30%.

5.1.4 Evaluation summary between years

The wetland conversion analysis underestimates wetland loss and overestimates wetland gain. Using the same standards as SOLRIS, the 50% polygon accuracy evaluation rule these results yielded an overall loss accuracy of 16.5% ±10% with a 90% confidence and an overall gain accuracy of 11.8% ± 5% with an 80% confidence. It was clear, based on these results, that this process was not an effective measure of area change in wetland features between the years of 1982 and 2002. An additional accuracy assessment using relaxed accuracy rules was calculated and yielded higher overall accuracies for both loss and gain, 46.7% ± 1% with a 90% confidence and 32.5% ± 5% with an 80% confidence respectively.

5.2 Wetland Conversion Estimates between years (1967-2002 and 1982-2002)

5.2.2 Conversion trends since 1967

Over the last 35 years, between 1967 and 2002, 5.8% of remaining wetlands in the study area were converted to other land uses (Table11). Figure 10 displays the wetland conversion for the 35 year (1967-2002) period by township. The most significant continued losses were noted in the south western counties of Kent, Lambton, and Essex and in the Golden Horseshoe county of Metro Toronto (specifically Scarborough).

During this same 35 year (1967-2002) period wetland loss was partially offset by the restoration of wetlands, a gain of approximately4.4%. These gains in wetland area recorded are likely overestimated and their value and permanency were not assessed in this comparison. Gains greater than 10% were noted in the two south western Ontario counties of Essex and Waterloo. Niagara County in the Golden Horseshoe also experience a gain greater than 10%.

The overall net decline in wetland extent from 1967 to 2002 was 1.5% of the 1967 wetland area (Table 11). Net wetland losses were noted in 56% of the counties, the remaining 44% had net wetland gains (Table 11). Kent in south western Ontario and Metro Toronto in the Golden Horseshoe had the greatest net percent losses, likely to agricultural and urban expansion respectively. Within Kent the losses were throughout the entire county. The major loss contributing to the overall net loss in Metro Toronto occurred in Scarborough. The net percent gains were all below 8% and occurred mostly in central Ontario and the Frontenac Axis however there were also gains in Waterloo and Brant.

Table 11: Wetland conversion statistics by county, 1967-2002

County	1967 Wetland Area	Amount of 1967 Wetland					
		Lost by 2002		Gained By 2002		Net Change	
		Ha	%	Ha	%	Ha	%
Brant	1,514	86	5.7%	143	9.5%	57	3.8%
Bruce	31,419	783	2.5%	470	1.5%	-313	-1.0%
Dufferin	13,459	768	5.7%	288	2.1%	-481	-3.6%
Dundas	14,950	1,565	10.5%	1,063	7.1%	-502	-3.4%
Durham	21,364	488	2.3%	525	2.5%	37	0.2%
Elgin	4,138	343	8.3%	42	1.0%	-301	-7.3%
Essex	4,345	1,424	32.8%	1,228	28.3%	-197	-4.5%
Frontenac*	12,695	96	0.8%	691	5.4%	595	4.7%
Glengarry	14,802	1,629	11.0%	523	3.5%	-1,106	-7.5%
Grenville	25,312	392	1.5%	2,293	9.1%	1,901	7.5%
Grey	55,102	1,058	1.9%	686	1.2%	-372	-0.7%
Haldimand-Norfolk	19,629	1,317	6.7%	1,775	9.0%	458	2.3%
Halton	4,382	172	3.9%	33	0.7%	-139	-3.2%
Hamilton-Wentworth	5,394	69	1.3%	242	4.5%	172	3.2%
Hastings*	15,719	151	1.0%	1,155	7.3%	1,003	6.4%
Huron	18,836	1,579	8.4%	828	4.4%	-751	-4.0%
Kent	5,451	3,010	55.2%	281	5.2%	-2,729	-50.1%
Lambton	17,927	6,638	37.0%	418	2.3%	-6,220	-34.7%
Lanark*	49,947	546	1.1%	938	1.9%	392	0.8%
Leeds*	24,335	668	2.7%	703	2.9%	35	0.1%
Lennox and Addington*	12,031	310	2.6%	1,035	8.6%	724	6.0%
Metro Toronto	115	60	52.5%	11	9.2%	-50	-43.2%
Middlesex	8,992	1,772	19.7%	114	1.3%	-1,658	-18.4%
Niagara	11,169	797	7.1%	1,696	15.2%	899	8.1%
Northumberland	15,299	214	1.4%	787	5.1%	573	3.7%
Ottawa-Carleton	37,051	2,601	7.0%	3,163	8.5%	562	1.5%
Oxford	6,519	337	5.2%	173	2.7%	-164	-2.5%
Peel	2,550	90	3.5%	42	1.7%	-48	-1.9%
Perth	6,074	673	11.1%	67	1.1%	-606	-10.0%
Peterborough	24,906	393	1.6%	714	2.9%	320	1.3%
Prescott	10,265	1,211	11.8%	532	5.2%	-679	-6.6%
Prince Edward	10,300	27	0.3%	803	7.8%	775	7.5%
Russell	2,308	168	7.3%	166	7.2%	-2	-0.1%
Simcoe*	42,116	2,258	5.4%	1,599	3.8%	-660	-1.6%
Stormont	16,433	1,244	7.6%	786	4.8%	-458	-2.8%
Victoria	31,838	635	2.0%	330	1.0%	-306	-1.0%
Waterloo	4,661	213	4.6%	489	10.5%	276	5.9%
Wellington	20,107	626	3.1%	211	1.0%	-415	-2.1%
York	12,362	759	6.1%	866	7.0%	108	0.9%
Full Study Area	635,818	37,171	5.8%	27,903	4.4%	-9,268	-1.5%

*Study area includes only part of the county, for extent see Figure 1
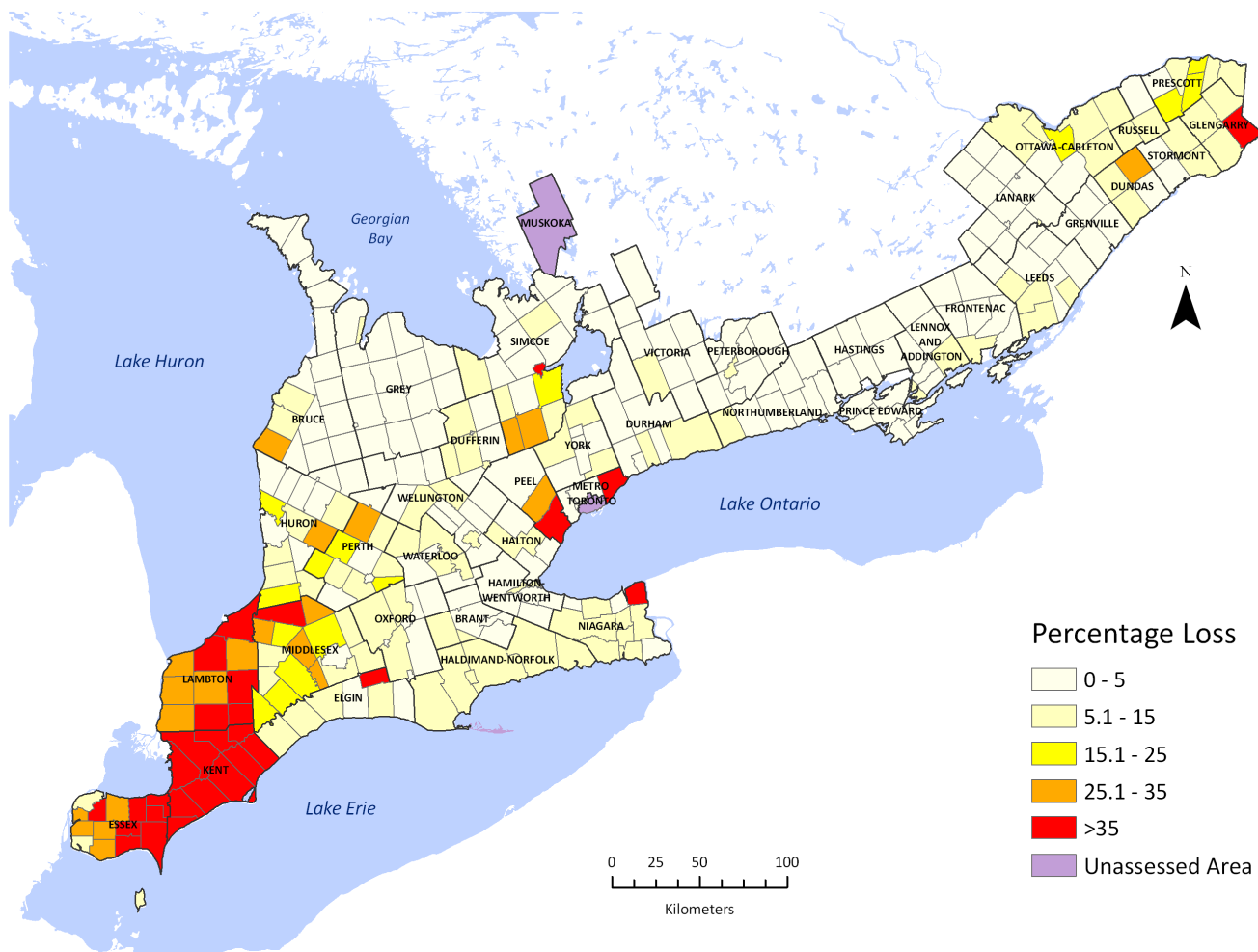
Figure 10: Conversion of 1967 wetland area by township, 1967 - 2002

5.2.2 Conversion trends since 1982

Between 1982 and 2002, 5.3% of remaining wetlands in the study area were converted to other land uses (Table12). Figure 11 displays the wetland conversion during the last 20 years by township.

Kent County, which experienced a decline in the 1967-1982 period, experienced the greatest percentage loss since 1982 (30%). Two other south western counties (Lambton and Essex), with declines in the 1967-1982 period, also continued this trend and in the period 1982-2002 underwent losses of more than 20% of their 1982 wetland coverage. Some of the townships within these three south western Ontario counties experienced losses greater than 30%, including Gosfield North, Maidstone, Sandwich West, north and west Tilbury, Camden, Chatham, Romney, Tilbury East, Zone, Brooke, Dawn, and Euphemia townships. Of particular interest were the townships of Glouchester (Ottawa-Carleton) and Landcaster (Glengarry), both experienced declines greater than 35%. The majority of the remaining counties experienced losses below 10%.

Wetland loss was partially offset by the restoration of wetlands during the 1982 to 2002 period. Over the 20 year period that was a gain of approximately 4.6%.Similar to the 1967 to 2002 period, the value and permanency of these gained wetlands, which may not be comparable to those that were lost, were not assessed in this comparison. The gains in wetland area recorded are likely overestimated simply because the scale and purpose of the 2002 dataset made it more efficient at mapping wetland area than the 1982 dataset. Ninety-eight percent of the gained wetlands recorded during this period were below 100 hectares in size.

The majority of the eastern Ontario counties underwent gains of less than 5% with the exception of Russell, where a gain of 6% was noted. In south western Ontario Haldimand-Norfolk experienced a significant gain, 18.7%. This county contained 5 wetland gains greater than 100 hectares each within the townships of Delhi and Norfolk. One of the wetlands gained in Delhi was actually the second largest wetland gained in the study area, 1,189 hectares. Essex County also underwent a significant gain, 47%, the result of many 10-50 hectare wetlands and one wetland greater than 600 hectares in Mersea Township. Moderate gains, between 5 to 10% were experienced in the other south western counties. Dufferin (north western Ontario) and Hamilton-Wentworth (Golden Horseshoe) underwent gains greater than 7%. Gains in both of these counties were the result of many relatively small features, all below 100 hectares. Many of these gains corresponded to natural areas not defined by the 1982 Land Systems data as identified by the validation findings presented in section 5.1.

Over this period net wetland gains were noted in 35% of the counties, the remaining 65% all had net wetland losses. As a result a 0.7% net decline in wetland extent occurred between 1982 and 2002 (Table 12).

Table 12: Wetland conversion statistics by county, 1982-2002

County	Amount of 1982 Wetland Area						
	Ha	Lost by 2002		Gained By 2002		Net Change	
		Ha	%	Ha	%	Ha	%
Brant	650	16	2.5%	30	4.7%	14	2.2%
Bruce	30,949	898	2.9%	1,370	4.4%	472	1.5%
Dufferin	11,531	430	3.7%	882	7.6%	451	3.9%
Dundas	16,916	1,859	11.0%	532	3.1%	-1,327	-7.8%
Durham	22,078	564	2.6%	353	1.6%	-211	-1.0%
Elgin	3,967	163	4.1%	92	2.3%	-71	-1.8%
Essex	2,384	550	23.1%	1,121	47.0%	571	24.0%
Frontenac*	14,236	111	0.8%	606	4.3%	495	3.5%
Glengarry	16,490	1,865	11.3%	70	0.4%	-1,795	-10.9%
Grenville	30,074	1,036	3.4%	428	1.4%	-608	-2.0%
Grey	53,395	1,102	2.1%	1,690	3.2%	587	1.1%
Haldimand-Norfolk	17,838	1,181	6.6%	3,343	18.7%	2,162	12.1%
Halton	4,556	207	4.5%	58	1.3%	-150	-3.3%
Hamilton-Wentworth	4,995	91	1.8%	463	9.3%	372	7.4%
Hastings*	17,908	375	2.1%	290	1.6%	-85	-0.5%
Huron	17,140	968	5.6%	852	5.0%	-117	-0.7%
Kent	3,007	902	30.0%	231	7.7%	-671	-22.3%
Lambton	12,918	3,150	24.4%	402	3.1%	-2,748	-21.3%
Lanark*	47,867	816	1.7%	1,138	2.4%	323	0.7%
Leeds*	24,868	632	2.5%	1,320	5.3%	688	2.8%
Lennox and Addington*	14,145	555	3.9%	326	2.3%	-229	-1.6%
Middlesex	6,922	677	9.8%	249	3.6%	-428	-6.2%
Niagara	15,679	1,857	11.8%	284	1.8%	-1,573	-10.0%
Northumberland	16,579	259	1.6%	453	2.7%	195	1.2%
Ottawa-Carleton	38,730	4,357	11.2%	5,329	13.8%	972	2.5%
Oxford	6,349	143	2.3%	285	4.5%	142	2.2%
Peel	2,524	67	2.6%	98	3.9%	31	1.2%
Perth	5,620	418	7.4%	53	0.9%	-365	-6.5%
Peterborough	25,042	440	1.8%	989	4.0%	549	2.2%
Prescott	10,991	1,247	11.3%	416	3.8%	-831	-7.6%
Prince Edward	11,315	39	0.3%	156	1.4%	116	1.0%
Russell	2,443	261	10.7%	145	5.9%	-116	-4.7%
Simcoe*	40,286	2,090	5.2%	1,537	3.8%	-553	-1.4%
Stormont	19,246	2,339	12.2%	347	1.8%	-1,992	-10.3%
Victoria	29,150	733	2.5%	396	1.4%	-336	-1.2%
Waterloo	4,772	100	2.1%	253	5.3%	153	3.2%
Wellington	15,559	314	2.0%	1,443	9.3%	1,129	7.3%
York	12,583	852	6.8%	935	7.4%	82	0.7%
Full Study Area	631,699	33,663	5.3%	28,964	4.6%	-4,699	-0.7%

*Study area includes only part of the county, for extent see Figure 1
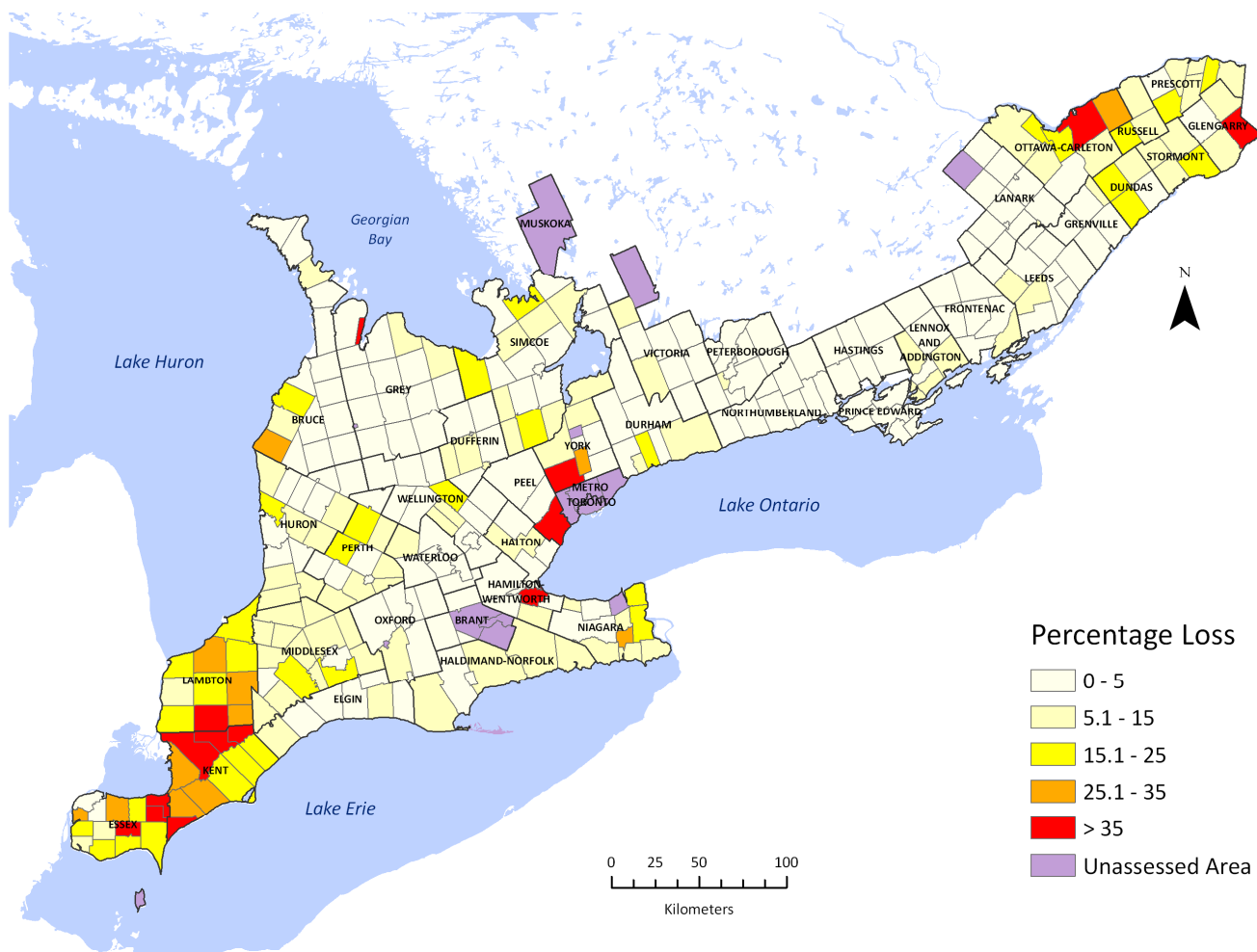
Figure 11: Conversion of 1982 wetland area by township, 1982-2002

6.0 Wetland Conversion since 2002

This analysis of wetland extent and conversion only applies to large wetlands and their status as of 2002. What has happened on the landscape since 2002 and to smaller wetlands? Both of these questions are currently being addressed using a composite baseline layer. A baseline layer was created using a combination of SOLRIS, evaluated wetlands, and the 2002 wetland extent created as the 'Fourth Approximation'. Unfortunately, at this time there is not a seamless layer available for the entire study area. Attempts were made to conduct an analysis at a regional scale using Ecological Land Classification (ELC) datasets created and maintained by Conservation Authorities (CA). Since ELC datasets are created by each individual CA the resolution, mapping methods and data classification often varies between regions and in many cases an accuracy assessment does not exist so use of these datasets may add uncertainty to the final results. Continued investigation into an adequate large scale dataset to measure wetland conversion since 2002 is on-going.

7.0 Conclusions

This report summarizes the analysis results by county and township in the southern Ontario study area based on an earlier study completed by Environment Canada in 1987. The original study's manual steps were translated into GIS routines and implemented on 40 counties (350 townships) within the Mixedwood Plains ecozone. The estimates of original wetland coverage and conversion for 1967 and 1982 were recalculated to ensure a consistent measurement of trends and for comparison to the original study while a third year was added to the analysis of trends. The results demonstrated that the manual approach could be replicated using GIS tools. A methodology for extending the analysis to 2002 based on mapping from OMNR's Southern Ontario Land Information System (SOLRIS) was developed. The translated GIS routines and methodologies used in the current study included enhanced and improved technologies and datasets to allow for more accurate estimates in the future. For example, relative to the original study, the pre-settlement GIS methodology captured 85% of the area deemed historic wetland in the original study, with a difference of only 353,569 hectares. This difference was primarily the result of using the County Soil Surveys and the quaternary geology data rather than the CLI Agricultural Capability maps and NTS marshes as well as the standardized selection of bottomland features, transecting and adjacent features only.

Wetland abundance across southern Ontario had continued to decline to 2002 with only 6.8% (560,844 ha) of pre-settlement wetland area remaining. The decline in wetlands since settlement has been most drastic in south western Ontario, parts of eastern Ontario, Niagara and the Toronto area, where over 85% of the original wetlands have been converted to other uses. In some regions of southern Ontario wetland loss is as much as 100 percent. Between 1982 and 2002, an additional 3.5% (70,854 ha) of the pre-settlement wetlands in the study area were lost, an average loss of 3,543 ha per year. This is equivalent to the loss of approximately 354 large 10 ha wetlands per year for the last 20 years. Conversion to agricultural lands, including field and forage crops, specialty crops, nurseries, rural properties and idle lands, urban brown fields, hydro right-of ways, edge of transportation corridors and

clearings within forests accounted for the most losses in all areas. Built-up lands, impervious and pervious, were the significant factor in the loss of wetlands within the Golden Horseshoe.

The 2002 SOLRIS wetland extent can be considered as the "Fourth Approximation" representing the most accurate and complete spatial database of the location and conversion of large wetlands (< 10 ha) in the Mixedwood Plains as of 2002. The results should be considered a regional estimate of wetland conversion trends, similar to the first study, and users should be aware that they measure trends within large wetlands only and are therefore a conservative estimate of wetland loss. The conversion trends experienced by smaller wetland below this threshold are not reflected in the analysis and a separate effort is underway to assess these wetlands. If wetlands less than 10 ha in size were included in these estimates, the annual loss would be even more significant.

The conversion analysis did not measure precise changes occurring over relative short time periods (e.g. 20 years). Precision (mapping scale) and class discrepancy were the major sources of error associated with these short term between year comparisons. Interpreted mapping created by different organizations using dissimilar methods limited the ability to understand these precise changes over short time frames. To effectively measure these precise changes, future work should focus on developing new standardized mapping approaches for tracking these precise changes in wetland conversion between years.

Furthermore, as noted in the original study, the conversion analysis does not capture wetlands that occur beyond the extents of the County Soil Surveys, bottomlands or in areas mapped as water bodies. Wetland along the Great Lakes coasts and within inland water bodies like Lake St. Clair and Lake Scugog are not factored into the analysis. As with the original analysis this update does not consider indirect degradation of wetlands or quality and functionality of remaining wetlands.

The major conclusions of the wetland analysis are:

1) By 2002, 72% or 1.4 million hectares of pre-settlement wetlands had been converted to other land uses.

2) With an overall accuracy of 93.5%, the 2002 SOLRIS wetland extent (the "Fourth Approximation") represents, as of 2002, the most accurate and complete spatial database of the location and conversion of large wetlands (> 10 ha) in the Mixedwood Plains.

3) Loss of pre-settlement wetland over the last 2 decades (1982 to 2002) is occurring at 3,543 hectares per year, an average reduction rate of 0.17% per year.

4) Extent and loss trends only apply to large wetlands and are therefore a conservative estimate of wetland loss.

5) Precision (mapping scale) and class discrepancy are the major sources of error associated with the 1967-2002 and 1982-2002 analyses.

8.0 Recommendations

The following sections present the recommendations to address identified data gaps and mapping standardization issues.

8.1 Gaps – Bottomlands and Coastal Wetlands

1) Additional conversion work should be focused on bottomland wetlands. Due to limitations with these data only 18% of the total mapped bottomland features were included in this analysis. Future work should attempt to create a standardized mapping approach that would be a significant improvement over manual interpretive approaches for regional level reporting. A high resolution DEM based approach would provide a promising means of mapping these features. Work is currently being done by OMAFRA however, an exact method and the most cost effective data source to do this has not yet been determined. **Work should therefore focus on identifying the most cost effective way of produce this bottomland mapping. Such work should compare and contrast the most promising methods and new data sources and include a scientifically acceptable accuracy assessment.** Once a standardized mapping product is available a new pre-settlement wetland extent should be created and estimates recalculated.

2) The current analysis, as well and the original analysis did not include coastal wetland areas along the Great Lakes coasts and within inland water bodies like Lake St. Clair and Lake Scugog. At present there is not a comprehensive estimate of historical and recent wetland loss in these areas, or a quantification of wetland gain. These areas are heavily impacted by anthropogenic stressor and there are site-specific losses being recorded. **A comprehensive standardized mapping approach should be developed to investigate historic and recent coastal wetland changes**.

8.2 Standardized Mapping Approach

1) During this analysis many challenges were experienced comparing interpreted mapping created by different organizations using dissimilar methods which limited our ability to understand wetland change over shorter time periods i.e. 1982-2002. Standardized analysis of image acquisitions presents a viable and cost effect alternative. Understanding fluctuating water levels would also be helpful for understanding changes in wetland communities as well as offer a means of calibrating detailed remote based wetland monitoring efforts. **Future work should focus on using imagery and water levels for landscape change detection.**

2) The overview of wetland extent and conversion trends in this analysis only applies to large wetlands (> 10 ha) and their status as of 2002. **The wetland conversion analysis should be expanded to include all wetland sizes and extent to present day.** Future work should focus on creating standardized mapping through image analysis as mentioned in previous recommendations. OMAFRA is currently working on an Agricultural Resource Inventory which may be suitable for change detection as an interim solution.

3) A large part of the error in estimating precise wetland loss (from 1982 to 2002) can be attributed to between mapping product class discrepancies. SOLRIS does not consider most pastured swamps wetland primary because of the OWES criteria of 'only near pristine pastured wetland can be considered wetland' (OMNR, 2003). However, the 1982 pastured forest is considered natural and therefore wetland where associated with wet soils. **More explicit text on the line between natural and converted would be helpful. Such an effort would help further standardize all natural inventory and monitoring programs.**

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Appendix A: Regional Grouping of Counties

Appendix A-1: Counties grouped by regional area

Regional Area	County
Golden Horseshoe	Durham, Halton, Hamilton-Wentworth, Metro Toronto, Niagara, Peel, York
South Western Ontario	Brant, Elgin, Essex, Haldiman-Norfolk, Huron, Kent, Lambton, Middlesex, Oxford, Perth, Waterloo, Wellington
North Western Ontario	Bruce, Dufferin, Grey, Muskoka, Simcoe
Central Ontario	Hastings, Lennox and Addington, Northumberland, Peterborough, Prince Edward, Victoria
Frontenac Axis	Frontenac
Eastern Ontario	Dundas, Glengarry, Grenville, Lanark, Leeds, Ottawa-Carleton, Prescott, Russell, Stormont

Appendix B: Township Statistics

Appendix B-1: Township wetland area statistics for c.1800, 1967, 1982 and 2002

County	Township	Pre-Settlement (c. 1800) Wetland Area		1967 Wetland Area		1982 Wetland Area		2002 Wetland Area	
		Ha	% of Township	Ha	% of Township	Ha	% of Township	Ha	% of Township
Brant	Brantford	273	0.9%	0	0.0%	0	0.0%	0	0.0%
	Burford	3,225	11.4%	505	1.8%	465	1.6%	349	1.2%
	Oakland	241	5.2%	63	1.4%	21	0.4%	47	1.0%
	Onondaga	281	3.2%	10	0.1%	0	0.0%	9	0.1%
	s. Dumfries	1,191	5.9%	143	0.7%	164	0.8%	193	1.0%
	Tuscorora	4,245	20.1%	793	3.8%	0	0.0%	562	2.7%
Bruce	Albemarle	2,992	12.0%	1,845	7.4%	1,929	7.8%	1,783	7.2%
	Amabel	7,615	26.0%	4,389	15.0%	4,497	15.4%	4,162	14.2%
	Arran	5,511	23.1%	1,866	7.8%	1,820	7.6%	1,801	7.6%
	Brant	3,894	13.3%	1,205	4.1%	1,224	4.2%	1,086	3.7%
	Bruce	5,718	20.1%	2,646	9.3%	2,874	10.1%	2,257	8.0%
	Carrick	3,383	13.2%	1,221	4.8%	1,084	4.2%	1,176	4.6%
	Culross	5,486	22.6%	3,063	12.6%	2,854	11.7%	3,108	12.8%
	Eastnor	6,917	29.8%	1,206	5.2%	1,071	4.6%	1,085	4.7%
	Elderslie	3,141	13.7%	800	3.5%	708	3.1%	772	3.4%
	Greenock	12,258	44.8%	7,340	26.8%	7,347	26.8%	7,416	27.1%
	Huron	13,186	54.1%	293	1.2%	244	1.0%	175	0.7%
	Kincardine	3,197	12.5%	184	0.7%	223	0.9%	160	0.6%
	Kinloss	4,448	22.0%	1,654	8.2%	1,588	7.9%	1,690	8.4%
	Lindsay	3,086	10.8%	1,583	5.6%	1,688	5.9%	1,342	4.7%
	Saugeen	1,281	7.3%	642	3.6%	232	1.3%	664	3.8%
	St. Edmunds	2,138	7.9%	1,483	5.4%	1,564	5.7%	1,254	4.6%
Dufferin	Amaranth	8,671	31.9%	3,434	12.6%	2,914	10.7%	3,167	11.7%
	East Garafraxa	2,778	16.6%	1,394	8.3%	1,218	7.3%	1,288	7.7%
	East Luther	6,150	37.2%	2,021	12.2%	1,666	10.1%	1,722	10.4%
	Melancthon	9,828	31.4%	4,607	14.7%	4,180	13.4%	4,245	13.6%
	Mono	2,379	8.3%	1,306	4.5%	993	3.5%	1,090	3.8%
	Mulmur	825	2.9%	589	2.1%	473	1.7%	571	2.0%
	Orangeville	302	18.7%	105	6.5%	84	5.2%	51	3.1%
	Shelburne	6	1.6%	3	0.8%	3	0.8%	3	0.9%
Dundas	Matilda	11,930	43.9%	3,120	11.5%	3,664	13.5%	2,263	8.3%
	Mountain	13,752	53.9%	3,551	13.9%	4,094	16.1%	3,236	12.7%
	Williamsburgh	13,504	51.3%	6,772	25.7%	7,789	29.6%	7,191	27.3%
	Winchester	14,247	57.0%	1,507	6.0%	1,368	5.5%	1,153	4.6%
Durham	Ajax	248	3.7%	105	1.6%	107	1.6%	66	1.0%
	Brock	8,859	20.7%	6,036	14.1%	6,416	15.0%	5,536	12.9%
	Clarington	4,512	7.3%	2,199	3.5%	2,405	3.9%	2,083	3.4%
	Oshawa	793	5.6%	92	0.7%	75	0.5%	114	0.8%
	Pickering	355	1.5%	123	0.5%	112	0.5%	69	0.3%
	Scugog	10,429	19.9%	7,146	13.7%	7,068	13.5%	7,014	13.4%
	Uxbridge	6,615	15.6%	5,409	12.8%	5,660	13.3%	5,161	12.2%
	Whitby	986	6.3%	253	1.6%	235	1.5%	234	1.5%

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County	Township	Pre-Settlement (c. 1800) Wetland Area		1967 Wetland Area		1982 Wetland Area		2002 Wetland Area	
		Ha	% of Township	Ha	% of Township	Ha	% of Township	Ha	% of Township
Elgin	Aldborough	4,700	14.4%	891	2.7%	816	2.5%	452	1.4%
	Bayham	1,827	7.3%	696	2.8%	713	2.8%	504	2.0%
	Dunwich	3,947	13.0%	779	2.6%	722	2.4%	581	1.9%
	Malahide	3,224	11.9%	882	3.2%	960	3.5%	584	2.1%
	S. Dorchester	647	4.8%	120	0.9%	12	0.1%	12	0.1%
	Southwold	2,345	7.4%	540	1.7%	540	1.7%	420	1.3%
	Yarmouth	861	2.9%	231	0.8%	204	0.7%	119	0.4%
Essex	Anderdon	9,666	93.6%	465	4.5%	215	2.1%	294	2.8%
	Colchester N.	11,905	89.3%	393	3.0%	242	1.8%	192	1.4%
	Colchester S.	8,600	57.1%	565	3.7%	474	3.1%	197	1.3%
	Gosfield N.	11,044	95.7%	113	1.0%	57	0.5%	12	0.1%
	Gosfield S.	7,250	55.9%	144	1.1%	96	0.7%	52	0.4%
	Maidstone	17,907	94.7%	572	3.0%	339	1.8%	194	1.0%
	Malden	8,572	93.7%	464	5.1%	171	1.9%	457	5.0%
	Mersea	20,137	72.9%	708	2.6%	345	1.2%	1,132	4.1%
	Pelee	3,203	72.8%	118	2.7%		0.0%	89	2.0%
	Rochester	13,087	94.5%	43	0.3%	75	0.5%	67	0.5%
	Sandwich S	10,677	97.3%	273	2.5%	118	1.1%	102	0.9%
	Sandwich West	4,184	69.6%	145	2.4%	87	1.4%	102	1.7%
	Tilbury N	10,157	94.3%	185	1.7%	145	1.3%	59	0.5%
	Tilbury West	9,537	96.1%	49	0.5%	20	0.2%	11	0.1%
	Windsor	9,854	82.0%	109	0.9%	0	0.0%	107	0.9%
Frontenac	Bedford*****	2,140	5.7%	1,234	3.3%	1,405	3.8%	514	1.4%
	Hinchinbrooke*****	5,224	17.1%	3,147	10.3%	4,264	14.0%	N/A	N/A
	Howe Island	739	20.2%	176	4.8%	185	5.1%	282	7.7%
	Kingston	3,158	14.8%	1,127	5.3%	1,054	4.9%	1,137	5.3%
	Loughborough*****	2,615	10.3%	1,350	5.3%	1,452	5.7%	1,272	5.0%
	Pittsburgh	4,879	22.9%	456	2.1%	713	3.3%	904	4.2%
	Portland*****	4,769	20.7%	3,343	14.5%	3,119	13.5%	2,997	13.0%
	Storrington	2,940	10.1%	1,381	4.7%	1,624	5.6%	1,320	4.5%
	Wolfe Island	3,446	26.1%	480	3.6%	419	3.2%	653	5.0%
Glengarry	Charlottenburgh	13,898	39.4%	4,847	13.8%	5,782	16.4%	4,510	12.8%
	Kenyon	10,987	32.1%	5,884	17.2%	6,373	18.6%	5,297	15.5%
	Lancaster	15,385	60.4%	2,119	8.3%	2,186	8.6%	995	3.9%
	Lochiel	15,110	48.7%	1,952	6.3%	2,149	6.9%	1,209	3.9%
Grenville	Augusta	11,715	37.8%	5,596	18.0%	7,214	23.3%	6,630	21.4%
	Edwardsburgh	11,492	37.0%	6,601	21.2%	7,894	25.4%	6,646	21.4%
	Oxford (On Rideau)	9,589	36.0%	4,671	17.5%	5,676	21.3%	5,191	19.5%
	South Gower	4,114	44.2%	1,774	19.1%	2,192	23.6%	1,845	19.8%
	Wolford	9,642	42.5%	6,669	29.4%	7,098	31.3%	7,390	32.6%

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County	Township	Pre-Settlement (c. 1800) Wetland Area		1967 Wetland Area		1982 Wetland Area		2002 Wetland Area	
		Ha	% of Township	Ha	% of Township	Ha	% of Township	Ha	% of Township
Grey	Artemesia	6,221	21.2%	4,173	14.2%	4,178	14.2%	3,776	12.9%
	Bentinck	5,868	18.4%	3,818	11.9%	3,975	12.4%	3,320	10.4%
	Collingwood	2,032	7.0%	1,233	4.2%	1,483	5.1%	1,201	4.1%
	Derby	4,870	28.6%	2,755	16.2%	2,415	14.2%	2,569	15.1%
	Egremont	6,094	19.9%	4,029	13.2%	3,801	12.4%	3,623	11.8%
	Euphrasia	4,280	13.8%	3,011	9.7%	3,163	10.2%	2,851	9.2%
	Glenelg	4,878	17.3%	3,468	12.3%	2,633	9.4%	2,909	10.3%
	Hanover	2	0.4%	2	0.3%	0	0.1%	2	0.3%
	Holland	5,580	19.5%	4,219	14.8%	4,314	15.1%	3,884	13.6%
	Keppel	8,918	23.3%	6,567	17.1%	6,850	17.9%	6,604	17.2%
	Normanby	4,583	15.6%	2,487	8.5%	2,349	8.0%	2,038	6.9%
	Osprey	7,424	25.2%	5,900	20.1%	5,751	19.5%	5,667	19.3%
	Proton	12,006	34.8%	7,651	22.2%	7,019	20.4%	6,991	20.3%
	Sarawak	767	17.4%	110	2.5%	193	4.4%	51	1.2%
	St. Vincent	1,931	6.9%	506	1.8%	539	1.9%	606	2.2%
	Sullivan	6,866	22.1%	2,850	9.2%	2,435	7.8%	2,440	7.9%
	Sydenham	3,493	11.0%	2,324	7.3%	2,296	7.2%	2,198	6.9%
Haldimand-Norfolk	Delhi	17,324	31.7%	6,844	12.5%	5,398	9.9%	5,378	9.8%
	Dunnville	14,460	45.9%	2,270	7.2%	2,639	8.4%	2,337	7.4%
	Haldimand	18,223	28.1%	1,946	3.0%	2,008	3.1%	1,205	1.9%
	Nanticoke	17,063	24.7%	1,005	1.5%	1,234	1.8%	775	1.1%
	Norfolk	19,601	29.4%	7,444	11.2%	6,486	9.7%	5,825	8.7%
	Simcoe	561	14.0%	120	3.0%	74	1.9%	52	1.3%
Halton	Burlington	2,335	12.2%	171	0.9%	124	0.7%	194	1.0%
	Halton Hills	2,845	10.2%	1,244	4.4%	1,339	4.8%	1,096	3.9%
	Milton	6,036	16.3%	2,898	7.8%	3,028	8.2%	2,477	6.7%
	Oakville	1,176	8.3%	69	0.5%	65	0.5%	40	0.3%
Hamilton-Wentworth	Ancaster	338	1.9%	37	0.2%	46	0.3%	28	0.2%
	Dundas	171	3.2%	88	1.7%	0	0.0%	95	1.8%
	Flamborough	10,504	21.3%	5,022	10.2%	4,648	9.4%	5,230	10.6%
	Glanbrook	1,395	6.8%	157	0.8%	162	0.8%	145	0.7%
	Hamilton	337	2.7%	0	0.0%	31	0.3%	0	0.0%
	Stoney Creek	2,278	23.3%	91	0.9%	108	1.1%	123	1.3%
Hastings	Hungerford*****	5,819	14.3%	3,808	9.3%	4,179	10.2%	2,987	7.3%
	Huntingdon******	3,569	15.4%	2,448	10.6%	2,559	11.1%	2,062	8.9%
	Rawdon	3,601	12.7%	2,133	7.5%	2,504	8.8%	2,129	7.5%
	Sidney	6,521	22.0%	1,741	5.9%	2,292	7.7%	2,353	8.0%
	Thurlow	6,563	30.5%	2,575	12.0%	2,975	13.8%	2,774	12.9%
	Tyendinaga	7,043	22.2%	3,015	9.5%	3,398	10.7%	3,197	10.1%

County	Township	Pre-Settlement (c. 1800) Wetland Area		1967 Wetland Area		1982 Wetland Area		2002 Wetland Area	
		Ha	% of Township	Ha	% of Township	Ha	% of Township	Ha	% of Township
Huron	Ashfield	9,262	34.1%	618	2.3%	414	1.5%	449	1.7%
	Colborne	1,807	12.2%	394	2.7%	426	2.9%	284	1.9%
	East Wawanosh	2,421	13.1%	1,061	5.7%	929	5.0%	1,094	5.9%
	Goderich	2,336	10.2%	331	1.4%	392	1.7%	307	1.3%
	Grey	8,203	29.7%	2,241	8.1%	1,706	6.2%	1,588	5.8%
	Hay	6,936	31.0%	1,993	8.9%	1,916	8.6%	1,821	8.1%
	Howick	5,119	17.8%	2,756	9.6%	2,464	8.6%	2,605	9.1%
	Hullett	2,548	11.2%	376	1.6%	851	3.7%	736	3.2%
	McKillop	4,589	20.4%	751	3.3%	450	2.0%	440	2.0%
	Morris	2,975	13.0%	1,274	5.6%	1,182	5.2%	1,274	5.6%
	Stanley	3,799	20.1%	404	2.1%	306	1.6%	300	1.6%
	Stephen	10,291	42.0%	2,169	8.8%	1,850	7.5%	1,189	4.8%
	Tuckersmith	1,470	8.5%	156	0.9%	134	0.8%	113	0.7%
	Turnberry	2,719	18.3%	1,901	12.8%	1,778	11.9%	1,826	12.3%
	Usborne	973	5.4%	46	0.3%	32	0.2%	0	0.0%
	West Wawanosh	3,898	22.4%	2,365	13.6%	2,311	13.3%	2,334	13.4%
Kent	Camden	8,260	46.4%	485	2.7%	273	1.5%	18	0.1%
	Chatham	21,291	53.7%	415	1.0%	216	0.5%	99	0.3%
	Dover	26,833	95.4%	1,799	6.4%	1,027	3.7%	1,266	4.5%
	Harwich	14,982	37.3%	425	1.1%	300	0.7%	198	0.5%
	Howard	5,605	21.8%	264	1.0%	82	0.3%	16	0.1%
	Orford	5,033	22.6%	453	2.0%	438	2.0%	200	0.9%
	Raleigh	23,828	81.5%	595	2.0%	229	0.8%	120	0.4%
	Romney	10,535	92.9%	422	3.7%	165	1.5%	74	0.7%
	Tilbury East	22,663	97.5%	427	1.8%	170	0.7%	132	0.6%
	Zone	1,787	14.7%	165	1.4%	107	0.9%	0	0.0%
Lambton	Bosanquet	12,384	37.5%	1,882	5.7%	1,117	3.4%	617	1.9%
	Brooke	17,240	55.5%	1,434	4.6%	1,178	3.8%	342	1.1%
	Dawn	25,376	89.2%	2,695	9.5%	2,363	8.3%	518	1.8%
	Enniskillen	29,247	81.7%	3,299	9.2%	2,242	6.3%	1,035	2.9%
	Euphemia	3,898	23.6%	502	3.0%	355	2.2%	118	0.7%
	Moore	9,182	30.8%	2,111	7.1%	1,568	5.3%	859	2.9%
	Plympton	12,836	39.4%	1,700	5.2%	1,124	3.4%	342	1.1%
	Sarnia	7,944	39.8%	1,178	5.9%	353	1.8%	441	2.2%
	Sombra Twp	23,390	77.5%	2,725	9.0%	2,320	7.7%	700	2.3%
	Warwick	2,741	9.0%	401	1.3%	298	1.0%	120	0.4%

County	Township	Pre-Settlement (c. 1800) Wetland Area		1967 Wetland Area		1982 Wetland Area		2002 Wetland Area	
		Ha	% of Township	Ha	% of Township	Ha	% of Township	Ha	% of Township
Lanark	Bathurst*****	7,817	31.2%	3,543	14.1%	3,646	14.6%	1,557	6.2%
	Beckwith*****	13,854	53.4%	8,752	33.8%	9,757	37.6%	8,138	31.4%
	Carleton Place	65	10.8%	3	0.5%	4	0.7%	4	0.7%
	Darling****	4,764	17.6%	3,335	12.3%	N/A	N/A	N/A	N/A
	Drummond*****	13,576	53.5%	8,414	33.1%	9,161	36.1%	7,896	31.1%
	Lanark*****	8,063	29.8%	5,872	21.7%	6,486	23.9%	648	2.4%
	Montague	11,604	38.6%	7,929	26.3%	8,340	27.7%	7,936	26.4%
	N. Burgess*****	3,610	21.0%	1,702	9.9%	1,871	10.9%	490	2.9%
	N. Elmsley*****	5,955	40.8%	3,350	22.9%	3,159	21.6%	3,374	23.1%
	Pakenham*****	3,829	14.8%	2,136	8.2%	2,256	8.7%	63	0.2%
	Perth	592	63.0%	187	19.9%	158	16.9%	234	24.9%
	Ramsay*****	4,934	18.7%	2,447	9.3%	2,877	10.9%	1,230	4.7%
	Smith Falls	155	19.1%	106	13.1%	134	16.5%	112	13.8%
	South Sherbrooke****	3,618	21.1%	2,172	12.7%	17	0.1%	N/A	N/A
Leeds	Bastard & S. Burgess*****	5,367	17.4%	2,771	9.0%	3,015	9.8%	2,483	8.1%
	Elizabethtown	11,104	31.7%	6,023	17.2%	6,010	17.2%	6,574	18.8%
	Front of Escott	5,422	21.5%	2,597	10.3%	2,491	9.9%	2,848	11.3%
	Front of Leeds & Lansdowne	13,466	48.3%	2,310	8.3%	2,157	7.7%	2,250	8.1%
	Front of Yonge	1,815	13.5%	795	5.9%	748	5.6%	727	5.4%
	Kitley	5,719	24.4%	3,375	14.4%	3,515	15.0%	3,850	16.4%
	N. Crosby*****	3,905	18.0%	1,805	8.3%	2,207	10.2%	169	0.8%
	Rear of Leeds & Lansdowne	3,700	14.3%	1,864	7.2%	1,809	7.0%	1,726	6.7%
	S. Crosby	3,054	14.3%	1,227	5.7%	1,461	6.8%	938	4.4%
	S. Elmsley*****	2,725	23.4%	1,568	13.5%	1,455	12.5%	1,451	12.4%
Lennox and Addington	Adolphustown	1,482	27.2%	207	3.8%	341	6.3%	224	4.1%
	Amhert Island	3,500	50.5%	596	8.6%	675	9.7%	710	10.2%
	Camden East******	8,747	22.9%	4,439	11.6%	4,796	12.6%	4,022	10.5%
	Ernestown	6,488	23.8%	1,005	3.7%	1,402	5.1%	1,011	3.7%
	N. Fredericksburgh	3,153	28.4%	606	5.5%	732	6.6%	559	5.0%
	Richmond	8,698	38.4%	2,660	11.8%	3,175	14.0%	2,974	13.1%
	S. Fredericksburgh	3,770	36.5%	686	6.6%	833	8.1%	675	6.5%
	Sheffield*****	2,529	7.0%	1,832	5.1%	2,192	6.1%	859	2.4%
Metro Toronto	Etobicoke	361	2.7%	0	0.0%	0	0.0%		0.0%
	North York	495	2.8%	0	0.0%	0	0.0%		0.0%
	Scarborough	511	2.7%	115	0.6%	0	0.0%	45	0.2%
	York	12	0.6%	0	0.0%	0	0.0%		0.0%

County	Township	Pre-Settlement (c. 1800) Wetland Area		1967 Wetland Area		1982 Wetland Area		2002 Wetland Area	
		Ha	% of Township	Ha	% of Township	Ha	% of Township	Ha	% of Township
Middlesex	Adelaide	1,814	9.4%	217	1.1%	212	1.1%	98	0.5%
	Biddulph	1,935	11.1%	222	1.3%	96	0.5%	38	0.2%
	Caradoc	6,109	17.9%	1,351	4.0%	631	1.9%	792	2.3%
	Delaware	824	8.5%	80	0.8%	72	0.7%	46	0.5%
	E. Williams	2,191	13.3%	460	2.8%	366	2.2%	217	1.3%
	Ekfrid	3,334	14.8%	564	2.5%	511	2.3%	250	1.1%
	Lobo	1,956	9.5%	165	0.8%	77	0.4%	68	0.3%
	London	3,113	8.9%	534	1.5%	495	1.4%	143	0.4%
	London City	194	1.2%	40	0.2%	0	0.0%	74	0.4%
	McGillivray	4,499	15.8%	795	2.8%	562	2.0%	320	1.1%
	Metcalfe	1,540	10.2%	355	2.4%	289	1.9%	151	1.0%
	Mosa	4,189	20.3%	1,944	9.4%	1,589	7.7%	816	4.0%
	North Dorchester	3,466	15.2%	1,389	6.1%	1,283	5.6%	1,084	4.7%
	W. Williams	3,390	22.2%	408	2.7%	301	2.0%	203	1.3%
	West Nissouri	1,574	7.5%	245	1.2%	252	1.2%	93	0.4%
	Westminster	986	4.7%	223	1.1%	186	0.9%	119	0.6%
Muskoka	Muskoka Lakes*	10,092	10.0%	1,202	1.2%	N/A	N/A	N/A	N/A
Niagara	Fort Erie	8,707	50.8%	1,331	7.8%	2,743	16.0%	1,900	11.1%
	Grimsby	2,210	32.0%	270	3.9%	385	5.6%	338	4.9%
	Lincoln	3,975	23.4%	156	0.9%	338	2.0%	233	1.4%
	Niagara	7,273	34.9%	1,396	6.7%	2,648	12.7%	1,430	6.9%
	Niagara-On-The-Lake	3,782	28.9%	111	0.8%	145	1.1%	12	0.1%
	Port Colborne	6,313	55.0%	1,343	11.7%	1,610	14.0%	1,206	10.5%
	St. Catharines	421	4.5%	0	0.0%	0	0.0%	11	0.1%
	Thorold	1,618	18.2%	175	2.0%	223	2.5%	167	1.9%
	Wainfleet	14,674	65.5%	3,071	13.7%	3,388	15.1%	2,730	12.2%
	Welland	2,427	28.7%	255	3.0%	429	5.1%	278	3.3%
	West Lincoln	17,528	33.5%	3,061	5.9%	3,769	7.2%	1,965	3.8%
Northumberland	Alnwick	1,208	11.3%	775	7.2%	662	6.2%	761	7.1%
	Brighton	4,327	19.5%	2,894	13.1%	3,069	13.8%	3,149	14.2%
	Cramahe	2,662	13.2%	1,693	8.4%	1,961	9.7%	1,700	8.4%
	Haldimand	3,118	9.5%	1,808	5.5%	1,858	5.7%	1,809	5.5%
	Hamilton	2,653	8.5%	968	3.1%	1,050	3.3%	922	2.9%
	Hope	1,245	4.5%	692	2.5%	687	2.5%	693	2.5%
	Murray	4,597	21.6%	2,507	11.8%	2,901	13.6%	2,914	13.7%
	Percy	3,345	15.2%	1,787	8.1%	1,904	8.6%	1,874	8.5%
	Seymour	5,317	16.7%	2,174	6.8%	2,488	7.8%	2,392	7.5%

County	Township	Pre-Settlement (c. 1800) Wetland Area		1967 Wetland Area		1982 Wetland Area		2002 Wetland Area	
		Ha	% of Township	Ha	% of Township	Ha	% of Township	Ha	% of Township
Ottawa-Carleton	Cumberland	18,575	58.9%	3,582	11.3%	3,645	11.5%	2,817	8.9%
	Gloucester	15,015	36.7%	4,250	10.4%	3,312	8.1%	4,245	10.4%
	Goulbourn	13,179	47.1%	5,384	19.2%	6,125	21.9%	5,833	20.8%
	March	4,575	34.0%	1,296	9.6%	1,425	10.6%	1,103	8.2%
	Napean	9,364	44.0%	978	4.6%	687	3.2%	1,050	4.9%
	Osgoode	19,931	51.0%	4,290	11.0%	4,973	12.7%	4,217	10.8%
	Rideau	23,472	56.0%	10,327	24.6%	10,937	26.1%	11,123	26.5%
	West Carleton	27,567	44.1%	6,944	11.1%	7,625	12.2%	6,725	10.8%
Oxford	Blandford	1,672	13.7%	918	7.5%	991	8.1%	934	7.7%
	Blenheim	3,298	11.8%	1,948	7.0%	2,041	7.3%	2,092	7.5%
	East Zorra - Tavistock	2,075	8.1%	363	1.4%	268	1.0%	283	1.1%
	Ingersoll	7	0.7%	0	0.0%	0	0.0%	0	0.0%
	Norwich	1,960	4.4%	813	1.8%	833	1.9%	709	1.6%
	Southwest Oxford	3,925	10.5%	1,061	2.8%	1,025	2.7%	765	2.0%
	Tillsonburg	2	0.1%	0	0.0%	0	0.0%	0	0.0%
	Woodstock	44	1.7%	28	1.1%	0	0.0%	23	0.9%
	Zorra	4,632	8.5%	1,388	2.6%	1,191	2.2%	1,113	2.1%
Peel	Brampton	1,192	4.3%	89	0.3%	16	0.1%	24	0.1%
	Caledon	5,432	7.8%	2,429	3.5%	2,487	3.6%	2,030	2.9%
	Mississauga	2,903	10.1%	33	0.1%	22	0.1%	0	0.0%
Perth	Blanshard	1,721	8.2%	14	0.1%	27	0.1%	26	0.1%
	Downie	4,883	24.0%	633	3.1%	653	3.2%	415	2.0%
	Ellice	2,749	11.8%	1,213	5.2%	1,177	5.0%	1,105	4.7%
	Elma	5,912	20.8%	821	2.9%	706	2.5%	259	0.9%
	Fullarton	2,585	15.0%	426	2.5%	370	2.1%	188	1.1%
	Hibbert	1,679	9.7%	350	2.0%	223	1.3%	216	1.3%
	Logan	4,083	18.0%	214	0.9%	212	0.9%	60	0.3%
	Mornington	4,843	22.9%	327	1.5%	318	1.5%	99	0.5%
	N. Easthope	1,558	8.9%	969	5.5%	981	5.6%	845	4.8%
	S. Easthope	1,165	12.2%	199	2.1%	144	1.5%	45	0.5%
	Stratford	549	24.0%	24	1.0%	15	0.7%	16	0.7%
	Wallace	1,889	9.1%	885	4.3%	792	3.8%	563	2.7%
Peterborough	Asphodel	4,284	25.4%	2,554	15.2%	2,251	13.4%	2,407	14.3%
	Cavan	3,880	14.6%	2,763	10.4%	2,954	11.1%	2,835	10.7%
	Douro	4,542	28.6%	2,821	17.8%	2,748	17.3%	2,884	18.2%
	Dummer	7,527	23.1%	6,303	19.3%	6,361	19.5%	5,929	18.2%
	Ennismore	2,277	24.5%	1,162	12.5%	1,191	12.8%	1,279	13.7%
	N. Monaghan	1,346	34.2%	579	14.7%	817	20.8%	736	18.7%
	Otonabee	9,008	28.2%	4,352	13.6%	4,386	13.7%	4,261	13.3%
	Peterborough	501	9.2%	104	1.9%	24	0.4%	153	2.8%
	S. Monaghan	1,716	20.1%	1,033	12.1%	1,124	13.1%	1,169	13.7%
	Smith	5,028	17.1%	3,234	11.0%	3,186	10.8%	3,238	11.0%

County	Township	Pre-Settlement (c. 1800) Wetland Area		1967 Wetland Area		1982 Wetland Area		2002 Wetland Area	
		Ha	% of Township	Ha	% of Township	Ha	% of Township	Ha	% of Township
Prescott	Alfred	12,225	66.8%	1,129	6.2%	1,228	6.7%	1,089	6.0%
	Caledonia	13,357	71.1%	4,011	21.3%	3,721	19.8%	3,413	18.2%
	East Hawkesbury	11,164	48.0%	1,325	5.7%	1,416	6.1%	1,124	4.8%
	Longueuil	4,833	57.5%	286	3.4%	360	4.3%	199	2.4%
	North Plantagenet	5,891	27.5%	1,310	6.1%	1,416	6.6%	1,161	5.4%
	South Plantegenet	10,724	50.8%	1,041	4.9%	1,232	5.8%	839	4.0%
	West Hawkesbury	5,027	38.2%	1,163	8.8%	1,618	12.3%	1,011	7.7%
Prince Edward	Ameliasburgh	3,996	20.1%	2,387	12.0%	2,396	12.1%	2,815	14.2%
	Athol	1,566	13.7%	630	5.5%	762	6.7%	821	7.2%
	Hallowell	3,945	18.9%	2,607	12.5%	2,790	13.4%	2,902	13.9%
	Hillier	3,032	19.7%	1,580	10.3%	1,719	11.2%	1,911	12.4%
	N. Marysburgh	1,060	10.5%	583	5.7%	688	6.8%	710	7.0%
	S. Marysburgh	1,047	9.8%	512	4.8%	562	5.3%	608	5.7%
	Sophiasburg	3,822	19.2%	2,000	10.0%	2,398	12.0%	2,658	13.3%
Russell	Cambridge	6,691	25.0%	1,248	4.7%	1,143	4.3%	1,082	4.0%
	Clarence	7,297	24.2%	729	2.4%	876	2.9%	729	2.4%
	Russell	8,186	40.9%	332	1.7%	424	2.1%	283	1.4%
Simcoe	Adjala	1,528	8.2%	760	4.1%	652	3.5%	527	2.8%
	Barrie	90	2.6%	44	1.3%	25	0.7%	18	0.5%
	Essa	2,659	9.5%	1,622	5.8%	1,496	5.3%	1,492	5.3%
	Flos	3,835	14.5%	1,243	4.7%	1,369	5.2%	1,203	4.6%
	Innisfil	3,191	11.2%	2,302	8.1%	1,611	5.6%	1,582	5.5%
	Mara	9,206	34.9%	5,874	22.3%	5,682	21.6%	5,948	22.6%
	Matchedash	4,965	23.5%	2,026	9.6%	2,695	12.7%	1,055	5.0%
	Medonte	5,218	18.1%	2,705	9.4%	2,972	10.3%	2,538	8.8%
	Nottawasaga	2,201	5.5%	1,122	2.8%	1,313	3.3%	981	2.5%
	Orillia	5,735	17.1%	2,920	8.7%	3,170	9.5%	2,631	7.8%
	Oro	3,787	11.8%	2,600	8.1%	2,662	8.3%	2,505	7.8%
	Rama***	4,499	25.8%	2,897	16.6%	2	0.0%	2,626	15.1%
	Sunnidale	7,065	34.1%	2,047	9.9%	2,222	10.7%	2,356	11.4%
	Tay	4,964	24.4%	2,454	12.1%	3,294	16.2%	2,670	13.1%
	Tecumseth	2,215	7.6%	1,040	3.6%	844	2.9%	663	2.3%
	Tiny	3,538	9.3%	1,842	4.8%	1,792	4.7%	1,913	5.0%
	Tosorontio	1,730	9.3%	972	5.2%	850	4.6%	698	3.8%
	Vespra	9,993	36.6%	6,238	22.9%	6,062	22.2%	6,296	23.1%
	West Gwillimbury	2,747	13.0%	1,408	6.7%	1,572	7.4%	1,373	6.5%
Stormont	Cornwall	8,302	31.2%	4,074	15.3%	5,368	20.2%	3,598	13.5%
	Finch	9,993	46.9%	686	3.2%	836	3.9%	697	3.3%
	Osnabruck	10,245	43.1%	5,967	25.1%	6,826	28.7%	6,035	25.4%
	Roxborough	13,145	43.1%	5,706	18.7%	6,216	20.4%	5,038	16.5%

County	Township	Pre-Settlement (c. 1800) Wetland Area		1967 Wetland Area		1982 Wetland Area		2002 Wetland Area	
		Ha	% of Township	Ha	% of Township	Ha	% of Township	Ha	% of Township
Victoria	Carden	2,397	11.6%	1,757	8.5%	1,665	8.0%	1,658	8.0%
	Eldon	5,058	18.7%	3,128	11.6%	3,125	11.6%	3,016	11.2%
	Emily	6,397	23.9%	4,062	15.2%	4,100	15.3%	4,248	15.8%
	Fenelon	5,858	20.7%	3,879	13.7%	3,761	13.3%	4,047	14.3%
	Laxton, Dibgy & Longford**	5,717	11.5%	2,470	5.0%	0	0.0%	1,389	2.8%
	Manvers	5,362	18.0%	4,309	14.5%	4,373	14.7%	4,083	13.7%
	Mariposa	10,386	29.9%	5,362	15.4%	5,048	14.5%	4,973	14.3%
	Ops	9,550	36.6%	4,524	17.3%	4,820	18.5%	4,647	17.8%
	Verulam	3,749	13.6%	2,347	8.5%	2,257	8.2%	2,652	9.6%
Waterloo	Cambridge	1,122	9.9%	384	3.4%	458	4.0%	491	4.3%
	Kitchener	667	4.8%	226	1.6%	220	1.6%	262	1.9%
	N. Dumfries	2,527	13.2%	1,254	6.5%	1,275	6.7%	1,581	8.3%
	Waterloo	406	6.0%	157	2.3%	154	2.3%	162	2.4%
	Wellesley	7,062	25.4%	750	2.7%	761	2.7%	620	2.2%
	Wilmont	1,750	6.5%	400	1.5%	496	1.9%	429	1.6%
	Woolwich	5,830	17.5%	1,490	4.5%	1,407	4.2%	1,413	4.2%
Wellington	Arthur	2,908	10.2%	1,289	4.5%	1,009	3.6%	1,110	3.9%
	Eramosa	2,758	14.5%	1,717	9.0%	1,457	7.7%	1,705	9.0%
	Erin	4,897	16.6%	3,592	12.2%	2,636	9.0%	3,418	11.6%
	Guelph	1,655	14.1%	843	7.2%	704	6.0%	894	7.6%
	Guelph City	649	9.5%	311	4.6%	226	3.3%	272	4.0%
	Maryborough	2,064	8.8%	929	4.0%	658	2.8%	769	3.3%
	Minto	5,137	17.1%	2,975	9.9%	2,404	8.0%	2,469	8.2%
	Nichol	1,086	9.2%	438	3.7%	315	2.7%	393	3.3%
	Peel	2,124	6.9%	941	3.0%	719	2.3%	703	2.3%
	Pilkington	919	7.3%	418	3.3%	304	2.4%	416	3.3%
	Puslinch	3,930	16.8%	2,601	11.1%	2,420	10.3%	2,648	11.3%
	West Garafraxa	2,731	13.8%	851	4.3%	531	2.7%	721	3.6%
	West Luther	6,213	30.0%	3,202	15.5%	2,175	10.5%	3,286	15.9%
York	Aurora	58	1.1%	23	0.4%	25	0.5%	24	0.5%
	East Gwillimbury	7,345	29.4%	4,487	18.0%	3,978	15.9%	3,858	15.4%
	Georgina	11,880	40.8%	5,870	20.2%	6,631	22.8%	5,965	20.5%
	King	3,972	11.6%	1,249	3.7%	1,209	3.5%	991	2.9%
	Markham	873	4.3%	34	0.2%	21	0.1%	13	0.1%
	Newmarket	13	0.3%	0	0.0%	0	0.0%	0	0.0%
	Richmond Hill	666	6.2%	119	1.1%	163	1.5%	68	0.6%
	Vaughan	1,134	4.2%	12	0.0%	41	0.2%	3	0.0%
	Whitchurch-Stouffville	1,390	6.5%	568	2.6%	515	2.4%	382	1.8%
	Full Study Area	2,026,591	24.8%	637,020	7.8%	631,699	7.7%	560,844	6.8%

* only partial coverage for 1967, no coverage for 1982 or 2002
**only partial coverage for 1967 and 2002, no coverage for 1982
***partial or missing 1982 coverage
****partial or missing 1982 and 2002 coverage
*****partial or missing 2002 coverage
******majority of area with 2002 coverage

Appendix B-2: Township wetland conversion statistics for 1967, 1982 and 2002

County	Township	Amount of Pre-Settlement Wetland Area					
		Lost by 1967		Lost by 1982		Lost by 2002	
		Ha	%	Ha	%	Ha	%
Brant	Brantford	273	100.0%	273	100.0%	273	100.0%
	Burford	2,720	84.3%	2,760	85.6%	2,876	89.2%
	Oakland	178	73.9%	220	91.4%	194	80.6%
	Onondaga	271	96.5%	281	100.0%	272	96.9%
	s. Dumfries	1,048	88.0%	1,027	86.2%	998	83.8%
	Tuscorora	3,452	81.3%	4,245	100.0%	3,684	86.8%
Bruce	Albemarle	1,148	38.3%	1,063	35.5%	1,209	40.4%
	Amabel	3,226	42.4%	3,118	40.9%	3,453	45.3%
	Arran	3,645	66.1%	3,691	67.0%	3,710	67.3%
	Brant	2,689	69.1%	2,669	68.6%	2,808	72.1%
	Bruce	3,072	53.7%	2,845	49.7%	3,461	60.5%
	Carrick	2,162	63.9%	2,298	67.9%	2,207	65.2%
	Culross	2,423	44.2%	2,632	48.0%	2,378	43.4%
	Eastnor	5,711	82.6%	5,846	84.5%	5,832	84.3%
	Elderslie	2,342	74.5%	2,433	77.5%	2,369	75.4%
	Greenock	4,918	40.1%	4,911	40.1%	4,843	39.5%
	Huron	12,894	97.8%	12,942	98.1%	13,011	98.7%
	Kincardine	3,012	94.2%	2,973	93.0%	3,037	95.0%
	Kinloss	2,794	62.8%	2,860	64.3%	2,758	62.0%
	Lindsay	1,503	48.7%	1,398	45.3%	1,744	56.5%
	Saugeen	639	49.9%	1,049	81.9%	617	48.2%
	St. Edmunds	655	30.6%	575	26.9%	884	41.3%
Dufferin	Amaranth	5,237	60.4%	5,757	66.4%	5,504	63.5%
	East Garafraxa	1,385	49.8%	1,561	56.2%	1,490	53.6%
	East Luther	4,129	67.1%	4,483	72.9%	4,428	72.0%
	Melancthon	5,221	53.1%	5,648	57.5%	5,583	56.8%
	Mono	1,073	45.1%	1,386	58.3%	1,290	54.2%
	Mulmur	236	28.6%	352	42.7%	254	30.8%
	Orangeville	197	65.1%	218	72.3%	251	83.2%
	Shelburne	3	52.9%	3	47.7%	2	42.1%
Dundas	Matilda	8,810	73.8%	8,266	69.3%	9,667	81.0%
	Mountain	10,201	74.2%	9,658	70.2%	10,516	76.5%
	Williamsburgh	6,732	49.8%	5,715	42.3%	6,313	46.7%
	Winchester	12,740	89.4%	12,879	90.4%	13,094	91.9%
Durham	Ajax	142	57.5%	141	56.9%	182	73.4%
	Brock	2,824	31.9%	2,444	27.6%	3,323	37.5%
	Clarington	2,313	51.3%	2,107	46.7%	2,430	53.8%
	Oshawa	701	88.4%	718	90.5%	680	85.7%
	Pickering	232	65.4%	242	68.3%	286	80.5%
	Scugog	3,282	31.5%	3,360	32.2%	3,415	32.7%
	Uxbridge	1,205	18.2%	955	14.4%	1,453	22.0%
	Whitby	733	74.3%	751	76.1%	752	76.3%

County	Township	Amount of Pre-Settlement Wetland Area					
		Lost by 1967		Lost by 1982		Lost by 2002	
		Ha	%	Ha	%	Ha	%
Elgin	Aldborough	3,810	81.1%	3,884	82.6%	4,249	90.4%
	Bayham	1,131	61.9%	1,114	61.0%	1,323	72.4%
	Dunwich	3,169	80.3%	3,225	81.7%	3,366	85.3%
	Malahide	2,342	72.6%	2,265	70.2%	2,640	81.9%
	S. Dorchester	528	81.5%	635	98.1%	635	98.1%
	Southwold	1,805	77.0%	1,805	77.0%	1,925	82.1%
	Yarmouth	630	73.2%	657	76.3%	742	86.1%
Essex	Anderdon	9,201	95.2%	9,450	97.8%	9,372	97.0%
	Colchester N.	11,511	96.7%	11,663	98.0%	11,713	98.4%
	Colchester S.	8,035	93.4%	8,126	94.5%	8,403	97.7%
	Gosfield N.	10,931	99.0%	10,986	99.5%	11,032	99.9%
	Gosfield S.	7,106	98.0%	7,154	98.7%	7,197	99.3%
	Maidstone	17,335	96.8%	17,568	98.1%	17,713	98.9%
	Malden	8,108	94.6%	8,402	98.0%	8,115	94.7%
	Mersea	19,429	96.5%	19,792	98.3%	19,005	94.4%
	Pelee	3,085	96.3%	3,203	100.0%	3,114	97.2%
	Rochester	13,044	99.7%	13,012	99.4%	13,019	99.5%
	Sandwich S	10,404	97.4%	10,559	98.9%	10,575	99.0%
	Sandwich West	4,039	96.5%	4,097	97.9%	4,082	97.6%
	Tilbury N	9,972	98.2%	10,012	98.6%	10,098	99.4%
	Tilbury West	9,489	99.5%	9,517	99.8%	9,527	99.9%
	Windsor	9,744	98.9%	9,854	100.0%	9,747	98.9%
Frontenac	Bedford*****	906	42.3%	734	34.3%	1,626	76.0%
	Hinchinbrooke*****	2,077	39.8%	959	18.4%	N/A	N/A
	Howe Island	563	76.2%	554	74.9%	457	61.8%
	Kingston	2,031	64.3%	2,104	66.6%	2,022	64.0%
	Loughborough*****	1,265	48.4%	1,163	44.5%	1,344	51.4%
	Pittsburgh	4,423	90.6%	4,167	85.4%	3,976	81.5%
	Portland*****	1,426	29.9%	1,650	34.6%	1,773	37.2%
	Storrington	1,559	53.0%	1,316	44.8%	1,620	55.1%
	Wolfe Island	2,965	86.1%	3,027	87.9%	2,792	81.0%
Glengarry	Charlottenburgh	9,051	65.1%	8,116	58.4%	9,388	67.6%
	Kenyon	5,103	46.4%	4,613	42.0%	5,689	51.8%
	Lancaster	13,265	86.2%	13,199	85.8%	14,390	93.5%
	Lochiel	13,158	87.1%	12,961	85.8%	13,901	92.0%
Grenville	Augusta	6,119	52.2%	4,501	38.4%	5,085	43.4%
	Edwardsburgh	4,891	42.6%	3,598	31.3%	4,846	42.2%
	Oxford (On Rideau)	4,918	51.3%	3,913	40.8%	4,398	45.9%
	South Gower	2,340	56.9%	1,922	46.7%	2,269	55.1%
	Wolford	2,972	30.8%	2,544	26.4%	2,251	23.3%

Continued on next page

County	Township	Amount of Pre-Settlement Wetland Area					
		Lost by 1967		Lost by 1982		Lost by 2002	
		Ha	%	Ha	%	Ha	%
Grey	Artemesia	2,047	32.9%	2,042	32.8%	2,444	39.3%
	Bentinck	2,050	34.9%	1,892	32.3%	2,548	43.4%
	Collingwood	798	39.3%	548	27.0%	831	40.9%
	Derby	2,114	43.4%	2,455	50.4%	2,300	47.2%
	Egremont	2,065	33.9%	2,293	37.6%	2,471	40.6%
	Euphrasia	1,269	29.7%	1,117	26.1%	1,429	33.4%
	Glenelg	1,410	28.9%	2,245	46.0%	1,969	40.4%
	Hanover	1	27.4%	2	77.3%	1	31.6%
	Holland	1,361	24.4%	1,266	22.7%	1,696	30.4%
	Keppel	2,351	26.4%	2,068	23.2%	2,314	25.9%
	Normanby	2,096	45.7%	2,235	48.8%	2,545	55.5%
	Osprey	1,524	20.5%	1,673	22.5%	1,757	23.7%
	Proton	4,356	36.3%	4,987	41.5%	5,015	41.8%
	Sarawak	657	85.6%	574	74.8%	715	93.3%
	St. Vincent	1,425	73.8%	1,392	72.1%	1,325	68.6%
	Sullivan	4,016	58.5%	4,431	64.5%	4,425	64.5%
	Sydenham	1,169	33.5%	1,196	34.3%	1,295	37.1%
Haldimand-Norfolk	Delhi	10,481	60.5%	11,927	68.8%	11,946	69.0%
	Dunnville	12,190	84.3%	11,821	81.7%	12,123	83.8%
	Haldimand	16,277	89.3%	16,215	89.0%	17,018	93.4%
	Nanticoke	16,058	94.1%	15,829	92.8%	16,289	95.5%
	Norfolk	12,157	62.0%	13,115	66.9%	13,775	70.3%
	Simcoe	441	78.6%	487	86.8%	509	90.7%
Halton	Burlington	2,164	92.7%	2,210	94.7%	2,141	91.7%
	Halton Hills	1,601	56.3%	1,507	53.0%	1,750	61.5%
	Milton	3,138	52.0%	3,009	49.8%	3,560	59.0%
	Oakville	1,106	94.1%	1,111	94.5%	1,136	96.6%
Hamilton-Wentworth	Ancaster	300	88.9%	291	86.3%	310	91.7%
	Dundas	83	48.6%	171	100.0%	76	44.3%
	Flamborough	5,483	52.2%	5,857	55.8%	5,275	50.2%
	Glanbrook	1,238	88.8%	1,233	88.4%	1,250	89.6%
	Hamilton	337	100.0%	306	90.7%	337	100.0%
	Stoney Creek	2,188	96.0%	2,171	95.3%	2,156	94.6%
Hastings	Hungerford*****	2,011	34.6%	1,640	28.2%	2,832	48.7%
	Huntingdon******	1,121	31.4%	1,010	28.3%	1,506	42.2%
	Rawdon	1,468	40.8%	1,098	30.5%	1,473	40.9%
	Sidney	4,780	73.3%	4,229	64.8%	4,168	63.9%
	Thurlow	3,988	60.8%	3,588	54.7%	3,789	57.7%
	Tyendinaga	4,028	57.2%	3,645	51.8%	3,847	54.6%

| County | Township | Amount of Pre-Settlement Wetland Area | | | | | |
| | | Lost by 1967 | | Lost by 1982 | | Lost by 2002 | |
		Ha	%	Ha	%	Ha	%
Huron	Ashfield	8,644	93.3%	8,849	95.5%	8,813	95.2%
	Colborne	1,413	78.2%	1,381	76.4%	1,523	84.3%
	East Wawanosh	1,360	56.2%	1,492	61.6%	1,327	54.8%
	Goderich	2,005	85.8%	1,944	83.2%	2,029	86.9%
	Grey	5,962	72.7%	6,498	79.2%	6,616	80.6%
	Hay	4,943	71.3%	5,020	72.4%	5,114	73.7%
	Howick	2,362	46.2%	2,655	51.9%	2,514	49.1%
	Hullett	2,172	85.2%	1,697	66.6%	1,812	71.1%
	McKillop	3,837	83.6%	4,139	90.2%	4,149	90.4%
	Morris	1,702	57.2%	1,793	60.3%	1,701	57.2%
	Stanley	3,395	89.4%	3,493	91.9%	3,499	92.1%
	Stephen	8,122	78.9%	8,441	82.0%	9,103	88.5%
	Tuckersmith	1,315	89.4%	1,336	90.9%	1,358	92.3%
	Turnberry	817	30.1%	941	34.6%	893	32.8%
	Usborne	928	95.3%	941	96.7%	973	100.0%
	West Wawanosh	1,533	39.3%	1,587	40.7%	1,564	40.1%
Kent	Camden	7,775	94.1%	7,987	96.7%	8,243	99.8%
	Chatham	20,875	98.0%	21,074	99.0%	21,191	99.5%
	Dover	25,034	93.3%	25,806	96.2%	25,567	95.3%
	Harwich	14,557	97.2%	14,683	98.0%	14,785	98.7%
	Howard	5,341	95.3%	5,524	98.5%	5,589	99.7%
	Orford	4,580	91.0%	4,595	91.3%	4,833	96.0%
	Raleigh	23,233	97.5%	23,599	99.0%	23,708	99.5%
	Romney	10,113	96.0%	10,370	98.4%	10,461	99.3%
	Tilbury East	22,236	98.1%	22,493	99.3%	22,531	99.4%
	Zone	1,622	90.8%	1,680	94.0%	1,787	100.0%
Lambton	Bosanquet	10,502	84.8%	11,267	91.0%	11,767	95.0%
	Brooke	15,806	91.7%	16,062	93.2%	16,897	98.0%
	Dawn	22,680	89.4%	23,012	90.7%	24,857	98.0%
	Enniskillen	25,948	88.7%	27,005	92.3%	28,212	96.5%
	Euphemia	3,397	87.1%	3,543	90.9%	3,780	97.0%
	Moore	7,071	77.0%	7,614	82.9%	8,323	90.6%
	Plympton	11,135	86.8%	11,712	91.2%	12,494	97.3%
	Sarnia	6,765	85.2%	7,591	95.6%	7,503	94.4%
	Sombra Twp	20,665	88.4%	21,070	90.1%	22,690	97.0%
	Warwick	2,340	85.4%	2,444	89.1%	2,621	95.6%

County	Township	Amount of Pre-Settlement Wetland Area					
		Lost by 1967		Lost by 1982		Lost by 2002	
		Ha	%	Ha	%	Ha	%
Lanark	Bathurst*****	4,273	54.7%	4,170	53.4%	6,260	80.1%
	Beckwith*****	5,102	36.8%	4,097	29.6%	5,716	41.3%
	Carleton Place	62	95.6%	61	93.3%	61	93.9%
	Darling****	1,429	30.0%	N/A	N/A	N/A	N/A
	Drummond*****	5,163	38.0%	4,416	32.5%	5,680	41.8%
	Lanark*****	2,191	27.2%	1,577	19.6%	7,415	92.0%
	Montague	3,676	31.7%	3,265	28.1%	3,669	31.6%
	N. Burgess*****	1,908	52.8%	1,739	48.2%	3,120	86.4%
	N. Elmsley*****	2,605	43.7%	2,796	47.0%	2,581	43.3%
	Pakenham*****	1,693	44.2%	1,573	41.1%	3,766	98.4%
	Perth	405	68.4%	433	73.2%	357	60.4%
	Ramsay*****	2,487	50.4%	2,057	41.7%	3,704	75.1%
	Smith Falls	49	31.5%	21	13.6%	43	27.7%
	South Sherbrooke****	1,446	40.0%	3,600	99.5%	N/A	N/A
Leeds	Bastard & S. Burgess*****	2,596	48.4%	2,352	43.8%	2,884	53.7%
	Elizabethtown	5,081	45.8%	5,093	45.9%	4,529	40.8%
	Front of Escott	2,825	52.1%	2,932	54.1%	2,574	47.5%
	Front of Leeds & Lansdowne	11,156	82.8%	11,309	84.0%	11,216	83.3%
	Front of Yonge	1,021	56.2%	1,068	58.8%	1,088	59.9%
	Kitley	2,344	41.0%	2,203	38.5%	1,868	32.7%
	N. Crosby*****	2,101	53.8%	1,698	43.5%	3,736	95.7%
	Rear of Leeds & Lansdowne	1,836	49.6%	1,891	51.1%	1,975	53.4%
	S. Crosby	1,827	59.8%	1,593	52.2%	2,116	69.3%
	S. Elmsley*****	1,157	42.4%	1,270	46.6%	1,274	46.8%
Lennox and Addington	Adolphustown	1,275	86.0%	1,140	77.0%	1,258	84.9%
	Amhert Island	2,903	83.0%	2,825	80.7%	2,790	79.7%
	Camden East******	4,308	49.3%	3,951	45.2%	4,726	54.0%
	Ernestown	5,484	84.5%	5,087	78.4%	5,477	84.4%
	N. Fredericksburgh	2,547	80.8%	2,421	76.8%	2,593	82.3%
	Richmond	6,037	69.4%	5,523	63.5%	5,724	65.8%
	S. Fredericksburgh	3,084	81.8%	2,936	77.9%	3,095	82.1%
	Sheffield*****	696	27.5%	337	13.3%	1,669	66.0%
Metro Toronto	Etobicoke	361	100.0%	361	100.0%	361	100.0%
	North York	495	100.0%	495	100.0%	495	100.0%
	Scarborough	396	77.5%	511	100.0%	466	91.2%
	York	12	100.0%	12	100.0%	12	100.0%

| County | Township | Amount of Pre-Settlement Wetland Area | | | | | |
| | | Lost by 1967 | | Lost by 1982 | | Lost by 2002 | |
		Ha	%	Ha	%	Ha	%
Middlesex	Adelaide	1,597	88.0%	1,602	88.3%	1,715	94.6%
	Biddulph	1,713	88.5%	1,839	95.1%	1,897	98.0%
	Caradoc	4,758	77.9%	5,478	89.7%	5,317	87.0%
	Delaware	745	90.4%	752	91.2%	778	94.4%
	E. Williams	1,731	79.0%	1,826	83.3%	1,974	90.1%
	Ekfrid	2,770	83.1%	2,823	84.7%	3,084	92.5%
	Lobo	1,791	91.6%	1,879	96.1%	1,888	96.5%
	London	2,579	82.8%	2,618	84.1%	2,970	95.4%
	London City	155	79.6%	194	99.8%	121	62.0%
	McGillivray	3,704	82.3%	3,937	87.5%	4,179	92.9%
	Metcalfe	1,185	76.9%	1,251	81.2%	1,389	90.2%
	Mosa	2,245	53.6%	2,600	62.1%	3,373	80.5%
	North Dorchester	2,078	59.9%	2,183	63.0%	2,382	68.7%
	W. Williams	2,982	88.0%	3,089	91.1%	3,187	94.0%
	West Nissouri	1,329	84.4%	1,322	84.0%	1,482	94.1%
	Westminster	763	77.4%	800	81.1%	867	87.9%
Muskoka	Muskoka Lakes*	8,890	88.1%	N/A	N/A	N/A	N/A
Niagara	Fort Erie	7,376	84.7%	5,964	68.5%	6,807	78.2%
	Grimsby	1,941	87.8%	1,825	82.6%	1,872	84.7%
	Lincoln	3,819	96.1%	3,637	91.5%	3,742	94.1%
	Niagara	5,877	80.8%	4,625	63.6%	5,843	80.3%
	Niagara-On-The-Lake	3,671	97.1%	3,637	96.2%	3,770	99.7%
	Port Colborne	4,970	78.7%	4,703	74.5%	5,107	80.9%
	St. Catharines	421	100.0%	421	100.0%	411	97.5%
	Thorold	1,443	89.2%	1,395	86.2%	1,451	89.7%
	Wainfleet	11,603	79.1%	11,286	76.9%	11,944	81.4%
	Welland	2,172	89.5%	1,998	82.3%	2,149	88.6%
	West Lincoln	14,467	82.5%	13,758	78.5%	15,563	88.8%
Northumberland	Alnwick	433	35.9%	546	45.2%	446	37.0%
	Brighton	1,433	33.1%	1,258	29.1%	1,178	27.2%
	Cramahe	969	36.4%	701	26.3%	962	36.1%
	Haldimand	1,309	42.0%	1,260	40.4%	1,309	42.0%
	Hamilton	1,684	63.5%	1,603	60.4%	1,730	65.2%
	Hope	553	44.4%	558	44.8%	552	44.3%
	Murray	2,091	45.5%	1,696	36.9%	1,683	36.6%
	Percy	1,558	46.6%	1,442	43.1%	1,471	44.0%
	Seymour	3,143	59.1%	2,829	53.2%	2,926	55.0%

Continued on next page

County	Township	Amount of Pre-Settlement Wetland Area					
		Lost by 1967		Lost by 1982		Lost by 2002	
		Ha	%	Ha	%	Ha	%
Ottawa-Carleton	Cumberland	14,993	80.7%	14,930	80.4%	15,758	84.8%
	Gloucester	10,766	71.7%	11,703	77.9%	10,771	71.7%
	Goulbourn	7,795	59.1%	7,053	53.5%	7,345	55.7%
	March	3,279	71.7%	3,150	68.8%	3,472	75.9%
	Napean	8,386	89.6%	8,678	92.7%	8,314	88.8%
	Osgoode	15,642	78.5%	14,958	75.0%	15,715	78.8%
	Rideau	13,145	56.0%	12,536	53.4%	12,349	52.6%
	West Carleton	20,623	74.8%	19,942	72.3%	20,842	75.6%
Oxford	Blandford	754	45.1%	681	40.7%	737	44.1%
	Blenheim	1,350	40.9%	1,257	38.1%	1,207	36.6%
	East Zorra - Tavistock	1,711	82.5%	1,807	87.1%	1,791	86.3%
	Ingersoll	7	100.0%	7	100.0%	7	100.0%
	Norwich	1,147	58.5%	1,127	57.5%	1,251	63.8%
	Southwest Oxford	2,864	73.0%	2,900	73.9%	3,160	80.5%
	Tillsonburg	2	100.0%	2	100.0%	2	100.0%
	Woodstock	16	35.7%	44	100.0%	21	47.1%
	Zorra	3,245	70.0%	3,442	74.3%	3,519	76.0%
Peel	Brampton	1,103	92.5%	1,177	98.7%	1,169	98.0%
	Caledon	3,004	55.3%	2,946	54.2%	3,403	62.6%
	Mississauga	2,871	98.9%	2,882	99.3%	2,903	100.0%
Perth	Blanshard	1,707	99.2%	1,694	98.4%	1,694	98.5%
	Downie	4,251	87.0%	4,231	86.6%	4,468	91.5%
	Ellice	1,536	55.9%	1,572	57.2%	1,644	59.8%
	Elma	5,091	86.1%	5,206	88.1%	5,653	95.6%
	Fullarton	2,159	83.5%	2,215	85.7%	2,397	92.7%
	Hibbert	1,329	79.2%	1,456	86.7%	1,463	87.1%
	Logan	3,869	94.8%	3,870	94.8%	4,023	98.5%
	Mornington	4,516	93.2%	4,525	93.4%	4,745	98.0%
	N. Easthope	589	37.8%	577	37.0%	713	45.8%
	S. Easthope	966	82.9%	1,021	87.6%	1,120	96.1%
	Stratford	526	95.6%	534	97.2%	534	97.1%
	Wallace	1,003	53.1%	1,097	58.1%	1,326	70.2%
Peterborough	Asphodel	1,730	40.4%	2,033	47.5%	1,877	43.8%
	Cavan	1,117	28.8%	926	23.9%	1,045	26.9%
	Douro	1,721	37.9%	1,794	39.5%	1,658	36.5%
	Dummer	1,224	16.3%	1,166	15.5%	1,598	21.2%
	Ennismore	1,115	49.0%	1,086	47.7%	999	43.9%
	N. Monaghan	767	57.0%	529	39.3%	611	45.4%
	Otonabee	4,656	51.7%	4,622	51.3%	4,747	52.7%
	Peterborough	397	79.2%	476	95.1%	348	69.5%
	S. Monaghan	683	39.8%	592	34.5%	547	31.9%
	Smith	1,794	35.7%	1,841	36.6%	1,790	35.6%

Continued on next page

County	Township	Amount of Pre-Settlement Wetland Area					
		Lost by 1967		Lost by 1982		Lost by 2002	
		Ha	%	Ha	%	Ha	%
Prescott	Alfred	11,096	90.8%	10,997	90.0%	11,136	91.1%
	Caledonia	9,347	70.0%	9,636	72.1%	9,945	74.5%
	East Hawkesbury	9,839	88.1%	9,748	87.3%	10,039	89.9%
	Longueuil	4,546	94.1%	4,473	92.6%	4,634	95.9%
	North Plantagenet	4,581	77.8%	4,475	76.0%	4,731	80.3%
	South Plantegenet	9,683	90.3%	9,492	88.5%	9,885	92.2%
	West Hawkesbury	3,864	76.9%	3,409	67.8%	4,016	79.9%
Prince Edward	Ameliasburgh	1,609	40.3%	1,600	40.0%	1,181	29.6%
	Athol	937	59.8%	804	51.3%	745	47.6%
	Hallowell	1,338	33.9%	1,155	29.3%	1,044	26.5%
	Hillier	1,451	47.9%	1,313	43.3%	1,120	36.9%
	N. Marysburgh	477	45.0%	372	35.1%	350	33.0%
	S. Marysburgh	535	51.1%	485	46.3%	439	41.9%
	Sophiasburg	1,821	47.7%	1,424	37.3%	1,164	30.4%
Russell	Cambridge	5,444	81.4%	5,548	82.9%	5,610	83.8%
	Clarence	6,569	90.0%	6,422	88.0%	6,569	90.0%
	Russell	7,853	95.9%	7,762	94.8%	7,903	96.5%
Simcoe	Adjala	768	50.3%	877	57.4%	1,001	65.5%
	Barrie	45	50.5%	65	72.1%	72	80.4%
	Essa	1,037	39.0%	1,163	43.7%	1,167	43.9%
	Flos	2,592	67.6%	2,466	64.3%	2,633	68.6%
	Innisfil	890	27.9%	1,580	49.5%	1,609	50.4%
	Mara	3,332	36.2%	3,524	38.3%	3,259	35.4%
	Matchedash	2,939	59.2%	2,270	45.7%	3,910	78.7%
	Medonte	2,513	48.2%	2,246	43.0%	2,680	51.4%
	Nottawasaga	1,079	49.0%	888	40.4%	1,219	55.4%
	Orillia	2,815	49.1%	2,565	44.7%	3,104	54.1%
	Oro	1,187	31.3%	1,125	29.7%	1,282	33.9%
	Rama***	1,601	35.6%	4,497	100.0%	1,873	41.6%
	Sunnidale	5,018	71.0%	4,843	68.5%	4,709	66.7%
	Tay	2,510	50.6%	1,669	33.6%	2,294	46.2%
	Tecumseth	1,175	53.1%	1,371	61.9%	1,553	70.1%
	Tiny	1,696	47.9%	1,746	49.3%	1,625	45.9%
	Tosorontio	759	43.9%	880	50.9%	1,032	59.6%
	Vespra	3,755	37.6%	3,931	39.3%	3,697	37.0%
	West Gwillimbury	1,339	48.7%	1,175	42.8%	1,373	50.0%
Stormont	Cornwall	4,228	50.9%	2,934	35.3%	4,704	56.7%
	Finch	9,307	93.1%	9,157	91.6%	9,296	93.0%
	Osnabruck	4,278	41.8%	3,419	33.4%	4,210	41.1%
	Roxborough	7,439	56.6%	6,929	52.7%	8,107	61.7%

Continued on next page

County	Township	Amount of Pre-Settlement Wetland Area					
		Lost by 1967		Lost by 1982		Lost by 2002	
		Ha	%	Ha	%	Ha	%
Victoria	Carden	640	26.7%	732	30.5%	739	30.8%
	Eldon	1,931	38.2%	1,934	38.2%	2,043	40.4%
	Emily	2,335	36.5%	2,296	35.9%	2,148	33.6%
	Fenelon	1,979	33.8%	2,096	35.8%	1,810	30.9%
	Laxton, Dibgy & Longford**	3,247	56.8%	5,717	100.0%	4,329	75.7%
	Manvers	1,053	19.6%	989	18.4%	1,279	23.9%
	Mariposa	5,024	48.4%	5,338	51.4%	5,413	52.1%
	Ops	5,026	52.6%	4,730	49.5%	4,904	51.3%
	Verulam	1,402	37.4%	1,491	39.8%	1,097	29.3%
Waterloo	Cambridge	738	65.8%	665	59.2%	631	56.2%
	Kitchener	441	66.1%	446	66.9%	404	60.7%
	N. Dumfries	1,272	50.4%	1,251	49.5%	945	37.4%
	Waterloo	249	61.4%	251	61.9%	243	60.0%
	Wellesley	6,312	89.4%	6,301	89.2%	6,442	91.2%
	Wilmont	1,350	77.1%	1,254	71.7%	1,321	75.5%
	Woolwich	4,340	74.4%	4,422	75.9%	4,417	75.8%
Wellington	Arthur	1,619	55.7%	1,899	65.3%	1,798	61.8%
	Eramosa	1,040	37.7%	1,300	47.2%	1,052	38.2%
	Erin	1,305	26.6%	2,260	46.2%	1,479	30.2%
	Guelph	812	49.1%	951	57.5%	761	46.0%
	Guelph City	338	52.1%	423	65.2%	377	58.1%
	Maryborough	1,135	55.0%	1,407	68.1%	1,296	62.8%
	Minto	2,162	42.1%	2,733	53.2%	2,668	51.9%
	Nichol	648	59.7%	771	71.0%	693	63.8%
	Peel	1,183	55.7%	1,405	66.2%	1,421	66.9%
	Pilkington	501	54.5%	615	66.9%	503	54.7%
	Puslinch	1,329	33.8%	1,510	38.4%	1,282	32.6%
	West Garafraxa	1,880	68.8%	2,200	80.5%	2,010	73.6%
	West Luther	3,011	48.5%	4,038	65.0%	2,927	47.1%
York	Aurora	35	60.2%	33	56.6%	34	59.3%
	East Gwillimbury	2,859	38.9%	3,368	45.8%	3,488	47.5%
	Georgina	6,009	50.6%	5,249	44.2%	5,914	49.8%
	King	2,723	68.6%	2,763	69.6%	2,981	75.1%
	Markham	839	96.1%	852	97.6%	859	98.5%
	Newmarket	13	100.0%	13	100.0%	13	100.0%
	Richmond Hill	547	82.1%	503	75.5%	598	89.7%
	Vaughan	1,121	98.9%	1,092	96.4%	1,131	99.7%
	Whitchurch-Stouffville	822	59.1%	876	63.0%	1,008	72.5%
	Full Study Area	1,389,571	68.6%	1,394,893	68.8%	1,465,747	72.3%

* only partial coverage for 1967, no coverage for 1982 or 2002
**only partial coverage for 1967 and 2002, no coverage for 1982
***partial or missing 1982 coverage
****partial or missing 1982 and 2002 coverage
*****partial or missing 2002 coverage
******majority of area with 2002 coverage

Appendix B-3: Between year, 1967-2002, wetland conversion statistics by township

County	Township	Amount of 1967 Wetland Area						
		Ha	Lost by 2002		Gained by 2002		Net Change	
			Ha	%	Ha	%	Ha	%
Brant	Brantford	0	0.00	0.0%	0.00	0.0%	0.00	0.0%
	Burford	505	65.42	13.0%	17.24	3.4%	-48.18	-9.5%
	Oakland	63	4.48	7.1%	0.00	0.0%	-4.48	-7.1%
	Onondaga	10	0.00	0.0%	0.00	0.0%	0.00	0.0%
	s. Dumfries	143	1.78	1.2%	24.69	17.3%	22.91	16.0%
	Tuscorora	793	14.31	1.8%	101.33	12.8%	87.02	11.0%
Bruce	Albemarle	1,845	0.00	0.0%	57.32	3.1%	57.32	3.1%
	Amabel	4,389	67.29	1.5%	127.44	2.9%	60.15	1.4%
	Arran	1,866	22.74	1.2%	5.11	0.3%	-17.64	-0.9%
	Brant	1,205	53.74	4.5%	17.50	1.5%	-36.24	-3.0%
	Bruce	2,646	383.25	14.5%	61.57	2.3%	-321.68	-12.2%
	Carrick	1,221	13.35	1.1%	17.30	1.4%	3.95	0.3%
	Culross	3,063	17.24	0.6%	24.08	0.8%	6.84	0.2%
	Eastnor	1,206	43.02	3.6%	20.49	1.7%	-22.53	-1.9%
	Elderslie	800	30.93	3.9%	12.55	1.6%	-18.38	-2.3%
	Greenock	7,340	38.72	0.5%	59.32	0.8%	20.60	0.3%
	Huron	293	77.96	26.6%	0.00	0.0%	-77.96	-26.6%
	Kincardine	184	9.38	5.1%	1.99	1.1%	-7.39	-4.0%
	Kinloss	1,654	25.60	1.5%	36.30	2.2%	10.69	0.6%
	Lindsay	1,583	0.00	0.0%	18.98	1.2%	18.98	1.2%
	Saugeen	642	0.00	0.0%	10.12	1.6%	10.12	1.6%
	St. Edmunds	1,483	0.00	0.0%	0.00	0.0%	0.00	0.0%
Dufferin	Amaranth	3,434	232.16	6.8%	144.31	4.2%	-87.84	-2.6%
	East Garafraxa	1,394	18.22	1.3%	11.53	0.8%	-6.68	-0.5%
	East Luther	2,021	254.04	12.6%	41.59	2.1%	-212.45	-10.5%
	Melancthon	4,607	239.53	5.2%	90.10	2.0%	-149.43	-3.2%
	Mono	1,306	9.48	0.7%	0.00	0.0%	-9.48	-0.7%
	Mulmur	589	7.26	1.2%	0.00	0.0%	-7.26	-1.2%
	Orangeville	105	7.58	7.2%	0.00	0.0%	-7.58	-7.2%
	Shelburne	3	0.00	0.0%	0.00	0.0%	0.00	0.0%
Dundas	Matilda	3,120	444.73	14.3%	82.82	2.7%	-361.90	-11.6%
	Mountain	3,551	485.64	13.7%	203.46	5.7%	-282.18	-7.9%
	Williamsburgh	6,772	196.52	2.9%	665.51	9.8%	468.99	6.9%
	Winchester	1,507	438.52	29.1%	111.34	7.4%	-327.18	-21.7%

County	Township	Amount of 1967 Wetland Area						
		Ha	Lost by 2002		Gained by 2002		Net Change	
			Ha	%	Ha	%	Ha	%
Durham	Ajax	105	4.72	4.5%	6.70	6.4%	1.98	1.9%
	Brock	6,036	161.55	2.7%	93.75	1.6%	-67.80	-1.1%
	Clarington	2,199	136.70	6.2%	150.73	6.9%	14.03	0.6%
	Oshawa	92	0.00	0.0%	47.55	51.8%	47.55	51.8%
	Pickering	123	4.19	3.4%	0.00	0.0%	-4.19	-3.4%
	Scugog	7,146	107.91	1.5%	75.46	1.1%	-32.45	-0.5%
	Uxbridge	5,409	48.70	0.9%	150.36	2.8%	101.66	1.9%
	Whitby	253	23.80	9.4%	0.00	0.0%	-23.80	-9.4%
Elgin	Aldborough	891	101.42	11.4%	0.00	0.0%	-101.42	-11.4%
	Bayham	696	28.16	4.0%	0.00	0.0%	-28.16	-4.0%
	Dunwich	779	71.98	9.2%	11.61	1.5%	-60.37	-7.8%
	Malahide	882	56.01	6.3%	15.16	1.7%	-40.85	-4.6%
	S. Dorchester	120	50.92	42.5%	0.00	0.0%	-50.92	-42.5%
	Southwold	540	29.46	5.5%	15.06	2.8%	-14.40	-2.7%
	Yarmouth	231	4.89	2.1%	0.00	0.0%	-4.89	-2.1%
Essex	Anderdon	465	128.67	27.7%	66.72	14.4%	-61.95	-13.3%
	Colchester N.	393	100.49	25.5%	50.20	12.8%	-50.29	-12.8%
	Colchester S.	565	154.25	27.3%	21.69	3.8%	-132.56	-23.5%
	Gosfield N.	113	67.96	60.2%	0.00	0.0%	-67.96	-60.2%
	Gosfield S.	144	79.61	55.3%	2.31	1.6%	-77.30	-53.7%
	Maidstone	572	197.54	34.5%	7.14	1.2%	-190.40	-33.3%
	Malden	464	64.02	13.8%	50.17	10.8%	-13.84	-3.0%
	Mersea	708	276.99	39.1%	795.58	112.4%	518.59	73.3%
	Pelee	118	15.97	13.5%	46.68	39.5%	30.71	26.0%
	Rochester	43	22.82	53.0%	59.12	137.2%	36.30	84.3%
	Sandwich S	273	113.81	41.7%	0.00	0.0%	-113.81	-41.7%
	Sandwich West	145	49.65	34.4%	60.26	41.7%	10.61	7.3%
	Tilbury N	185	112.90	61.1%	42.23	22.9%	-70.67	-38.3%
	Tilbury West	49	23.48	48.2%	0.00	0.0%	-23.48	-48.2%
	Windsor	109	16.22	14.8%	25.55	23.3%	9.33	8.5%
Frontenac	Bedford*****	1,234	0.00	0.0%	2.81	0.2%	2.81	0.2%
	Hinchinbrooke*****	3,147	0.00	0.0%	0.00	0.0%	0.00	0.0%
	Howe Island	176	0.00	0.0%	91.17	51.7%	91.17	51.7%
	Kingston	1,127	62.40	5.5%	68.48	6.1%	6.08	0.5%
	Loughborough*****	1,350	4.78	0.4%	29.66	2.2%	24.88	1.8%
	Pittsburgh	456	10.15	2.2%	300.23	65.8%	290.07	63.6%
	Portland*****	3,343	18.55	0.6%	54.32	1.6%	35.78	1.1%
	Storrington	1,381	0.00	0.0%	91.10	6.6%	91.10	6.6%
	Wolfe Island	480	0.00	0.0%	53.28	11.1%	53.28	11.1%

Continued on next page

County	Township	Amount of 1967 Wetland Area						
		Ha	Lost by 2002		Gained by 2002		Net Change	
			Ha	%	Ha	%	Ha	%
Glengarry	Charlottenburgh	4,847	270.05	5.6%	262.09	5.4%	-7.97	-0.2%
	Kenyon	5,884	308.26	5.2%	171.85	2.9%	-136.41	-2.3%
	Lancaster	2,119	768.72	36.3%	52.94	2.5%	-715.78	-33.8%
	Lochiel	1,952	282.32	14.5%	36.39	1.9%	-245.93	-12.6%
Grenville	Augusta	5,596	66.48	1.2%	787.85	14.1%	721.37	12.9%
	Edwardsburgh	6,601	163.90	2.5%	520.81	7.9%	356.91	5.4%
	Oxford (On Rideau)	4,671	89.37	1.9%	520.18	11.1%	430.82	9.2%
	South Gower	1,774	60.23	3.4%	130.50	7.4%	70.27	4.0%
	Wolford	6,669	12.07	0.2%	333.48	5.0%	321.42	4.8%
Grey	Artemesia	4,173	109.68	2.6%	40.55	1.0%	-69.13	-1.7%
	Bentinck	3,818	66.12	1.7%	7.40	0.2%	-58.72	-1.5%
	Collingwood	1,233	5.98	0.5%	0.00	0.0%	-5.98	-0.5%
	Derby	2,755	91.12	3.3%	10.30	0.4%	-80.82	-2.9%
	Egremont	4,029	110.29	2.7%	0.00	0.0%	-110.29	-2.7%
	Euphrasia	3,011	18.38	0.6%	29.41	1.0%	11.03	0.4%
	Glenelg	3,468	65.71	1.9%	8.87	0.3%	-56.84	-1.6%
	Hanover	2	0.00	0.0%	0.00	0.0%	0.00	0.0%
	Holland	4,219	39.81	0.9%	17.06	0.4%	-22.75	-0.5%
	Keppel	6,567	36.19	0.6%	190.02	2.9%	153.83	2.3%
	Normanby	2,487	71.75	2.9%	1.50	0.1%	-70.25	-2.8%
	Osprey	5,900	39.50	0.7%	49.81	0.8%	10.31	0.2%
	Proton	7,651	222.96	2.9%	30.37	0.4%	-192.59	-2.5%
	Sarawak	110	9.37	8.5%	0.00	0.0%	-9.37	-8.5%
	St. Vincent	506	14.20	2.8%	232.55	45.9%	218.34	43.1%
	Sullivan	2,850	134.12	4.7%	31.19	1.1%	-102.93	-3.6%
	Sydenham	2,324	22.38	1.0%	36.53	1.6%	14.14	0.6%
Haldimand-Norfolk	Delhi	6,844	475.55	6.9%	522.27	7.6%	46.72	0.7%
	Dunnville	2,270	209.90	9.2%	425.59	18.7%	215.69	9.5%
	Haldimand	1,946	165.68	8.5%	181.64	9.3%	15.96	0.8%
	Nanticoke	1,005	66.92	6.7%	133.98	13.3%	67.06	6.7%
	Norfolk	7,444	390.59	5.2%	500.28	6.7%	109.69	1.5%
	Simcoe	120	8.26	6.9%	10.83	9.0%	2.57	2.1%
Halton	Burlington	171	5.80	3.4%	9.92	5.8%	4.11	2.4%
	Halton Hills	1,244	12.14	1.0%	4.64	0.4%	-7.50	-0.6%
	Milton	2,898	153.74	5.3%	18.09	0.6%	-135.65	-4.7%
	Oakville	69	0.00	0.0%	0.00	0.0%	0.00	0.0%

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			Ha	%	Ha	%	Ha	%
Hamilton-Wentworth	Ancaster	37	0.00	0.0%	0.00	0.0%	0.00	0.0%
	Dundas	88	10.22	11.6%	16.94	19.3%	6.72	7.6%
	Flamborough	5,022	56.87	1.1%	186.12	3.7%	129.24	2.6%
	Glanbrook	157	2.00	1.3%	7.15	4.6%	5.15	3.3%
	Hamilton	0	0.00	0.0%	0.00	0.0%	0.00	0.0%
	Stoney Creek	91	0.00	0.0%	31.35	34.5%	31.35	34.5%
Hastings	Hungerford*****	3,808	8.87	0.2%	163.51	4.3%	154.64	4.1%
	Huntingdon******	2,448	11.94	0.5%	40.52	1.7%	28.59	1.2%
	Rawdon	2,133	12.11	0.6%	100.79	4.7%	88.67	4.2%
	Sidney	1,741	18.43	1.1%	339.89	19.5%	321.45	18.5%
	Thurlow	2,575	86.93	3.4%	299.22	11.6%	212.30	8.2%
	Tyendinaga	3,015	13.11	0.4%	210.92	7.0%	197.81	6.6%
Huron	Ashfield	618	22.76	3.7%	8.14	1.3%	-14.61	-2.4%
	Colborne	394	81.50	20.7%	9.27	2.4%	-72.23	-18.3%
	East Wawanosh	1,061	9.07	0.9%	11.86	1.1%	2.79	0.3%
	Goderich	331	0.00	0.0%	0.00	0.0%	0.00	0.0%
	Grey	2,241	307.36	13.7%	27.99	1.2%	-279.37	-12.5%
	Hay	1,993	292.07	14.7%	204.68	10.3%	-87.40	-4.4%
	Howick	2,756	76.03	2.8%	10.30	0.4%	-65.73	-2.4%
	Hullett	376	26.82	7.1%	400.63	106.6%	373.81	99.5%
	McKillop	751	208.82	27.8%	12.88	1.7%	-195.95	-26.1%
	Morris	1,274	18.49	1.5%	47.79	3.8%	29.30	2.3%
	Stanley	404	49.62	12.3%	33.93	8.4%	-15.69	-3.9%
	Stephen	2,169	459.66	21.2%	37.96	1.7%	-421.70	-19.4%
	Tuckersmith	156	0.00	0.0%	0.00	0.0%	0.00	0.0%
	Turnberry	1,901	2.61	0.1%	0.00	0.0%	-2.61	-0.1%
	Usborne	46	6.66	14.6%	0.00	0.0%	-6.66	-14.6%
	West Wawanosh	2,365	17.04	0.7%	22.30	0.9%	5.26	0.2%
Kent	Camden	485	285.56	58.8%	0.00	0.0%	-285.56	-58.8%
	Chatham	415	280.87	67.6%	21.37	5.1%	-259.50	-62.5%
	Dover	1,799	791.25	44.0%	81.87	4.6%	-709.38	-39.4%
	Harwich	425	151.92	35.7%	0.00	0.0%	-151.92	-35.7%
	Howard	264	165.05	62.5%	0.00	0.0%	-165.05	-62.5%
	Orford	453	191.47	42.3%	97.96	21.6%	-93.51	-20.7%
	Raleigh	595	364.50	61.2%	13.41	2.3%	-351.08	-59.0%
	Romney	422	362.79	86.0%	43.19	10.2%	-319.61	-75.7%
	Tilbury East	427	291.36	68.2%	23.03	5.4%	-268.33	-62.8%
	Zone	165	125.15	76.0%	0.00	0.0%	-125.15	-76.0%

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			Ha	%	Ha	%	Ha	%
Lambton	Bosanquet	1,882	1,054.91	56.1%	253.12	13.5%	-801.79	-42.6%
	Brooke	1,434	530.13	37.0%	14.63	1.0%	-515.50	-36.0%
	Dawn	2,695	1,110.49	41.2%	9.53	0.4%	-1,100.95	-40.8%
	Enniskillen	3,299	1,078.33	32.7%	14.96	0.5%	-1,063.37	-32.2%
	Euphemia	502	204.11	40.7%	3.89	0.8%	-200.22	-39.9%
	Moore	2,111	557.83	26.4%	34.18	1.6%	-523.64	-24.8%
	Plympton	1,700	678.19	39.9%	0.00	0.0%	-678.19	-39.9%
	Sarnia	1,178	407.93	34.6%	40.39	3.4%	-367.54	-31.2%
	Sombra Twp	2,725	890.23	32.7%	47.29	1.7%	-842.94	-30.9%
	Warwick	401	125.53	31.3%	0.00	0.0%	-125.53	-31.3%
Lanark	Bathurst*****	3,543	96.42	2.7%	39.09	1.1%	-57.33	-1.6%
	Beckwith*****	8,752	138.40	1.6%	178.84	2.0%	40.44	0.5%
	Carleton Place	3	0.00	0.0%	0.00	0.0%	0.00	0.0%
	Darling****	3,335	0.00	0.0%	0.00	0.0%	0.00	0.0%
	Drummond*****	8,414	35.31	0.4%	355.60	4.2%	320.30	3.8%
	Lanark*****	5,872	0.00	0.0%	19.08	0.3%	19.08	0.3%
	Montague	7,929	157.85	2.0%	215.80	2.7%	57.95	0.7%
	N. Burgess*****	1,702	30.60	1.8%	0.00	0.0%	-30.60	-1.8%
	N. Elmsley*****	3,350	50.89	1.5%	67.15	2.0%	16.26	0.5%
	Pakenham*****	2,136	0.00	0.0%	0.00	0.0%	0.00	0.0%
	Perth	187	0.00	0.0%	30.08	16.1%	30.08	16.1%
	Ramsay*****	2,447	26.32	1.1%	32.21	1.3%	5.89	0.2%
	Smith Falls	106	9.98	9.4%	0.00	0.0%	-9.98	-9.4%
	South Sherbrooke****	2,172	0.00	0.0%	0.00	0.0%	0.00	0.0%
Leeds	Bastard & S. Burgess*****	2,771	7.19	0.3%	73.29	2.6%	66.11	2.4%
	Elizabethtown	6,023	40.67	0.7%	129.35	2.1%	88.68	1.5%
	Front of Escott	2,597	89.38	3.4%	85.06	3.3%	-4.31	-0.2%
	Front of Leeds & Lansdowne	2,310	148.38	6.4%	149.02	6.5%	0.63	0.0%
	Front of Yonge	795	87.54	11.0%	64.34	8.1%	-23.20	-2.9%
	Kitley	3,375	0.00	0.0%	109.71	3.3%	109.71	3.3%
	N. Crosby*****	1,805	41.66	2.3%	7.18	0.4%	-34.48	-1.9%
	Rear of Leeds & Lansdowne	1,864	96.84	5.2%	81.81	4.4%	-15.02	-0.8%
	S. Crosby	1,227	124.56	10.2%	3.30	0.3%	-121.27	-9.9%
	S. Elmsley*****	1,568	32.24	2.1%	0.00	0.0%	-32.24	-2.1%

County	Township	Amount of 1967 Wetland Area						
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Lennox and Addington	Adolphustown	207	17.44	8.4%	19.46	9.4%	2.02	1.0%
	Amhert Island	596	29.37	4.9%	136.29	22.9%	106.92	17.9%
	Camden East******	4,439	84.71	1.9%	151.77	3.4%	67.05	1.5%
	Ernestown	1,005	57.59	5.7%	80.72	8.0%	23.13	2.3%
	N. Fredericksburgh	606	21.55	3.6%	31.36	5.2%	9.81	1.6%
	Richmond	2,660	77.14	2.9%	431.90	16.2%	354.76	13.3%
	S. Fredericksburgh	686	16.12	2.3%	125.99	18.4%	109.88	16.0%
	Sheffield*****	1,832	6.24	0.3%	57.03	3.1%	50.79	2.8%
Metro Toronto	Etobicoke	0	0.00	0.0%	0.00	0.0%	0.00	0.0%
	North York	0	0.00	0.0%	0.00	0.0%	0.00	0.0%
	Scarborough	115	60.32	52.5%	10.61	9.2%	-49.71	-43.2%
	York	0	0.00	0.0%	0.00	0.0%	0.00	0.0%
Middlesex	Adelaide	217	20.69	9.5%	0.00	0.0%	-20.69	-9.5%
	Biddulph	222	68.50	30.8%	0.00	0.0%	-68.50	-30.8%
	Caradoc	1,351	221.97	16.4%	37.66	2.8%	-184.31	-13.6%
	Delaware	80	27.20	34.2%	0.00	0.0%	-27.20	-34.2%
	E. Williams	460	95.61	20.8%	0.00	0.0%	-95.61	-20.8%
	Ekfrid	564	85.40	15.1%	0.00	0.0%	-85.40	-15.1%
	Lobo	165	48.15	29.2%	10.54	6.4%	-37.61	-22.8%
	London	534	101.40	19.0%	0.00	0.0%	-101.40	-19.0%
	London City	40	0.70	1.8%	0.00	0.0%	-0.70	-1.8%
	McGillivray	795	364.71	45.9%	21.08	2.7%	-343.63	-43.2%
	Metcalfe	355	39.48	11.1%	0.00	0.0%	-39.48	-11.1%
	Mosa	1,944	419.05	21.6%	15.58	0.8%	-403.47	-20.8%
	North Dorchester	1,389	108.37	7.8%	19.14	1.4%	-89.24	-6.4%
	W. Williams	408	114.76	28.1%	0.00	0.0%	-114.76	-28.1%
	West Nissouri	245	32.79	13.4%	0.00	0.0%	-32.79	-13.4%
	Westminster	223	23.48	10.5%	10.22	4.6%	-13.26	-5.9%
Muskoka	Muskoka Lakes*	1,202	N/A	N/A	N/A	N/A	N/A	N/A
Niagara	Fort Erie	1,331	52.28	3.9%	588.89	44.3%	536.61	40.3%
	Grimsby	270	0.00	0.0%	22.52	8.4%	22.52	8.4%
	Lincoln	156	14.55	9.3%	48.21	30.9%	33.67	21.6%
	Niagara	1,396	108.74	7.8%	256.49	18.4%	147.74	10.6%
	Niagara-On-The-Lake	111	47.33	42.7%	0.00	0.0%	-47.33	-42.7%
	Port Colborne	1,343	146.05	10.9%	142.44	10.6%	-3.61	-0.3%
	St. Catharines	0	0.00	0.0%	0.00	0.0%	0.00	0.0%
	Thorold	175	17.76	10.2%	32.68	18.7%	14.92	8.5%
	Wainfleet	3,071	216.71	7.1%	219.02	7.1%	2.31	0.1%
	Welland	255	26.17	10.3%	85.16	33.4%	58.99	23.1%
	West Lincoln	3,061	167.02	5.5%	300.62	9.8%	133.61	4.4%

Continued on next page

75

County	Township	Amount of 1967 Wetland Area						
		Ha	Lost by 2002		Gained by 2002		Net Change	
			Ha	%	Ha	%	Ha	%
Northumberland	Alnwick	775	1.52	0.2%	9.44	1.2%	7.92	1.0%
	Brighton	2,894	9.80	0.3%	99.17	3.4%	89.36	3.1%
	Cramahe	1,693	27.47	1.6%	78.28	4.6%	50.80	3.0%
	Haldimand	1,808	18.61	1.0%	103.48	5.7%	84.87	4.7%
	Hamilton	968	41.41	4.3%	38.77	4.0%	-2.64	-0.3%
	Hope	692	35.71	5.2%	32.70	4.7%	-3.02	-0.4%
	Murray	2,507	0.00	0.0%	260.28	10.4%	260.28	10.4%
	Percy	1,787	19.02	1.1%	45.38	2.5%	26.37	1.5%
	Seymour	2,174	60.52	2.8%	119.56	5.5%	59.04	2.7%
Ottawa-Carleton	Cumberland	3,582	520.90	14.5%	85.30	2.4%	-435.60	-12.2%
	Gloucester	4,250	624.78	14.7%	659.93	15.5%	35.15	0.8%
	Goulbourn	5,384	196.74	3.7%	441.95	8.2%	245.21	4.6%
	March	1,296	156.26	12.1%	24.45	1.9%	-131.81	-10.2%
	Napean	978	150.18	15.4%	209.58	21.4%	59.40	6.1%
	Osgoode	4,290	391.56	9.1%	464.47	10.8%	72.90	1.7%
	Rideau	10,327	207.92	2.0%	914.13	8.9%	706.22	6.8%
	West Carleton	6,944	352.89	5.1%	363.00	5.2%	10.10	0.1%
Oxford	Blandford	918	27.12	3.0%	19.35	2.1%	-7.76	-0.8%
	Blenheim	1,948	26.63	1.4%	84.12	4.3%	57.49	3.0%
	East Zorra - Tavistock	363	42.82	11.8%	12.00	3.3%	-30.82	-8.5%
	Ingersoll	0	0.00	0.0%	0.00	0.0%	0.00	0.0%
	Norwich	813	27.25	3.4%	0.00	0.0%	-27.25	-3.4%
	Southwest Oxford	1,061	133.43	12.6%	49.62	4.7%	-83.81	-7.9%
	Tillsonburg	0	0.00	0.0%	0.00	0.0%	0.00	0.0%
	Woodstock	28	0.00	0.0%	0.00	0.0%	0.00	0.0%
	Zorra	1,388	79.39	5.7%	7.77	0.6%	-71.62	-5.2%
Peel	Brampton	89	29.94	33.7%	0.00	0.0%	-29.94	-33.7%
	Caledon	2,429	38.35	1.6%	42.08	1.7%	3.73	0.2%
	Mississauga	33	21.71	66.5%	0.00	0.0%	-21.71	-66.5%
Perth	Blanshard	14	0.00	0.0%	7.70	55.3%	7.70	55.3%
	Downie	633	78.51	12.4%	10.04	1.6%	-68.47	-10.8%
	Ellice	1,213	52.42	4.3%	28.64	2.4%	-23.78	-2.0%
	Elma	821	241.81	29.5%	0.00	0.0%	-241.81	-29.5%
	Fullarton	426	41.52	9.7%	10.59	2.5%	-30.94	-7.3%
	Hibbert	350	61.62	17.6%	10.24	2.9%	-51.38	-14.7%
	Logan	214	48.52	22.6%	0.00	0.0%	-48.52	-22.6%
	Mornington	327	34.14	10.4%	0.00	0.0%	-34.14	-10.4%
	N. Easthope	969	55.81	5.8%	0.00	0.0%	-55.81	-5.8%
	S. Easthope	199	35.48	17.8%	0.00	0.0%	-35.48	-17.8%
	Stratford	24	0.00	0.0%	0.00	0.0%	0.00	0.0%
	Wallace	885	23.65	2.7%	0.00	0.0%	-23.65	-2.7%

Continued on next page

County	Township	Amount of 1967 Wetland Area						
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			Ha	%	Ha	%	Ha	%
Peterborough	Asphodel	2,554	15.62	0.6%	64.79	2.5%	49.16	1.9%
	Cavan	2,763	21.04	0.8%	56.80	2.1%	35.76	1.3%
	Douro	2,821	20.54	0.7%	87.60	3.1%	67.06	2.4%
	Dummer	6,303	72.98	1.2%	15.21	0.2%	-57.77	-0.9%
	Ennismore	1,162	20.77	1.8%	35.21	3.0%	14.44	1.2%
	N. Monaghan	579	23.68	4.1%	150.58	26.0%	126.90	21.9%
	Otonabee	4,352	151.65	3.5%	222.83	5.1%	71.19	1.6%
	Peterborough	104	10.62	10.2%	12.82	12.3%	2.21	2.1%
	S. Monaghan	1,033	0.00	0.0%	40.22	3.9%	40.22	3.9%
	Smith	3,234	56.18	1.7%	27.47	0.8%	-28.71	-0.9%
Prescott	Alfred	1,129	149.11	13.2%	136.31	12.1%	-12.80	-1.1%
	Caledonia	4,011	610.72	15.2%	145.36	3.6%	-465.36	-11.6%
	East Hawkesbury	1,325	81.74	6.2%	74.49	5.6%	-7.26	-0.5%
	Longueuil	286	46.27	16.2%	10.62	3.7%	-35.65	-12.5%
	North Plantagenet	1,310	14.60	1.1%	21.60	1.6%	7.00	0.5%
	South Plantegenet	1,041	164.87	15.8%	55.74	5.4%	-109.12	-10.5%
	West Hawkesbury	1,163	143.48	12.3%	87.58	7.5%	-55.90	-4.8%
Prince Edward	Ameliasburgh	2,387	8.02	0.3%	204.85	8.6%	196.83	8.2%
	Athol	630	4.65	0.7%	78.67	12.5%	74.02	11.8%
	Hallowell	2,607	0.08	0.0%	156.26	6.0%	156.18	6.0%
	Hillier	1,580	3.93	0.2%	92.75	5.9%	88.82	5.6%
	N. Marysburgh	583	10.57	1.8%	34.72	6.0%	24.15	4.1%
	S. Marysburgh	512	0.00	0.0%	26.71	5.2%	26.71	5.2%
	Sophiasburg	2,000	0.00	0.0%	208.58	10.4%	208.58	10.4%
Russell	Cambridge	1,248	121.45	9.7%	24.22	1.9%	-97.23	-7.8%
	Clarence	729	20.38	2.8%	116.88	16.0%	96.50	13.2%
	Russell	332	25.91	7.8%	24.90	7.5%	-1.01	-0.3%

County	Township	Amount of 1967 Wetland Area						
		Ha	Lost by 2002		Gained by 2002		Net Change	
			Ha	%	Ha	%	Ha	%
Simcoe	Adjala	760	191.68	25.2%	11.61	1.5%	-180.07	-23.7%
	Barrie	44	22.01	49.5%	0.00	0.0%	-22.01	-49.5%
	Essa	1,622	60.24	3.7%	47.87	3.0%	-12.38	-0.8%
	Flos	1,243	58.59	4.7%	37.12	3.0%	-21.47	-1.7%
	Innisfil	2,302	565.45	24.6%	2.84	0.1%	-562.61	-24.4%
	Mara	5,874	156.57	2.7%	96.80	1.6%	-59.77	-1.0%
	Matchedash	2,026	27.03	1.3%	65.28	3.2%	38.25	1.9%
	Medonte	2,705	140.57	5.2%	0.00	0.0%	-140.57	-5.2%
	Nottawasaga	1,122	104.36	9.3%	39.20	3.5%	-65.16	-5.8%
	Orillia	2,920	126.56	4.3%	48.89	1.7%	-77.67	-2.7%
	Oro	2,600	11.07	0.4%	22.95	0.9%	11.88	0.5%
	Rama***	2,897	55.57	1.9%	23.06	0.8%	-32.51	-1.1%
	Sunnidale	2,047	31.46	1.5%	348.43	17.0%	316.97	15.5%
	Tay	2,454	54.99	2.2%	295.22	12.0%	240.22	9.8%
	Tecumseth	1,040	300.40	28.9%	13.99	1.3%	-286.42	-27.5%
	Tiny	1,842	13.77	0.7%	133.19	7.2%	119.42	6.5%
	Tosorontio	972	108.86	11.2%	0.00	0.0%	-108.86	-11.2%
	Vespra	6,238	133.21	2.1%	330.34	5.3%	197.13	3.2%
	West Gwillimbury	1,408	95.92	6.8%	81.89	5.8%	-14.02	-1.0%
Stormont	Cornwall	4,074	269.67	6.6%	167.14	4.1%	-102.52	-2.5%
	Finch	686	32.37	4.7%	140.59	20.5%	108.22	15.8%
	Osnabruck	5,967	275.50	4.6%	312.26	5.2%	36.76	0.6%
	Roxborough	5,706	666.65	11.7%	165.78	2.9%	-500.87	-8.8%
Victoria	Carden	1,757	75.93	4.3%	30.06	1.7%	-45.86	-2.6%
	Eldon	3,128	69.61	2.2%	120.66	3.9%	51.05	1.6%
	Emily	4,062	23.95	0.6%	35.98	0.9%	12.03	0.3%
	Fenelon	3,879	13.59	0.4%	25.63	0.7%	12.04	0.3%
	Laxton, Dibgy & Longford**	2,470	14.02	0.6%	0.00	0.0%	-14.02	-0.6%
	Manvers	4,309	36.81	0.9%	16.80	0.4%	-20.01	-0.5%
	Mariposa	5,362	272.08	5.1%	17.90	0.3%	-254.18	-4.7%
	Ops	4,524	123.15	2.7%	65.93	1.5%	-57.22	-1.3%
	Verulam	2,347	6.02	0.3%	16.69	0.7%	10.68	0.5%
Waterloo	Cambridge	384	31.88	8.3%	123.68	32.2%	91.81	23.9%
	Kitchener	226	11.69	5.2%	0.00	0.0%	-11.69	-5.2%
	N. Dumfries	1,254	0.00	0.0%	186.71	14.9%	186.71	14.9%
	Waterloo	157	0.00	0.0%	0.00	0.0%	0.00	0.0%
	Wellesley	750	57.26	7.6%	33.71	4.5%	-23.55	-3.1%
	Wilmont	400	7.91	2.0%	41.43	10.4%	33.53	8.4%
	Woolwich	1,490	104.12	7.0%	103.26	6.9%	-0.86	-0.1%

Continued on next page

County	Township	Amount of 1967 Wetland Area						
		Ha	Lost by 2002		Gained by 2002		Net Change	
			Ha	%	Ha	%	Ha	%
Wellington	Arthur	1,289	54.89	4.3%	0.00	0.0%	-54.89	-4.3%
	Eramosa	1,717	11.81	0.7%	0.00	0.0%	-11.81	-0.7%
	Erin	3,592	27.32	0.8%	18.29	0.5%	-9.03	-0.3%
	Guelph	843	29.22	3.5%	9.25	1.1%	-19.97	-2.4%
	Guelph City	311	42.82	13.8%	3.18	1.0%	-39.64	-12.8%
	Maryborough	929	34.14	3.7%	0.00	0.0%	-34.14	-3.7%
	Minto	2,975	84.70	2.8%	0.00	0.0%	-84.70	-2.8%
	Nichol	438	0.00	0.0%	0.00	0.0%	0.00	0.0%
	Peel	941	68.11	7.2%	0.00	0.0%	-68.11	-7.2%
	Pilkington	418	13.44	3.2%	0.00	0.0%	-13.44	-3.2%
	Puslinch	2,601	24.55	0.9%	113.65	4.4%	89.10	3.4%
	West Garafraxa	851	85.85	10.1%	16.92	2.0%	-68.93	-8.1%
	West Luther	3,202	149.56	4.7%	49.67	1.6%	-99.89	-3.1%
York	Aurora	23	0.00	0.0%	0.00	0.0%	0.00	0.0%
	East Gwillimbury	4,487	409.33	9.1%	246.23	5.5%	-163.10	-3.6%
	Georgina	5,870	211.54	3.6%	605.05	10.3%	393.51	6.7%
	King	1,249	110.45	8.8%	15.21	1.2%	-95.24	-7.6%
	Markham	34	4.32	12.8%	0.00	0.0%	-4.32	-12.8%
	Newmarket	0	0.00	0.0%	0.00	0.0%	0.00	0.0%
	Richmond Hill	119	2.52	2.1%	0.00	0.0%	-2.52	-2.1%
	Vaughan	12	0.00	0.0%	0.00	0.0%	0.00	0.0%
	Whitchurch-Stouffville	568	20.83	3.7%	0.00	0.0%	-20.83	-3.7%
	Full Study Area	637,020	37,171.47	5.8%	27,903.35	4.4%	-9,268.12	-1.5%

* only partial coverage for 1967, no coverage for 2002
**only partial coverage for 1967 and 2002
**** & *****partial or missing 2002 coverage
******majority of area with 2002 coverage

Appendix B-4: Between year, 1982-2002, wetland conversion statistics by township

County	Township	Amount of 1982 Wetland Area						
		Ha	Lost by 2002		Gained by 2002		Net Change	
			Ha	%	Ha	%	Ha	%
Brant	Burford	465	16.20	3.5%	0.93	0.2%	-15.27	-3.3%
	Oakland	21	0.00	0.0%	11.12	53.9%	11.12	53.9%
	s. Dumfries	164	0.00	0.0%	18.44	11.2%	18.44	11.2%
Bruce	Albemarle	1,929	4.41	0.2%	61.86	3.2%	57.45	3.0%
	Amabel	4,497	64.70	1.4%	153.91	3.4%	89.21	2.0%
	Arran	1,820	23.47	1.3%	37.40	2.1%	13.93	0.8%
	Brant	1,224	43.51	3.6%	88.15	7.2%	44.63	3.6%
	Bruce	2,874	472.80	16.5%	23.80	0.8%	-449.01	-15.6%
	Carrick	1,084	8.62	0.8%	102.04	9.4%	93.42	8.6%
	Culross	2,854	8.89	0.3%	90.24	3.2%	81.35	2.9%
	Eastnor	1,071	62.94	5.9%	153.41	14.3%	90.47	8.4%
	Elderslie	708	3.68	0.5%	41.94	5.9%	38.26	5.4%
	Greenock	7,347	28.71	0.4%	123.77	1.7%	95.06	1.3%
	Huron	244	73.51	30.1%	0.00	0.0%	-73.51	-30.1%
	Kincardine	223	25.52	11.4%	0.00	0.0%	-25.52	-11.4%
	Kinloss	1,588	43.24	2.7%	55.38	3.5%	12.14	0.8%
	Lindsay	1,688	30.98	1.8%	24.73	1.5%	-6.26	-0.4%
	Saugeen	232	2.69	1.2%	401.62	172.8%	398.93	171.6%
	St. Edmunds	1,564	0.00	0.0%	11.80	0.8%	11.80	0.8%
Dufferin	Amaranth	2,914	158.35	5.4%	376.95	12.9%	218.60	7.5%
	East Garafraxa	1,218	6.80	0.6%	31.40	2.6%	24.60	2.0%
	East Luther	1,666	84.69	5.1%	76.35	4.6%	-8.34	-0.5%
	Melancthon	4,180	160.21	3.8%	243.47	5.8%	83.26	2.0%
	Mono	993	8.51	0.9%	61.32	6.2%	52.81	5.3%
	Mulmur	473	0.00	0.0%	84.76	17.9%	84.76	17.9%
	Orangeville	84	11.87	14.2%	7.62	9.1%	-4.25	-5.1%
	Shelburne	3	0.00	0.0%	0.00	0.0%	0.00	0.0%
Dundas	Matilda	3,664	687.18	18.8%	68.97	1.9%	-618.20	-16.9%
	Mountain	4,094	638.32	15.6%	24.08	0.6%	-614.25	-15.0%
	Williamsburgh	7,789	352.74	4.5%	367.58	4.7%	14.84	0.2%
	Winchester	1,368	180.59	13.2%	70.89	5.2%	-109.70	-8.0%
Durham	Ajax	107	12.44	11.6%	0.00	0.0%	-12.44	-11.6%
	Brock	6,416	236.27	3.7%	114.23	1.8%	-122.04	-1.9%
	Clarington	2,405	120.32	5.0%	69.63	2.9%	-50.69	-2.1%
	Oshawa	75	0.00	0.0%	30.51	40.4%	30.51	40.4%
	Pickering	112	4.22	3.8%	0.00	0.0%	-4.22	-3.8%
	Scugog	7,068	93.96	1.3%	34.58	0.5%	-59.38	-0.8%
	Uxbridge	5,660	46.37	0.8%	58.36	1.0%	11.99	0.2%
	Whitby	235	50.15	21.3%	45.44	19.3%	-4.72	-2.0%

County	Township	Amount of 1982 Wetland Area						
		Ha	Lost by 2002		Gained by 2002		Net Change	
			Ha	%	Ha	%	Ha	%
Elgin	Aldborough	816	43.74	5.4%	0.00	0.0%	-43.74	-5.4%
	Bayham	713	11.10	1.6%	16.00	2.2%	4.89	0.7%
	Dunwich	722	35.31	4.9%	11.34	1.6%	-23.97	-3.3%
	Malahide	960	64.63	6.7%	0.00	0.0%	-64.63	-6.7%
	S. Dorchester	12	0.00	0.0%	12.21	99.6%	12.21	99.6%
	Southwold	540	3.49	0.6%	52.69	9.8%	49.21	9.1%
	Yarmouth	204	4.86	2.4%	0.00	0.0%	-4.86	-2.4%
Essex	Anderdon	215	52.97	24.6%	115.46	53.7%	62.50	29.0%
	Colchester N.	242	29.20	12.1%	31.20	12.9%	2.00	0.8%
	Colchester S.	474	82.45	17.4%	0.00	0.0%	-82.45	-17.4%
	Gosfield N.	57	21.55	37.5%	0.00	0.0%	-21.55	-37.5%
	Gosfield S.	96	19.05	19.8%	0.00	0.0%	-19.05	-19.8%
	Maidstone	339	105.54	31.1%	0.00	0.0%	-105.54	-31.1%
	Malden	171	14.33	8.4%	67.62	39.6%	53.29	31.2%
	Mersea	345	65.87	19.1%	699.98	203.2%	634.11	184.1%
	Rochester	75	13.84	18.5%	25.51	34.1%	11.67	15.6%
	Sandwich S	118	3.91	3.3%	10.72	9.1%	6.80	5.8%
	Sandwich West	87	26.85	30.9%	37.86	43.6%	11.01	12.7%
	Tilbury N	145	104.34	72.1%	25.22	17.4%	-79.11	-54.7%
	Tilbury West	20	9.89	49.4%	0.00	0.0%	-9.89	-49.4%
	Windsor	0	0.00	0.0%	107.37	0.0%	107.37	0.0%
Frontenac	Bedford*****	1,405	2.12	0.2%	0.00	0.0%	-2.12	-0.2%
	Hinchinbrooke*****	4,264	0.00	0.0%	0.00	0.0%	0.00	0.0%
	Howe Island	185	0.00	0.0%	73.54	39.6%	73.54	39.6%
	Kingston	1,054	32.57	3.1%	74.98	7.1%	42.41	4.0%
	Loughborough*****	1,452	11.50	0.8%	28.68	2.0%	17.18	1.2%
	Pittsburgh	713	39.87	5.6%	114.54	16.1%	74.67	10.5%
	Portland*****	3,119	6.02	0.2%	142.74	4.6%	136.72	4.4%
	Storrington	1,624	15.12	0.9%	58.54	3.6%	43.42	2.7%
	Wolfe Island	419	3.75	0.9%	112.95	27.0%	109.21	26.1%
Glengarry	Charlottenburgh	5,782	452.43	7.8%	50.73	0.9%	-401.69	-6.9%
	Kenyon	6,373	282.79	4.4%	19.57	0.3%	-263.23	-4.1%
	Lancaster	2,186	834.52	38.2%	0.00	0.0%	-834.52	-38.2%
	Lochiel	2,149	295.09	13.7%	0.00	0.0%	-295.09	-13.7%
Grenville	Augusta	7,214	335.76	4.7%	130.66	1.8%	-205.10	-2.8%
	Edwardsburgh	7,894	265.78	3.4%	76.66	1.0%	-189.13	-2.4%
	Oxford (On Rideau)	5,676	240.88	4.2%	71.79	1.3%	-169.09	-3.0%
	South Gower	2,192	144.80	6.6%	24.86	1.1%	-119.94	-5.5%
	Wolford	7,098	48.78	0.7%	123.97	1.7%	75.19	1.1%

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County	Township	Amount of 1982 Wetland Area						
		Ha	Lost by 2002		Gained by 2002		Net Change	
			Ha	%	Ha	%	Ha	%
Grey	Artemesia	4,178	111.46	2.7%	19.86	0.5%	-91.60	-2.2%
	Bentinck	3,975	56.17	1.4%	25.70	0.6%	-30.47	-0.8%
	Collingwood	1,483	167.88	11.3%	19.62	1.3%	-148.27	-10.0%
	Derby	2,415	10.39	0.4%	154.27	6.4%	143.88	6.0%
	Egremont	3,801	60.89	1.6%	68.96	1.8%	8.08	0.2%
	Euphrasia	3,163	14.24	0.5%	12.06	0.4%	-2.18	-0.1%
	Glenelg	2,633	43.84	1.7%	628.99	23.9%	585.15	22.2%
	Holland	4,314	13.39	0.3%	25.71	0.6%	12.32	0.3%
	Keppel	6,850	136.06	2.0%	88.37	1.3%	-47.69	-0.7%
	Normanby	2,349	57.66	2.5%	12.92	0.6%	-44.74	-1.9%
	Osprey	5,751	37.62	0.7%	106.91	1.9%	69.29	1.2%
	Proton	7,019	95.51	1.4%	165.36	2.4%	69.85	1.0%
	Sarawak	193	78.77	40.8%	0.00	0.0%	-78.77	-40.8%
	St. Vincent	539	60.37	11.2%	0.00	0.0%	-60.37	-11.2%
	Sullivan	2,435	97.37	4.0%	261.22	10.7%	163.84	6.7%
	Sydenham	2,296	60.83	2.6%	99.58	4.3%	38.75	1.7%
Haldimand-Norfolk	Delhi	5,398	215.62	4.0%	1,738.64	32.2%	1,523.02	28.2%
	Dunnville	2,639	298.44	11.3%	375.75	14.2%	77.31	2.9%
	Haldimand	2,008	138.42	6.9%	229.77	11.4%	91.35	4.6%
	Nanticoke	1,234	139.40	11.3%	104.39	8.5%	-35.01	-2.8%
	Norfolk	6,486	389.19	6.0%	875.52	13.5%	486.33	7.5%
	Simcoe	74	0.00	0.0%	19.34	26.1%	19.34	26.1%
Halton	Burlington	124	0.00	0.0%	21.29	17.1%	21.29	17.1%
	Halton Hills	1,339	22.39	1.7%	26.12	2.0%	3.74	0.3%
	Milton	3,028	184.84	6.1%	10.10	0.3%	-174.75	-5.8%
	Oakville	65	0.00	0.0%	0.00	0.0%	0.00	0.0%
Hamilton-Wentworth	Ancaster	46	0.00	0.0%	0.00	0.0%	0.00	0.0%
	Dundas	0	0.00	0.0%	59.65	0.0%	59.65	0.0%
	Flamborough	4,648	47.23	1.0%	402.92	8.7%	355.69	7.7%
	Glanbrook	162	12.29	7.6%	0.00	0.0%	-12.29	-7.6%
	Hamilton	31	31.08	99.7%	0.00	0.0%	-31.08	-99.7%
	Stoney Creek	108	0.00	0.0%	0.00	0.0%	0.00	0.0%
Hastings	Hungerford*****	4,179	28.43	0.7%	73.51	1.8%	45.07	1.1%
	Huntingdon******	2,559	27.05	1.1%	15.77	0.6%	-11.27	-0.4%
	Rawdon	2,504	30.91	1.2%	0.00	0.0%	-30.91	-1.2%
	Sidney	2,292	89.37	3.9%	92.65	4.0%	3.28	0.1%
	Thurlow	2,975	96.16	3.2%	0.87	0.0%	-95.29	-3.2%
	Tyendinaga	3,398	103.57	3.0%	107.31	3.2%	3.74	0.1%

County	Township	Amount of 1982 Wetland Area						
		Ha	Lost by 2002		Gained by 2002		Net Change	
			Ha	%	Ha	%	Ha	%
Huron	Ashfield	414	43.29	10.5%	117.56	28.4%	74.27	18.0%
	Colborne	426	88.71	20.8%	0.00	0.0%	-88.71	-20.8%
	East Wawanosh	929	0.00	0.0%	133.13	14.3%	133.13	14.3%
	Goderich	392	4.54	1.2%	0.00	0.0%	-4.54	-1.2%
	Grey	1,706	151.08	8.9%	78.12	4.6%	-72.96	-4.3%
	Hay	1,916	252.45	13.2%	244.89	12.8%	-7.56	-0.4%
	Howick	2,464	10.99	0.4%	76.05	3.1%	65.06	2.6%
	Hullett	851	89.37	10.5%	0.00	0.0%	-89.37	-10.5%
	McKillop	450	42.92	9.5%	31.32	7.0%	-11.60	-2.6%
	Morris	1,182	41.48	3.5%	57.91	4.9%	16.43	1.4%
	Stanley	306	13.60	4.4%	20.06	6.5%	6.46	2.1%
	Stephen	1,850	220.11	11.9%	27.19	1.5%	-192.91	-10.4%
	Tuckersmith	134	0.00	0.0%	0.00	0.0%	0.00	0.0%
	Turnberry	1,778	6.93	0.4%	37.43	2.1%	30.50	1.7%
	Usborne	32	2.87	8.8%	0.00	0.0%	-2.87	-8.8%
	West Wawanosh	2,311	0.00	0.0%	27.87	1.2%	27.87	1.2%
Kent	Camden	273	105.87	38.7%	0.00	0.0%	-105.87	-38.7%
	Chatham	216	90.79	42.0%	0.00	0.0%	-90.79	-42.0%
	Dover	1,027	292.16	28.4%	125.00	12.2%	-167.16	-16.3%
	Harwich	300	55.36	18.5%	0.00	0.0%	-55.36	-18.5%
	Howard	82	16.78	20.6%	0.00	0.0%	-16.78	-20.6%
	Orford	438	65.84	15.0%	31.98	7.3%	-33.86	-7.7%
	Raleigh	229	61.52	26.9%	17.07	7.5%	-44.45	-19.4%
	Romney	165	92.60	56.1%	24.44	14.8%	-68.16	-41.3%
	Tilbury East	170	56.40	33.2%	32.34	19.1%	-24.06	-14.2%
	Zone	107	64.31	60.0%	0.00	0.0%	-64.31	-60.0%
Lambton	Bosanquet	1,117	181.24	16.2%	11.00	1.0%	-170.24	-15.2%
	Brooke	1,178	367.58	31.2%	0.00	0.0%	-367.58	-31.2%
	Dawn	2,363	937.82	39.7%	0.00	0.0%	-937.82	-39.7%
	Enniskillen	2,242	412.98	18.4%	25.33	1.1%	-387.65	-17.3%
	Euphemia	355	121.83	34.3%	0.00	0.0%	-121.83	-34.3%
	Moore	1,568	203.57	13.0%	21.51	1.4%	-182.06	-11.6%
	Plympton	1,124	288.71	25.7%	0.00	0.0%	-288.71	-25.7%
	Sarnia	353	86.79	24.6%	294.10	83.3%	207.31	58.7%
	Sombra Twp	2,320	498.22	21.5%	36.89	1.6%	-461.33	-19.9%
	Warwick	298	51.53	17.3%	13.60	4.6%	-37.93	-12.7%

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Lanark	Bathurst*****	3,646	91.16	2.5%	209.90	5.8%	118.75	3.3%
	Beckwith*****	9,757	158.51	1.6%	69.46	0.7%	-89.05	-0.9%
	Carleton Place	4	0.00	0.0%	0.00	0.0%	0.00	0.0%
	Drummond*****	9,161	18.97	0.2%	164.22	1.8%	145.25	1.6%
	Lanark*****	6,486	4.05	0.1%	0.00	0.0%	-4.05	-0.1%
	Montague	8,340	310.23	3.7%	321.13	3.9%	10.90	0.1%
	N. Burgess*****	1,871	18.50	1.0%	0.00	0.0%	-18.50	-1.0%
	N. Elmsley*****	3,159	115.92	3.7%	304.66	9.6%	188.74	6.0%
	Pakenham*****	2,256	23.86	1.1%	0.00	0.0%	-23.86	-1.1%
	Perth	158	0.00	0.0%	68.09	43.0%	68.09	43.0%
	Ramsay*****	2,877	62.72	2.2%	0.00	0.0%	-62.72	-2.2%
	Smith Falls	134	11.68	8.7%	0.81	0.6%	-10.87	-8.1%
	South Sherbrooke****	17	0.00	0.0%	0.00	0.0%	0.00	0.0%
Leeds	Bastard & S. Burgess*****	3,015	15.10	0.5%	35.91	1.2%	20.81	0.7%
	Elizabethtown	6,010	71.53	1.2%	484.87	8.1%	413.34	6.9%
	Front of Escott	2,491	61.89	2.5%	243.64	9.8%	181.75	7.3%
	Front of Leeds & Lansdowne	2,157	80.63	3.7%	244.64	11.3%	164.02	7.6%
	Front of Yonge	748	30.62	4.1%	110.31	14.8%	79.69	10.7%
	Kitley	3,515	7.64	0.2%	82.29	2.3%	74.65	2.1%
	N. Crosby*****	2,207	64.80	2.9%	0.00	0.0%	-64.80	-2.9%
	Rear of Leeds & Lansdowne	1,809	101.36	5.6%	96.79	5.3%	-4.57	-0.3%
	S. Crosby	1,461	171.17	11.7%	0.00	0.0%	-171.17	-11.7%
	S. Elmsley*****	1,455	27.62	1.9%	21.78	1.5%	-5.83	-0.4%
Lennox and Addington	Adolphustown	341	32.92	9.6%	7.08	2.1%	-25.83	-7.6%
	Amhert Island	675	2.74	0.4%	84.34	12.5%	81.60	12.1%
	Camden East******	4,796	58.66	1.2%	55.10	1.1%	-3.56	-0.1%
	Ernestown	1,402	170.03	12.1%	14.90	1.1%	-155.12	-11.1%
	N. Fredericksburgh	732	26.28	3.6%	38.19	5.2%	11.91	1.6%
	Richmond	3,175	179.47	5.7%	93.54	2.9%	-85.92	-2.7%
	S. Fredericksburgh	833	68.35	8.2%	33.25	4.0%	-35.10	-4.2%
	Sheffield*****	2,192	16.75	0.8%	0.00	0.0%	-16.75	-0.8%

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Middlesex	Adelaide	212	28.73	13.5%	12.68	6.0%	-16.05	-7.6%
	Biddulph	96	5.80	6.1%	0.00	0.0%	-5.80	-6.1%
	Caradoc	631	103.38	16.4%	29.75	4.7%	-73.64	-11.7%
	Delaware	72	9.96	13.8%	0.00	0.0%	-9.96	-13.8%
	E. Williams	366	35.53	9.7%	16.37	4.5%	-19.16	-5.2%
	Ekfrid	511	68.01	13.3%	26.53	5.2%	-41.48	-8.1%
	Lobo	77	8.15	10.6%	27.07	35.3%	18.92	24.7%
	London	495	42.05	8.5%	0.00	0.0%	-42.05	-8.5%
	London City	0	0.24	0.0%	56.91	0.0%	56.68	0.0%
	McGillivray	562	48.24	8.6%	11.41	2.0%	-36.83	-6.6%
	Metcalfe	289	13.62	4.7%	0.00	0.0%	-13.62	-4.7%
	Mosa	1,589	163.95	10.3%	42.71	2.7%	-121.23	-7.6%
	North Dorchester	1,283	68.59	5.3%	25.10	2.0%	-43.48	-3.4%
	W. Williams	301	16.19	5.4%	0.00	0.0%	-16.19	-5.4%
	West Nissouri	252	28.59	11.3%	0.00	0.0%	-28.59	-11.3%
	Westminster	186	35.50	19.0%	0.00	0.0%	-35.50	-19.0%
Niagara	Fort Erie	2,743	408.70	14.9%	12.06	0.4%	-396.64	-14.5%
	Grimsby	385	23.68	6.1%	0.00	0.0%	-23.68	-6.1%
	Lincoln	338	6.78	2.0%	0.00	0.0%	-6.78	-2.0%
	Niagara	2,648	618.02	23.3%	0.00	0.0%	-618.02	-23.3%
	Niagara-On-The-Lake	145	31.77	21.9%	0.00	0.0%	-31.77	-21.9%
	Port Colborne	1,610	224.30	13.9%	38.72	2.4%	-185.58	-11.5%
	Thorold	223	18.08	8.1%	0.00	0.0%	-18.08	-8.1%
	Wainfleet	3,388	243.47	7.2%	232.88	6.9%	-10.59	-0.3%
	Welland	429	111.29	26.0%	0.00	0.0%	-111.29	-26.0%
	West Lincoln	3,769	170.65	4.5%	0.00	0.0%	-170.65	-4.5%
Northumberland	Alnwick	662	0.00	0.0%	19.31	2.9%	19.31	2.9%
	Brighton	3,069	41.39	1.3%	124.02	4.0%	82.63	2.7%
	Cramahe	1,961	22.76	1.2%	0.00	0.0%	-22.76	-1.2%
	Haldimand	1,858	9.02	0.5%	41.40	2.2%	32.38	1.7%
	Hamilton	1,050	44.94	4.3%	28.01	2.7%	-16.93	-1.6%
	Hope	687	20.21	2.9%	49.11	7.1%	28.89	4.2%
	Murray	2,901	21.76	0.7%	118.78	4.1%	97.02	3.3%
	Percy	1,904	23.04	1.2%	44.16	2.3%	21.12	1.1%
	Seymour	2,488	75.66	3.0%	28.70	1.2%	-46.96	-1.9%

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Ottawa-Carleton	Cumberland	3,645	968.41	26.6%	582.32	16.0%	-386.08	-10.6%
	Gloucester	3,312	1,235.32	37.3%	2,486.61	75.1%	1,251.29	37.8%
	Goulbourn	6,125	329.15	5.4%	231.17	3.8%	-97.98	-1.6%
	March	1,425	250.30	17.6%	36.73	2.6%	-213.57	-15.0%
	Napean	687	151.92	22.1%	579.40	84.4%	427.48	62.3%
	Osgoode	4,973	704.38	14.2%	293.61	5.9%	-410.77	-8.3%
	Rideau	10,937	236.76	2.2%	928.33	8.5%	691.56	6.3%
	West Carleton	7,625	480.37	6.3%	190.53	2.5%	-289.84	-3.8%
Oxford	Blandford	991	14.70	1.5%	0.00	0.0%	-14.70	-1.5%
	Blenheim	2,041	3.41	0.2%	102.17	5.0%	98.76	4.8%
	East Zorra - Tavistock	268	10.53	3.9%	0.00	0.0%	-10.53	-3.9%
	Norwich	833	17.34	2.1%	16.71	2.0%	-0.63	-0.1%
	Southwest Oxford	1,025	62.47	6.1%	53.58	5.2%	-8.89	-0.9%
	Tillsonburg	0	0.00	0.0%	0.00	0.0%	0.00	0.0%
	Woodstock	0	0.00	0.0%	20.61	0.0%	20.61	0.0%
	Zorra	1,191	34.46	2.9%	92.09	7.7%	57.64	4.8%
Peel	Brampton	16	0.00	0.0%	23.59	151.7%	23.59	151.7%
	Caledon	2,487	45.17	1.8%	73.92	3.0%	28.75	1.2%
	Mississauga	22	21.68	100.0%	0.00	0.0%	-21.68	-100.0%
Perth	Blanshard	27	3.02	11.2%	0.00	0.0%	-3.02	-11.2%
	Downie	653	65.82	10.1%	11.03	1.7%	-54.79	-8.4%
	Ellice	1,177	11.72	1.0%	10.81	0.9%	-0.91	-0.1%
	Elma	706	153.37	21.7%	0.00	0.0%	-153.37	-21.7%
	Fullarton	370	10.23	2.8%	0.00	0.0%	-10.23	-2.8%
	Hibbert	223	5.34	2.4%	10.24	4.6%	4.90	2.2%
	Logan	212	45.90	21.6%	0.00	0.0%	-45.90	-21.6%
	Mornington	318	39.45	12.4%	0.00	0.0%	-39.45	-12.4%
	N. Easthope	981	53.22	5.4%	5.42	0.6%	-47.80	-4.9%
	S. Easthope	144	15.50	10.8%	5.76	4.0%	-9.74	-6.8%
	Stratford	15	0.00	0.0%	0.00	0.0%	0.00	0.0%
	Wallace	792	14.44	1.8%	10.09	1.3%	-4.34	-0.5%
Peterborough	Asphodel	2,251	21.07	0.9%	222.44	9.9%	201.37	8.9%
	Cavan	2,954	56.00	1.9%	25.59	0.9%	-30.41	-1.0%
	Douro	2,748	0.00	0.0%	283.57	10.3%	283.57	10.3%
	Dummer	6,361	110.52	1.7%	180.97	2.8%	70.45	1.1%
	Ennismore	1,191	18.68	1.6%	72.45	6.1%	53.77	4.5%
	N. Monaghan	817	70.05	8.6%	25.32	3.1%	-44.73	-5.5%
	Otonabee	4,386	121.71	2.8%	75.63	1.7%	-46.08	-1.1%
	Peterborough	24	1.09	4.5%	2.53	10.4%	1.44	5.9%
	S. Monaghan	1,124	7.94	0.7%	10.66	0.9%	2.72	0.2%
	Smith	3,186	33.09	1.0%	90.01	2.8%	56.92	1.8%

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Prescott	Alfred	1,228	105.28	8.6%	16.62	1.4%	-88.66	-7.2%
	Caledonia	3,721	390.53	10.5%	188.24	5.1%	-202.30	-5.4%
	East Hawkesbury	1,416	119.61	8.4%	193.18	13.6%	73.57	5.2%
	Longueuil	360	40.81	11.3%	0.00	0.0%	-40.81	-11.3%
	North Plantagenet	1,416	56.85	4.0%	0.06	0.0%	-56.80	-4.0%
	South Plantegenet	1,232	285.56	23.2%	17.91	1.5%	-267.65	-21.7%
	West Hawkesbury	1,618	248.35	15.3%	0.00	0.0%	-248.35	-15.3%
Prince Edward	Ameliasburgh	2,396	0.00	0.0%	79.68	3.3%	79.68	3.3%
	Athol	762	10.98	1.4%	22.99	3.0%	12.01	1.6%
	Hallowell	2,790	4.55	0.2%	15.86	0.6%	11.32	0.4%
	Hillier	1,719	1.12	0.1%	22.81	1.3%	21.69	1.3%
	N. Marysburgh	688	4.21	0.6%	0.00	0.0%	-4.21	-0.6%
	S. Marysburgh	562	17.47	3.1%	0.00	0.0%	-17.47	-3.1%
	Sophiasburg	2,398	1.08	0.0%	14.40	0.6%	13.31	0.6%
Russell	Cambridge	1,143	100.42	8.8%	77.52	6.8%	-22.90	-2.0%
	Clarence	876	96.56	11.0%	67.64	7.7%	-28.93	-3.3%
	Russell	424	63.68	15.0%	0.00	0.0%	-63.68	-15.0%
Simcoe	Adjala	652	81.35	12.5%	16.72	2.6%	-64.62	-9.9%
	Barrie	25	0.00	0.0%	0.58	2.3%	0.58	2.3%
	Essa	1,496	13.98	0.9%	115.59	7.7%	101.61	6.8%
	Flos	1,369	81.18	5.9%	14.05	1.0%	-67.13	-4.9%
	Innisfil	1,611	78.83	4.9%	131.80	8.2%	52.97	3.3%
	Mara	5,682	93.33	1.6%	194.34	3.4%	101.01	1.8%
	Matchedash	2,695	107.40	4.0%	0.00	0.0%	-107.40	-4.0%
	Medonte	2,972	168.82	5.7%	11.08	0.4%	-157.74	-5.3%
	Nottawasaga	1,313	202.67	15.4%	30.03	2.3%	-172.64	-13.2%
	Orillia	3,170	172.81	5.5%	28.32	0.9%	-144.48	-4.6%
	Oro	2,662	16.93	0.6%	15.52	0.6%	-1.41	-0.1%
	Rama***	2	0.00	0.0%	0.00	0.0%	0.00	0.0%
	Sunnidale	2,222	24.15	1.1%	190.31	8.6%	166.16	7.5%
	Tay	3,294	524.34	15.9%	111.36	3.4%	-412.98	-12.5%
	Tecumseth	844	156.94	18.6%	23.94	2.8%	-133.00	-15.8%
	Tiny	1,792	33.00	1.8%	151.12	8.4%	118.12	6.6%
	Tosorontio	850	45.60	5.4%	0.00	0.0%	-45.60	-5.4%
	Vespra	6,062	161.96	2.7%	502.21	8.3%	340.25	5.6%
	West Gwillimbury	1,572	126.63	8.1%	0.00	0.0%	-126.63	-8.1%
Stormont	Cornwall	5,368	850.94	15.9%	12.46	0.2%	-838.48	-15.6%
	Finch	836	80.56	9.6%	137.20	16.4%	56.64	6.8%
	Osnabruck	6,826	576.95	8.5%	87.34	1.3%	-489.62	-7.2%
	Roxborough	6,216	830.16	13.4%	109.87	1.8%	-720.29	-11.6%

Continued on next page

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Victoria	Carden	1,665	108.52	6.5%	45.98	2.8%	-62.55	-3.8%
	Eldon	3,125	98.44	3.2%	144.38	4.6%	45.94	1.5%
	Emily	4,100	8.41	0.2%	17.51	0.4%	9.09	0.2%
	Fenelon	3,761	37.19	1.0%	88.91	2.4%	51.72	1.4%
	Manvers	4,373	39.86	0.9%	0.00	0.0%	-39.86	-0.9%
	Mariposa	5,048	272.82	5.4%	60.60	1.2%	-212.22	-4.2%
	Ops	4,820	167.30	3.5%	18.10	0.4%	-149.20	-3.1%
	Verulam	2,257	0.00	0.0%	20.81	0.9%	20.81	0.9%
Waterloo	Cambridge	458	0.00	0.0%	77.77	17.0%	77.77	17.0%
	Kitchener	220	3.71	1.7%	41.70	18.9%	37.99	17.2%
	N. Dumfries	1,275	0.54	0.0%	62.62	4.9%	62.08	4.9%
	Waterloo	154	0.00	0.0%	0.00	0.0%	0.00	0.0%
	Wellesley	761	44.56	5.9%	0.00	0.0%	-44.56	-5.9%
	Wilmont	496	12.17	2.5%	17.06	3.4%	4.90	1.0%
	Woolwich	1,407	39.33	2.8%	54.22	3.9%	14.89	1.1%
Wellington	Arthur	1,009	10.50	1.0%	11.02	1.1%	0.52	0.1%
	Eramosa	1,457	12.84	0.9%	108.04	7.4%	95.20	6.5%
	Erin	2,636	9.01	0.3%	414.98	15.7%	405.97	15.4%
	Guelph	704	12.90	1.8%	76.23	10.8%	63.33	9.0%
	Guelph City	226	0.00	0.0%	23.77	10.5%	23.77	10.5%
	Maryborough	658	13.45	2.0%	71.05	10.8%	57.60	8.8%
	Minto	2,404	39.86	1.7%	110.26	4.6%	70.40	2.9%
	Nichol	315	32.55	10.3%	38.73	12.3%	6.18	2.0%
	Peel	719	0.00	0.0%	17.01	2.4%	17.01	2.4%
	Pilkington	304	23.73	7.8%	30.37	10.0%	6.64	2.2%
	Puslinch	2,420	33.25	1.4%	123.56	5.1%	90.30	3.7%
	West Garafraxa	531	125.80	23.7%	116.42	21.9%	-9.38	-1.8%
	West Luther	2,175	0.00	0.0%	301.33	13.9%	301.33	13.9%
York	Aurora	25	0.00	0.0%	0.00	0.0%	0.00	0.0%
	East Gwillimbury	3,978	277.74	7.0%	586.94	14.8%	309.20	7.8%
	Georgina	6,631	371.11	5.6%	272.58	4.1%	-98.53	-1.5%
	King	1,209	119.54	9.9%	46.60	3.9%	-72.94	-6.0%
	Markham	21	0.00	0.0%	0.00	0.0%	0.00	0.0%
	Richmond Hill	163	49.55	30.4%	0.00	0.0%	-49.55	-30.4%
	Vaughan	41	15.90	38.5%	0.00	0.0%	-15.90	-38.5%
	Whitchurch-Stouffville	515	18.57	3.6%	28.41	5.5%	9.85	1.9%
	Full Study Area	631,698	33,663.05	5.3%	28,964.14	4.6%	-4,698.91	-0.7%

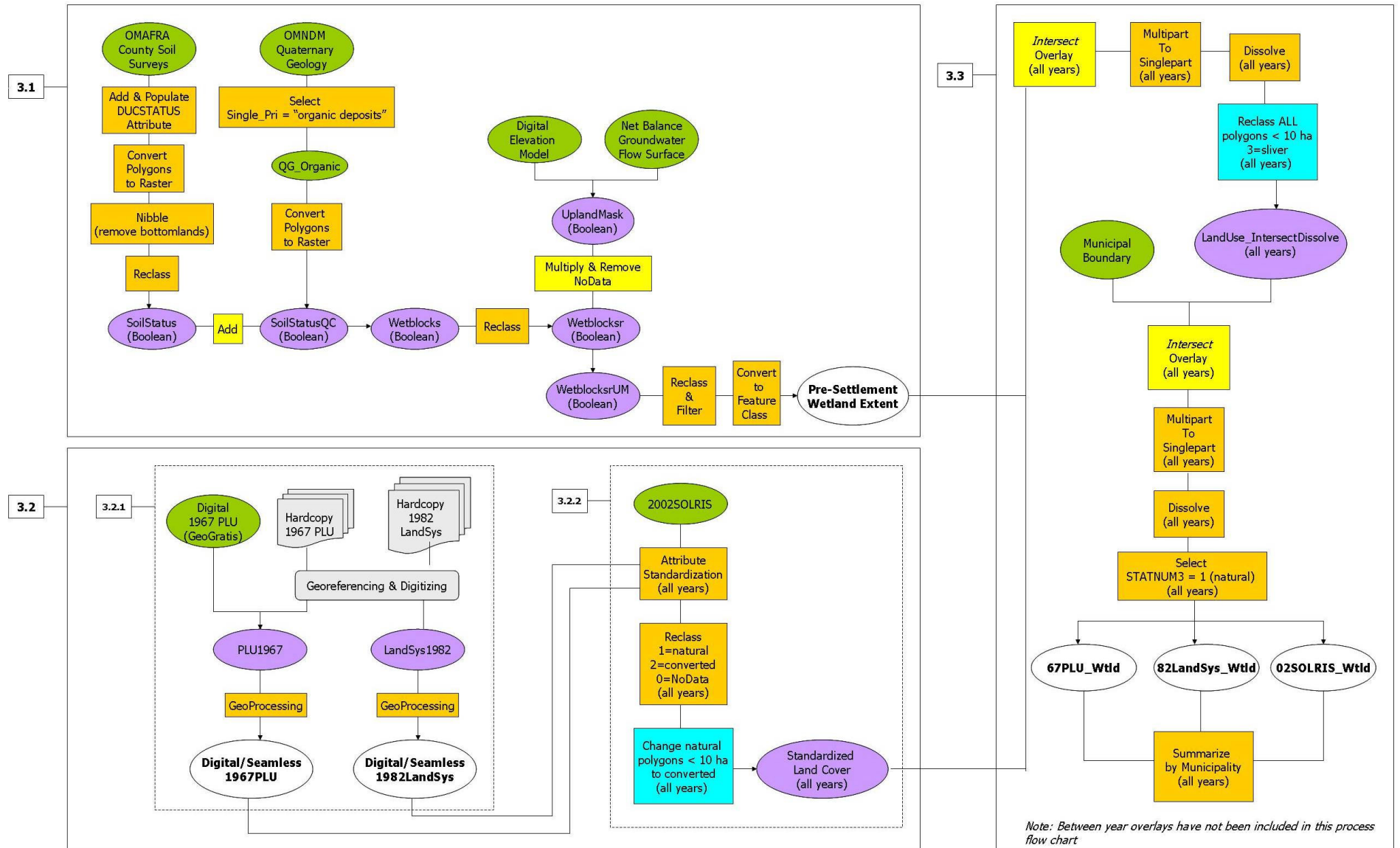****partial or missing 1982 and 2002 coverage
*****partial or missing 2002 coverage
******majority of area with 2002 coverage

Appendix C: GIS Process Flow Chart

Appendix C-1: GIS Process Flow Chart

Appendix D: GIS Tools and Parameters

Appendix D-1: Creation of Pre-Settlement Wetland Extent

Methodology 1 (Section 3.1)

Calculate <u>DUCSTATUS</u> attribute

      i. Create new field in OMAFRA soils dataset called DUCSTATUS
      ii. Populate SoilStatus: wetland=1, upland=2, bottomland=3, other (NoData, Water, etc.)=0

  b. Create "WetSoil Blocks"

      i. From the DUCSTATUS raster, create a raster mask where bottomlands=NoData and all other categories equal one.
      ii. Use the NIBBLE command to remove the bottomlands from the SoilStatus raster.
      iii. Reclassify SoilStatus raster so that Wetsoils=1 and remaining categories are 0

  c. Inclusion of quaternary geology (abbr. QG) to create "QG WetSoil Blocks"

      i. Select QG where SINGLE_PRI = "organic deposits"
      ii. Convert to raster (should be a Boolean raster with organic deposits equal 1 and remaining area is 0).
      iii. Add SoilStatus Boolean and QG Boolean
      iv. Reclassify so that wetland blocks=1 and remaining values are zero.

  d. Condition with upland mask created from MRI-Darcy Net Balance Model

      i. Upland mask is a Boolean raster with the upland portions set to NoData
      ii. Multiply the Upland Mask and the Wetland Blocks (soils and geology). The NoData areas in the mask should be removed in the process
      iii. Reclassify so that wetland blocks equal one and remainder are NoData.
      iv. Filter the remaining speckle in the wetland blocks using the Major Filter tool (4 neighbours, majority threshold)
      v. Convert to feature class using BatchWtldConnected (do not generalize boundary)

Note: The pre-settlement wetland is in raster format. When data were converted to vector format, some polygons were disconnected in narrow areas. As a result, these disconnected polygons were treated as being less than 10 ha, when in fact they should have remained connected and treated as greater than 10 ha. The area of the polygons that should have been treated as greater than or equal to 10ha is approximately 2,700 ha. A batch file was created to connect these disconnected polygons during the conversion to vector format.

Appendix D-2: Preparation and Standardization of Land Cover Datasets

Methodology 2 (Section 3.2)

Part 1 – Data Preparation for 1967 and 1982 Datasets (Section 3.2.1)

<u>1967 CLI Present Land Use</u>

Data Acquisition Version
- Enter all acquired digitized data into this first version of a file geodatabase; this version is not to be edited.

Review Version
Review/clean attribute data:
- Are the map codes valid?
- Do the codes correspond to the descriptions?
- Are there blank codes with a description; if so, can a map code be derived?
- Can the map codes be rolled into a user code?
- Ensure that Unknown values have no corresponding codes, descriptions.
- Are all other attributes entered?

Review/clean spatial data:
- Are the features, valid delineated land use features? Roads, small lakes, islands are not.
- Perform a topology validation to check for sliver overlaps and gaps.
- Is the whole of the map sheets digitized? Are internal rivers digitized?
- Test the topology of map sheets by amalgamating the map sheets into one feature class.

Standard Version
- Create a standard database, and import within it, the original data from all data sources.

QA Version
- Print map sheets with unknown polygons highlighted and with map codes within polygon.
- Use original maps to identify unknown polygons and spot check sampled known polygons.
- Enter discovered unknown values into digitized map.

Edgematching Version
- Merge the map sheets into one feature class.
- Use NTS boundaries to edgematch.

Featurematching Version
- Use QUICKBIRD, SWOOP, and GTA2002 orthophotography to feature match all polygons.

Shift Correction Version
- Sample the map sheets to analyze the shift errors over 80m.
- Use QUICKBIRD, SWOOP, and GTA2002 orthophotography to correct identified shifts greater than 80m.

Topology Version
- Run a topology validation using the following topology parameters: Cluster tolerance of 0.000000009; Must not overlap (action is Merge); Must be larger than the cluster tolerance (action is Delete); Must not have gaps (action is Create Feature).

Final Processing Version
- Roll up "map codes/descriptions" into "user codes/descriptions".
- Final geoprocessing: explode, dissolve.
- Final check for small polygons and topology.

1982 Land Systems

Digitizing and Edgematching
- The maps were digitized on a lower tier municipality basis.
- Edgematching was performed by using MNR lot and MAH municipality boundary layers, both at scale of 1:10000.

Topology
- After the digitizing and edgematching process, there were slivers, mostly at the boundaries. They were removed using topology validation.
- The topology parameters were: Cluster tolerance of 0.0000000214; Must not overlap (action is Subtract); Must be larger than cluster tolerance (action is Delete); and Must not have gaps (action is Create Feature).
- After topology validation, slivers were merged with adjacent polygons having the longest shared border, with the Eliminate tool.
- Slivers that spanned the length of more than one adjacent polygon were manually cut and merged with the appropriate polygons.

Feature Matching
- Feature matching was performed at the upper tier and lower tier municipality borders on the features that represented "woodland", "water", and "swamp, marsh or bog". Their respective USER_CODEs are "Z", "W", and "X".
- Feature matching was performed using 2002 GTA, QuickBird, and SWOOP orthophotography, as well as OBM layers.

Roads Processing
- The original maps for Ottawa_Carleton contained roads. These have been removed by using the "Nibble" and "Simplify Polygon" geoprocessing tools.
- Also, polygons of highway 401 which appeared sporadically in Eastern Ontario have been manually merged into adjoining polygons.

Other Geoprocessing
- Unknown polygons that have an area of 0 (under 1 hectare) have been grouped with adjoining polygons.
- Multipart polygons have been exploded.
- Water features that outline the study area; for example, St. Lawrence River, have been removed.

Part 2 – Standardization of 1967, 1982 and 2002 Datasets (Section 3.2.2)

The objective is to standardize classes and scale of all three land cover datasets.

1967 CLI Present Land Use

1. Create a USE2 field and populate with USE. Change Productive Woodland (T) and Non-Productive Woodland (U) categories into a single category by populating USE2 with TU for these classes.
2. Dissolve based on USE2 to collapse TU spatially (PLUdissolveTU). (Note: uncheck Create multiple features).
3. Create the STATNUM field and populate with 1=natural, 2=converted, 0=NoData or Water using lookup table.
4. Change natural polygons < 10ha to converted in a new field called STATNUM2
5. Dissolve based on STATNUM2 field

1982 Land Systems

1. Create a USE2 field and populate with USER_CODE. Change Woodland (Z) and Pastured Woodland (ZP) categories into a single category by populating USE2 with ZZP for these classes.
2. Dissolve based on USE2 to collapse ZZP spatially (LSdissolveZZP). (Note: uncheck Create multiple features).
3. create the STATNUM field and populate with 1=natural, 2=converted, 0=NoData or Water using lookup table.
4. Change natural polygons < 10ha to converted in a new field called STATNUM2
5. Dissolve based on STATNUM2 field

2002 SOLRIS

1. Collapse natural classes into single categories to match Land Sys using SOLRIS_group_natural_classes (Info table – not visible in Windows Explorer) - SOLRISR.
     - forest=27,
     - wetland =50
     - tall grass prairie and savannah into tallgrass=20
     - Open water to include shallow water=66

2. Remove roads from dataset with the nibble command (SOLRISN)
3. Convert to polygon.
4. Create the STATNUM field and populate with 1=natural, 2=converted, 0=NoData or Water
5. Change natural polygons < 10ha to converted in a new field called STATNUM2
6. Dissolve based on STATNUM2 field

Appendix D-3: Overlay Analysis

Methodology 3 (Section 3.3)

<u>Pre-settlement wetlands and land cover</u>

The following steps need to be applied to each land cover dataset resulting from *Methodology 2*

1. Intersect pre-settlement wetlands and land cover
2. Explode (multipart to single part polygon)
3. Dissolve based on STATNUM2 field
4. Create STATNUM3, transfer values from STATNUM2 and change all polygons < 10ha to a 3 in the STATNUM3 field
5. Intersect Municipal fabric
6. Summarize by township and county

<u>Between year Overlay Analysis</u>

The following steps were done using the 1967 and 1982 dataset.

Loss between YYYY and 2002 (replace the YYYY with the dataset for the year of interest)

1. Intersect YYYY wetland extent and 2002 SOLRIS land cover (YYYY wetland extent is generated in steps above, use layer prior to municipal intersection)
2. Explode (multipart to single part polygon)
3. Dissolve based on STATNUM2 field
4. Create STATNUM3, transfer values from STATNUM2 and change all polygons < 10ha to a 3 in the STATNUM3 field
5. Intersect Municipal fabric
6. Summarize converted (2) features by township and county

Gain between YYYY and 2002 (replace the YYYY with the dataset for the year of interest)

1. Intersect YYYY converted extent and 2002 SOLRIS land cover (YYYY converted extent is generated in steps above, use layer prior to municipal intersection)
2. Explode (multipart to single part polygon)
3. Dissolve based on STATNUM2 field
4. Create STATNUM3, transfer values from STATNUM2 and change all polygons < 10ha to a 3 in the STATNUM3 field
5. Intersect Municipal fabric
6. Summarize natural (1) features by township and county

 Note: Batch files have been created to run these analyses