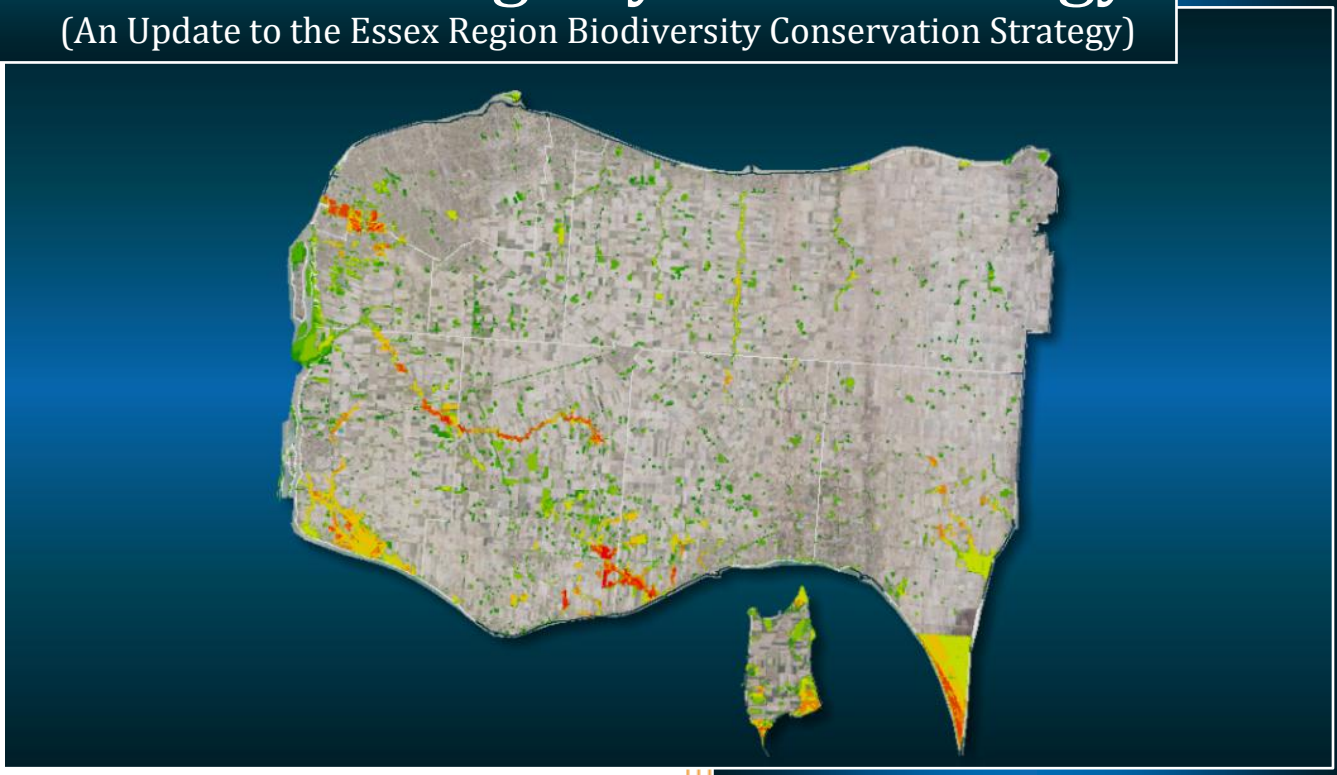
2013

Essex Region Natural Heritage System Strategy

(An Update to the Essex Region Biodiversity Conservation Strategy)



Essex Region Conservation Authority

THE CORPORATION OF THE COUNTY OF ESSEX
SUNPARLOR OF CANADA

Essex Region Conservation Authority

Corporation of the County of Essex

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Report prepared by: Dan Lebedyk, *Conservation Biologist* (ERCA), Rebecca Belanger, *Conservation Planner*, Tom Dufour, *Geomatics Technician* (ERCA) and Michael Nelson, *Watershed Planner* (ERCA).

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Copies of this report may be obtained from:

Essex Region Conservation Authority
360 Fairview Ave. W., Suite 311
Essex ON N8M 1Y6

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1 INTRODUCTION

1.1 Background

A natural heritage system is defined as “an ecologically based delineation of nature and natural function- a system of connected or to be connected green and natural areas that provide ecological functions over a longer period of time and enable movement of species” (Ontario Ministry of Natural Resources, 2010). Natural heritage systems encompass natural heritage features of various terrestrial types, functions and linkages between them. The concept of natural heritage system planning is now recognized and utilized world-wide in order to protect and improve biodiversity and ecological function in the long term. Another important component of the natural heritage system recognized by the Provincial Policy Statement (PPS) is the important linkage between natural heritage and water features based on ecological functions such as hydrological connectivity.

In the fall of 2008, the Corporation of the County of Essex entered into an agreement with the Essex Region Conservation Authority (ERCA) to undertake a natural heritage system mapping and prioritization exercise. The intent of this Essex Region Natural Heritage System Strategy (ERNHSS) is to accurately map existing natural heritage features as well as to prioritize habitat restoration opportunities within the region. This strategy includes a broad, landscape level natural heritage modeling exercise utilizing the ERCA Geographic Information System (GIS) as the main tool for the analysis.

Environment Canada, in partnership with other government agencies, has developed a guideline document entitled "*How Much Habitat is Enough? - A Framework for Guiding Habitat Rehabilitation in Great Lakes Areas of Concern*" (Environment Canada, *et al*., 1998; Environment Canada, 2004), which provides a methodology to establish habitat restoration guidelines and priorities for degraded ecosystems utilizing geographical information systems (GIS) technology. In 2002, the Essex Region Biodiversity Conservation Strategy (BCS) (ERCA, 2002) was completed and was the first attempt at completing a comprehensive spatial analysis of all natural areas within the Essex region. This analysis resulted in a depiction of existing natural heritage features, as well as recommended restoration opportunities based on application of the guidelines from the Environment Canada framework.

The ERNHSS is considered to be an update to the original BCS completed in 2002; however it is not intended to duplicate all analyses completed in 2002. Rather, the purpose of this study is to meet current Provincial Policy directives utilizing up-to date GIS technology and data to produce an accurate prioritization of the natural heritage system, both from the standpoint of identifying high priority core natural heritage features for stewardship and securement as well as identify high priority restoration opportunities which will maximize ecological benefits.

1.2 Regional Context

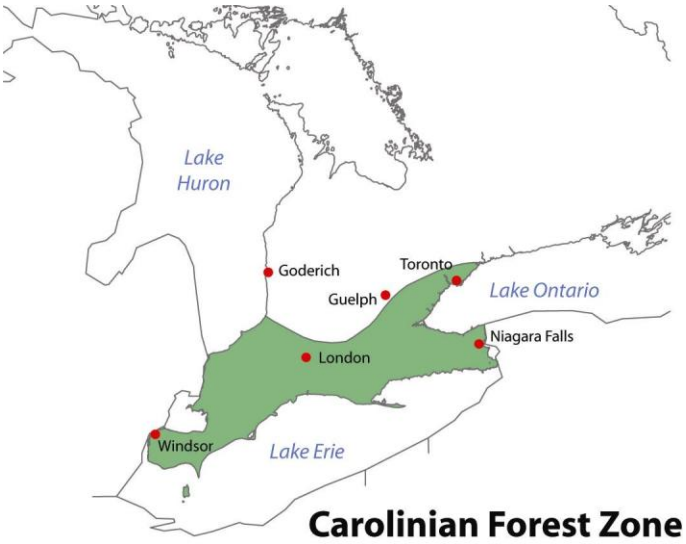

Figure 1: Map of the Carolinian Forest Zone

The County of Essex is located in the extreme southwest quadrant of the Carolinian Canada forest zone, which is roughly delineated south of a line running from Grand Bend to Toronto (Figure 1). The southerly location and moderate climate of this region is the main reason for the existence of such a unique and diverse ecosystem in Canada. Although the Carolinian forest zone is quite small in comparison with other vegetation zones, it hosts a greater number of floral and faunal species than any other ecosystem in Canada (Carolinian Canada, 2006). It is estimated that approximately 2,200 species of herbaceous plants are found here and there are seventy different species of trees alone. Approximately 400 bird species have been recorded in this zone - over half of the bird species in all of Canada (Carolinian Canada, 2006).

Prior to European Settlement, the Essex region was dominated by lush natural areas including Carolinian woodlands, wetlands and tallgrass prairies. Since this time of settlement in the 1830's, much of the original natural resources of the Essex region have either been removed from the landscape or have become extremely degraded as a direct or indirect result of clearing and drainage for timber, agriculture, and urban development (ERCA, 1986; Oldham, 1983). Within the region, there has been an overall loss of approximately 97% of the original wetland area (Snell, 1989) and 95% of the original forest area (Vandall, 1979). This has resulted in a degraded ecosystem characterized by a lack of riparian habitat, wetland area and appropriate buffers, forest cover and core natural areas, few green linkages between natural features, and poor water quality and aquatic habitat. Our region's remaining natural heritage, consisting of small, isolated remnants of forest, wetland, prairie, savanna, alvar, and riparian habitat, constitutes one of the lowest percentages of natural cover of any region in Ontario (Oldham, 1983).

> *"It was realized in the latter half of the nineteenth century that too much timber had been wastefully cut; in many cases only to reveal land that was not profitable to farming. Some criticized earlier generations which had 'ripped away' the forest. They believed that the solutions to the problems lay in replacing the trees."*
>
> From: Fur Trade To Farmstead (ERCA, 1986) paraphrasing the Bureau of Forestry in 1885.

It has long been realized that this cumulative loss and alteration of the region's natural heritage (i.e., habitats) since European settlement has had profound consequences on the region's

sustainability and ecosystem health, necessitating the need to significantly increase the extent and quality of remaining natural habitats.

1.3 Study Purpose

The purpose of the ERNHSS is to assist the County of Essex in determining an appropriate strategy to protect natural heritage features and their functions as part of the update to the Official Plan process. The current Official Plan supports the preparation of a regional natural heritage system strategy through policies such as in Section 1.3.3 Natural Environment Areas:

> *"...although good for farming, these past practices have resulted in limited habitat, few green linkages between natural features and poorer water quality. As a result, it is increasingly important to work with private property owners in their efforts to preserve these remaining areas and enhance their effectiveness through promoting the development or preservation of natural linkages between the areas and increasing the amount of core natural area."*
>
> (County of Essex, 2002)

In addition, within Section 3.4 Natural Environment Areas, Section 3.4.2 Goals states:

> "*f) to establish framework with which the County and local municipalities will incorporate comprehensive and innovative policies in local Official Plans in an attempt to work with private property owners toward preserving and enhancing natural heritage features;*
>
> *g) to increase the size of core natural areas and to create and protect important natural area linkages and corridors as part of linked greenway systems, connecting wildlife habitat areas to each other, human settlements to human settlements and people to nature. Inter-municipal coordination to accomplish this goal is encouraged."*
>
> (County of Essex, 2002)

One component of the ERNHSS is to scientifically identify and prioritize the system of natural heritage features from a regional perspective. The study area includes all urban and rural lands within the Essex region, including the County of Essex and its seven lower tier municipalities, the City of Windsor, and the Township of Pelee. Completed at the landscape scale, this study should be considered a "broad brush" depiction of the natural system of features and linkages to support biodiversity within the Essex region. The original BCS completed in 2002 serves as baseline information for this study. The ERNHSS is an update to this existing spatial database which will result in a more accurate and up to date assessment of the extent of the region's existing natural vegetation and identify the prioritized natural heritage system.

> *"Natural heritage systems are identified to help define integrated networks of conservation lands and waters linked by natural and restored corridors. System definition is a practical technique to define conservation and protection objectives in land-use, watershed and resource planning. They can also define baseline or benchmark landscape systems against which to monitor cumulative effects and assess acceptable levels of landscape change."*
>
> *(Riley and Mohr, 1994)*

Applying similar restoration guidelines as in the 2002 BCS, the ERNHSS will depict lands recommended for restoration and then prioritize these opportunities. Strategic planning for the restoration of ecosystem features focuses on identifying high priority opportunities to restore features and ecological functions that have been lost or degraded, in a fashion that maximizes ecological benefit. The objective of these measures is to increase the size, connectivity, and quality of core natural heritage features, through restoration, buffering and the creation of natural corridors and linkages, thereby improving ecosystem diversity and ecological function. This is the first step in the construction of a healthy, self-sustaining, natural heritage system. This holistic approach that works towards restoring, to the extent possible, ecological function, linkage, and diverse species composition that comprise undegraded natural ecosystems is more likely to ensure that maximum biodiversity is conserved over the long term. Strategic planning for restoration and conservation of biodiversity is based on the premise that all existing natural areas remain intact and that there is no further loss.

A connected and diverse natural heritage system also provides a scenic landscape with opportunities for extensive trail systems, in appropriate locations. The outcome of this study will provide updated baseline information useful for developing and strengthening policies focused on the natural heritage system.

1.4 Natural Heritage System Approach

Core natural areas provide habitat for a wide variety of animals and plants. In general, the larger the natural area, the more diversity that can exist within it. However, isolated patches of habitat alone are not adequate to sustain healthy populations of plants and animals. Core natural features must be connected with each other. While some species of wildlife do travel over agricultural lands between natural features, others require vegetated corridors between the major core areas. These corridors are essential in order to allow for migration of wildlife, to provide escape routes, and to foster biodiversity of natural communities and genetic pools through immigration and emigration.

> *"The science of landscape ecology suggests that the diversity of native species and communities can be sustained by a system of core natural areas with connecting corridors. In many parts of the Carolinian region, natural habitats are fragmented and isolated. It is vital to protect those habitats that remain, to buffer them from incompatible nearby land use, and to restore large core areas and connecting corridors in appropriate locations."*
>
> *(Reid and Symmes, 1997)*

In fragmented landscapes such as the Essex region, the identification of natural heritage systems, and the associated recommendations designed for their protection and restoration, can accomplish the following:

1. Maintain or enhance the overall diversity and health of native species populations;
2. Conserve rare plant communities (e.g. alvars, tallgrass prairies);
3. Assist in the recovery of Species at Risk;
4. Maintain and enhance natural corridors for wildlife movement and genetic exchange;
5. Help protect the quality and quantity of water resources;
6. Establish priorities for restoration, stewardship and securement; and,

7. Assist decision makers in making sound, informed decisions on how and where development should occur without compromising the ecological integrity of natural systems.

The results from the ERNHSS will guide where high priority habitat restoration is recommended to promote a more healthy and self-sustaining ecosystem.

> *"The diversity and connectivity of natural features in an area, and the long-term ecological function and biodiversity of natural heritage systems, should be maintained, restored or, where possible, improved, recognizing linkages between and among natural heritage features and areas, surface water features and ground water features."*
>
> Provincial Policy Statement 2005, policy 2.1.2
> (Ontario Ministry of Municipal Affairs and Housing, 2005)

The changes to Provincial policies and legislation, including those brought about in the 2005 Provincial Policy Statement (PPS), provide new opportunities for further strengthening the County of Essex environment and water resource policies. The PPS undertakes a "systems approach as a centralized theme". Undertaking a natural heritage systems approach to planning reinforces the understanding that natural features have strong ecological ties to other physical features and areas in the landscape and encourages biodiversity.

The term "natural heritage system" as defined in Section 6.0 of the PPS is *"a system made up of natural heritage features and areas, linked by natural corridors which are necessary to maintain biological and geological diversity, natural functions, viable populations of indigenous species and ecosystems. These systems can include lands that have been restored and areas with the potential to be restored to a natural state."* (Ontario Ministry of Municipal Affairs and Housing, 2005). Therefore the vision for the natural heritage system within the Essex region consists of the core natural features, which are linked by existing and proposed natural corridors such as shelterbelts, hedgerows and watercourses, which when fully restored will ensure the overall functioning of the ecosystem. According to the Province of Ontario's Natural Heritage Reference Manual regarding the creation and protection of the natural heritage system, *"Where few natural areas remain, identifying a connected natural heritage system may not be possible except where efforts are made to encourage restoration or rehabilitation. In such parts of the province, the emphasis should be on protecting most of the remaining natural area and lands surrounding it where natural cover can be improved or restored."* (Ontario Ministry of Natural Resources, 2010).

The following statements are general objectives which are appropriate for any type of natural heritage study:

1. Protect the best features (based on significance, representation and distribution);
2. Large areas are more valuable and are typically more significant and of higher preference for protection (particularly creating interior forest habitat);
3. Strive to create and enhance biodiversity, which is a key determinant of ecological health;
4. Those sites with lesser amounts or opportunities for disturbance are of higher value;
5. Promote connectivity and natural linkages between natural features.

It is expected that the ERNHSS will result in an accurate depiction of the overall natural heritage system within the Essex region and provide the necessary background justification providing for its protection and restoration. In addition, the resulting natural heritage system is intended to accomplish multiple watershed management objectives concurrently; for example, public and private stewardship initiatives, consistency in addressing planning applications, encourage and support watershed and sub-watershed studies and identify areas for natural heritage inventories where necessary.

The purpose of the ERNHSS is also to provide the various planning jurisdictions with the information and tools necessary to update their natural heritage policies in their respective Official Plans. As well, the up to date mapping of natural heritage features produced from the ERNHSS will be useful for each of the lower-tier municipalities in order to facilitate the implementation of natural heritage systems approaches at the local levels, where those do not currently exist.

1.5 Detroit River Remedial Action Plan (RAP) Context

In 1986, through the Great Lakes Water Quality Agreement, the United States and Canada agreed to clean up 43 Areas of Concern (AOCs) across the Great Lakes Basin, which have identified “beneficial use impairments” such as the loss of fish and wildlife habitat and the degradation of fish and wildlife populations.

One of the goals of the 2002 BCS was to apply the restoration guidelines outlined in "*How Much Habitat is Enough? - A Framework for Guiding Habitat Rehabilitation in Great Lakes Areas of Concern*" (Environment Canada, *et al*., 1998; Environment Canada, 2004) to the Detroit River AOC. The ERNHSS applies the same guidelines and is considered to be a more accurate application of the various guidelines to the region’s landscape. The application of these habitat rehabilitation guidelines results in the establishment of appropriate local targets for natural area cover, and will continue to assist the Detroit River Canadian Cleanup (DRCC) in the following:

- providing a review of existing habitat conditions;
- defining data gaps;
- developing delisting criteria for impaired beneficial use #14, loss of fish and wildlife habitat;
- developing implementation plans, and;
- prioritizing implementation project proposals.

2 METHODOLOGY

The Corporation of the County of Essex retained ERCA to complete the study. Bill King, *Manager, Planning Services* was the lead administrative staff person from the County of Essex involved with the study. Rebecca Belanger, ERCA *Conservation Planner* coordinated the study. Report preparation was completed by Dan Lebedyk, *Conservation Biologist*, Tom Dufour, *Geomatics Technician*, Rebecca Belanger, *Conservation Planner* and Michael Nelson, *Watershed Planner*. All maps (and associated GIS data analysis) were produced by the following ERCA staff – Tom Dufour, *Geomatics Technician* and Jovana Ilic, *Assistant GIS Technician*. The following methods were utilized by technical staff to generate the ERNHSS.

2.1 GIS Data Compilation

The following information was compiled into a Geographic Information System (GIS) for this study. The data is from a series of sources, vintages, and scales, and are described below. The data used was considered the best available data at the time of the study. A complete list of data inputs is available in Table 1 within the Appendix.

- **Digital Aerial Photography:** 2008 10 cm resolution digital air photography was utilized for the delineation of natural features in Essex County and the City of Windsor while 30 cm resolution 2006 digital aerial photography was utilized for the Township of Pelee. Photography was provided by the County of Essex, City of Windsor, the Township of Pelee and Point Pelee National Park. This digital aerial photography was also used to correct and refine the GIS layers originally generated through the 2002 BCS.
- **Watercourses:** Watercourse centreline data within the ERCA watershed was delineated using 2004 black and white 10cm digital aerial photography for the mainland, and 30cm digital aerial photography for Pelee Island. Watercourse data within the Lower Thames Valley Conservation Authority (LTVCA) watershed was provided by the Town of Lakeshore and Municipality of Leamington. Subwatershed delineations and floodplain mapping was provided by ERCA and LTVCA.
- **Natural areas and features:**
    - Provincially Significant Wetland (PSW) boundaries were obtained from the Ontario Ministry of Natural Resources (OMNR).
    - Areas of Natural and Scientific Interest (ANSI) boundaries were obtained from the OMNR.
    - Environmentally Significant Area (ESA) boundaries and associated data are compiled, maintained and provided by ERCA. The ESA's dataset was last updated in 2006.
    - Forested features, valleylands and other natural features were delineated by ERCA using digital aerial photography.
- **Normalized Difference Vegetation Index (NDVI):** NDVI (Weier and Herring, 2000) data and analysis was produced from 2006 satellite imagery and provided by ERCA.
- **Physiography:** Physiography data (1:600:000) was obtained from Ontario Geological Survey (Chapman and Putnam, 1984).
- **Land Ownership:** Land identified as held in public ownership. Derivative product compiled by ERCA.

- **Nature Conservancy of Canada (NCC) Priority Areas:** Priority provided by the NCC (NCC, 2008).

The majority of the work performed for this study consisted of GIS mapping and analysis. The GIS generated all maps, statistics, and documentation describing the current state of natural vegetation and, ultimately, areas for possible restoration. ESRI's ArcGIS software was used to compile, manage and analyse the digital data. The data was imported into, and managed by, ESRI's File Geodatabases framework. Geoprocessing was used as the system for manipulating the data (e.g. overlays, buffers) in defined workflows. ESRI's ModelBuilder was used to manage these geoprocessing workflows. ModelBuilder is a visual programming language that can be used as a tool to encapsulate workflows. The benefits of using ModelBuilder include their reusability, automation, and use as a visual representation of analysis operations.

DISCLAIMER – Due to the variety of sources, vintages, formats, and scales of the input datasets, the accuracy of any data, statistics, or maps reported in this document is herby qualified. The appropriate scale for mapping and reporting data at a landscape level is 1:10,000 or greater. Statistics within the ERNHSS are reported with two significant digits for consistency but should not be interpreted as a claim of its accuracy, due to the scale of the exercise.

2.2 Analysis of Existing Natural Features

A complete list of data outputs is available in Table 4 of the Appendix. Throughout the document the use of the terms 'areas' and 'features' may be used interchangeably. The intent is to use the term areas to refer to a locally identified natural area where the use of the term feature is used to refer to an identified feature.

2.2.1 Forest Cover

Forest cover within the ERNHSS refers to features which were identified through aerial photography interpretation as natural features with tree cover. These features not only include vegetation communities which meet the definition of a "forest" based on the Ecological Land Classification (ELC) system - a treed community with greater than 60% tree cover, but also include features which meet the ELC definition of a "woodland" - a treed community composed of between 35% and 60% tree cover (Lee et. al., 1998). In addition, this layer also includes features which were readily identifiable from aerial photography as containing greater than approximately 10% tree cover, which is now referred to as "sparsely treed" communities in the newest version of the ELC system currently in development (Lee, 2011).

The initial mapping phases included an update to the existing "forest cover layer" which consisted of removing features where structures and yards now exist based on air photo interpretation. Although this mapping exercise updates the "forest cover" boundary delineations through interpretation of the 2008 air photos available for the region, it does not differentiate between various treed community types, except for the distinction of swamp forest. Those treed features which resulted in being included in both the forest cover layer (from air photo interpretation) and the wetland layer (from the Provincially Significant Wetland layer) were categorized as swamp forest to be included in the calculation of percentage of wetlands for each

jurisdiction and watershed. This is in recognition of the role of these features in providing a wetland hydrologic function such as groundwater recharge. Additional level of detail with respect to specific ELC vegetation types can only be defined accurately through field application of the ELC on the ground.

No minimum size limit was set for delineated patches; however discretion was utilized in order to identify features of sufficient size to be mapped. Substantial efforts were made to remove discernible anthropogenic land uses such as manicured, residential yards, orchards, etc. from the resulting forest cover layer. Hedgerows (i.e., long linear features of woody vegetation typically separating agricultural fields) were also not included within the forest cover dataset. In addition, areas such as golf courses, roadside plantings, windbreaks, non-native plantings, anthropogenic parkland, or treed boulevards which are actively managed to reduce understory growth (e.g., through mowing), were not included in the delineation of forest cover, as these non-natural habitats do not serve in providing significant ecosystem functions, such as wildlife habitat. However, a small number of municipal parks and golf courses have initiated a program to naturalize sections of their properties, allowing woody and herbaceous vegetation to re-establish beneath the tree canopy. These wooded features associated with and adjacent to golf courses were identified, delineated, and retained in the forest cover layer.

Plantations of native species have been included in the forest layer, as these areas have been planted in order to re-establish future forests. Detailed records were available for those plantations that were established through the ERCA tree planting program. Features over five acres in size were delineated from ERCA records and included in the forest layer.It is realized that in some cases it may be several years until such time as these plantations will require no further maintenance to control weeds, have a closed canopy, and have developed a substantial understory complete with associated wildlife. However, because participating landowners sign Stewardship Agreements as part of these planting projects, it is expected that these plantations will remain in the landscape; and in order to prevent the ERNHSS from becoming quickly "out of date" with respect to the amount of forest cover in the landscape, it was decided to include these "young" forests within the layer, realizing their future ecological role.

Once the data for the forest cover layer had been verified and corrected, spatial analysis on the information was conducted. GIS software was used to determine the total amount and the relative percentage of forest cover within each jurisdiction and watershed. In addition, the size of the largest forest patch, and the amount of forest cover either 100 m or 200 m from edge (i.e., how much of the forest cover is considered to be interior forest habitat) was also calculated. The amount of interior forest was calculated for forested features greater than 10 ha in size, as smaller features would not contain any interior forest habitat.

2.2.2 Riparian Analysis

The 2005 ERCA watercourse dataset, digitized from 2004 aerial photography, was utilized for the mapping and analysis of riparian habitat. This dataset includes both natural watercourses and open Municipal Drains.

2.2.3 Built-up Areas

As part of the study, existing developed and other anthropogenic land uses (e.g., transportation corridors, quarries, urbanized areas, etc.) were mapped as areas of exclusion where natural features no longer exist and where large scale restoration would not be possible. These were used to refine the final layers for all existing natural features as well as areas for potential wetland buffer, riparian buffer and other restoration opportunities. Built up areas identified by the OMNR through their SOLRIS product. Transportation features were compiled by ERCA from various municipal sources as well as from ERCA data.

2.2.4 Wetland Extent

The 2012 Provincially Significant Wetland (PSW) dataset was obtained from the OMNR and utilized for the mapping and calculation of existing inventoried and identified wetlands. As mentioned above, all features known to be swamp forest were included in the wetland calculations. Once the data for wetland extent had been checked and corrected, spatial analysis on the information was conducted. Spatial analysis was conducted to determine the percent of a reporting area (jurisdiction or watershed) that is occupied by wetland habitat. There may be wetlands that have not been evaluated by the Ministry of Natural Resources. In most cases, these features are captured as an existing natural feature.

2.2.5 Extent of Other Natural Features

Other natural features include meadows, grasslands, tallgrass prairie, alvars, and shrub thickets and some open water features but are not explicitly described as such in the GIS database. Features within this layer are those which have been identified as natural features through past natural heritage inventories and evaluations (e.g., Candidate Natural Heritage Sites (CNHSs), Environmentally Significant Areas (ESAs), Significant Valleylands, etc.) but are not already included within the forest or wetland layers, or which were otherwise discernible through aerial photography interpretation. Details regarding the characteristics of these other natural features will be added to the GIS database as information becomes available.

2.2.6 Prioritization Criteria

Existing natural features were then prioritized with respect to natural heritage significance. This prioritization exercise assessed the relative significance of natural heritage features through the summation of overlapping recognitions which have been identified through various natural heritage evaluations and analyses. The following set of criteria was utilized in the prioritization exercise. These criteria were felt to capture the full range of environmental variables considered within all known assessments completed within the region.

1. **Existing Natural Feature** – There are 2 types of existing natural features. Each type is mutually exclusive of the other.
    a. **Wetland** represents those features identified by the OMNR as Provincially Significant Wetlands (PSW) through application of the Ontario Wetland Evaluation System (OWES) (OMNR, 1994). Wetlands are areas which are

seasonally or permanently covered by shallow water, as well as lands where the water table is close to or at the surface. In either case, the presence of abundant water has caused the formation of hydric soils and has favoured the dominance of either hydrophytic plants or water tolerant plants.

b. **Terrestrial** represents those features being the greatest extent of identified terrestrial (upland) natural heritage areas (e.g., forests, woodlands, thickets, meadows, prairies, alvars), Candidate Natural Heritage Sites (CNHSs), valleylands, and plantations regardless of size, and not already included within the other existing layers. Excludes any area identified as a wetland.

2. **Areas of Natural or Scientific Interest (ANSI)** are areas of land and water that represent significant biological features that contain exemplary representative examples of the many natural landscapes, communities, plants and animals found in the 14 natural regions of the province. ANSIs are identified by the OMNR by surveying regions and evaluating sites to decide which have the highest value for conservation, scientific study and education.
3. **Environmentally Significant Area (ESA)** are remnant, regionally and provincially significant, natural ecosystems, as identified by ERCA, which contain features such as significant landforms, linkage systems, migratory stopovers, communities, hydrology, diversity, rare species, large size, research or educational value and aesthetic or historical value. ESAs serve to protect and provide habitat for all species of flora and fauna (rare, endangered, or otherwise), as well as protecting representative examples of plant associations, landforms, and other features that are part of our natural heritage.
4. **Significant Valleyland** represents features identified by the ERCA that occur in a valley or other landform depression that has water flowing through or standing for some period of the year. These features often link or border natural areas and provide ecological functions such as habitat (including refuge), corridor, or buffering from adjacent land use impacts. Significant Valleyland features are identified utilizing guidelines provided in the *Natural Heritage Reference Manual* (OMNR, 2010) and are based on the following features:
    a. more or less continuous natural areas providing connections within the watershed;
    b. contains a diversity of native species, natural communities and landscapes;
    c. provides ecological functions such as habitat, passage, refuge, hydrological flow, and buffering from adjacent areas.
5. **Significant Woodland** being treed features that are greater than 2 ha in size. All woodland features that met the size criteria were considered (ie. upland woodlands and swamp forests).
6. **Interior Forest** consisting of treed features which is a minimum of 100 m inside the length of its perimeter (100 m from edge). Thus, a feature must be greater than 200 m width to contain any interior forest. All woodland features were considered (ie. upland woodlands and swamp forests).

7. **Favourable Vegetation Index (NDVI - Healthy Riparian Vegetation Cover)** being features within 200 m of a main watercourse of a subwatershed that is estimated as having healthy riparian vegetation cover within that area using the Normalized Difference Vegetation Index (NDVI) (Weier and Herring, 2000).
8. **Favourable Physiography** being any existing natural feature underlain by a favourable physiography type (i.e., sand plain, beach, or limestone plain) as identified within the Ontario Geological Survey (OGS) soils mapping. The unique habitats created by these uncommon and distinct physiographic features result in ecosystems that typically support a greater diversity of plant species as well as support a greater number of rare species in comparison with the region's more common clay plain type of physiography. Natural features associated with the identified favourable physiography typically include rich Carolinian forests, tallgrass prairies and savannas, alvars, and dynamic beach-associated vegetation communities.
9. **Flood Land** being existing natural features within the 1:100 year floodplain of a watercourse or large waterbody as identified by the ERCA and LTVCA. This criterion was utilized in recognition of those natural areas which are associated with the dynamic nature of flood prone areas.
10. **Public Land** being existing natural features within public ownership (including federal, provincial, municipal, and Conservation Authority and non-government organization) which are typically secured and managed for conservation purposes. These lands include primarily national parks, provincial parks and nature reserves, conservation areas, as well as municipally-owned properties which have been identified as existing natural features.
11. **Nature Conservancy of Canada (NCC) Priority Land** being existing natural features within lands identified as a priority for protection (including lands which are already protected) by the Nature Conservancy of Canada (NCC). These lands have been identified within the NCC's Essex Forests and Wetlands Natural Area Conservation Plan (NCC, 2008).

Occurrences of rare, threatened or endangered species, from the OMNR Natural Heritage Information Centre's databases, were felt to be already inherent in other already utilized evaluations of significance, such as ANSI, ESA or CNHS evaluations. Specific locations of endangered or threatened species or mapping of their significant habitat are not available in a form or to the level of detail to add value, and therefore are not specifically included in the prioritization analysis. In addition, no mapping of Significant Wildlife Habitat has been completed for the region, and is therefore also not directly incorporated into the analysis. If this information does become available in the future, this could add additional criteria for consideration within the prioritization exercise.

All criteria were weighted equally and polygons were evaluated with respect to presence or absence. The evaluation of each criteria resulted in the generation of 11 unique data layers. These layers were overlain onto each other and their accumulation summed. The final result of the overlay process was rasterized (25 m x 25 m grid) to generalize the data.

A technical list of criteria specifications for prioritizing existing natural areas is available in Table 2 of the Appendix.

2.3 Restoration Guidelines/Local Targets

The habitat guidelines outlined in the Environment Canada Framework (Environment Canada, *et al*., 1998; Environment Canada, 2004) represent the optimum conditions for diverse, healthy, functioning ecosystems. Based on input from the original BCS committee, the results of ERCA investigations, and practical considerations for long-term ecosystem health these optimal environmental guidelines were adapted to the Essex region yielding appropriate interim local targets. These local targets reflected an overall desire to ensure:

- that ecosystem integrity was protected and maintained;
- that those aspects of the ecosystem which have been lost or degraded over time were restored and enhanced to healthy, self-sustaining, diverse conditions; and
- that the resulting potential and proposed land use changes were practical, feasible, and realistic based on the local context.

2.3.1 Guiding Principles

Due to the history of land use in the Essex region, especially agricultural land clearing, there are few natural areas remaining. Consequently, further losses should be prevented to the greatest extent possible. Co-ordinated steps should be taken to rebuild a pattern of core areas, nodes and corridors of natural features back into the landscape. Restoration planning should concentrate on enhancing, linking and building outwards from existing core natural features in the landscape. This will greatly improve and diversify the biodiversity of the Essex region.

Each of the following principles are comprised of a series of goals, designed to protect and enhance the natural features and ecological functions; to restore those features/functions that have been degraded; and to guide future development in a manner that will ensure the long-term health of the environment. These principles and goals guided the development of the ERNHSS. Goal achievement will be accomplished through full implementation of the ERNHSS.

- To stop further losses of significant natural features and to minimize other losses.

Goals:

- Identify and preserve significant environmental features and ecological functions (e.g., fish and aquatic habitat, significant woodlands, significant wetlands, significant valleylands, and (indirectly) habitats of threatened and endangered species).
- Perpetuate existing significant vegetation communities.
- No loss of existing natural areas
- No loss of existing habitat and buffering along watercourses.
- Identify and preserve sensitive water quality and quantity features and hydrologic functions.

- To achieve a net increase in natural cover and enhance the existing ecological resources.

Goals:

- Restore appropriate biological communities to yield diverse composition and age structure of vegetation.
- Natural communities - to increase the area of naturally sustaining or successional vegetation.
- Uplands - to retain and improve the existing woodland communities without losses.
- Wetlands - to retain and improve the existing wetland communities without losses.
- Riparian habitat - to retain existing habitat and restore riparian vegetation and watercourse buffers.
- Tallgrass prairie/savanna/alvar habitats - to retain existing habitats and restore/enhance where appropriate.
- Reduce the impacts of existing agricultural and/or urban land uses in an effort to reduce degradation of natural ecosystems.

- To create and improve linkages between natural areas.

Goal:

- Net gain of appropriate, priority linkages and corridors.

- To prescribe for the creation/restoration of larger contiguous areas of natural communities.

Goal:

- To identify, protect, and restore (utilizing existing fragments) major natural nodes.

- To monitor guiding principles and goals, as they provide a direct measure of the state of the environment; and modify as appropriate so as to accommodate new information and/or changes that occur.

2.3.2 Forest Habitat

Guidelines for the protection and restoration of woodlands are based on objectives to promote healthy, self-sustaining treed ecosystems. Planting to expand existing areas and/or create new forested areas responds to the goal to increase the percentage of total forest cover within the Essex region, as well as increase the amount of interior forest habitat. Enhancement and creation of natural corridors to produce a greenway system involves vegetative plantings that would extend the valleylands and stream corridor systems, connect woodlands and vegetative remnants, and re-establish linkages to major natural nodes. This in turn would create new habitat and terrestrial resource areas, reduce fragmentation, facilitate the movement of native plant and animal species, and increase the percentage of natural cover. It is estimated that for plantation type tree-planting, the planting of one million trees will yield an increase in forest cover of one percent. An improvement program would include natural succession regeneration or active plantings at suitable locations. Further study to prescribe the details of a restoration concept should be completed for each site to ensure compatibility with the local environment. Examples of restoration opportunities include:

- natural regeneration or plantings on retired or marginal lands;
- restoration of vegetated corridors in high priority areas to improve corridor function and connectivity between major natural nodes;
- natural regeneration or plantings to provide buffers to significant or sensitive areas (e.g. ESAs, ANSIs, PSWs, proximity to Species at Risk populations, etc.) where needed and where feasible;
- regeneration in areas of high land conversion (i.e., fields to greenhouses);
- wooded areas expanded and consolidated to reduce edge effect by active planting and natural regeneration measures.

Forest Habitat Guidelines (from Environment Canada, 2004)

1) Percent forest cover
   - 30%
2) Size of largest forest patch
   - more than one 100 ha forest patch which is a minimum 500 m in width
3) Percent of watershed that is forest cover 100 m and 200 m from edge
   - 100 m or farther from the edge > 10%
   - 200 m or farther from the edge > 5%
4) Forest shape and proximity to other areas
   - circular or square in shape
   - in close proximity to adjacent patches (within 2 km)
5) Fragmented landscapes and the role of corridors
   - corridors designed to facilitate species movement should be a minimum of 100 m in width
   - corridors designed for specialist species should be a minimum of 500 m wide and refined to meet the needs of the target species
6) Forest quality - species composition and age structure
   - species composition - as naturally diverse as possible
   - age structure - ideal basal area (m^2/Ha) on average:
     - polewood (10 - 24 cm) - 4
     - small (26 - 38 cm) - 6
     - medium (40 - 48 cm) - 5
     - large (50+ cm) - 5
     - Total – 20 (OMNR, 1990; 1993)

While it is recognized that the forest guidelines from the Framework (Environment Canada, *et al*., 1998; Environment Canada, 2004) include a recommendation of at least 30% forest cover, it is realized that within the Essex region this target may be impractical to achieve due to the extent of deforestation that has taken place since European settlement. Therefore, no specific local target for the amount of forest cover has been set, but rather efforts are recommended to be concentrated on reforestation opportunities which improve function such as reducing edge effect, increasing interior forest habitat and providing connecting linkages. This is due to the fact that interior forest habitat supports many neotropical migrant and interior-specialist bird species, which require sheltered, quiescent conditions away from the forest edge to successfully forage

and reproduce. Forest restoration opportunities concentrate on creating larger, more consolidated and regular forest patches which are circular or square in shape thereby providing more interior habitat than smaller sized forests which are elongate or irregular in shape.

Possible restoration areas were selected, targeting openings and edge irregularities associated with existing forest patches, consolidation of adjacent forest patches to increase overall core area and the amount of interior forest habitat, and restoration to create connecting linkages between disjunct core areas. The extent of restoration opportunities were then mapped and compared to the extent of existing natural heritage features. Spatial analysis then showed the predicted effects of restoration.

2.3.3 Riparian Habitat

Riparian areas occur immediately adjacent to rivers and streams and are inhabited by diverse plant communities adapted to the hydrology, nutrient-rich soils, and microclimates found in this transition zone between land and water (Daigle and Havinga, 1996). The variation in moisture conditions, plant communities, and natural debris provides habitat, protection, and movement corridors for a wide variety of aquatic, avian, terrestrial fauna, and especially to highly sensitive herptiles (Daigle and Havinga, 1996). There is a need to have adequate vegetative cover present to protect banks and dissipate energy during high flows. Plant communities in the riparian area are an important source of coarse and large woody debris - a food source for stream invertebrates and an important structural component.

The general emphasis of stream and aquatic habitat restoration is to improve the overall physical structure of the stream channels and bordering shorelines while restoring the stream's natural morphological characteristics. In addition, within the Essex region, agriculture is the dominant land use with causing watercourse sedimentation due to the lack of appropriate buffering, which is one of the major causes of water quality degradation. It is also recognized that surface and sub-surface drainage has historically been planned to outlet directly into municipal drains and watercourses rather than into header tiles and settling ponds. This traditional method of agricultural drainage has also contributed to sedimentation in watercourses and nutrient loadings as there is no control on flow or movement through the drainage system. The riparian restoration efforts recommended in this section when combined with controlled agricultural drainage systems and related in-field beneficial management practices will provide optimum water quality improvements. Riparian restoration, focusing on the establishment of effective buffering to reduce sediment inputs into watercourses, is considered to be one of the most important restoration initiatives recommended for agricultural lands within the Essex region.

Riparian Habitat Guidelines (from Environment Canada, 2004)

1) Percent of natural vegetation along first to third order streams
   - 75% of stream length should be naturally vegetated - either woody or grassy
2) Amount of natural vegetation adjacent to streams
   - generally, 30 m naturally vegetated buffer on both sides would be optimal. For specific functions:

    - species diversity - 3 to 100 m
    - wildlife movement (corridors) - 3 to 200 m
    - sediment removal - 10 to 60 m
    - nutrient removal - 3 to 90 m
3) water temperature moderation - 15 to 30 m
4) Total suspended solids concentrations
    - below 25 mg/l for the majority of the year
5) Percent of urbanized watershed that is impervious
    - less than 15%

Stream rehabilitation techniques could be employed to achieve a stable equilibrium of erosion and deposition along degraded reaches. Measures to rehabilitate and enhance riparian habitat, aquatic habitat and general water quality could include:

- stabilization of currently eroding stream banks, preferably using natural channel design techniques and natural materials (such as root wads, live-log crib walls, willow brush bundles and live willow stakes);
- replanting of vegetative buffer zones using native plant species to stabilize stream banks, reduce sedimentation, filter nutrients, improve groundwater infiltration, provide shade, increase vegetative diversity, as well as function as effective corridors and linkages;
- inclusion of buffer zones in engineer's reports for municipal drains; and,
- restriction of livestock access to watercourses.

As part of the study, a 30 m riparian buffer was placed on either side of existing watercourses to delineate areas for potential riparian habitat restoration. This width is a recommended generalized guideline which should function to provide wildlife habitat and corridors for wildlife movement, as well as assist in the removal of sediments and nutrients from surface stormwater runoff (Environment Canada, *et al*., 1998; Environment Canada, 2004). ArcGIS software was used to determine the percent of a study area that is proposed to be restored to riparian habitat.

2.3.4 Wetland Habitat

Guidelines for the protection and restoration of wetlands are based on objectives to return the system to a close approximation of the predisturbance ecosystem (i.e., it would be persistent and self-sustaining although dynamic in its composition, structure and functioning). Goals include the restoration of functional values such as providing persistent vegetative cover, filtration, storage of flood waters, self-maintaining fish and wildlife populations, and de-nitrification.

Wetland Habitat Guidelines (from Environment Canada, 2004)

1) Percent wetlands in watershed or sub-watershed
    - 10% in each major watershed; 6% in each sub-watershed; or restore to original percentage
2) Amount of natural vegetation adjacent to wetland
    - 240 m of adjacent natural habitat (can be herbaceous or woody vegetation)
3) Wetland type
    - marshes and swamps

4) Wetland location
   - original headwater swamps
   - on-stream or floodplain marshes and swamps on second and third order watercourses
   - lacustrine wetlands
   - any other location
5) Wetland size
   - swamps - as large as possible
   - marshes - range of sizes
6) Wetland shape
   - swamps - regularly shaped with minimum edge and maximum interior habitat
   - marshes - irregularly shaped with maximum interspersion

Spatial analysis of the existing natural features was conducted to determine the percent wetland across the study area, in particular with respect to the habitat guidelines for wetland quantity and quality.

Potential areas for wetland rehabilitation and restoration were selected. Areas targeted for rehabilitation and restoration included linkages between established wetlands, as well as new wetlands to provide diversity in habitat (e.g., mudflats, river delta marshes and headwater swamps). Some key criteria utilized to determine the most feasible locations for wetland restoration include location within the floodplain, appropriate physiography such as the presence of marsh or muck soils, potential groundwater recharge areas, and lands situated in close proximity to other wetlands or the shoreline. Marshes and swamps are the two wetland types that are most practical for widespread restoration. Marshes are easier to create, rehabilitate and manage and a newly created marsh can become at least partially functional within only a few years. In contrast, newly created swamps may take much longer before becoming fully functional due to the length of time required for the woody species (i.e., trees and shrubs) to mature.

A buffer of 240 m wide was also placed around existing wetlands to identify potential areas for habitat restoration. This critical function zone provides cover for wildlife species requiring both wetland and upland habitat, reduces the rate of nest predation to moderate levels, and provides very good removal of sediments and nutrients (Environment Canada, *et al*., 1998; Environment Canada, 2004). Site specific restoration plans for the buffer area should be developed in order to take into consideration the critical attributes of the area of interest, including the desired existing or future wildlife populations affected, as well as the adjacent land use stressors.

2.3.5 Fish Habitat

Guidelines for the protection and restoration of fish and fish habitat are based on objectives to maintain/rehabilitate fish species composition and diversity to promote healthy, self-sustaining populations. To protect, maintain and enhance fish and aquatic habitats, a minimum buffer should be established for the main watercourses and their tributaries (see Section 2.3.3 Riparian Habitat). These buffer areas targeted for restoration are to be used as a guide in the development of site specific protection and restoration initiatives (i.e., fish habitat management plans). The actual buffer dimensions should be based on criteria established through a detailed, site-specific

assessment of the existing shoreline and stream bank characteristics, the specific aquatic communities and populations which would benefit, as well as input from relevant agencies such as the OMNR and Fisheries and Oceans Canada (DFO). It should also integrate such aspects as groundwater seepage, geomorphology, streamside vegetation, shoreline and benthic characteristics, barriers, and opportunities for stormwater management that best fit the specific site characteristics for habitat protection/restoration. In the interim, riparian habitat guidelines will be generally employed until specific recommendations resulting from the completion of site-specific fish habitat management plans become available.

2.3.6 Tallgrass Prairie, Savanna, and Alvar

Tallgrass prairies, savannas, and alvars are some of the most endangered ecological communities in the Essex region. Tallgrass communities once covered a significant part of southern Ontario's landscape. Owing to degradation and destruction through urban development, agriculture, pollution and mismanagement, less than 3 percent of the original southern Ontario extent remains. Most remnants exist in small, isolated patches; with the municipalities of the City of Windsor and the Town of LaSalle containing some of the most extensive intact remnants in Ontario. As these highly diverse communities themselves are rare and threatened so too are many of the wildlife species which depend on these communities for their survival (Rodger, 1998).

To make significant strides toward recovering tallgrass communities region-wide, a larger, more coordinated and strategic approach is required. The *Tallgrass Communities of Southern Ontario: A Recovery Plan* (Rodger, 1998) produced by the World Wildlife Fund and the Ontario Ministry of Natural Resources deals with recovering tallgrass communities as a whole, across their range in Ontario. The overall goal of this Recovery Plan is to recover, reconstruct and conserve a representative network of tallgrass communities, and to recover and protect the full complement of plant and animal life that makes up these diverse ecological communities. To do this on a region-wide scale in a strategic and comprehensive manner, the following goals (adapted from Rodger, 1998) provide key direction:

- Improve communication, coordination and information-sharing among those involved in tallgrass community conservation, such as Tallgrass Ontario.
- Compile information on the extent of all remaining tallgrass community remnants, as well as areas of high restoration potential.
- Encourage restoration and habitat creation initiatives where appropriate to enlarge existing remnants, and create linkages as well as new habitat.
- Encourage rehabilitation and enhancement of tallgrass remnants through sound management.
- Raise public awareness and appreciation of tallgrass communities.
- Encourage basic and applied research relevant to tallgrass community conservation.

Detailed information is required with respect to the extent of existing remnants, as well as areas of high restoration potential based on landscape context and physiography. This information will generally focus within the sand plain regions found within the City of Windsor and the Town of LaSalle. As this information becomes available, through partnerships with key organizations such as Tallgrass Ontario, a Tallgrass Communities Protection and Restoration Plan should be

developed to guide specific initiatives within the target areas. In addition, site specific biological inventories should be completed across all potential areas in the region to determine the presence of these rare habitat types. In many cases, these rare vegetation communities are also identified as being provincially rare and considered as Significant Wildlife Habitat.

2.3.7 Species at Risk

Species at risk are usually dependent on particular habitat conditions which provide species-specific features for certain life processes (e.g., reproduction, feeding grounds, etc.). Identification of such habitats, and any recommendations for their enhancement or management, are usually prescribed in species-specific Recovery Plans or Recovery Strategies. In addition, Habitat Regulations and Habitat Descriptions may also be useful references to inform natural heritage protection. When information from these Recovery Plans or Recovery Strategies becomes available, identified Regulated or General Habitat should be overlaid and incorporated into habitat restoration plans, and protected in land use plans where feasible. In addition, management plans for sustaining rare and unusual plant communities should be prepared on a watershed-wide basis.

2.3.8 Prioritization Criteria

Restoration opportunities were then prioritized. This prioritization exercise assessed the relative significance of the restoration opportunities through the summation of overlapping benefits which consist of application of the restoration guidelines as well as consideration of other preferences. The following set of criteria was utilized in the prioritization exercise. These criteria were felt to capture the full range of appropriate considerations for indicating relative priority of restoration opportunities.

1. **Identified Restoration Opportunity** – There are 3 types of restoration opportunities identified, and each is mutually exclusive of the other:
    a. **Wetland Buffer** - Areas identified as restoration opportunities within 240 m of a wetland feature.
    b. **Riparian Buffer** - Areas identified as restoration opportunities within 30 m of a 1st to 3rd order stream.
    c. **Other** - Areas identified as restoration opportunities through a qualitative interpretation of the existing landscape using available aerial photography. These include opportunities to increase interior forest habitat, consolidate forest patch shape/reduce edge, wetland restoration areas, as well as provide linkage and connectivity between core natural features.
2. **Favourable Physiography** - Areas identified as restoration opportunities that are underlain by a favourable physiography type (i.e., sand plain, beach, or limestone plain) as identified within the Ontario Geological Survey (OGS) physiography mapping. The unique habitats created by these uncommon and distinct physiographic features result in ecosystems that typically support a greater diversity of plant species as well as support a greater number of rare species in comparison with the region's more common clay plain

type of physiography. Natural features associated with the identified favourable physiography typically include rich Carolinian forests, tallgrass prairies and savannas, alvars, and dynamic beach-associated vegetation communities.

3. **Flood Land** - Areas identified as restoration opportunities within the floodplain of a watercourse or large waterbody as identified by the ERCA and LTVCA.
4. **Public Land** - Areas identified as restoration opportunities that are within public ownership (including federal, provincial, municipal, conservation authority and non-government organization properties). These lands can include national parks, provincial parks and nature reserves, conservation areas, as well as municipally-owned properties.
5. **Nature Conservancy of Canada (NCC) Priority Land**- Areas identified as restoration opportunities that are within lands identified as a priority for protection/restoration (including lands which are already protected) by the Nature Conservancy of Canada (NCC). These lands have been identified within the NCC's Essex Forests and Wetlands Natural Area Conservation Plan (NCC, 2008).

All criteria were weighted equally and polygons were evaluated with respect to presence or absence. The evaluation of these 5 criteria resulted in the generation of 5 unique data layers. These layers were overlain onto each other and their accumulation summed. The final result of the overlay process was rasterized (25 m x 25 m grid) to generalize the data.

A technical list of criteria specifications for prioritizing potential restoration opportunities is available in Table 3 of the Appendix.