BEACON ENVIRONMENTAL

GUIDING SOLUTIONS IN THE NATURAL ENVIRONMENT

Environmental Impact Study (EIS) Performance Evaluation for the City of London

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Executive Summary

Beacon Environmental was retained by the City of London in August 2012 to develop a program for and to undertake a performance evaluation of nine sites identified by the City where natural heritage features deemed to be significant have been identified for protection through the planning process.

This study involved undertaking various types of evaluations through a combination of background document review, desktop mapping analyses, and field assessments to address the various evaluation questions being posed. This study also involved consultations with City staff throughout the process and benefitted from input provided by Dave Hayman of BioLogic (a consulting firm that has been undertaking EIS as well as biological monitoring in the City for many years) and the City's Environmental and Ecological Planning and Advisory Committee (EEPAC).

Through detailed examination of nine case studies, we found that the policies and practices related to EIS implementation have been effective at ensuring the overall area of natural heritage features identified for protection through the planning process in the City of London. They have also been effective at ensuring that proponents follow established protocols and policies in the execution of their EIS. However, there is some evidence that there are encroachments along the edges of natural areas that may be negatively impacting the ecological functions of these areas. Recommendations to help manage encroachments are provided below.

In addition, there is also evidence suggesting some shifts in the types of ecological communities, in particular the wetland features, possibly as a result of the changes in land uses in the immediate area and/or the broader catchment area. Some shifts are to be expected, and are unavoidable in a context of urbanization, and some shifts may simply be a result of natural successional processes. Assessing if, and to what extent, these shifts are in fact having an overall negative impact on the City's natural areas would require a broader and more comprehensive study at a larger scale (e.g., watershed) rather than a site-specific scale.

At the site-specific scale, the findings of this study indicate that the City's former and ongoing practice of requiring fencing between the backs of lots and public natural areas has been quite successful in minimizing encroachments, and that putting public trails between the backs of lots and public natural areas may also contribute to limiting some types of encroachments (e.g., mowing). The establishment of buffers also appears to have been effective in reducing encroachment impacts within the feature itself by effectively "absorbing" these impacts within the buffer. As discussed in the report, for encroachment mitigation, buffers of up to 10 m between the feature edge and the rear lot line seem to be adequate. However, some other gaps and opportunities for improvement have been identified.

Specific recommendations related to the gaps and opportunities identified through this study are provided below.

Based on the findings of this study, it is recommended that the City of London implement the following 12 recommendations related to its policies and by-laws, Environmental Management Guidelines, EIS process and ecological monitoring.

POLICIES, BY-LAWS AND ENVIRONMENTAL MANAGEMENT GUIDELINES

1. **Update the adjacent lands triggers for environmental studies as per the current Natural Heritage Reference Manual (OMNR 2010) in the 2007 Environmental Management Guidelines (EMG) and/or the City's Official Plan.**

2. **Add a requirement in Section 1.0 of the 2007 EMG for a policy compliance section or table that:**
    a. **identifies the applicable policies and legislation from the Provincial Policy Statement, City's Official Plan, UTRCA regulations, Species-at-Risk legislation, and any others**
    b. **specifies which policies and/or legislative clauses are applicable to the given site / study area (e.g., presence or absence of significant wetlands)**
    c. **describes, in brief, how the applicable policies have been addressed through the EIS (e.g., through feature protection and/or mitigation to anticipated impacts);**

3. **Develop more specific guidance in Section 1.0 of the 2007 EMG regarding the level of natural heritage data collection required for Community Plans, Area Plans and Secondary Plans (e.g., vegetation communities mapped and identified to Community Series level, verification of the type and extent of fish habitat in watercourses, etc.).**

4. **Make minor updates and expansions in Section 2.0 of the 2007 EMG with respect to:**

    a. **clarifying the inventory protocol**
    b. **adding guidance with respect to the need to address Species at Risk, and**
    c. **updating references to applicable guidance documents as appropriate, and adding text that cites the most current document but indicates that any superceding documents will apply.**

5. **Specifically mention the possibility of including buffers as part of the natural heritage area acquisition process in Section 15.3.4 of the Official Plan.**

6. **Consider developing and implementing an Encroachment By-law (as in the City of Mississauga) to regulate unauthorized land uses, such as encroachments, into public natural areas, and also be used as a tool for outreach and education.**

ENVIRONMENTAL IMPACT STUDY PROCESS AND IMPLEMENTATION

7. **Through the implementation of natural heritage policies:**

    a. **Continue to require fencing (without gates) as well as public trails between back lots and protected natural areas to limit encroachments, and**
    b. **Keep the boundaries of ecological buffers outside the rear lot line.**

8. **Improve and expand engagement and stewardship related to foster broad support for natural heritage protection and management as resources permit. Specific examples related to reducing encroachments into protected natural areas include:**

    a. **Distribution, and redistribution of clear, colourful pamphlets outlining "how to care for the natural area in your neighborhood" every year**

    b. **Advertisements in local community guides and/or newspapers to raise awareness about local natural area stewardship (e.g., "why your yard waste isn't good for your neighborhood woodland or ravine")**

    c. **Installation of signs at the trail heads of community natural areas clearly identifying uses that are not permitted**

    d. **Holding stewardship events in City-owned natural areas to undertake activities such as garbage removal, removal of invasive species that can be pulled or cut by hand, enhancement plantings with site-appropriate native plants, boardwalk construction, etc.**

    e. **Considering providing designated yard waste drop off locations in each neighbourhood and/or increasing the frequency of yard waste pick-up, and**

    f. **Considering allowing residents who move in prior to 75% completion of a development to landscape their lots (if they desire) as long as they select materials from an approved list of site-appropriate native species.**

9. **Ensure EIS recommendations are carried forward to the Subdivision Agreement, as appropriate, by (a) requiring EIS to include a concise summary of all recommendations in conclusion, and (b) ensuring that a City Planner with natural heritage / ecological expertise is involved in the development and finalization of the Subdivision Agreement.**

10. **Allocate staffing resources to ensure that the items in the Subdivision Agreement, and the supporting detailed designs, are actually being implemented as approved. This type of post-construction monitoring is fairly straight forward and would include items like installation and maintenance of proper silt fencing, as well as tree or vegetation protection.**

CITY-WIDE ECOLOGICAL MONITORING

11. **Seek opportunities to work with the Upper Thames River Conservation Authority, and others, to specifically evaluate the ability of public trails between back lots and protected natural areas to limit encroachments.**

12. **Consider undertaking a carefully designed and well-replicated study (potentially with funding from a development–sponsored long-term monitoring fund as well as with support from other non-governmental organizations, and in collaboration with the**

UTRCA) over an extended period (e.g., ideally more than a decade) on a City-wide scale that measures the current status of key indicators of natural heritage in the City, and compares it with the status of that those same indicators in, say, a decade, and can be replicated in the future.

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Appendices

1. Introduction

1.1 Purpose and Scope of this Study

Beacon Environmental was retained by the City of London in August 2012 to develop a program for and to undertake a performance evaluation of nine sites identified by the City where natural heritage features deemed to be significant have been identified for protection through the planning process.

The City of London, like all municipalities, is required to be in compliance with the Provincial Policy Statement (PPS) (2014) which specifies that development adjacent to, or within, significant natural heritage features is not to be permitted "*unless it has been demonstrated that there will be no negative impacts on the natural features or their ecological functions*". Typically, this is demonstrated through an Environmental Impact Study (EIS) that is supposed to: (a) identify what is "significant"[1] on site (with consideration for applicable policies and guidelines), and then (b) recommend measures to ensure that these features, and the related functions that make them significant from a natural heritage perspective, are "*maintained, restored or, where possible, improved*" (2014 PPS). These recommendations can include protection, mitigation (including identification of buffers) and/or compensation (e.g., habitat creation), but the ultimate objective is generally to achieve, as a minimum, "no net loss" of significant natural heritage features and functions.

Many EIS are approved in London (and many other municipalities) every year, however whether or not "no net loss" has actually been achieved on the ground after the development has been approved and built is rarely assessed, particularly for terrestrial[2] natural heritage features. The primary purpose of this study is to assess the extent to which, for nine case studies, "no net loss" has actually been achieved through the City's planning process.

It was recognized at the outset of this study that there would be limitations on what could be assessed at the site-specific scale with the available information[3] and within the timing window for this study (i.e., August 2012 – August 2013). Some discussion of these limitations is provided in **Section 1.2**. There are, however, a number of readily measurable indicators of impacts related to developments adjacent to protected natural areas that may be directly attributed to the development, and readily assessed at the site-specific level within a single year (as required as part of this study). It is these types of indicators that were examined for each case study using the available data combined with some desktop analyses, and supplemented with a season of field work to evaluate the overall "performance" of several aspects of the City's EIS process.

A summary of the specific evaluation questions that are being addressed through this study are presented in **Section 1.3**, followed by the Methodology (**Section 2**), Findings (**Section 3**), Discussion (**Section 4**) and Summary of Recommendations (**Section 5**).

[1] The term "significant" is a loaded one when it comes to natural heritage, and what is significant depends on a variety of factors including the scale at which it is assessed, the biophysical context of the jurisdiction in which it is assessed, and the applicable policies. In the context of the City of London, the key documents used to determine natural heritage significance are the Official Plan, which must be consistent with the current Provincial Policy Statement, and the supporting Environmental Management Guidelines which were first developed in 1997 and last revised in 2007.

[2] "Terrestrial" in this study includes wetlands.

[3] For the nine case studies identified there is data from different EIS collected 10 to 15 years ago, and in some cases some scoped follow-up assessments or monitoring, which can be compared with data collected in 2013.

1.2 Study Limitations

While the value of information that can be gained through monitoring is becoming more widely recognized by planners and land use managers, making direct causal links between changes in natural heritage functions and changes in adjacent land uses (e.g., from agricultural and /or natural to residential, commercial or industrial uses), particularly at the site-specific level, can be very difficult. In particular, monitoring the ecological integrity of natural heritage areas and systems in urbanizing environments represents a significant technical challenge because of, among other things, the numbers of factors that can influence remnant ecosystems that need to be considered, the different scales at which different factors operate, and the difficulty in finding suitable control sites or establishing replicates.

In general, undertaking sound statistical analyses on impact assessment studies in the "real world", particularly in relation to ecological questions, is very challenging. The "BACI" approach (before-and-after-control-impact), which requires parallel data collection on the impact site as well as a corresponding un-impacted control site, has been put forward by some researchers as a possible approach for generating useful statistics related to impact assessment (described in Smith 2002), but even this method has a number of limitations and is often not useful for identifying causal relationships, particularly in complex and dynamic ecosystems over time (Smith *et al*.,1993, Stewart-Oaten *et al*., 1986).

Many important environmental factors that influence ecosystems operate at a regional scale (e.g., climate change, overall levels and distribution of natural heritage features in the landscape). Isolating regional scale effects from those related to urbanization at a local scale, and attributing those effects to urbanization is generally not possible without undertaking broader regional scale studies. Take, for example, a proposed residential subdivision in an old field adjacent to a significant woodland. As part of the Environmental Impact Study (EIS) a breeding bird study was completed that provided a snapshot of the breeding bird diversity in the portion of the woodland adjacent to the proposed development. If a comparable one-season breeding bird survey was done following construction of the development, and the species composition has changed, it is impossible to link this change to the presence of the development with any confidence. Why? Because changes in bird species composition at the site-specific level may be attributable to a range of other factors that have little or nothing to do with the development *per se* (e.g., construction of a new road on the other side of the woodland, cumulative loss in overall forest cover at the City-wide or watershed scale, changes in range shifts related to climate change). Different individuals with different levels of experience conducting surveys can also influence the numbers of species identified, as can changes in weather from one season to the next.

Changes in plant populations over time can be more readily assessed at the site-specific scale, but such assessments should involve fixed plots or transects that are stratified along established disturbance gradients. In order to be scientifically robust enough to draw reasonably defensible conclusions, the study design needs to include controls as well as adequate replication, and should also involve several years of data collection, preferably by the same individual(s). A study completed to this level of scientific rigour is typically not within the means of a municipality, nor within their area of expertise. Nor is it feasible to undertake this type of study at the site-specific scale; it requires inclusion of replication across multiple sites as well as controls located in natural areas where development has not occurred in the adjacent lands.

Making causal links between changes in natural heritage feature functions (e.g., such as species diversity levels and/or abundance) and changes in land use is, despite these challenges, possible, but requires very carefully designed studies that can be carried out over an extended period of time in a systematic manner and that have considered the need for adequate replication, consistent pre- and post construction data collection methodologies, and appropriate control sites. Such an approach is not possible within the scope of this study, and therefore wildlife and botanical surveys were not undertaken as part of the core field work. There were, however, a number of site-specific features and/or species of interest to the City that were screened for (i.e., presence / absence, and condition) as part of the field work.

1.3 Performance Evaluation Questions

The starting point for any monitoring study is knowing what questions are being asked. The questions should guide the type and extent of data collection, as well as the assessment and/or analysis of that data. For this study, the City identified six types of monitoring, and related questions, to be evaluated, as presented in **Table 1**.

Table 1. Summary of evaluation types and related questions to be assessed through this study.

Type of Performance Evaluation	Study Specific Question
A. Baseline	A. (a) Did the Environmental Impact Studies (EIS) follow the data collection standards for terrestrial natural heritage features and functions in place at the time? (b) Based on the data collected, what were the key ecological features and functions identified in the EIS for protection from negative impacts?
B. Policy Compliance	B. Did the Environmental Impact Studies (EIS) consider all the relevant policies for terrestrial natural heritage features and functions in place at the time?
C. Implementation	C. Were the recommendations identified in the Environmental Impact Studies (EIS) carried forward to the (a) Draft Plans, (b) Subdivision Agreements, and (c) the actual sites?
D. Effectiveness	D. Were the mitigation measures effective at (a) achieving no net loss of the area identified for protection, (b) preventing readily apparent impacts to the protected area related to the change in adjacent land use, and (c) protecting the key features and ecological functions* for which the area was identified as significant and protected?
E. Validation	E. Were there processes in place to (a) verify implementation at the site level, and (b) verify effectiveness of terrestrial natural heritage protection / mitigation / compensation measures?
F. Adaptive Management	F. If validation monitoring occurred, were any actions taken in response to findings, if required?

*Note: It will only be possible to answer this question in part, if at all, given the scope of this study.

This study involved a combination of background document review, desktop mapping analyses, and field assessments to address the various evaluation questions being posed. Baseline evaluation, policy compliance evaluation, validation evaluation and adaptive management were all assessed using a combination of background document review and supplementary discussions with City staff. Input was also provided by Dave Hayman of BioLogic, a consulting firm that has been undertaking EIS as well as biological monitoring in the City for many years, and the City's Environmental and Ecological Planning and Advisory Committee (EEPAC).

Implementation assessments and effectiveness assessments were conducted with a combination of desktop mapping analyses and site assessments. The details of these approaches are provided in **Section 2 (Methodology)**, but the focus of the field component was on the assessment of indicators of impacts related to developments adjacent to protected natural areas that could be directly attributed to the development, and readily assessed at the site-specific level within a single year. The field component also assessed (to the extent possible within the scope of this study) the extent to which key features and functions identified for protection through the development process remain on the landscape.

The answers to the questions listed above for each of the nine case studies, as provided in **Section 3 (Findings)**, provide some insights as to how well the City's EIS process has been performing over the past 10 to 15 years. These findings, combined with a review of the current policies and guidelines applicable to the EIS , as provided in **Section 4 (Discussion)**, are the basis for suggestions about what might be done to improve this process, as provided in **Section 5 (Summary of Recommendations)**.

2. Methodology

The methodology described in this section has been applied to nine case studies selected by the City of London:

1. Stoney Creek (39T-99506) Auburn
2. Hunt Club West (39T-02512) Hampton
3. Applegate Lambeth (39T-97598) Kape
4. Warbler Woods West (39T-02506) Sifton
5. Sunningdale Corlon (39T-00512) Corlon
6. Powell Drain (39T-99522) Drewlo
7. Talbot Village (39T-00514) Southside
8. Black Maple (39T-90019, 39T-92016) Matthews
9. Highland Ridge (39T-04501) Norquay

The nine case study sites were selected by the City because they met the following criteria:

- The site contained one or more terrestrial natural heritage feature(s) (including wetlands) identified as being significant and worthy of protection by the City that triggered an Environmental Impact Study (EIS), or some type of comparable study, to assess the anticipated impacts of the proposed development on the significant feature(s) and recommend appropriate protection, mitigation and/or compensation measures.
- The EIS and approval process for the site (including appeals to the Ontario Municipal Board in some cases) has been completed, and the approved development has been built for at least several years.
- The sites are located in various locations throughout the City.
- The studies are considered representative examples of how the EIS process has been implemented over the past 10 to 15 years.

Performance evaluation for this study has been undertaken by addressing specific questions related to six aspects (as per **Table 1**) related to the Environmental Impact Study (EIS) process for each of these cases, with a focus on post-development activities and impacts. Each of these is described in the subsections below under the six headings, as follows:

- Baseline Evaluation
- Policy Compliance Evaluation
- Implementation Evaluation
- Effectiveness Evaluation
- Validation Evaluation
- Adaptive Evaluation

In all cases, performance measures were identified that could be readily measured and assessed at the site-specific level, and linked to the proposed / approved development.

2.1 Baseline Evaluation

QUESTIONS: (a) Did the Environmental Impact Studies (EIS) follow the data collection standards for terrestrial natural heritage features and functions in place at the time? (b) Based on the data collected, what were the key ecological features and functions identified in the EIS for protection from negative impacts?

Baseline evaluation for natural heritage features and functions is typically associated with up front pre-development data collection to identify key features and functions. For this study, which evaluated the EIS process in retrospect, the scope of the baseline evaluation was limited to: (a) verifying the extent to which the data collection met the standards in place at the time[4], and (b) screening the available documents for the key ecological features and functions identified for protection through the EIS process.

2.2 Policy Compliance Evaluation

QUESTION: Did the Environmental Impact Studies (EIS) consider all the relevant policies for terrestrial natural heritage features and functions in place at the time?

Policy compliance evaluation for natural heritage features and functions is typically related to ensuring that all protection, mitigation and/or compensation measures to be implemented prior to, during and immediately following construction of the development have been implemented as per the applicable policies. For this study, which evaluated the EIS process in retrospect, there was no opportunity to systematically evaluate the extent to which all stipulated protection, mitigation and/or compensation measures were actually implemented prior to, during and immediately following construction of the development. In lieu, policy compliance evaluation for this study consisted of screening the available EIS documents to verify if the applicable natural heritage guidelines and policies were considered.

For all case studies, except for the Black Maple site, the 1997 Provincial Policy Statement would have been in effect. This policy stated that municipal Official Plans had to “have regard for” the applicable natural heritage policies of the Province. Additional applicable City policies and guidelines are presented in the findings (**Section 3**), and reflect those in effect at the time of application approval for the given site. As with the baseline evaluation, this assessment was not a peer review exercise or critique of the EIS reports *per se*, as all of these studies were subject to review by various City staff and ultimately approved. The focus of the assessments was on the extent to which the City required consistency with the applicable policies in these various site-specific case studies.

2.3 Implementation Evaluation

QUESTION: Were the recommendations identified in the Environmental Impact Studies (EIS) carried forward to the (a) Draft Plans, (b) Subdivision Agreements, and (c) the actual sites?

[4] The data collection standards found in Section 2 of the City’s Environmental Management Guidelines, which have been in effect since 1997 and used in draft prior to that, will be the standard used for this screening process.

For the purposes of this study, implementation evaluation was assessed based on an analysis of the extent to which recommendations made in the EIS were implemented. This was assessed, to the extent possible, through a combination of desktop review (of the EIS and Environmental Management Plans, approved Draft Plans and Subdivision Agreements) and field assessment. A specific component of this analysis was to try to determine the extent to which any recommended buffers to protected features were implemented on the ground, as well as any related mitigation measures such as fencing (with or without gates).

2.4 Effectiveness Evaluation

QUESTION: Were the mitigation measures (buffers, setbacks, barriers) effective at (a) achieving no net loss of the area identified for protection and (b) preventing readily apparent impacts to the protected area related to the change in adjacent land use?

As discussed in **Section 1.2** of this report, it was not possible through this study to fully assess the effectiveness of the recommended measures for natural heritage protection, mitigation and/or compensation, particularly in terms of the status of local plant or wildlife populations. Rather, the study focussed on indicators that could be:

- readily linked to impacts associated with changes in land uses adjacent to the protected natural heritage feature (and its buffers, where applicable) associated with the approved development were identified for use;
- reasonably assessed at the site-specific level within a single year (as required as part of this study); and
- used to compare available information about baseline conditions with current conditions to be assessed in spring 2013.

Notably, in all cases, field assessments were restricted to the City-owned natural areas (and their buffers where applicable). Since all of the protected natural areas in the identified case studies are City-owned, and accessible via City-owned lands, there was no need to obtain landowner permissions. Nonetheless, field staff carried identification and a letter of permission from the City at all times.

The six specific indicators selected are presented in **Table 2**, and incorporate many of the potential impacts identified in the checklist of development impacts found in the City's EIS Guidelines (City of London 2007).

For indicator #3, "maintenance of ecological connectivity", there was no regional-scale assessment of ecological connectivity because of the site-specific nature of the project. Rather, the approach was to try and distinguish between loss of terrestrial ecological connectivity at the local scale that was approved through the planning process, and that which may have occurred despite approved plans to maintain it, with a focus on development related to the specific case study, and not other projects or developments in adjacent lands.

Table 2. Effectiveness evaluation indicators to be used for the nine case studies.

Indicator	Measure	Methods	Locations	Notes
1. Extent of Natural Area	Comparison of hectares of total natural area identified for protection / mitigation / compensation in the original EIS and hectares of protected natural area in 2013.	Comparison of the original EIS recommendations and mapping (to be digitized using GIS) of areas to be protected (including any identified mitigation and/or compensation areas) with the current extent of natural area.	The entirety of the subject lands for every EIS.	
2. Diversity of Habitats	Comparison of basic types of natural area identified for protection / mitigation / compensation in the original EIS and basic types of protected natural area in 2013.	Desktop comparison of EIS-era air photos and the original EIS vegetation classification and mapping with current conditions in terms of Community Level Ecological Land Classification. The City has provided basic ELC classification that has been done on a City-wide level that should assist this analysis.	The entirety of the subject lands for every EIS.	This analysis may be supplemented with some field verification of ELC communities.
3. Maintenance of Ecological Connectivity	Loss of identified ecological linkages (with roads or other types of infrastructure) at the site-specific scale.	Comparison of the original EIS recommendations, mapping and extent and configuration of natural areas (to be digitized using GIS) with the current extent and configuration of natural area. Connectivity to natural areas in the immediately adjacent lands will be considered.	The entirety of the subject lands for every EIS as well as immediately adjacent lands (i.e., within 120 m).	This indicator is unique in that is assesses a change irrespective of EIS recommendations.
4. Edge Effects / Encroach-ments	Frequency and extent (i.e., percent cover) of documented encroachments into the protected natural area related to the adjacent land uses.	Field assessments along the edges of each of the protected natural areas where it abuts development to determine the presence / absence and extent of encroachments and disturbances using a standardized data collection form (see **Appendix B**). Edges to be broken down into ~100 m segments. Individual data sheets to be completed (a) in each edge segment and (b) for different adjacent land uses (e.g., houses vs. parks).	Up to 30 m from the external feature boundary, including buffers where applicable.	Data collection will be supplemented with photo-documentation. The recreational impacts will focus on unauthorized activities, and will acknowledge but not assess impacts of trails that have been installed as part of an approved process.
5. Invasive Species	Relative abundance of invasive species.	To be assessed through the Encroachments Checklist (see **Appendix B**) and include notation of species.		
6. Recreational Impacts	Frequency of observed recreational impacts (e.g., unauthorized trails, BMX jumps).	To be assessed through the Encroachments Checklist (see **Appendix B**) and to distinguish between impacts extending from the feature edge and from within the feature (if possible).		

The encroachment assessments (indicator #4) were to be based on data collected using an established "encroachment checklist" (as per **Appendix B**). The checklist was developed specifically for this study however many of the categories were adapted from the Upper Thames River Conservation Authority's (UTRCA's) checklist used for documenting encroachments adjacent to individual properties. For this study, the objective was to collect data on the types and extent of edge impacts to the natural areas as a whole, therefore assessments were conducted along standardized segments (between 80 m and 120 m long, and 30 m wide) along the boundaries of natural areas abutting other land uses (primarily residential lots) in all case studies.

Notably, it was acknowledged at the outset of this study that it would be very difficult to distinguish between post-development and some pre-development impacts in the protected natural areas (e.g., presence of invasive species, informal trail creation), as discussed in **Section 4**.

The composition of plant and wildlife (and particularly breeding bird and amphibian) communities in a given landscape is an important indicator that can be used to track ecosystem changes over time. However, as discussed in **Section 1.2**, changes in community composition are very difficult to attribute to land use changes on a site-specific scale, particularly as part of a short-term study and when there are so many other confounding factors in the landscape. Therefore, plant and wildlife surveys designed to document species breeding and/or residing on site were not undertaken as part of this study. Should the City be interested in developing a better understanding of shifts in species composition in response to land use changes in the City, recommendations for appropriate monitoring are provided in **Sections 5 and 6**.

Despite the fact that we were not be able to definitively link any changes in species or community composition to the extent to which EIS recommendations from the immediately adjacent development were, or were not, implemented, we did undertake several site-specific assessments to verify the general vegetative quality and condition of specific habitats of interest to the City, as well as check for the presence of some species of interest, as part of our work in selected case studies. These site-specific assessments included:

1. Stoney Creek: Assessment of the general quality and condition of the riparian vegetation associated with the created wetland and the realigned west tributary, and of impacts along the recreational trail (notably most trail structures were installed prior to build-out);
2. Hunt Club West: Apparent impacts of the retaining wall on residual vegetation and verification for the presence of yellow spotted salamanders (reported and photographed by a resident in their swimming pool cover in early spring following development);
3. Applegate/Lambeth: Verification for a rare plant (Green Dragon) observed by B. Bergsma on a site visit in the floodplain;
4. Warbler Woods West: Apparent impacts of the paved trail adjacent to the ESA;
5. Sunningdale Corlon: Apparent impacts of the storm water management system on the ravine and floodplain vegetation;
6. Powell Drain / Drewlo: Verification of the presence / absence of plant species documented in the wetland in 2002 following construction, but before the storm water management pond breach in 2007;
7. Talbot Village: Apparent impacts of the storm water management facility on the protected Silver Maple Swamp;

8. Black Maple: Assessment of the general vegetative quality and condition of the Black Maple stand; and
9. Highland Ridge: Assessment of the general vegetative quality and condition of the Buttonbush swamp.

2.5 Validation Evaluation

QUESTION: Were there processes in place to (a) verify implementation at the site level, and (b) verify effectiveness of terrestrial natural heritage protection / mitigation / compensation measures?

This component of the assessment will also largely be a desktop exercise and will include consideration of:

- Site supervision or monitoring requirements in the EIS and/or Subdivision Agreement(s);
- Presence / absence of reporting related to any monitoring requirements; and
- Comparison of the scope and scale of the various monitoring done related to terrestrial natural heritage features and functions.

It will also involve further discussions with the City to assess the extent to which terrestrial monitoring has been required and enforced related to EIS recommendations. Suggestions for improving this process, where appropriate, will be made in **Section 4**.

2.6 Adaptive Management

QUESTION: If validation monitoring occurred, were any actions taken in response to findings, if required?

This assessment was based a critical review of the available documents supplemented with discussions with City planning staff to determine if any adaptive management was undertaken for any of the nine case study sites where issues were identified through monitoring undertaken during and/or following construction. Correct, adaptive management requires a validation process. An additional consideration for this assessment was revisions that have been made to City policies and guidelines over the years in response to actual and/or perceived issues, primarily through the development of and revisions to components of the City's Environmental Management Guidelines (2007). An assessment of how the City has already responded to issues is provided in **Section 3**, and discussion of further responses that may be appropriate is provided in **Section 4**.

3. Findings

A total of nine site-specific planning applications (as listed in **Table 3**) adjacent to natural areas in the City of London were assessed for this study based on examination of a combination of background documents (technical reports and relevant policy documents and guidelines), air photos (both older and more current), and field assessments (as described in **Section 2**). The findings of the specific assessments are described in the following sections, and are largely presented in tables that summarize results for each of the nine case studies.

Table 3. Overview of selected case studies.

Case Study Name (File No.) Proponent	Location in City	Key Ecological Features and/or Functions Identified for Protection	PLANNING PROCESS (a) Application Accepted (b) EIS Finalized (c) OMB Appeal Resolved (d) Subdivision Agreement Finalized
1. Stoney Creek (39T-99506) Auburn	north central	• Locally significant wetland • Northdale woodland – large area and internal linkages • Northdale tributary	(a) 1999 (b) February 2000 (c) February 3 and 11, 2000; July 11, 2000 (d) February 20, 2001; April 23, 2003; July 26, 2005
2. Hunt Club West (39T-02512) Hampton	northwest	• Thames River corridor and aquatic habitat in Thames River • High quality communities with rare species (Community 10 – Butternut, Community 2, Community 8B) • Uncommon plant species (Swamp fly honeysuckle) in Community 5 (transplant recommended) • Area sensitive bird species (Black and White Warbler) (Communities 3 and 5) • Slope stability	(a) 2002 (b) May 2003 (c) N/A (d) February 16, 2004
3. Applegate Lambeth (39T-97598) Kape	southwest	Lower Dingman Corridor ESA and associated functions including: • hydrological functions • terrestrial habitat • migration corridor • habitat for significant species (Red-bellied Woodpecker) • aquatic habitat and fish habitat in creek	(a) 1997 (b) October 3, 1997 (c) N/A (d) February 2, 1999
4. Warbler Woods West (39T-02506)	northwest	Warbler Woods ESA and associated functions including: • upland deciduous forest with diverse communities • habitat for rare and significant species • steep slopes, conveyance of surface flows, microhabitats	(a) 2002 (b) April 8, 2002 (c) N/A (d) December 10, 2003

Case Study Name (File No.) Proponent	Location in City	Key Ecological Features and/or Functions Identified for Protection	PLANNING PROCESS (a) Application Accepted (b) EIS Finalized (c) OMB Appeal Resolved (d) Subdivision Agreement Finalized
		• ground water recharge, potential discharge • linkage/corridor function	
5. Sunningdale Corlon (39T-00512) Corlon	northwest	Sunningdale ESA including and associated functions including: • aquatic habitat of Medway Creek • large forest habitat block, supporting area sensitive species • high quality Sugar Maple-Beach forest community • suitable habitat for rare and sensitive species (including False Rue Anemone, Swamp Lousewort, and Twin Leaf)	(a) 2000 (b) July, 2000 (c) N/A (d) August 8, 2001
6. Powell Drain (39T-99522) Drewlo	north central	• Locally significant wetlands and associated Powell Drain • Habitat for LeConte's Violet in Community 5 • Buffering (Communities 7 and 9) • Wildlife habitat (Communities 6 and 4) • Flood and erosion control areas Groundwater recharge area	(a) 1999 (b) September, 1999 (c) January 5, 2001 (d) August 23, 2002; October 9, 2007
7. Talbot Village (39T-00514) Southside	southwest	• Organic deciduous swamp providing habitat for flora and fauna (including Spotted Salamander and Red-bellied Woodpecker) • Wooded slope edge (supporting significant Hickory Hairstreak Butterfly)	(a) 2000 (b) June 16, 2009 (c) N/A (d) July 27, 2010
8. Black Maple (39T-90019, 39T-92016) Matthews	northeast	• Black Maple forest	(a) 1990, 1992 (b) June + December 1996 (c) N/A (d) September 17, 1997
9. Highland Ridge (39T-04501) Norquay	southwest	• Wetlands: Buttonbush thicket swamp, willow thicket swamp, forb marsh • Sugar Maple-White Oak forest with American Chestnut, False Hop Sedge, and Yellow Mandarin • Lowland communities	(a) 2004 (b) July 20, 2004 (c) N/A (d) July 26, 2005; September 8, 2005

3.1 Baseline Evaluation

QUESTIONS: (a) Did the Environmental Impact Studies (EIS) follow the data collection standards for terrestrial natural heritage features and functions in place at the time? (b) Based on the data collected, what were the key ecological features and functions identified in the EIS for protection from negative impacts?

The City's data collection standards for ecological inventories, which are currently contained in Section 2 of their Environmental Management Guidelines (last revised Jan. 2007), have been in place since 1997 (B. Bergsma, pers. comm., 2013) and only subject to some minor refinements over the years since that time, and therefore would have applied to all of the nine planning applications examined for this study. These standards provide a sound rationale and useful background to explain the need for such data collection, and lay out the following requirements for terrestrial habitats:

- SCOPING DATA REQUIREMENTS:
  - Where available data is up to three years old and meets the City's standards it may be applied to the site and used to reduce the need for site-specific studies, however at least two site visits will be required to verify and document existing conditions.
  - Data four to 10 years old may be used to supplement, but should not replace, current field studies.
  - Where a feature and its functions are to be retained (e.g., buffers established through a subwatershed study are to be maintained), the need to site-specific data collection may also be reduced.

- INVENTORY PROTOCOL:
  - Surveys required for plants and wildlife over the spring, summer and fall to capture optimal windows for identification - and breeding for birds and amphibians - of plants, birds (both migrating and breeding), herpetofauna (amphibians and reptiles), and butterflies.
  - Vegetation community assessment, ideally over spring, summer and fall, following the Ecological Land Classification (ELC) protocol that includes a summary of tree species, a basic assessment of community condition, a summary of disturbance factors, and consideration of the relationship to local topography.
  - Notations of the status of both flora and faunal species of significance /conservation priority at the global, national, provincial, and regional scales as well as mapping of significant plant communities and/or wildlife habitat areas.
  - A full list of bird species observed with indications of if they are confirmed, probable or possible breeders, and maps showing the location of nesting species where appropriate.
  - Incidental observations of other wildlife and mapping of significant wildlife habitat areas.
  - Assessment of linkage functions.

In general, our review of these standards found that they are comprehensive and provide good guidance for the various aspects of data collection that may need to be addressed as part of an environmental study. In terms of policy compliance of the nine case studies with these standards, it was moderate to high, as illustrated in **Table 4**. Explanatory notes are included in the body of the table.

Table 4. Overview of data collection standards compliance.

Case Study	Terrestrial Ecological Data Collection	Natural Heritage Feature(s) Identified	(a) Compliance of the Ecological Data Collection with Established Standards?	(b) What Significant Natural Heritage Features and/or Functions Were Identified for Protection
1. Stoney Creek	• Surveys for flora and fauna conducted in spring, summer and fall • Vegetation inventory and community mapping (ELC) conducted in spring, summer and fall • Breeding bird and wildlife data from Sub-watershed Study and other sources • Wetland evaluation and delineation • Significant woodland boundary delineation and tree preservation study	Woodland Wetland Watercourse	YES - Surveys for flora and fauna were completed over spring, summer and fall covering all the appropriate timing windows, and vegetation communities were classified using ELC. YES – Species lists were screened using the current lists available at the time and full lists are included. NO – A linkage assessment that considers external connections is lacking. NO - The date of the EIS is Feb. 2000 and much of the wildlife data relies on the sub-watershed records collected in 1994, therefore to be in compliance with the guidelines more current , site-specific data collection, particularly for breeding birds and amphibians (which were almost entirely records from local residents) , should have been required.	• Locally significant wetland • Northdale woodland – large area and internal linkages • Northdale tributary
2. Hunt Club West	• Vegetation classification (ELC) • Breeding bird, fish and other wildlife data from the River Bend Community Plan	Woodland Valleyland / Watercourse	YES - Vegetation communities were classified using ELC. NO – Species lists were not included and most – if not all – species data relied on older studies. YES – A linkage assessment was provided. NO - The date of the EIS is July 2002, and most of the plant and wildlife data relies on the records collected as part of the Riverbend Community Plan first completed in April 1998, therefore to be in compliance with the guidelines more current , site-specific data collection should have been required, particularly given the older records of reptile Species at Risk in the area.	• Thames River corridor and aquatic habitat in Thames River • High quality communities with rare species (Community 10 – Butternut, Community 2, Community 8B) • Uncommon plant species (Swamp fly honeysuckle) in Community 5 (transplant recommended) • Area sensitive bird species (Black and White Warbler) (Communities 3 and 5)

Case Study	Terrestrial Ecological Data Collection	Natural Heritage Feature(s) Identified	(a) Compliance of the Ecological Data Collection with Established Standards?	(b) What Significant Natural Heritage Features and/or Functions Were Identified for Protection
				• Slope stability
3. Apple-gate Lam-beth	• Aquatic habitat • Vegetation communities • Flora and fauna inventory (Sept. 24) • Incidental wildlife • ESA boundary verification	Woodland Valleyland / Watercourse	NO - Surveys for flora and fauna only done once in fall. Window for breeding birds and amphibians missed completely. More comprehensive surveys should have been required but were not, likely because this was a second EIS to replace an unacceptable one. YES - Vegetation communities were classified, but not using using ELC as the EIS pre-dates the release of the ELC manual in 1998, and significant areas of groundwater seepage were assessed. YES – Species lists were screened using the current lists available at the time and full lists are included. YES – A linkage assessment was provided.	Lower Dingman Corridor ESA and associated functions including: • hydrological functions • terrestrial habitat • migration corridor • habitat for significant species (Red-bellied Woodpecker) • aquatic habitat and fish habitat in creek
4. Warbler Woods West	• Spring and summer ELC and flora (May, June, July) • Breeding birds (May and June) • Incidental wildlife (May, June) and winter wildlife survey (March)	Woodland	YES - Surveys for flora and fauna were completed over spring and summer covering all the appropriate timing windows, and vegetation communities were classified using ELC. YES – Species lists were screened using the current lists available at the time and full lists are included. YES – A linkage assessment was provided.	Warbler Woods ESA and associated functions including: • upland deciduous forest with diverse communities • habitat for rare and significant species • steep slopes, conveyance of surface flows, microhabitats • ground water recharge, potential discharge • linkage/corridor function
5. Sunning - dale Corlon	• Relied mostly on Sub-watershed Study (1993) and Community Plan (1997) • Breeding bird survey (single visit, July 7) • Targeted vegetation inventory of ESA buffer	Woodland Valleyland / Watercourse	YES - Surveys for flora and fauna were completed as part of the Subwatershed Study and Community Plan with the latter being one year prior to the EIS, so current, and supplemented with a single breeding bird survey and two vegetation surveys. Vegetation communities were classified using ELC. YES – Species lists were screened using the current lists available at the time and full lists are included.	Sunningdale ESA including and associated functions including: • aquatic habitat of Medway Creek • large forest habitat block, supporting area sensitive species • high quality Sugar Maple-

Case Study	Terrestrial Ecological Data Collection	Natural Heritage Feature(s) Identified	(a) Compliance of the Ecological Data Collection with Established Standards?	(b) What Significant Natural Heritage Features and/or Functions Were Identified for Protection
	and potential SWM locations (June, July)		YES – A linkage assessment was provided.	Beach forest community • suitable habitat for rare and sensitive species (including False Rue Anemone, Swamp Lousewort, and Twin Leaf)
6. Powell Drain	• Vegetation communities (ELC) • Flora inventory (three seasons) • Breeding birds and amphibians (spring and summer) • Incidental wildlife (three seasons) • Aquatic habitat assessment and other terrestrial data from Uplands Community Plan (1997)	Woodland Wetland Valleyland / Watercourse	YES - Surveys for flora and fauna were completed over spring, summer and fall covering all the appropriate timing windows, and vegetation communities were classified using ELC. This data was also supplemented with data from the Community Plan collected two years prior to completion of the EIS. YES – Species lists were screened using the current lists available at the time and full lists are included. NO – A linkage assessment that considers external connections is lacking.	• Locally significant wetlands and associated Powell Drain • Habitat for LeConte's Violet in Community 5 • Buffering (Communities 7 and 9) • Wildlife habitat (Communities 6 and 4) • Flood and erosion control areas • Groundwater recharge area
7. Talbot Village	• Vegetation communities (ELC) • Relied mostly on data from the North Talbot Community Plan (1999) • Previous ELC confirmed/ updated in the field (August)	Woodland Wetland	YES - Surveys vegetation communities were classified using ELC. UNKNOWN – The timing windows for flora and fauna surveys were not provided in the EIS or North Talbot Community Plan so are unknown. NO – Species lists were screened using the current lists available at the time and full lists are not included. YES – Consideration of external connections is provided. NO - The North Talbot Community Plan was published in	• Organic deciduous swamp providing habitat for flora and fauna (including Spotted Salamander and Red-bellied Woodpecker) – Locally/Provincially Significant Wetland[5] • Wooded slope edge (supporting significant

[5] There appears to be a discrepancy in this case: the EIS (2000) states a wetland evaluation was done (using OWES 1993) and classified the wetland as Class 4 to 7, so locally significant in London. However, correspondence from the City's Ecologist Planner in 2009 indicates that she thinks the wetland should have been classified as Class 1 to 3 which would have made it a Provincially Significant Wetland.

Case Study	Terrestrial Ecological Data Collection	Natural Heritage Feature(s) Identified	(a) Compliance of the Ecological Data Collection with Established Standards?	(b) What Significant Natural Heritage Features and/or Functions Were Identified for Protection
			1999 and while the application was accepted in 2000, the EIS was not finalized until 2009 and therefore some more current and site-specific data collection was warranted for vegetation and wildlife.	Hickory Hairstreak Butterfly)
8. Black Maple	• Previous studies • Site investigation to characterize Black Maple forest	Woodland Valleyland / Watercourse	NOT APPLICABLE This case is unique because no EIS was completed for this site. In 1990 a consultant was retained to prepare a tree retention analysis, and when the case was taken to the OMB two subsequent environmental reports were prepared in relation to the hearing. It is also different from the other case studies because it is the only one to pre-date application of the City's Data Collection Standards for Ecological Inventory (first released in 1997). Therefore even though site-specific wildlife studies (particularly breeding birds) may have provided additional information, none were required at the time.	• Black Maple forest with old growth characteristics
9. Highland Ridge	• ELC/flora • Breeding birds (May, June, July and August) • Breeding amphibians	Wetland (LSW) Valleyland / Watercourse	YES - Surveys for flora and fauna were completed over spring, summer and fall covering all the appropriate timing windows, and vegetation communities were classified using ELC. YES – Species lists were screened using the current lists available at the time and full lists are included. PARTIAL – Some discussion of local-scale ecological linkages is provided in response to the City's comments on the EIS.	• Wetlands: Buttonbush thicket swamp, willow thicket swamp, forb marsh • Sugar Maple-White Oak forest with American Chestnut, False Hop Sedge, and Yellow Mandarin • Lowland communities

3.2 Policy Compliance Evaluation

QUESTION: Did the Environmental Impact Study/ies (EIS) consider all the relevant policies for terrestrial natural heritage features and functions in place at the time?

As summarized in **Table 5**, the nine case studies selected were all development applications that were accepted by the City between 1997 and 2004, except for the Black Maple site (#8) which was accepted in two phases in 1990 and 1992. Therefore, in all cases except for Black Maple (#8) the 1997 Provincial Policy Statement (PPS) would have been in effect (as opposed to the current 2005 PPS).

Similarly, all case studies except for Black Maple (#8) would have been subject to the City's Official Plan with the approved portions of Official Plan Amendment (OPA) 88 incorporated[6]. For Black Maple, the City's 1978 Official Plan would have been the primary planning document in force at the time the planning application was accepted by the City, although OPA 88 was introduced and approved by the time of Subdivision Agreement finalization.

In the City of London, it has been standard practice to develop a Community Plan[7], often in conjunction with a Subwatershed Study or a higher level environmental study, prior to accepting site-specific development proposals. Therefore, most of the case studies also fell within a Community Plan area and were also subject to the relevant direction and policies of those respective plans.

The City's current Environmental Management Guidelines (EMG) (most recently consolidated in 2007), were not in effect as a whole at the time of these case studies. However, the current Section 2 - Data Collection Standards for Ecological Inventory, and Section 3 – Guideline Document for Environmentally Significant Areas Identification, Evaluation and Boundary Delineation, were both first released for use in 1997 and therefore would have been in effect at the time of all of these case studies (once again, except for Black Maple #8). Notably, the extent to which EIS (or comparable studies) complied with the data collection standards is reviewed in **Section 3.1** and discussed in **Section 4.1**, and is not included in this section.

Draft EIS Guidelines and Significant Woodlands Guidelines (now also included in the EMG) were also available for consideration, although not in effect, during the planning processes for the older case studies (i.e., #2 – Hunt Club West, #4 – Warbler Woods West, and #10 – Highland Ridge). These are discussed in this section.

In general, the case studies were compliant with the policies in place at the time of the acceptance of the applications in so far as the appropriate policy documents were referenced, and the relevant natural heritage policies at both the Provincial and local (i.e., City) scales appear to have been respected based on the documents reviewed. This finding is not unexpected since these EIS were all subject to review by City staff as well as the City's Ecological and Environmental Planning Advisory Committee (EEPAC) prior to approval. One small exception to this is the Stoney Creek EIS.

[6] For this review, the City provided the 2000 Official Plan consolidation which includes OPA 88 and reflects the policies that would have been in place for all case studies (except Black Maple #8).

[7] The City's Community Plans are comparable to Secondary Plans undertaken in other municipalities, and represent an intermediate planning stage between the Official Plan and the Subdivision or Site Plan that directs growth and development.

Table 5. Overview of policy compliance.

Case Study	PLANNING PROCESS (a) Application Accepted (b) EIS Finalized (c) OMB Appeal Resolved (d) Subdivision Agreement Finalized	Applicable Policies*	Did the Environmental Impact Study/ies (EIS) consider all the relevant policies for terrestrial natural heritage features and functions in place at the time?
1. Stoney Creek	(a) 1999 (b) February 2000 (c) February 3 and 11, 2000; July 11, 2000 (d) February 20, 2001; April 23, 2003; July 26, 2005	• PPS (1997) • OPA 88 • Stoney Creek Community Plan (1998)	**ALMOST** The PPS (1997), OWES (1993), NHRM (1999), Stoney Creek Community Plan (1998) and City's Draft Criteria for Significant Woodlands were all considered. OPA 88 was also considered except for the ecological buffer policies (15.3.6).
2. Hunt Club West	(a) 2002 (a) May 2003 (b) N/A (c) February 16, 2004	• PPS (1997) • OPA 88 • Riverbend Community Plan Area (1998)	**YES** The PPS (1997), OPA 88, and Riverbend Community Plan (1998) were all considered.
3. Applegate Lambeth	(a) 1997 (b) October 3, 1997 (c) N/A (d) February 2, 1999	• PPS (1997) • OPA 88	**YES** The PPS (1997) and OPA 88 were both considered.
4. Warbler Woods West	(a) 2002 (b) April 8, 2002 (c) N/A (d) December 10, 2003	• PPS (1997) • OPA 88 • Riverbend Community Plan (1998)	**YES** The PPS (1997) and OPA 88 were both considered along with the Riverbend Community Plan (1998), and NHRM (1999).
5. Sunningdale Corlon	(a) 2000 (b) July, 2000 (c) N/A (d) August 8, 2001	• PPS (1997) • OPA 88 • Sunningdale North Community Plan (2004)	**YES** The PPS (1997) and OPA 88 were both considered along with the Sunningdale Community Plan (1998).
6. Powell Drain	(a) 1999 (b) September, 1999 (c) January 5, 2001 (d) August 23, 2002; October 9, 2007	• PPS (1997) • OPA 88 • Uplands Community Plan (1997) / OPA 163	**YES** The PPS (1997) and OPA 88 were both considered along with the Uplands Community Plan (1998) / OPA 163 and the City's Vegetation Patch Evaluation Guidelines (March 1998).
7. Talbot Village	(a) 2000 (b) June 16, 2009 (c) N/A (d) July 27, 2010	• PPS (1997) • OPA 88 • North Talbot Community Plan (1999) / OPA 181	**IN PART** It was agreed the Community Plan addressed PPS (1997) requirements; however the EIS does not speak to OPA 88, and recommends use of a portion of a significant wetland for storm water management.
8. Black Maple	(a) 1990, 1992 (b) Not EIS – scoped environmental studies - June + December 1996 (c) N/A (d) September 17, 1997	• Wetlands Policy (1992) • 1987 Official Plan	**NO** There was no EIS, the PPS (1997) was not yet in effect, the site would not have been large enough to be considered through the Wetlands Policy (1992), and the City did not have any of its Environmental Management Guidelines in place. However, the 1987 Official Plan (Section 15) provided direction for the protection of Significant Woodlands as well as consideration for buffers. There was limited regard for this policy.
9. Highland Ridge	(a) 2004 (b) July 20, 2004 (c) N/A (d) July 26, 2005; September 8, 2005	• PPS (1997) • OPA 88 • Species at Risk Act (2002)	**NO** The EIS, and the related responses to City comments on it, only mention the 1997 PPS as it relates to aggregate policies but also mentions the federal Species at Risk Act.

* Policies were considered "applicable" based on being in effect at the time the application was accepted by the City.

For Stoney Creek (Case Study #1)[8], while most of the applicable policies were considered and respected through the EIS, the conformity with the ecological buffer policies in place at the time is the one key area of weakness. The EIS acknowledges that the greatest potential impact to the protected significant woodland are along the western edge where lots will immediately about the feature (see p. 27), and recommends "pre-stressing" of the edge prior to construction in conjunction with some planting of native woodland shrubs and conifers as a mitigative measure. It also recommends fencing for all lots backing on to newly created woodland edge. The EIS also recommends some preservation of existing trees within the rear lot lines.

The policies of OPA 88 (included in Official Plan 2000), Section 15.3.6, indicate that buffers "may be required" around components of the Natural Heritage System and that their location, width and composition is to be specified through a site-specific study. The policies also indicate that additional techniques, such as fencing, may be implemented to mitigate anticipated impacts. So strictly speaking, there is no absolute policy requirement for a buffer. However, given that significant impacts were anticipated as a result of residential development right up against a significant woodland, lack of consideration for any type of buffer between the feature edge and the rear lot line to mitigate for some of the anticipated impacts would appear to be a gap in the policy review and analysis.

Notably, the Stoney Creek Community Plan (1998) Environmental Management Strategy speaks to buffering the ESA in the area as well as significant stream corridors and floodplains at the subdivision stage, but not specifically to buffering significant woodlands.

For Hunt Club West (Case Study #2), all of the applicable policies were considered through the EIS and the subsequent Environmental Management Plan. The EIS includes a section that specifically speaks to each of the policies in Section 15.4 of the Official Plan, and considers a range of options for avoiding and mitigating impacts, including the use of vegetated buffers and fencing. Although the EIS fails to address or identify any stewardship options, the subsequent Environmental Management Plan provides comprehensive recommendations on this topic. The City's Draft EIS Guidelines and Significant Woodlands Guidelines which were available but not in effect at the time this application was accepted were not mentioned in the EIS.

For Applegate (Case Study #3), even though the data collection was not comprehensive as it should have been (see **Table 4**), all of the applicable policies were considered through the EIS including consideration of ecological linkages and the appropriateness of ecological buffers in various locations as a primary mitigative measure, in conjunction with fencing, limited trail access, and some educational and stewardship initiatives.

For Warbler Woods (Case Study #4), all of the applicable policies were considered through the EIS, including consideration of ecological linkages and the appropriateness of ecological buffers in various locations as a primary mitigative measure, in conjunction with fencing, edge naturalization, and some educational and stewardship initiatives (e.g., signs). The City's Draft EIS Guidelines and Significant Woodlands Guidelines which were available but not in effect at the time this application was accepted were not mentioned in the EIS.

[8] Consideration of conformity with the significant woodlands policies in place at the time was already subject to an OMB hearing and decision, and will not be re-considered here in retrospect.

For Sunningdale-Corlon (Case Study #5), all of the applicable policies were considered through the EIS including consideration of ecological linkages and the appropriateness of ecological buffers in various locations as a primary mitigative measure, in conjunction with fencing, directed access via trail management, the use of open space adjacent to protected natural areas, and various educational and stewardship initiatives (e.g., "green stamps" in traffic circles and at the ends of cul-de-sacs).

For Powell Drain (Case Study #6), the appropriate policy documents are referenced and there is apparent compliance with the appropriate policies related to natural heritage: the locally significant wetland is identified for protection, measures for protection of an uncommon plant community - Le Conte's Marsh Violet – are provided, and a re-vegetated buffer of 15 m is recommended around the wetland, and naturalization of the adjacent storm water management pond is identified as an ecological enhancement. The natural heritage features were also screened against the City's Vegetation Patch Evaluation Guidelines (March 1998) – now contained within the EMG, including consideration of connections – both hydrologic and terrestrial – with adjacent patches and watercourses.

In the case of Talbot Village (Case Study #7), it was agreed by City Planning staff at the time that the Community Plan addressed PPS (1997) requirements, and that the EIS would focus on implementation of recommendation from the original Natural Heritage Strategy and municipal policy (D. Hayman, Memo dated Feb. 8, 2014). Although the original EIS (2000) speaks to the North Talbot Community Plan (and selected related OPA 181) policies, it does not speak to compliance with London's in effect OPA 88. The primary weakness of this EIS is that it used the OWES (1993) to classify the central feature, an organic deciduous swamp with other associated smaller wetland units, as locally significant, and then fails to (a) consider the applicable Official Plan policies or (b) address how using portions of these wetland units for storm water overflow might impact the structure and composition of the vegetation communities (including habitat for four regionally rare plants), and potentially impact the on-site habitat for spotted salamander.

Allowing development (including infrastructure like storm water management ponds) in locally significant wetlands is permissible under the 1997 PPS, but could have been considered in contravention of the City's Official Plan in place at the time which includes locally significant wetlands within "natural heritage areas designated as Open Space" (policy 15.3.1) and specifies that permitted uses in Open Space are limited to "non-intensive uses" (Chapter 8a). In subsequent internal City correspondences (B. Bergsma, Feb. 2009) it would appear that upon closer examination by the City's Ecologist Planner, the wetland assessment was also not as rigorous as it should have been, and could have resulted in a Provincially Significant Wetland classification.

The Black Maple site (Case Study #8) is a different from the other case studies in that the 1997 PPS was not yet in effect, and the 1987 Official Plan was in effect (rather than OPA 88). Furthermore, the site would not have been large enough – or wet enough - to be considered through the Wetlands Policy (1992), and (like many of the case studies) the City did not yet have any of its Environmental Management Guidelines in place. As a result of the absence of a policy frame work like that which existed for the other case studies, no EIS was required and the proponent was only asked to provide a "tree retention analysis". However, once the results from this analysis showed this feature to be an uncommon Black Maple forest with old growth characteristics, the City refused to allow re-zoning to residential and the case was taken to the OMB by the development proponent. Notably, some impact assessment work (related to the potential impacts of the storm water drainage system on the retained portion of the Black Maple forest) was required as a condition of the OMB settlement and was completed in 1996, but from no EIS was completed to specifically address terrestrial ecology issues.

For the Black Maple site, the primary applicable policies were the City's 1987 Official Plan. Not unlike the OPA 88 policies, these included significant Woodlands and Woodlands as features to be included in Natural Heritage Areas designated as Open Space, and also required some consideration of ecological buffers as a mitigative measure (along with other potential measures such as fencing). The primary gap that is apparent in a review of this case is that the Significant Woodland was not identified or delineated as fully as it would have been if the City's Boundary Delineation Guidelines (Chapter 3 of the current EMG) would have been in place. The focus was on preservation of the portions of the woodland with the most healthy specimens, rather than consideration for the functions of adjacent wooded lands in supporting the functions of the woodland as a whole. In addition, there is no consideration for buffers as part of the mitigation to protecting the feature from changes in adjacent land uses – the focus was exclusively on maintaining the protected area's hydrologic regime and preventing water quality impacts related to runoff. While buffers were not specifically required by the policies of the time, they should have at least been considered by the environmental studies conducted by the proponent. It might also have been helpful if the buffer guidelines (now Chapter 6 of the EMG) would have been in place at the time. It is our understanding that this case, and others, helped confirm the need for such guidelines.

The Highland Ridge site (Case Study #9), despite being a fairly comprehensive EIS in terms of data collection and assessment, is weak from a policy compliance perspective. The 1997 PPS is not mentioned at all in the EIS except in relation to the aggregate policies (as they relate to the northern portion of the site), and the City's OPA 88 is not mentioned at all. The EIS does, however, discuss the federal Species at Risk Act (2002) in relation to the historical Badger records in the area. The City's Draft EIS Guidelines and Significant Woodlands Guidelines which were available but not in effect at the time this application was accepted were not mentioned in the EIS.

3.3 Implementation Evaluation

QUESTION: Were the recommendations identified in the Environmental Impact Studies (EIS) carried forward to the (a) Draft Plans, (b) Subdivision Agreements, and (c) the actual site?

This component of the assessment was divided into two parts: (1) the comparison of EIS recommendations with Subdivision Agreement clauses, and (2) the comparison of EIS / Subdivision Agreement recommendations related to buffers and fencing, and their implementation in the field.

3.3.1 EIS Recommendations vs. Subdivision Agreement Clauses

A comprehensive comparison between the EIS recommendations and what was ultimately carried forward to the approved Subdivision Agreement for each of the nine case studies was completed as part of this study. The "clause by clause" details of this analysis have been provided to the City under separate cover. The high level results of this analysis are summarized below and presented in **Table 6**.

Table 6. Overview of relationship between EIS recommendations and Subdivision Agreement clauses related to terrestrial natural heritage.

Case Study	EIS Recommendations Made	Related Subdivision Agreement Clauses*	Comments
1. Stoney Creek	EIS (2000) : 8 Scoped EIS (2001): 13	Subdivision Agreement Phase 1 (Feb 2001): no corresponding clause found Subdivision Agreement Phase 2 (Apr 2003): 6 of 8 recommendations Subdivision Agreement Phase 3 (July 2005): 1 of 8 recommendations Subdivision Agreement Phase 1 (Feb 2001): no corresponding clause found Subdivision Agreement Phase 2 (Apr 2003): 9 of 13 recommendations Subdivision Agreement Phase 3 (July 2005): no corresponding clause found	According to OMB decision, conditions of draft approval require the proponent to prepare and implement tree preservation in areas in proximity to the woodlot area; however, no corresponding clause found in any Subdivision Agreement. Range from 0% carry forward to 75% carry forward, and average of 24%
2. Hunt Club West	EIS : 6 Environmental Management Plan: 32	Subdivision Agreement: 2 of 6 recommendation Subdivision Agreement: 32 of 32 recommendations	33% carry forward 100% carry forward
3. Applegate Lambeth	EIS: 10	Subdivision Agreement: 3 of 10 recommendations	30% carry forward
4. Warbler Woods West	EIS: 14	Subdivision Agreement: 3 of 14 recommendations PLUS 2 additional clauses not found in EIS	21% carry forward
5. Sunningdale Corlon	EIS: 15	Subdivision Agreement: 11 of 15 recommendations	73% carry forward
6. Powell Drain	EIS: 7	Subdivision Agreement Phase 1 (May 2002) : 2 of 7 recommendations Subdivision Agreement Phase 2 (April 2007): 2 of 7 recommendations Subdivision Agreement Phase 3: 2 of 7 recommendations	29% carry forward
7. Talbot Village	EIS (including monitoring): 32	Subdivision Agreement: 32 of 32 recommendation	100% carry forward
8. Black Maple	NO EIS completed	Subdivision Agreement Requirements (December 1998): 22 clauses	This analysis is not applicable as there were not EIS recommendations *per se*.
9. Highland Ridge	EIS: 12	Subdivision Agreement: 3 of 12 recommendations PLUS 5 additional clauses not found in EIS	25% carry forward

* From final approved subdivision agreements only.

In general, we found that:

- Each EIS varied in terms of the type and detail of recommendations made concerning natural heritage feature protection, storm water management, erosion and sediment control, mitigation, and monitoring.
- The extent to which the recommendations of the EIS were carried forward to the Subdivision Agreement(s) varied among case studies. However, in most cases, one or more of the EIS recommendations were not included in the Subdivision Agreement(s).
- The reason for this was not apparent based on the review, but it is understood that some of the lack of carry forward may have been in response to comments (from the City or EEPAC or others), or as a result of discussions and negotiations between the City and the proponent that took place subsequent to approval of the EIS.
- Conversely, in two cases Subdivision Agreements contained one or more clauses pertaining to the protection, restoration, and/or monitoring of natural heritage features / functions which were not specifically recommended in the EIS. The reason for this was not apparent based on the review, but is assumed to be in response to comments (from the City or EEPAC or others), or as a result of discussions and negotiations between the City and the proponent that took place subsequent to approval of the EIS.
- The level of detail to which the Subdivision Agreements address the EIS recommendations varied widely among case studies. For example, in the case of Hunt Club West and North Talbot, the subdivision agreements simply contained a general clause stating that the owner/proponent agrees to implement all the recommendations of the EIS. Conversely, in the case of Stoney Creek, the Phase 2 Subdivision Agreement contains multiple specific clauses expressing very detailed monitoring requirements. This may be, in part, due to the fact that this case went to the OMB, but may also reflect the different approaches of the different planners involved.

3.3.2 Fencing Recommended vs. Fencing Implemented

The extent to which the recommendations related to fencing and buffers were carried forward on site is summarized in **Table 7** and discussed below. All of the case studies ultimately recommended fencing between lots and adjacent natural areas, if not through the EIS then through the Subdivision Agreement. In all cases, except one (Warbler Woods), fencing without gates was specified. Fences appear to have been implemented consistently at all sites except for Powell Drain, however it appears that in most cases that some residents have installed gates despite the original specifications for un-gated fences. We have assumed that this is a post-construction encroachment by residents rather than a lack of compliance on the proponent's due to the intermittent presence of gated fences.

Occasionally, unfenced lots were observed in areas where fencing was required. There were a number of lots adjacent to the Powell Drain wetlands that were unfenced (see **Photo 1**) as well as at Hunt Club West (see **Photo 2**). One lot at Stoney Creek (see **Photo 3**) and several lots at Black Maple (see **Photo 4**) were also unfenced. It did not appear that fences had ever been installed along these lots, although it is possible that in some cases fences were installed and subsequently removed by homeowners. This is assumed to be a lack of compliance on the builder's part, but may be post-construction non-compliance by homeowners as well.

3.3.3 Recommended Buffers vs. Buffers Implemented

Buffer requirements were much more variable than fencing requirements among the nine case studies, and ranged from no buffer to up to 10 m between the protected feature boundary and the rear lot lines. Where recommended buffers were either relatively small (e.g., 5 m or less) and/or variable it was difficult to verify implementation in the field. It appears that in most cases where buffers were recommended they were implemented as prescribed, except possibly for Hunt Club West and /or Powell Drain.

Photo 1. Unfenced lots along Segment J at Powell Drain

Photo 2. Unfenced lot along segment B at Hunt Club West Riverbend

Photo 3. Unfenced lot (background) along Segment B at Stoney Creek

Photo 4. Unfenced lot along Segment D at Black Maple

Table 7. Overview of Buffers and Fencing Required and Implemented.

Case Study	Fence required?	Buffers required?	Natural Area Boundary					Compliance	
			Fence with gates	Fence without gates	Retaining Wall	Buffer	Open	Fencing implemented?	Buffers Implemented?
1. Stoney Creek	Yes, without gates	No	x	x			x	one lot with gates	N/A
2. Hunt Club West	Yes, without gates and/or alternative retaining wall, monuments and fencing arrangements acceptable to Manager of Planning and Development	Root zone buffer to woodland communities 2 and 10 not to exceed 5 m recommended in EIS; requirement not specified in subdivision agreement	x	x	x	x	x	some lots with gates, some unfenced	Likely. Could not be field verified, but based on measurements of air photos, the depths of lot abutting woodlands are consistent with approved plan of subdivision.
3. Applegate Lambeth	Yes, without gates	No	x	x				gated and ungated fences	N/A
4. Warbler Woods West	Yes, gated/ungated not specified	Variable buffers, 3-10 m	x	x		x		gated and ungated fences	Yes
5. Sunningdale Corlon	Yes, without gates	variable buffers and stable slope setbacks	x	x		x		several lots with gates, most without	Yes
6. Powell Drain	Yes, without gates	5 m buffer from wetland community 5 recommended in EIS; 5 m buffer from wetland community 4 recommended in OMB ruling	x	x		x	x	several unfenced lots (primarily along segments h and j) and several lots with gates in fence	Likely. Based on measurements taken from recent air photos, the depths of lots abutting wetlands are consistent with approved plans of subdivision.
7. Talbot Village	Yes, without gates	10 m buffer to wetland	x	x		x		gated and ungated fences	Yes
8. Black Maple	Yes, without gates	No	x	x			x	some lots with gates	N/A
9. Highland Ridge	Yes, without gates	10 m buffer to wetland, 5 m buffer to streams		x		x		no gates observed	Yes

Buffers consistent with the recommended widths were evident at:

- Warbler Woods West where variable buffers ranging from 3 m to 10 m were recommended in the EIS (2002);
- Sunningdale Corlon where the EIS (2000) recommended 4 m buffers to the mature woodland at the north end of the subdivision and stable slope setbacks were required further south;
- Talbot Village where 10 m buffers were required for the protected wetlands (2000, 2009), which were implemented according to the approved development plan; and

- Highland Ridge which included 5 m buffers to the stream and 10 m buffers to wetlands, although in a few areas it was noted that the distance between the rear lot line and the steam appeared to be less than 5 m.

Buffers were more difficult to discern at Hunt Club West and Powell Drain:

- At Hunt Club West a buffer of up to 5 m from the drip line adjacent to two forest communities was recommended in the EIS (2002). Due to the unspecific nature of the buffer recommendation, field verification was difficult. However, based on a comparison of the approved plan of subdivision with recent (post-development) air photos of the site, it appears that the buffers were implemented according to the approved plan.
- At Powell Drain, the EIS (1999) recommended a 5 m buffer to wetland Community 5 located on the west side of the development. For wetland Community 4 (situated along the south end of the property), the EIS proposed conservation easements or zoning restrictions on proposed lots situated within the western portion of the wetland. A subsequent report from the Commissioner on Planning and Development recommended a minimum 5 m buffer/naturalization area be placed adjacent to wetland Community 4, but permitted lot placement within the buffer, provided that landowners were encouraged to naturalize those lots through stewardship and education. At Powell Drain, a 5 m buffer was also recommended around wetland Community 4, but several of the lots in the approved Draft Plan appear to abut the wetland edge such that the EIS buffer recommendation may not have been implemented in all cases. However, based on a comparison of the approved plan of subdivision with recent (post-development) air photos of the site, it appears that the layout and dimensions of the lots abutting the wetlands were implemented according to the final approved Plan of Subdivision.

Although no statistical analyses were done on these data, there does not appear to be a correlation between presence of a buffer and the number of encroachments. Although no buffers were prescribed for the two sites with the highest average number of encroachments per segment and lot (i.e., Black Maple and Applegate), no buffers were prescribed for Stoney Creek either, which had one of the lowest rates of encroachments per segment and lot. Nonetheless, the presence of encroachments of varying types was widespread across all sites (as described in **Section 3.4**).

3.4 Effectiveness Evaluation

QUESTION: Were the mitigation measures (buffers, setbacks, barriers) effective at (a) achieving no net loss of the area identified for protection, and (b) preventing readily apparent impacts to the protected area related to the change in adjacent land use?

As discussed in **Section 2**, this study focussed on indicators that could be readily measured, assessed and linked to the site-specific development based on a single season of field surveys. This resulted in completion of the following assessments:

1. Extent of Natural Area: Hectares of total natural area identified for protection / mitigation / compensation in the original EIS vs. current hectares of protected natural area.
2. Diversity of Habitats: Basic vegetation types identified for protection / mitigation / compensation in the original EIS vs. basic vegetation types protected currently.

3. Maintenance of Ecological Connectivity: Loss of identified ecological linkages (with roads or other types of infrastructure) at the site-specific scale.
4. Edge Effects / Encroachments: Frequency and extent of documented encroachments into the protected natural (measured along 80 m to 120 m transects up to 30 m deep).
5. Invasive Species: Relative abundance of invasive species (assessed along 80 m to 120 m transects up to 30 m from the rear lot line).
6. Recreational Impacts: Frequency of observed recreational impacts (e.g., unauthorized trails) (assessed along 80 m to 120 m transects, up to 30 m deep).

An overview of the results of these assessments is provided in **Table 8**. More detailed findings related to indicators #1 (shifts in vegetation communities), #2 (changes in extent of natural area), #4 (encroachments) and #5 (invasive species) is provided in the following sub-sections.

3.4.1 Changes in Extent and Types of Natural Areas (indicators 1 and 2)

Our analyses found that there have been no substantial changes in the amount of natural area identified for protection in the EIS compared to the area remaining protected as natural area in 2013. Our analyses also found that overall, the basic types of natural areas (i.e. basic ELC vegetation community types as per Lee *et al.* 1998) identified for protection / mitigation / compensation in the original EIS has been maintained in most (six out of nine) cases. Changes observed were changes in wetland community types, presumably in response to alteration of the local and / or regional hydrologic regimes (which may or may not be related to the site-specific development). A more detailed description is provided for each case study below.

#1 Stoney Creek

Communities identified for protection, in whole or in part, included: Dry-Fresh Sugar Maple deciduous forest, Fresh-Moist Poplar Deciduous Forest, Gray Dogwood Mineral Thicket Swamp, and Scotch Pine Coniferous Plantation. Based on field investigations, no major changes to the areal extent of these habitats identified for protection has occurred over the past decade or so. In addition, no major changes were observed regarding the general composition communities identified for protection.

Communities identified for restoration were Meadow Marsh and Shallow Marsh. Some changes to the species composition (not the area) of the restored marsh habitats were observed. The species composition of the marsh appears to have shifted over time from a forb dominated habitat that could have been classified as a Forb Mineral Meadow Marsh (MAM2-10) to a wetland dominated by cattails, grasses, sedges, and bulrushes in 2013 that would be classified as a Cattail Mineral Shallow Marsh (MAS2-1).

According to the consultant responsible for monitoring this wetland restoration for the first three years after creation, the restoration was a success in terms of creating a Meadow Marsh habitat. However, during the intervening years between completion of the three-year monitoring and assumption of the area by the City, a channel was created (possibly by a muskrat) between the storm water management pond and the marsh resulting in water quality degradation, and presumably the shift in vegetation composition (D. Hayman, Memo dated Feb. 8th, 2014).

Table 8. Summary of Effectiveness Evaluation Results for the Nine Case Studies

Case Study	(1) Loss (or gain) of basic habitat types	(2) Change in size of natural area(s) protected	(3) Interruption or loss of ecological linkages	(4) Edge effects/ encroachments	(5) Introduction of Invasive Species	(6) Recreational Impacts
1. Stoney Creek	Change in composition and classification of restored wetland	No change	No	Trail, dumping, introduction of trees/ shrubs/ ornamentals, bird feeders, play equipment	No	Informal trails, play equipment
2. Hunt Club West	No change	No change	No	Trails, dumping, introduction of trees/ shrubs/ ornamentals, mulch, mown grass, composter, outdoor lighting, removal of natural vegetation	No	Two informal trails from rear lots
3. Applegate Lambeth	No change	No change	No	Dumping, introduction of trees/ shrubs/ ornamentals, mown grass, removal of natural vegetation	No	None
4. Warbler Woods West	No change	No change	No	Dumping, introduction of trees/ shrubs/ ornamentals, mown grass, stairs	No	None
5. Sunningdale Corlon	No change	No change	No	Dumping, introduction of trees/ shrubs/ ornamentals, mown grass, trails, bird feeder, composter	No	Informal trails
6. Powell Drain	Change in composition and classification of restored wetland	No change	No	Trails, dumping, fill/grading, introduction of trees/shrubs/ornamentals, introduction of food crops, mown grass, trails, bird feeder, deck, fence, shed, readily moveable items, introduction of invasive species, removal of natural vegetation	Goutweed planted along fence line of one lot	Two informal trails from paved park path
7. Talbot Village	Changes in wetland community types	No change	No	Dumping, introduction of trees/shrubs/ornamentals, introduction of food crops, mown grass, trails, bird feeders, mulch, flagstones, trails	No	Informal trails
8. Black Maple	No change	No change	No	Dumping, introduction of trees/shrubs/ornamentals, mown grass, trails, bird feeders, trails, retaining wall, drainage system, introduction of invasive species, removal of natural vegetation	Periwinkle and Goutweed adjacent to one lot	Informal trails
9. Highland Ridge	No change	No change	Culvert improperly installed at stream road crossing resulting in impeded flows downstream	Dumping, introduction of trees/shrubs/ornamentals, mulch	No	None

#2 Hunt Club West

Several deciduous and mixed forest communities associated with the Thames River valley were identified for protection including: Dry-Fresh Sugar Maple-Oak Deciduous Forest, Dry-Fresh White Oak Deciduous Forest, Dry-Fresh White Cedar Mixed Forest, Dry-Fresh White Pine-Sugar Maple Mixed Forest, Dry-Fresh White Ash Deciduous Forest, and Dry-Fresh Sugar Maple-Beech Deciduous Forest. No significant changes in communities were observed in 2013.

#3 Applegate Lambeth

Several deciduous swamp and forest communities associated with the Dingman Creek valley were identified for protection including: Crack Willow Mineral Swamp, Bur Oak Mineral Swamp, Dry-Fresh White Ash Deciduous Forest, and Dry-Fresh Sugar Maple-White Ash Deciduous Forest.No significant changes in these community types were observed in 2013 based on analysis of current air photos and field investigations.

#4 Warbler Woods

Communities identified for protection included: Dry-Fresh Oak-Hickory Deciduous Forest, Dry-Fresh-Moist Black Locust Deciduous Forest, Dry-Fresh White Ash-Hickory Deciduous Forest, Old Field Meadow. Based on the 2013 work, there were no major changes in basic community types identified for protection in the EIS.

#5 Sunningdale-Corlon

Communities identified for protection in the EIS included: Dry-Fresh Sugar Maple-Hickory Deciduous Forest, Fresh Sugar Maple-Beech Deciduous Forest, Dry-Fresh White Ash Deciduous Forest, Willow Mineral Deciduous Swamp and Cultural Thicket. Based on analysis of recent air photos as well as field investigations, the community types identified for protection in the EIS have not changed significantly post-development.

#6 Powell Drain

Communities identified for protection in the EIS included: Willow Mineral Thicket Swamp, Cattail Mineral Shallow Marsh, Forb Mineral Meadow Marsh, Dogwood Organic Thicket Swamp, Dry-Fresh Poplar Deciduous Forest, Mixed Shallow Water Aquatic, Fresh-Moist Sugar Maple Deciduous Forest, Scotch Pine Coniferous Plantation, Dry-Fresh Old Field Meadow.

No significant changes to the basic community types identified for protection in the EIS were identified. Based on a review of the EIS vegetation mapping and the results of field investigations conducted in 2013, there appears to have been a shift in species composition of several wetland communities; however, the basic community types (i.e. Thicket Swamp, Meadow Marsh, Shallow Marsh) have not changed. For example, the cattail shallow marsh community identified in the EIS (unit 3.2) is still a marsh but is presently dominated by Lakebank Sedge (*Carex lucustris*) (see **Photo 1**) and Common Reed (*Phragmites australis*).

#7 Talbot Village

Communities identified for protection in the EIS include: Dry-Fresh Sugar Maple-Hickory Deciduous Forest, Silver Maple Organic Deciduous Swamp, Forb Organic Shallow Marsh, Dry-Moist Old Field Meadow, Fresh-Moist Sugar Maple-White Elm Deciduous Forest and Cultural Thicket.

Based on field investigations and review of recent aerial photography, it appears that the area and basic habitat types recommended for protection have been effectively protected; however, some differences were observed in terms of species composition within some of the wetland communities. Specifically, a portion of the Silver Maple swamp community identified as "W4" in the EIS contained many dead trees in 2013, relatively sparse tree cover, and an understory of Buttonbush such that this area could be classified as Buttonbush thicket swamp rather than Silver Maple swamp. In addition, community "W3" identified in the EIS (2000, 2009) as a Forb Mineral Shallow Marsh (see **Figure A-7**, **Appendix A**) contained a significant amount of standing water and little vegetation cover aside from sparse amounts of Buttonbush (see **Photo 6**). However, the reasons for these shifts are complex and may not be related to development of the Talbot Village site, but more so to surface water management in the broader area.

According to the consultant responsible for monitoring these wetland communities (note: a monitoring report has recently been submitted to the City and is under review), prior to the construction of the storm water management fore bay, overland flows from off-site were being directed to the wetlands with minimal quantity or quality controls resulting in substantial erosion and sediment delivery, and initiating shifts to the Silver Maple Swamp prior to development of the site. Post-development issues with the new storm water flow outlet being plugged with construction sediment and silt for an extended period of time (e.g., approximately two years) compounded impacts to these habitats by preventing the maintenance of surface water flows to these wetlands for an extended period of time (D. Hayman, Memo dated Feb. 8th, 2014), likely contributing to the shift from marsh to meadow habitat (**Photo 5**).

Photo 5. Sedge meadow previously identified as a cattail marsh

Photo 6. Shallow aquatic community previously identified as a Forb Mineral Shallow Marsh in EIS

#8 Black Maple

The primary community identified for protection was a Black Maple forest. During the 2013 field investigation it was confirmed that the Black Maple forest is still present on the site. Black Maple remains dominant with the majority of tree being large, mature specimens measuring over 60 cm in diameter at breast height (DBH). Co-dominant species included Bur Oak, Black Cherry, and Bitternut Hickory. Common Buckthorn is abundant in the sub-canopy.

#9 Highland Ridge

Communities identified for protection include: Fresh-Moist Black Walnut Lowland Deciduous Forest, Forb Mineral Meadow Marsh, Forb Mineral Shallow Marsh, Buttonbush Mineral Thicket Swamp, Willow Mineral Thicket Swamp, Gray Dogwood Mineral Thicket Swamp and Dry-Fresh Sugar Maple-Hickory Deciduous Forest. During the 2013 field investigations, no significant changes were observed in the community types identified for protection in the EIS.

3.4.2 Encroachments Assessment

Tables 8-a through 8-d show the numbers and types of encroachments on each site by distance from the rear lot line (i.e., 0 m to10 m, 10 m to 20 m, 20 m to 30 m). Tables are grouped into the same categories as developed for the Encroachment Checksheet (i.e., site alteration, landscaping, structures, and recreational impacts) provided in **Appendix A**. In general, the vast majority of encroachments were documented within 0 m to10 m of the rear lot lines (see **Tables 8-a through 8-d**). In many cases, encroachments occurred within the first few meters of the rear lot lines, and very

few encroachments extended 20 m to 30 m beyond the lots. Informal trails were the most common encroachment to extend 20 m or more beyond the rear lot lines (**Table 8-d**).

The encroachments observed varied considerably in terms of their frequency. Overall, the top four most common encroachments, listed in order of frequency, were:

1. dumping in natural areas (which in nearly all cases consisted of lawn and garden debris such as grass clippings, branches, dead plants, etc. (**Table 8-a**)
2. mowing and sodding into the buffer and/or natural area (**Table 8-c**)
3. creation of informal trails (documented in all but three sites) (**Table 8-d**), and
4. introduction of vegetation (mainly trees and shrubs) which occurred in all sites . (**Table 8-c**).

However, not all encroachments result in comparable levels of observed impacts, and some consideration needs to be given to the magnitude of the impacts associated with a given encroachment. In this study, two encroachments resulting in the most extensive impacts from an areal perspective were mowing / sodding and informal trail creation. Although common, in most cases the extent or severity of yard debris dumping was generally light or minimal, and the introduction of trees/shrubs was the least impactful, often associated with one or two trees planted just outside the rear lot line. As noted in **Table 8-b(i)** versus **Table 8-b(ii)**, structural encroachments, which in general were one of the least common forms of encroachment, were primarily comprised of readily removable structures; relatively few encroachments were of more permanent structures such as decks or stairs.

Although some of the sites assessed have formal trails running along the portions of the protected natural area(s), impacts associated with formal trail access points and formal trail usage were not examined as part of this study unless this impact fell within the 30 m study “zone” behind lots. In these areas, some observations were made related to the presence or absence of trails between protected natural areas and rear lot lines, and the extent to which this did (or did not) appear to influence the type and frequency of encroachment along rear lot lines (see **Section 3.4.3**).

Tables 8-e shows the number of encroachments in each segment for each site and the average number of encroachments per monitoring segment (80 m to 120 m long each), while **Table 8-f** shows the numbers of encroachments per lot per site, and on average per site. This analysis illustrates the variability in encroachments per segment and shows that there are segments where encroachments are more concentrated, suggesting activities by neighbours (to encroach or not to) may be influencing each other. It also illustrates which sites had greater overall frequencies of encroachments.

It could not be determined through this study if observed differences between sites are significant. However, observations of general trends in the data indicated that:

- Black Maple has the highest average number of encroachments per segment (8.4) and the second highest per lot (1.68), with debris dumping and mown grass being the most common encroachments at this site, while
- Highland Ridge had both the lowest average number of encroachments per segment (1.6) and per lot, one of the lowest magnitudes of encroachments.

Table 8-a. Frequency of Site Alteration in Natural Area and/or Buffer

Case Study	Dumping			Fill and/or grading			Total
	0-10 m	10-20 m	20-30 m	0-10 m	10-20 m	20-30 m	
1. Stoney Creek	17	1	1	1			**20**
2. Hunt Club	9	2	1	1			**13**
3. Applegate	10	7					**17**
4. Warbler Woods	3	3					**6**
5. Sunningdale	9	4					**13**
6. Powell Drain	20	2		2			**24**
7. Talbot Village	23	2					**25**
8. Black Maple	19	2		1			**22**
9. Highland Ridge	4						**4**
Total	**114**	**23**	**2**	**5**	**0**	**0**	**144**

Table 8-b(i). Frequency of Readily Moveable Structures in Natural Area and/or Buffer

Case Study	Bird Bath			Composter			Bird Feeders			Play Equipment			Other Readily Moveable Items			Total
	0-10 m	10-20 m	20-30 m	0-10 m	10-20 m	20-30 m	0-10 m	10-20 m	20-30 m	0-10 m	10-20 m	20-30 m	0-10 m	10-20 m	20-30 m	
1. Stoney Creek							1			1		1				**3**
2. Hunt Club				1												**1**
3. Applegate																**0**
4. Warbler Woods																**0**
5. Sunningdale	1			1												**2**
6. Powell Drain	3						5						1			**9**
7. Talbot Village							3									**3**
8. Black Maple							4									**4**
9. Highland Ridge																**0**
Total	**4**	**0**	**0**	**2**	**0**	**0**	**13**	**0**	**0**	**1**	**0**	**1**	**1**	**0**	**0**	**22**

Table 8-b(ii). Frequency of More Permanent Structures in Natural Area and/or Buffer

Case Study	Deck			Fence			Shed			Outdoor lighting			Stairs			Retaining Walls			Sprinkler/Irrigation System			Total
	0-10 m	10-20 m	20-30 m	0-10 m	10-20 m	20-30 m	0-10 m	10-20 m	20-30 m	0-10 m	10-20 m	20-30 m	0-10 m	10-20 m	20-30 m	0-10 m	10-20 m	20-30 m	0-10 m	10-20 m	20-30 m	
1. Stoney Creek																						**0**
2. Hunt Club										1												**1**
3. Applegate																						**0**
4. Warbler Woods													1									**1**
5. Sunningdale																						**0**
6. Powell Drain	1			1			2															**4**
7. Talbot Village																						**0**
8. Black Maple																1			2			**3**
9. Highland Ridge																						**0**
Total	**1**	**0**	**0**	**1**	**0**	**0**	**2**	**0**	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**2**	**0**	**0**	**9**

Table 8-c. Frequency of Landscaping Encroachments in Natural Area and/or Buffer

Case Study	Introduction of trees/shrubs			Introduction of horticultural garden/ ornamentals			Introduction of food crops			Other: Mulch			Introduction of invasive species			Other: Flagstones/Pavers			Mown Grass			Removal of Natural Vegetation			Total
	0-10 m	10-20 m	20-30 m	0-10 m	10-20 m	20-30 m	0-10 m	10-20 m	20-30 m	0-10 m	10-20 m	20-30 m	0-10 m	10-20 m	20-30 m	0-10 m	10-20 m	20-30 m	0-10 m	10-20 m	20-30 m	0-10 m	10-20 m	20-30 m	
1. Stoney Creek	1			1																		2			4
2. Hunt Club	1			1						1									2			1			6
3. Warbler Woods	3	1																	9						13
4. Applegate	5			2															11	1		1			20
5. Sunningdale	1			1															2						4
6. Powel Drain	5			3									1						14			1			24
7. Talbot Village	9	2	1	5			1			2						1			16	2					39
8. Black Maple	2			1									1						5			1			10
9. Highland Ridge	1			2						1															4
	28	**3**	**1**	**16**	**0**	**0**	**1**	**0**	**0**	**4**	**0**	**0**	**2**	**0**	**0**	**1**	**0**	**0**	**59**	**3**	**0**	**6**	**0**	**0**	**124**

Table 8-d. Frequency of Recreational Impacts in Natural Area and/or Buffer

Case Study	Trail from Boundary			Trail within Edge			Total
	0-10 m	10-20 m	20-30 m	0-10 m	10-20 m	20-30 m	
1. Stoney Creek	5	2	2	2			11
2. Hunt Club	2	2	2				6
3. Applegate							0
4. Warbler Woods							0
5. Sunningdale	4	1	1	1			7
6. Powell Drain	4	2	2	1			9
7. Talbot Village	1	1					2
8. Black Maple	2	1					3
9. Highland Ridge							0
Total	**18**	**9**	**7**	**4**	**0**	**0**	**38**

Table 8-e. Number of encroachments per ~ 100 m evaluation segment

Case Study	Segment														Total	Average no. of encroachments per segment
	A	B	C	D	E	F	G	H	I	J	K	L	M	N		
1. Stoney Creek	5	8	4	1	1	4	2	2	1	2	4	4	-	-	**38**	3.17
2. Hunt Club West	7	4	12	4	-	-	-	-	-	-	-	-	-	-	**27**	6.75
3. Applegate Lambeth	4	9	11	6	6	-	-	-	-	-	-	-	-	-	**36**	7.20
4. Warbler Woods West	2	2	10	6	-	-	-	-	-	-	-	-	-	-	**20**	5.00
5. Sunningdale-Corlon	11	4	5	5	1		-	-	-	-	-	-	-	-	**26**	5.20
6. Powell Drain	4	8	1	4	7	4	4	5	13	20	-	-	-	-	**70**	7.00
7. Talbot Village	8	7	5	2	3	2	4	3	4	5	10	4	5	7	**69**	4.92
8. Black Maple	7	8	11	7	9	-	-	-	-	-	-	-	-	-	**42**	8.40
9. Highland Ridge	0	2	2	1	3	-	-	-	-	-	-	-	-	-	**8**	1.60

Table 8-f. Number of encroachments per lot along surveyed boundaries

Case Study	Total Number of Encroachments	Total Number of Lots Along Survey Boundary	Average Number of Encroachments per Lot
1. Stoney Creek	38	51	0.75
2. Hunt Club West	27	18	1.50
3. Applegate	36	20	1.80
4. Warbler Woods West	20	17	1.18
5. Sunningdale Corlon	26	36	0.72
6. Powell Drain	70	64	1.09
7. Talbot Village	69	63	1.10
8. Black Maple	42	25	1.68
9. Highland Ridge	8	23	0.35

3.4.3 Special Feature or Species of Interest Assessments

#1 Stoney Creek: *Assessment of the general quality and condition of the riparian vegetation associated with the created wetland and the realigned west tributary, and of impacts along the recreational trail (notably most trail structures were installed prior to build-out).*

An inventory of the vascular plants within the created wetland was completed in June of 2013. The location of the wetland is shown on **Figure A-1** (**Appendix A**). A total of 29 species were documented in 2013, compared to 64 species document in 2004 by LandSaga Biogeographical.

The species composition of the created wetland appears to have changed over time. Cattails, grasses, sedges, and bulrushes were dominant in 2013, whereas forbs were dominant in 2004.

Dominant species documented in 2004:

- *Aster puniceus*
- *Aster lanceolatus*
- *Eupatorium maculatum*
- *Verbena hastata*
- *Scirpus atrovirens*
- *Leersia oryzoides*
- *Typha latifolia*
- *Rhamnus frangula*
- *Phalaris arundinacea*
- *Eupatorium perfoliatum*
- *Salix discolor*
- *Agrostis stolonifera*

Dominant flora documented in 2013:

- *Typha latifolia*
- *Leerzia oryzoides*
- *Carex* spp. (*Carex lacustris, C. stipata, C. bebbii*)
- *Eleocharis* sp.
- *Scirpus* spp. (*Scirpus atrovirens, S. validus, S. micocarpus)*
- *Eupatorium maculatum*

Currently, much of the marsh is dominated by Broad-leaved Cattail (*Typha latifolia*), with a stand of Narrow-leaved Cattail (Typha angustifolia) along the eastern edge. There are gaps in the cattails which are colonized primarily by Rice Cutgrass (*Leersia oryzoides*) in association with various sedges, bulrushes, and Spikerush (*Eleocharis* sp.). There are also several patches of Gray Dogwood (*Cornus racemosa*) and Pussy Willow (*Salix discolor*).

The results of the 2013 wetland inventory compared with the 2004 inventory indicate a notable shift in species composition and wetland type. Cattails, grasses, sedges, and bulrushes were dominant in 2013, whereas forbs were dominant in 2004. Based on the 2004 data, the wetland would likely have been classified as a Forb Mineral Meadow Marsh (MAM2-10). Based on the 2013 data, the wetland is classified as a Cattail Mineral Shallow Marsh (MAS2-1). This change is species composition and wetland classification can likely be attributed to a change in wetland hydrology, including longer periods of inundation which would favour the growth of cattails over forbs.

Vegetation along the realigned west tributary appears to be well naturalized with native vegetation including forest, thicket swamp, and meadow marsh (see **Photos 9 though 11**). Meadow marsh vegetation is primarily associated with the stream bed and lower stream banks and includes species such as Rice Cutgrass, Joe-pye Weed, Fowl Manna Grass, and Jewelweed. Some invasive species including Mulitflora Rose and Glossy Buckthorn were observed along the banks. The stream flows mostly through forest as well as dogwood thicket swamp. At the south end of the site, near Grenfell Drive, the tributary banks have been heavily reinforced with stone. The upper banks in this area are well vegetated, primarily with old field meadow species and young trees. The lower banks and stream side support a diversity of wetland forbs and graminoids.

Photo 7. View of wetland restoration

Photo 8. View of wetland restoration

Photo 9. Realigned west tributary bordered by meadow marsh vegetation

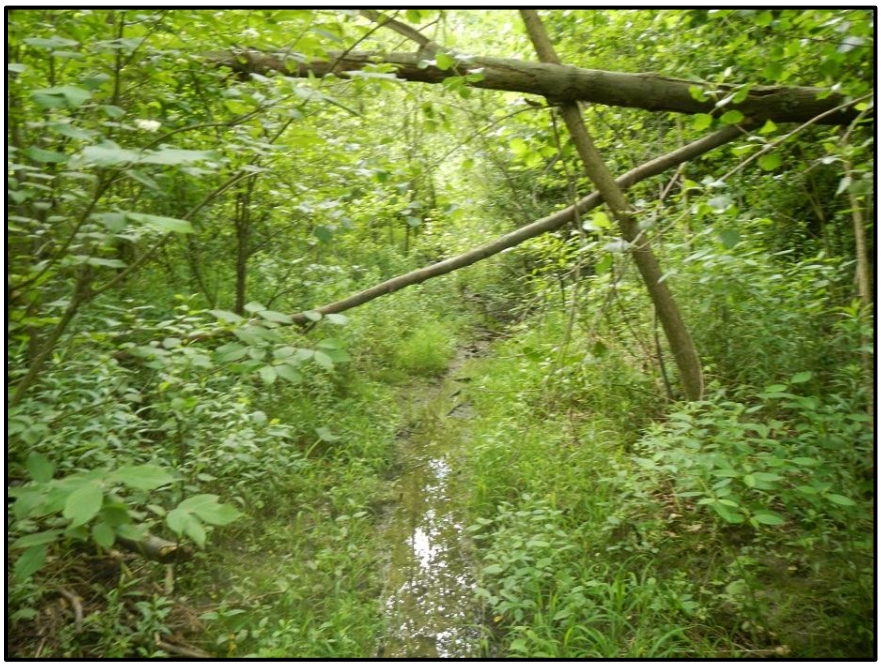

Photo 10. Realigned west tributary through woodland

Photo 11. Realigned west tributary just north of Grenfell Dr.

Impacts of the trail system appear to be relatively minor. Damage to some trees along the trail was noted (see **Photo 12**) and graffiti/tags were observed on a number of trees along the trail (see **Photo 13**). Several informal side trails were also noted. One side trail led to two constructed tee-pees (see **Photo 14**) near the centre of the woodlot. Based on discussions with a local resident, the tee-pees are relatively new.

Photo 12. Damage to tree along trail in Stoney Creek Woodlot

Photo 13. Tagged tree along trail in Stoney Creek woodlot

Photo 14. Teepee constructed in Stoney Creek woodlot

#2 Hunt Club West: *Apparent impacts of the retaining wall on residual vegetation and verification for the presence of yellow spotted salamanders*

There were no apparent impacts of the retaining wall on the adjacent vegetation. Vegetation was observed growing right up the edge of the wall (see **Photo 15** and **16**). Some minor dumping/debris accumulation was observed at the base of the retaining wall.

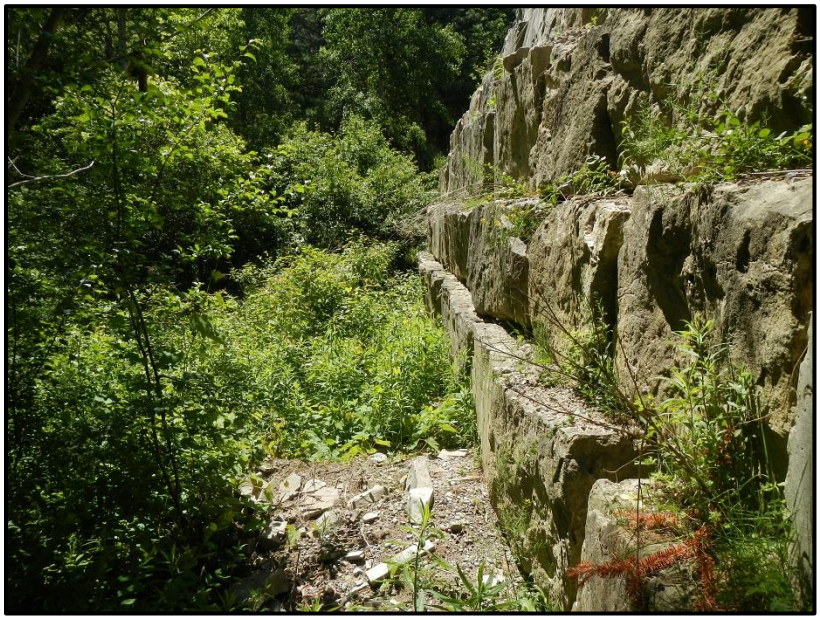

Photo 15. Vegetation along retaining wall at Hunt Club West

Photo 16. Vegetation along retaining wall at Hunt Club West

A search for salamanders was undertaken in June 2013, which involved searching on under suitable cover objects such as old logs. No Yellow Spotted Salamanders were found; however, this does not exclude the possibility that the species is in the area. A number of Red-backed Salamanders (see **Photo 17**) were observed in the valley just southeast of the development (see **Figure A-2, Appendix A**), which indicates that the area continues to provide habitat suitable for salamanders.

Photo 17. Two Red-backed Salamanders at Hunt Club West Riverbend

#3 Applegate-Lambeth: *Verification for a rare plant (Green Dragon) in the floodplain*

A small population of Green Dragon (*Arisaema dracantonium*) was observed in the floodplain during field investigations conducted in June 2013 (see **Photo 18**). The documented locations of Green Dragon are shown on **Figure A-3** (**Appendix A**).

Photo 18. Green Dragon (*Arisaema dracantonium*) observed at Applegate Lambeth

#4 Warbler Woods West: *Apparent impacts of the paved trail adjacent to the ESA*

The impacts of the paved trail adjacent to the ESA were assessed in terms of the function of the trail to prevent encroachments into the natural area. The paved trail runs through an old field between the lots to the west and the woodland to east. The presence of a paved trail between the lots and the ESA appears to have limited some types of encroachments such as mowing beyond the rear lot lines. Mowing was observed along the rear of several lots, which extended to the edge of the trail and typically not beyond (see **Photo 19**).

Dumping of yard waste was fairly minimal at this site; however, several occurrences of minor dumping (lawn clippings, old potted plants) were observed on the east side of the paved trail. In one instance, three small piles of lawn clippings were recorded within the old field just a few meters from the trail. In another area, several discarded potted plants and some soils piles were recorded east of the paved trail within the forest edge.

A couple of other sites in London, including Applegate Lambeth and Powell Drain, have segments of paved trails beyond the rear lot lines abutting natural areas. Dumping of yard waste was observed

beyond the paved trails at these sites as well, but very few other types of encroachments were observed. These observations indicate that the presence of paved trails between rear lot lines and the adjacent ESA may limit some types of encroachment (such as mowing, placement of structures, and vegetation removal) but not all types of encroachments (such as dumping of yard waste).

Photo 20. Mowing between rear lot line and paved trail at Warbler Woods West

#5: Sunningdale Corlon: *Apparent impacts of the storm water management system on the ravine and floodplain vegetation*

The location of the ravine and floodplain vegetation downstream of the storm water management pond is shown on **Figure A-5** (**Appendix A**). Aside from the direct removal of ravine vegetation to construct the SWM facility, the impacts of the SWM facility on the downstream environment appear to be minimal. While no detailed pre-development information on the floodplain vegetation is available to compare with the existing conditions, the following observations were made during field investigations concerning the conditions downstream of the SWM pond:

- A small marsh is situated at the base of the SWM pond outfall. The marsh is dominated by Rice Cutgrass (*Leersia oryzoides*), Broadleaf Arrowhead (*Sagittaria latifolia*), Narrow-leaved Cattail (*Typha angustifolia*), and Reed Canary Grass (*Phalaris arundinacea*). Soils were saturated and there appeared to be some seepage in this area.
- Two distinct channels originate from the marsh. The two channels converge approximately 10 m into the Willow swamp community forming a single stream channel. The stream flows in a southerly, meandering direction through the Willows swamp and into a large open marsh community (see **Photo 21**) before converging with Medway Creek.

- A Snapping Turtle (a Species at Risk in Ontario) was observed along the stream near the confluence with Medway Creek.
- The quality of the floodplain marsh community appeared to be generally good with a moderate diversity of wetland plants. Twenty-six vascular plant species were recorded; however, the inventory should not be considered comprehensive. Dominant species include Reed Canary Grass (*Phalaris arundinacea*), sedges (predominantly *Carex stricta* and *Carex lacustris*), Skunk Cabbage (*Symplocarpus foetidus*), and True Forget-me-not (*Myosotis scorpodies*). The tree canopy is sparse with scattered willows and dead hardwoods. In addition to the SWM system, the marsh is fed by several other drainages from the adjacent slope as well as groundwater seepage.
- There was no evidence of excessive sediment deposition within the valley from the SWM pond or excessive flows into the valley from the SWM pond (i.e. no significant erosion, flattened vegetation, etc. was observed).

Photo 21. Floodplain Marsh downstream of SWM pond at Sunningdale Corlon

The EIS for Sunningdale Corlon (2000) identified a regionally rare plant species, Twinleaf (*Jeffersonia diphylla*), in the Sunningdale ESA. A small population of Twinleaf (see **Photo 22**) was observed and recorded in the Sugar Maple forest north of the development (see **Figure A-5**) during field investigations.

Photo 22. Twinleaf population at Sunngingdale Corlon

#6: Powell Drain / Drewlo: *Verification of the presence / absence of plant species documented in the wetland in 2002 following construction, but before the storm water management pond breach in 2007*

A list of plants observed in the Powell Drain wetland in 2013 and prior to 2007 is provided in **Appendix C**. The list of plants observed prior to 2007 include species documented in monitoring plots in 2002 (2006) as well as species recorded in ELC unit 4 (Willow Mineral Thicket Swamp) from the EIS (1999), which corresponds approximately with the wetland area surveyed in 2013.

A total of 87 species were documented prior to 2007 and a total of 71 species were documented in 2013. A total of 40 species were observed in 2013 as well as prior to 2007. A total of 26 species were identified in the wetland in 2013, which were not previously identified. A total of 45 species were documented prior to 2007, which were not identified in 2013.

There are several explanations for the discrepancies in the number of species recorded in the wetland. One explanation is that certain plants were simply overlooked from one year to the other. Certain species, such as violets, sedges, and asters, are identifiable or more noticeable at specific times of the year; therefore, if the survey times differed, then different species would have been recorded in different years. Another explanation is that the wetland area that was surveyed in 2013 did not directly correspond with the previous wetland survey area, such that certain species were recorded in one year and not the other based on the area of land covered. Despite the differences in the number of species recorded, based on the list of species observed in both in 2013 and prior to 2007, it does not appear that the general character and dominant species composition of the wetland have changed dramatically since development.

#7 Talbot Village: *Apparent impacts of the storm water management facility on the protected Silver Maple Swamp*

Impacts to the Silver Maple swamp were difficult to assess given a lack of detailed baseline data. However, during the 2013 field investigations it was observed that a large portion of the Silver Maple swamp community identified as "W4" in the EIS (2000, 2009) (see **Figure A-7, Appendix A**) contained many dead trees, relatively sparse live tree cover, and an understory of Buttonbush (see **Photos 23** and **24**), such that this area could be classified as Buttonbush thicket swamp rather than Silver Maple swamp. Some of this change may have occurred as a result of storm water management related to development, although some tree die-back was already occurring prior to development (D. Hayman, Memo dated Feb. 8, 2014).

Photo 23. Open area in the Silver Maple swamp dominated by Buttonbush

Photo 24. Open area in the Silver Maple swamp dominated by Buttonbush

#8 Black Maple: *Assessment of the general vegetative quality and condition of the Black Maple stand*

During the 2013 field investigation it was confirmed that the Black Maple forest is still present on the site (see **Figure A-8, Appendix A**). Black Maple remains the canopy dominant and the majority of trees being are large, mature specimens measuring over 60 cm in diameter at breast height (DBH). Most to the Black Maple trees were in good to fair condition; however, a number were showing signs of decline. Co-dominant species included Bur Oak, Black Cherry, Bitternut Hickory, Basswood, and White Elm. Common Buckthorn is abundant in the sub-canopy and understory, along with Choke Cherry and Tatarian Honeysuckle. Very little Black Maple regeneration was observed.

Based on the community description and assessment from previous environmental reports (1996), the structure and composition of the Black Maple forest has not changed significantly since development. However, the aging Black Maples and the conspicuous lack of Black Maple regeneration suggests that over time, as the Black Maple die out, the forest may transition to a new forest type such as an Oak or Hickory forest.

#9 Highland Ridge: *Assessment of the general vegetative quality and condition of the Buttonbush swamp*

The Buttonbush swamp at Highland Ridge (see **Figure A-9, Appendix A**) retains its defining characteristic – an abundance of Buttonbush (see **Photo 25**), which covers approximately 75% of the wetland area. There is a very sparse canopy of dead or dying willow. Little ground flora was present at the time of survey due to deep water (~0.5 m deep); however, some submerged aquatic vegetation

(pondweeds, algae) and Duckweed (*Lemna minor*) were observed. Most herbaceous vegetation was observed along the western edge of the swamp. The water was very murky with sediment.

Photo 25. Buttonbush Swamp at Highland Ridge

3.4.4 Invasive Species

Invasive species were commonly encountered at all sites. The most common invasive species recorded were:

- Common Buckthorn (*Rhamnus cathartica*)
- Glossy Buckthorn (*Frangula alnus/Rhamnus frangula*)
- Garlic Mustard (*Alliaria petiolata*)
- Dame's Rocket (*Hesperis matronalis*)
- Tartarian Honeysuckle (*Lonicera tatarica*)

Other invasive species observed included:

- Multiflora Rose (*Rosa multiflora*)
- Common Reed (*Phragmites australis*)
- Scotch Pine (*Pinus sylvestris*)
- Black Locust (*Robinia pseudo-acacia*)
- Lily of the Valley (*Convallaria majalis*)

All of these species are ubiquitous across southern Ontario, and have been for quite some time. Without comprehensive baseline documentation of the abundance of invasive species populations at each site prior to development, it is impossible to conclusively link the current presence and abundance of these species with development on the sites. However given how pervasive they are, it is likely that many of these species were already established prior to development.

At two sites, the introduction of invasive species can be reasonably linked to the development. Goutweed (*Aegopodium podagraria*) is a common garden ornamental that can escape cultivation and become invasive in forest understories. This species was observed planted along the rear of one lot at Powell Drain and Black Maple; however, in both cases the extent of Goutweed spread into the protected area was minimal. Perwinkle (*Vinca minor*) is another common garden plant that can become somewhat invasive in forest understories. Periwinkle was observed planted behind one lot at Black Maple.

There are several non-native trees approved for planting as street trees in the City of London, which can be invasive under certain conditions, and could potentially spread into natural areas. These include:

- Hedge Maple (*Acer campestre*)
- Amur Maple (*Acer ginnala*)
- Norway Maple (*Acer platanoides*)
- Sycamore Maple (*Acer pseudoplatanus*)
- Tatarian Maple (*Acer tataricum*)
- Horsechestnut (*Aesculus hippocastanum*)
- European Alder (*Alnus glutinosa*)
- European Hornebeam (*Carpinus betulus*)
- Amur Maakia (*Maackia amurensis*)
- Flowering and Domestic Crab apple (*Malus* spp.)
- Callery Pear (*Pyrus calleryana*)
- European Mountain Ash (*Sorbus aucuparia*)

None of these tree species were documented within in the surveyed portions of any of the nine sites. It is possible that individuals of some of these species were overlooked, but no trees listed above occurred in significant enough numbers to have been noticed and documented (City of London 2012).

3.5 Validation Evaluation

QUESTION: Were there processes in place to (a) verify implementation at the site level, and (b) verify effectiveness of terrestrial natural heritage protection / mitigation / compensation measures?

Ecological monitoring can also be – and is often – divided into three basic types:

1. Compliance monitoring: monitoring to ensure the basic terms of the subdivision (or site plan) agreement during and immediately post-construction are met (e.g., equipment kept out of tree protection zones, fencing installed as buffers implemented as specified, etc.)

2. Short-term biological / ecological monitoring: one to three years following construction
3. Long-term monitoring: monitoring to assess if the ecological feature(s) and their functions are being maintained in the long-term (i.e., four to ten years, or sometimes longer)

Compliance monitoring is relatively straightforward and requires (a) a qualified individual to assess for compliance at key intervals during and following build out, and (b) a reporting mechanism that guides the level of detail and format required, as well as the timing for reporting. Compliance monitoring can, and is often, done by professionals retained by the proponent, but their work should be overseen and reviewed by qualified municipal staff. As noted by proponents who undertake ecological monitoring in the City, this is often the time when some of the greatest immediate impacts occur to protected natural areas (D. Hayman, pers. comm., Sept. 2013).

Short-term monitoring is typically focussed, when it considers terrestrial ecology, on the maintenance of pre-development water levels and water quality, as well as the survival of new plantings. Sometimes it includes plant and/or wildlife species assessments, however the period of time to verify any actual changes in community composition is usually too short.

Long-term ecological monitoring that tries to assess changes in relation to development in a municipality is more complex, expensive and lengthy, but is the only type of monitoring that can (if properly designed and implemented) start to identify trends in relation to responses of biotic communities and species to changes in land use.

Monitoring required for natural heritage considerations as part of the EIS (or the subsequent Subdivision Agreement) is summarized for each case study in **Table 9**. We found:

- Only a third of the cases specified the need for compliance monitoring, despite the fact that this is the simplest and often the most cost-effective, form of monitoring.
- About half of the cases included requirements for short-term (e.g., two years following construction) monitoring, but varied widely in the scope and scale of monitoring. For Warbler's Woods only visual site inspections and photo-monitoring were recommended (and undertaken), while Stoney Creek and Talbot Village each required the development of comprehensive monitoring programs for the protected and created wetlands on site, including collection of data on plants and wildlife.
- None of the case studies required long-term monitoring except for Hunt Club West which required spot checks of planted materials.

We also found that typically the Subdivision Agreements contained more detail and direction regarding required monitoring than the original EIS document.

For Stoney Creek (Case Study #1), a comprehensive monitoring program was required through the Subdivision Agreement that included (in addition to a number of aquatic and water quality/quantity monitoring measures) floristic quality (plot-based) and wildlife monitoring (diversity and abundance) of the protected locally significant wetland. This program included a total of 13 field visits throughout each year to capture the various target groups / species, including migrant species to assess the replication of the meadow marsh. Notably, the monitoring program ultimately developed by the City included specific requirements for wetland replication (i.e., baseline data, specific monitoring measures, target or threshold for each measure as well as performance indicators) as well as a list of contingency measures and corrective actions to address some of the anticipated issues. Although a

comprehensive program was developed and implemented over the established two year period, there was no final synthesis report to make sense of all the data.

Powell Drain (Case Study #6) is one of the few case studies to have the proposed ecological monitoring documented in a report (October 2001) and maps (i.e., identification of six fixed monitoring locations within the wetland area of concern, and basic descriptions of the vegetation communities prior to construction in the wetland and immediately adjacent lands prior to construction). The City provided a number of comments on the monitoring protocol in December 2001 that requested revisions to the protocol, but these comments appear not to have been addressed in a revised report or addendum memo submitted to the City. What is confirmed is that in May of 2006 there was a breach in the adjacent storm water management pond as a result of a storm event causing some major siltation of the protected wetland. According to the chronological record provided by the City, the breach was detected immediately and the response (of silt removal) was also in place within a week of the event and continued for more than six weeks until complete. Temporary measures were then put in place and inspection continued on a regular basis (i.e., several visits per month) until a second breach was detected in December 2006, followed by repairs and maintenance work over December 2006 and January 2007. No further records of breaches were documented.

The monitoring program for Talbot Village (Case Study #7) was also specific and comprehensive. It included plots by hydrologic zone, consistent plant species sampling within plots along with collection of other related environmental parameters (such as soils, water chemistry, and hydroperiod) and specified reporting content and frequency, as well as possible statistical approaches. The City also specified thresholds for when mitigation will be required and the scope of the mitigation.

The wildlife monitoring undertaken for the Highland Ridge site between 2005 and 2007 was well-documented and included an assessment of vegetation communities (using ELC), breeding birds, and herptiles. The monitoring report states its purpose: "*to evaluate wildlife diversity and abundance over the two years (2006 – 2007) relative to the baseline data ... and document the effectiveness of implemented mitigation measures to reduce impacts (development envelope and buffers)*". Documented findings included: some minor shifts in the ELC communities, persistence of vernal pool breeding habitat but some apparent decline in herptile species diversity (e.g., eastern spotted newt, the midland painted turtle and garter snake were not relocated), and apparent decline in breeding bird species diversity (e.g., loss of species less tolerant to development).

Table 9. Overview of monitoring requirements

Case Study	Key Ecological Features and/or Functions Identified for Protection	MONITORING REQUIRED			Process for Enforcement and Corrective Actions
		Compliance	Short-term	Long-term	
1. Stoney Creek	• Locally significant wetland • Northdale woodland – large area and internal linkages • Northdale tributary	Not specified in EIS, but some (e.g., erosion control supervision) required in Subdivision Agreement.	Two-year monitoring of meadow marsh and constructed wetland. Criteria and targets set by the City.	None	Reporting required 1x/yr for two years. Subdivision Agreement: 27 (c) "*The subdivider agrees, at his sole expense, to undertake any corrective actions required and identified as a result of the on-going monitoring period to the constructed wetland facility up to the end of the required monitoring period.*" Note: More specific guidance given through Subdivision Agreement than EIS.
2. Hunt Club West	• Thames River corridor and aquatic habitat in Thames River • High quality communities with rare species (Unit 10 – Butternut, Unit 2, Unit 8B) • Uncommon plant species (Swamp fly honeysuckle) in Community 5 (transplant recommended) • Area sensitive bird species (Black and White Warbler) (Units 3 and 5) • Slope stability	None	Environmental Management Plan (2003) recommended photographic log and record of condition of ESA buffer / edge.	Environmental Management Plan (2003) recommended spot check of planted material. Longer term but very limited.	Annual reporting required for three to five years. Note: Subdivision Agreement refers to EMP guidance
3. Applegate Lambeth	Lower Dingman Corridor ESA and associated functions including: • hydrological functions • terrestrial habitat • migration corridor • habitat for significant species (Red-bellied Woodpecker) • aquatic habitat and fish habitat in creek	None	None	None	N/A
4. Warbler	Warbler Woods ESA and associated	None	Very limited,	None	A letter report required each year.

Case Study	Key Ecological Features and/or Functions Identified for Protection	MONITORING REQUIRED			Process for Enforcement and Corrective Actions
		Compliance	Short-term	Long-term	
Woods West	functions including: • upland deciduous forest with diverse communities • habitat for rare and significant species • steep slopes, conveyance of surface flows, microhabitats • ground water recharge, potential discharge • linkage/corridor function		qualitative record – a photographic log and visual assessment.		EIS and Environmental Management Plan recommended: • Photographic log and record of condition of ESA buffer / edge • A letter report to the City after completion of construction, and then 2 years after build out Note: not carried forward to the Subdivision Agreement.
5. Sunning-dale Corlon	Sunningdale ESA including and associated functions including: • aquatic habitat of Medway Creek • large forest habitat block, supporting area sensitive species • high quality Sugar Maple-Beach forest community • suitable habitat for rare and sensitive species (e.g.,False Rue Anemone, Twin Leaf)	Periodic inspections.	None	None	No reporting requirements. The EIS recommends inspection during construction to ensure various measures / conditions are implemented as identified in the plans, but nothing beyond that.
6. Powell Drain	• Locally significant wetlands and associated Powell Drain • Habitat for LeConte's Violet in Community 5 • Buffering (Communities 7 and 9) • Wildlife habitat (Communities 6, 4) • Flood and erosion control areas Groundwater recharge area	Site inspection one year following grading to ensure the mitigation measures are in place.	Biological monitoring of Powell Drain and the constructed wetland. Floristic quality – Com #4 – pre and post construction data collection required.	None	The EIS recommends monitoring within the Powell Drain and the maintained and enhanced portions of the wetland to provide feedback on the effectiveness and success of the mitigating measures to maintain the LSW. Note: More specific guidance given through Subdivision Agreement than EIS.
7. Talbot Village	• Organic deciduous swamp providing habitat for flora and fauna	Site inspection one year	Two years of data collection	Transferred to City after	The monitoring program determined with specific direction from the City (2009), is

Case Study	Key Ecological Features and/or Functions Identified for Protection	MONITORING REQUIRED			Process for Enforcement and Corrective Actions
		Compliance	Short-term	Long-term	
	(including Spotted Salamander and Red-bellied Woodpecker) - Locally/Provincially Significant Wetland[9] • Wooded slope edge (supporting significant Hickory Hairstreak Butterfly)	following grading to ensure the mitigation measures are in place.	on a wide range of parameters, including flora and wildlife	initial monitoring completed.	specific and comprehensive. The monitoring results were submitted to the City in 2013 and are under review. Note: More specific guidance given through Subdivision Agreement than EIS.
8. Black Maple	• Black Maple forest	None	None	None	OMB – encouraged partnership with the University to monitor the site, but no evidence of any monitoring done. OMB: "*Should the system be in poor condition ... then the subdivider hereby agrees to repair and/or modify the system in accordance with the recommendations of its professional engineer... Subsequent to the completion of the aforementioned requirements, the subdivider agrees to carry out further monitoring … on the ecosystem to the satisfaction of the City of London ....*"
9. Highland Ridge	• Wetlands: Buttonbush thicket swamp, willow thicket swamp, forb marsh • Sugar Maple-White Oak forest with American Chestnut, False Hop Sedge, and Yellow Mandarin • Lowland communities	None	Wildlife diversity and abundance monitoring was undertaken for two sequential years along with vegetation community monitoring.	None	"28(am)*The Owner shall implement the approved monitoring program of wildlife diversity and abundance through all stages of development on the site, all to the satisfaction of the General Manager of Planning and Development*." Note: The monitoring design was stratified across the vegetation community types but had no replication.

[9] There appears to be a discrepancy in this case: the EIS (2000) states a wetland evaluation was done (using OWES 1993) and classified the wetland as Class 4 to 7, so locally significant in London. However, correspondence from the City's Ecologist Planner in 2009 indicates that she thinks the wetland should have been classified as Class 1 to 3 which would have made it a Provincially Significant Wetland.

It is increasingly recognized that in order to effectively integrate natural areas in urbanizing environments, the residents who will be living in these communities need to respect the value of these areas and even take some ownership of them in terms of helping to steward them. As shown in **Table 10**, about half of the case study EIS recognized that stewardship is an important component of post-construction management and monitoring, and recommend one or more measures to educate and engage the local community.

Standard recommendations include:

- Development of a brochure on how to be a good neighbour to your local natural area
- Providing access to support engagement, but also trying to control or manage that access to minimize encroachments and impacts to the feature
- Identifying local partners with whom to engage

Notably, stewardship recommendations were not provided by the most current EIS, which would appear to be an oversight. It is also interesting that the two sites with the highest average number of encroachments per segment and per lot (Black Maple and Applegate Lambeth) are the only two sites for which stewardship manuals/brochures were not distributed to homeowners as a condition of the subdivision agreement. In addition, it would appear that the trail network recommended for Talbot Village fails to balance appropriate access with ecological protection (i.e., access points to the wetland every 200 m seems excessive for a natural area of this size).

London has a City-wide guide to "Living with Natural Areas" (last updated in 2010), and has also developed a number of site-specific guides tailored to a specific community and adjacent ESA. However, these flyers are not re-circulated after the initial circulation to new homeowners and the recommended partnerships have not been actively pursued due to lack of resources (B. Bergsma, pers. comm., Aug. 2013)

3.6 Adaptive Management

QUESTION: If validation monitoring occurred, were any actions taken in response to findings, if required?

As illustrated in **Table 9**, in most cases where monitoring is recommended, there are also some measures in place to try and ensure compliance, and that the developer pay for any mitigation required to remediate a natural heritage situation. The City has also, to their credit, established thresholds with many of these indicators that, if they are surpassed, trigger a specified level of compensation.

Although we did not document any responses first hand as part of our review, we were provided with some erosion control logs that documented responses to the storm water pond at Powell Drain breaching as a result of a significant storm event. This log illustrated a rapid response time and continued regular verification of the situation over almost a year following the breaching event.

Table 10. Overview of stewardship recommendations and implementation

Case Study	Stewardship Measure(s) Recommended	Stewardship Measure(s) Implemented*
1. Stoney Creek	• None	• None
2. Hunt Club West	• Homeowner brochure for Kains Woods ESA developed • Stewardship program (i.e., Earth Day, Weed Removal Day, Spring Bird Count, Nature Monitoring, Fall Arbour Day, Fall Owl Hoot) recommended as part of the Environmental Management Plan • Partnership between the Hampton Group to establish an Environmental Trust or Stewardship Group recommended as part of the Environmental Management Plan	• Homeowner brochure for Kains Woods ESA developed and assumed to have been circulated at least to first homeowners • Stewardship Program and partnership never pursued
3. Applegate Lambeth	• EIS recommends public education about living next to an ESA be circulated and community stewardship activities be undertaken, along with a well marked trail to control access	• Homeowner brochure does not appear to have been developed or circulated • Trail management not implemented
4. Warbler Woods West	• Homeowner brochure for Warbler Woods West ESA	• Homeowner brochure for Warbler Woods West ESA developed and assumed to have been circulated at least to first homeowners
5. Sunning-dale Corlon	• EIS recommends public education about living next to an ESA that includes “green” markers in the community • Sunningdale Community Plan (1998) “*A public education program for areas outside the ESA boundary is necessary to encourage wildlife-friendly landscaping for private yards, portions of public parks, and any large institutional or condominium ownership blocks*.”	• Site-specific public education not implemented beyond development of the homeowner brochure, which does not mention that gates should not be installed in the fencing
6. Powell Drain	• Homeowner brochure for Uplands Crossing	• Homeowner brochure for Uplands Crossing developed and assumed to have been circulated at least to first homeowners
7. Talbot Village	• Integration of a multi-regional trail and watercourse crossing, as well as multiple pedestrian access points	• Staff are currently reviewing the Talbot Village trail implementation and anticipate completion in 2013/2014
8. Black Maple	• No stewardship initiatives were recommended	• No stewardship initiatives were implemented
9. Highland Ridge	• No stewardship initiatives were recommended	• No stewardship initiatives were implemented

* The current status of the various stewardship items was verified with City staff

4. Discussion of Report Findings

This study represents an important first step in trying to fill the information gap with respect to the effectiveness of the EIS process in the City of London. However, it is important to acknowledge that while providing useful information, this study is neither scientific (i.e., the assessments were not designed for any type of statistical analyses) nor definitive. Nonetheless, this assessment of nine case studies has provided a useful review of some of the City's practices related to EIS, provided a number of insights, and has pointed to some areas for potential improvement in these practices.

In addition, this study does not represent a simple "apples for apples" comparison. While the sites share a number of characteristics (e.g., all were proposals for residential development adjacent to natural heritage features identified as significant through the planning process in the City of London), each site is also unique (e.g., contains different types and sizes and natural heritage features, as well as different development configurations and designs). Furthermore, the Environmental Impact Studies (or in some cases Environmental Reviews or Management Plans) completed in support of the various applications differ in terms of the scope and detail of recommendations made concerning natural heritage. Therefore, verification of the implementation of approved measures in the field several years after the fact was not always straightforward. While we have attempted to extract as many useful results as possible from the available information, and identify trends and/or opportunities for improvement where possible, in general our findings should be viewed as potential trends and preliminary results based on a close and thorough review of a relatively small sample size of case studies.

Further discussion related to each of the six types of evaluation identified for this study is provided in the following sections.

4.1 Baseline Evaluation: Discussion of Data Collection Standards

In general, the data collection for the EIS case studies was reasonably consistent with the City's Data Collection Standards for Ecological Inventory, although there were a couple of cases where older data from other studies (Subwatershed and/or Community Plans) was largely relied upon and should have been updated. One common element that became apparent was that none of the studies, except for one, included a simple table summarizing the type and date of inventory. A requirement for such a table (as well as the names of the surveyors involved) is included in the City's current Environmental Management Guidelines, and should be specifically requested as part of the review process.

While our review of the City's data collection standards for ecological inventories (currently contained in Section 2 of their Environmental Management Guidelines (EMG), last revised Jan. 2007) found that they are quite comprehensive, we have identified some opportunities for minor updates:

- Inventory Protocol: The "five-season" breakdown of timing windows for studies that may be required is a useful refinement of the typical "three-season" characterization, but overlooks some timing windows specific to some wildlife groups that may also need to be considered as part of the EIS process. For example, the third timing window for late breeding amphibians and some reptiles (i.e., June) and the winter survey window for owls (late winter / early spring) are not specified.

- Special Requirements for Species at Risk: Mention should also be made of some of the new and evolving protocols from OMNR related to certain endangered and threatened species that go above and beyond the standard survey protocols, and the need to pre-screen specifically for Species at Risk, and then follow-up with OMNR and include applicable species-specific survey protocols if any records arise through the pre-screening process. For example, current draft guidance includes requests for three survey visits to confirm Bobolink habitat use rather than the standard two visits for breeding birds.

- References: A number of the references in this section have been superseded by more current versions of documents / publications and should be updated. These include:
    - NHIC rare plant list by Oldham 1996 has been superceded by Brinker 2009
    - Breeding Bird Atlas by Cadman 1987 has been superceded by a 2005 version
    - OMNR Species at Risk lists under COSSARO are being updated regularly and the reference should simply be the website

These updates and/or improvements should be considered as part of future amendments to Section 2 of the EMG.

4.2 Policy Compliance Evaluation: Discussion of Policy Conformity

The nine case studies selected were all development applications that were accepted by the City between 1997 and 2004, except for the Black Maple site (#8) which was accepted in two phases in 1990 and 1992. Therefore, in all cases except for Black Maple (#8), the 1997 Provincial Policy Statement (PPS) would have been in effect. The natural heritage policies in 1997 PPS are as follows:

> *2.3.1 Natural heritage features and areas will be protected from incompatible development.*
> *a. Development and site alteration will not be permitted in:*
> - *significant wetlands south and east of the Canadian Shield; and*
> - *significant portions of the habitat of endangered and threatened species.*
>
> *b. Development and site alteration may be permitted in:*
> - *fish habitat;*
> - *significant wetlands in the Canadian Shield;*
> - *significant woodlands south and east of the Canadian Shield;*
> - *significant valleylands south and east of the Canadian Shield;*
> - *significant wildlife habitat; and*
> - *significant areas of natural and scientific interest*
>
> *if it has been demonstrated that there will be no negative impacts on the natural features or the ecological functions for which the area is identified.*
>
> *2.3.2 Development and site alteration may be permitted on adjacent lands to a) and b) if it has been demonstrated that there will be no negative impacts on the natural features or on the ecological functions for which the area is identified.*

2.3.3 The diversity of natural features in an area, and the natural connections between them should be maintained, and improved where possible.

While similar to the 2005 PPS in terms of the basic natural heritage feature categories identified for protection, and the two-tiered approach to protection for these features, the 1997 PPS lacks the policy language that speaks to a systems approach, long term protection, diversity and restoration introduced in the 2005 PPS. The 1997 PPS also stated that municipal Official Plans had to "have regard for" the applicable natural heritage policies of the Province, while the 2005 PPS changed this to a requirement for municipalities to "be consistent with" the applicable natural heritage policies. While the 1997 PPS provided a solid basis for protection of the various components of a natural heritage system, it did not emphasize the need for the maintenance of connectivity, and consideration of diversity and restoration as part of long-term protection in the way that the 2005 PPS does.

The City of London Official Plan which was in place for all nine case studies, with the exception of Black Maple (#8) is OPA 88. With respect to natural heritage, OPA 88 is somewhat more progressive than the 1997 PPS in that it embeds the principle of taking an "ecosystem approach", going beyond no net loss by encouraging net gains in environmental quality, and directs the City to develop and implement a monitoring program.

In general, the level of compliance of the various EIS with the policy documents in place at the time was fairly good, with a few exceptions. However, the level of compliance was difficult to assess definitively because of the lack of a table or section dedicated to policy compliance in any of the EIS, or related environmental studies. These studies, for the most part, referenced the appropriate documents and stated they had been considered, but did not explicitly illustrate how policies were compliant. The inclusion of a more systematic policy compliance section or table in future EIS would facilitate the review process, and require proponents to be explicit about their policy interpretations.

In addition, we observed that the scope and level of detail of natural heritage in the Community Plans was relatively high level. If more detail and direction related to natural heritage were provided at this planning scale, this would facilitate implementation of EIS and other smaller scale environmental studies at the site scale, and may help avoid the exceptional cases where natural heritage policies are interpreted contrary to the City's intent.

4.3 Implementation Evaluation

The high degree of variability in the extent to which EIS (and Environmental Management Plan) recommendations got carried forward into the final Subdivision Agreements is notable. Overall the average rate of "carry forward" across eight of the cases studies (excluding #8 because no EIS was completed) is less than half (i.e., 46%). Some of this is attributable to the Subdivision Agreements simplifying some of the EIS recommendations, as well as some of the issues identified being resolved following finalization. However, the relatively low rate of carry forward is also attributable, in part, to some EIS recommendations being either intentionally dropped (e.g., perhaps due to cost of implementation or challenges around feasibility) or overlooked through the planning process.

The latter issue can be addressed by requiring EIS to include a concise summary of all recommendations in conclusion, as well as by ensuring that a City Planner with natural heritage /

ecological expertise is involved in the development and finalization of all Subdivision Agreements to ensure all the appropriate recommendations are ultimately carried forward.

The results of the buffers and fencing analyses also provide some food for thought, particularly considered in conjunction with some of the encroachment results in **Section 3.4**. It would appear that the City has taken a position that un-gated fences between natural areas and the backs of residential lots is an effective tool for minimizing encroachments. Indeed, the case study field work showed that both the incidence and extent of encroachments were consistently greater behind lots without gates, and somewhat greater behind lots with gated fences, than behind those with un-gated fences. This finding is consistent with recent findings by McWilliam *et al*. (2010) who studied almost 200 rear yards abutting municipally-owned natural areas across southern Ontario and found that the most effective design approach for minimizing encroachments was fencing without gates. This suggests that the City is on the right track with its current approach requiring un-gated fencing as a mitigation measure.

The findings related to buffers are harder to interpret. In general, it did not appear that the presence or absence of a buffer influenced the presence or extent of encroachment. However, encroachments were almost entirely limited to the first 10 m from the rear lot line[10], and largely limited to the first five m. Therefore where there was little or no buffer, the encroachments observed extended into the natural area, whereas where there were buffers, the encroachments were largely "absorbed" by the buffer zone, presumably minimizing the direct impact on the protected natural area. Consequently, a 5 m to 10 m buffer could be an effective planning tool to mitigate the impacts of encroachments alone (setting aside the other potential functions of buffers) along the residential / natural area interface.

Although the City's Guidelines for Determining Setbacks and Ecological Buffers (Council approved April 20, 2004) were not in effect for any of the case studies examined, the City asked us to consider these guidelines in relation to our findings and provide some comment based on our expertise on this topic. The authors of this report recently completed a literature review of ecological buffers (Beacon Environmental 2010) for a consortium of conservation authorities in and around the Greater Toronto Area and note which included a review of hundreds of scientific papers on the topic. This review and discussions with the conservation authorities, brought us to the same fundamental position established by the City of London regarding buffers: basically there is no simple "one size fits all" solution for buffers, but there is adequate science to support some low end minimums, so the most defensible solution is to establish reasonable minimums and then increase widths, where appropriate, based on site-specific considerations (e.g. soils, topography, vegetative structure of the buffer, etc.).

There are, however, several notable areas of discrepancy between the direction provided in the City's guidelines, and our findings, including the following:

- London's guidelines state "*impacts generally expected from urban development can often be avoided or mitigated*" with buffers, whereas our opinion is that buffers can mitigate some impacts, but cannot be expected to compensate for broader system-wide natural heritage deficiencies.
- London's guidelines also ascribe functions to buffers beyond protection of the feature from impacts associated with adjacent lands used (e.g., contribution to habitat and species diversity), whereas our opinion is that buffers primarily function as protection tools. Although

[10] This finding is also consistent with the McWilliam *et al.* (2010) study that found that 95% of encroachments occurred within the first 20 m from the lot line, with the greatest concentration of encroachments within the first 10 to 12 m from the lot line.

they may provide some other functions incidentally, they should not be identified based on these "incidental" functions.

- The City's guidelines do not speak to potential opportunities for reducing buffer widths through design measures as part of the process for buffer establishment.
- Buffers that are wider and/or contain a variety of habitat types are not necessarily more effective; as stated above they should not be used to compensate for other deficiencies in a natural heritage system.
- While the minimums identified in the guidelines for different habitat types are within the "moderate" risk ranges identified through our research, some of them are a bit high for "minimums".

These discrepancies aside, we also agree strongly that the boundary of the buffer must be outside the rear lot lines. It was evident through this study, and has been verified through our experience in other municipalities, that expecting homeowners to voluntarily retain a portion of their rear yards as naturalized space continuous with the adjacent natural area is rarely effective, and created potential management headaches for the municipality.

4.4 Effectiveness Evaluation

It is encouraging that more than a decade since the implementation of the various EIS, the overall area (i.e., hectares) and general habitat types of natural areas identified for protection have been maintained. In addition, we found that no previously existing local-scale linkages within the sites or in the immediately adjacent lands had bene compromised as a result of the proposed developments. This speaks to the general effectiveness of the EIS process, at least on a couple of lewith respect to overall quantity and physical connectivity.

There are, however, indications that some vegetation communities are losing native diversity and undergoing shifts in composition as a result of development on the site and/or in the broader landscape. For example, the plant diversity at Stoney Creek appears to have decreased almost 50%, while the vegetation at Powell Drain appears largely unchanged. In some cases, such as the Black Maple forest, there appears to be minimal change to the vegetative structure and composition of the dominant species, but the absence of regeneration of this species suggests composition will shift in the future. To what extent these changes are a response to the impacts of development, and to what extent they reflect the naturally dynamic nature of ecosystems is hard to discern.

Fencing, in general, in the residential rear lot-natural area interface, appears to be an effective mitigative tool for minimizing encroachments. However, many of the sites had a combination of gated and ungated fences along the rear property lines abutting the natural area, so it is difficult to compare the effectiveness of gated fences versus non-gated fences at deterring encroachments. Nonetheless, it is noteworthy, that the two sites with no gated access to the natural area (Highland Ridge and Stoney Creek) both had the lowest number of encroachments per segment. Sunningdale Corlon had only a slightly lower average number of encroachments per lot (0.72) compared to Stoney Creek (0.75) and the majority of fenced lots at Sunningdale Corlon were also without gates. Conversely, Powell Drain also had very few gated fences, but had the third highest average rate of encroachments per segment, possibly attributable to a very high number of encroachments along segment "J", which

has several unfenced lots abutting the protected area. This suggests some influence among neighbours.

4.5 Validation Evaluation: Discussion of Short and Long-term Monitoring

OPA 88, the Official Plan policies in effect for all of the case studies except for one, directs the City to develop and implement a monitoring program "*to measure changes in environmental quality and assess the effectiveness of the Official Plan's environmental goal, objectives and policies*" (policy 2.9.3) and also stipulates that an EIS shall include "*a monitoring plan to measure the potential effects on the environment if demonstrated to be necessary"* (policy 15.5(d)). The current Official Plan (2006) also stipulates that an EIS shall include "*an implementation strategy for mitigation measures including a monitoring plan to measure the potential effects on the environment if demonstrated to be necessary"* (policy 15.5).

This monitoring appears to be undertaken, in an inconsistent manner, through the Subdivision planning process, at least for the first couple years following build out for some sites. Although where it has been undertaken, it has been done quite thoroughly. The big question is, though, what is the data collection informing? While site-specific plant and monitoring data can be informative, if the study has not been set up with replicates or stratified appropriately, then it can't be used to try and identify any trends in relation to impacts potentially caused by the new development.

As discussed in **Section 1.2**, while encroachments can be readily assessed and monitored on the site-specific scale, changes in species populations and vegetation community composition are very difficult to attribute to land use changes on a site-specific scale, particularly as part of short-term (i.e. one to three year) studies.

If the City is interested in developing a better understanding of shifts in species (e.g., breeding birds) composition in response to land use changes, we suggest a carefully designed and well-replicated study with controls be established that allows for systematic data collection over an extended period (e.g., at least five years but ideally more than a decade) on a City-wide scale. The City could consider requiring development proponents to contribute to a monitoring fund as part of their required monitoring through the approval process, and these funds could be dedicated to the establishment of such a study and the subsequent data collection, analysis and reporting. UTRCA may be willing to be a partner in this endeavour, as may others, and it may be possible to secure some funding and/or technical support through organizations such as the Trillium Foundation.

4.6 Adaptive Management: Adjusting to New Information

It appears from our review that the City is already quite responsive to new information, and both willing and able to adapt. This was illustrated in the rapid and thorough response to the breach in the storm water ponds beside Powell Drain, and is also illustrated in the ongoing development and updating of the City's Environmental Management Guidelines (2007) which strive to integrate the most current scientific and technical findings in the field.

However, there does appear to be some lack of implementation and / or follow-through with respect to the various stewardship initiatives identified through the EIS and Draft Plan process (as shown in

Table 10). As in many municipalities, this is likely related to a lack of staff resources to undertake this additional work, as well as the tendency to let follow-up monitoring commitments that may be considered "less important" slide once Draft Plan Approval is given. However, this represents a key area for potential improvement in the City's practices. The private residential landowners are, as described in **Section 3.4**, responsible for most (if not all) of the edge encroachments documented into adjacent natural areas, and therefore educating them about how to minimize their impacts on adjacent natural areas, and fostering community stewardship for these local natural areas, is the only way to address these types of impacts.

The City is working with the UTRCA to better monitor and educate landowners about edge encroachments. This work would be complimented by implementing the additional recommendations identified in the approved EIS (as per **Table 10**).

4.7 Study Conclusions

The following conclusions are based on the study findings described in **Section 3** and discussed in **Sections 4.1 through 4.6**.

As shown in **Table 11**, most of the nine case studies complied with the data collection standards (baseline) as well as the natural heritage policies in effect at the time. However, key gaps were identified with respect to:

- IMPLEMENTATION: i.e., many recommendations made in the EIS were only carried forward to the Subdivision Agreements in part, or in some cases not at all, and
- VALIDATION: i.e., specific recommendations for follow-up on the extent to which mitigation measures related to terrestrial ecology were implemented during or after construction were not made in most EIS or Subdivision Agreements.

The "on the ground" effectiveness of the EIS process is difficult to fully assess on a site-specific basis and, without long-term and systematically collected data, can only be assessed in a limited way. Based on the case studies reviewed, the EIS process in London between 1990 and 2005 appears to have been reasonably effective at protecting the natural areas identified as significant on an area (i.e., hectare for hectare) basis. It has also been effective at maintaining pre-existing ecological connections between protected natural areas.

However, the plant species composition and diversity of some of the significant features protected appears to have changed in a post-development context. A number of the protected wetlands appear to have undergone shifts in species composition and diversity. These changes may be related to the changes in adjacent land uses associated with the actual EIS assessed, and/or other land use changes in the broader landscape. Although the overall quantity of water going to a wetland feature may be reasonably well maintained after development, urbanization often affects the frequency of water level fluctuations, as well as the degree of fluctuation in a given season or year, which can in turn affect the plant species composition and diversity. Changes in water quality, which were not assessed as part of this study, can also play a role. Responses of vegetation communities to such changes also tend to be quicker in herbaceous wetlands, as opposed to communities dominated by trees and shrubs that take longer to respond to environmental changes.

Table 11. General answers to the questions assessed through this study

Type of Performance Evaluation	Study Specific Question	General Findings
Baseline	1) (a) Did the Environmental Impact Studies (EIS) follow the data collection standards for terrestrial natural heritage features and functions in place at the time? (b) Based on the data collected, what were the key ecological features and functions identified in the EIS for protection from negative impacts?	1a) In most cases, yes 1b) In all cases significant wetlands, woodlands and/or valleylands (as well as associated watercourses) were identified for protection. In many cases these included significant habitats, hydrologically sensitive areas, and areas with ecological linkage functions.
Policy Compliance	2) Did the Environmental Impact Studies (EIS) consider all the relevant policies terrestrial natural heritage features and functions in place at the time?	2) In most cases, yes
Implementation	3) Were the recommendations identified in the Environmental Impact Studies (EIS) carried forward to the (a) Draft Plans, (b) Subdivision Agreements, and (c) the actual site?	3a) and 3b) In many cases, recommendations were not all carried forward from the EIS. In some cases, new recommendations were introduced to the Subdivision Agreement. 3c) Most recommendations that were carried forward to the Subdivision Agreement appear to have been implemented, but a number of them could not be verified in retrospect.
Effectiveness	4) Were the mitigation measures effective at (a) achieving no net loss of the area identified for protection, (b) preventing readily apparent impacts to the protected area related to the change in adjacent land use, and (c) protecting the key features and ecological functions for which the area was identified as significant and protected.	4a) yes 4b) In part - in a number of cases the wetlands appear to have experienced some changes in plant community composition, possibly as a result of changes in adjacent land uses 4c) This question could not be answered through this study beyond the findings for 4a and 4b.
Validation	5) Were there processes in place to (a) verify implementation at the site level, and (b) verify effectiveness of terrestrial natural heritage protection / mitigation / compensation measures?	5a) and 5b) Requirements for any type of site inspection / supervision during or after construction were only identified in a third of the case studies. Monitoring undertaken at two of the three cases where it occurred did not verify the effectiveness of recommended measures on any level.
Adaptive Management	6) If validation monitoring occurred, were any actions taken in response to findings, if required?	6) In one case where monitoring detected an issue, procedures were put in place to ensure corrective actions were effective.

Specific conclusions that we have drawn from the assessment of the nine case studies that spanned from the early 1990's to 2005 related to the City of London's EIS process are as follows:

1) **The EIS were generally compliant with data collection standards and natural heritage policies in placed at the time, although compliance would have been easier to ascertain with the inclusion of summary tables for each of these in the EIS.**

2) **There were gaps in the number and level of detail of EIS recommendations that were carried forward to the Subdivision Agreement.**

3) **Natural heritage features identified for protection through the EIS process have, on a hectare per basis, been maintained, as have site-specific linkages to and from these features.**

4) **Some changes to the quality (i.e., plant species composition) of some of these natural areas, in particular the wetlands, were observed, which appear to be related to changes in surface water quality and / or quality. These changes may be related to one or more of the following: site-specific development-related impacts, broader scale urbanization and/or inadequate post-development monitoring and management.**

5) **Encroachments (e.g., mowing, dumping of yard waste, placement of structures, informal trail creation) between the rear lot lines and the first 30 m of the adjacent protected natural areas (and their buffers where applicable) occurred in all sites, but were largely restricted to the first 10 m from the rear lot lines and appeared to be less frequent where rear lots were fenced and gated. In addition, very limited data suggested the presence of formal trails between rear lot lines and protected natural areas may reduce the incidence of some types of encroachments (i.e., mowing, structures, landscaping) but not others (e.g., informal trail creation).**

6) **The presence of buffers of approximately 4 m to 10 m between rear lot lines and protected natural areas did not appear to affect the frequency or types of encroachments, but where the buffers did exist they were able to "absorb" the impacts of most of the encroachments, whereas where they were not in place the encroachments occurred directly within the natural area.**

7) **The monitoring undertaken was inconsistent and generally short-term. Specifically, follow-up on the extent to which approved mitigation measures related to terrestrial ecology were implemented during and/ after construction was inconsistent. Short-term monitoring studies undertaken varied in their level of detail and were not tied to any adaptive management.**

8) **The City has been quick and thorough in its responses to reported issues related to storm water management.**

9) **Although the City has a number of stewardship measures (e.g., information booklets, signs) in place, there are opportunities to improve support of stewardship to reduce incidences of encroachments, while potentially engaging local residents in basic natural area care.**

5. Recommendations

The performance evaluation completed as part of this study was also to include a critical review of City policy documents relevant to the EIS process to identify any potential gaps or opportunities for improvement, as well as input form City staff and key representatives of the development community with extensive experience with the implementation of EIS in the City of London over the past decade or so. Therefore, the following recommendations incorporate considerations from:

- the findings of the desktop and field assessments completed as part of this study related to the nine case studies (as summarized in **Section 4.7**)
- a critical review of relevant sections of the City's 2007 Environmental Management Guidelines (EMG) (i.e., Sections 1, 2 and 5) and Official Plan (i.e., Chapter 15, Environmental Policies)
- input provided by City staff and representatives of the development community[11] based on their experience related to the implementation of EIS in the City, and
- the consulting team's experience with similar situations in other municipalities in southern Ontario.

The recommendations are discussed in **Sections 5.1 through 5.4** and summarized in **Section 5.5**.

5.1 Recommendations for the City's Environmental Management Guidelines

As part of this study we were asked to consider the three following sections of the City's Environmental Management Guidelines (last revised January 2007) (EMG):

- Section 1.0: Guidelines for the Preparation and Review of Environmental Impact Studies (EIS)
- Section 2.0: Data Collection Standards for Ecological Inventory
- Section 5.0: Guidelines for Determining Setbacks and Ecological Buffers

SECTION 1.0: In general these guidelines are comprehensive and lay out a good process. The guidelines could, however, be updated to:

- incorporate adjacent lands triggers as provided in Table 4-2 of the 2010 Natural Heritage Reference Manual (Ontario Ministry of Natural Resources)
- require a specific requirement for a policy compliance section or table (to facilitate the review process, and require proponents to be explicit about their policy interpretations).

In addition, we observed that the scope and level of detail of natural heritage in the Community Plans reviewed was relatively small and coarse. If more detail and direction related to natural heritage were provided at this planning scale, it would facilitate implementation of EIS and other smaller scale environmental studies at the site scale, and may help avoid the exceptional cases where natural heritage policies are interpreted contrary to the City's intent. Notably, more current Community Plans,

[11] Input was provided by Jim Kennedy, President of the London Development Institute, and Dave Hayman, a Senior Scientist at BioLogic, through discussions held at the City on September 26, 2013 and a subsequent memo dated Feb. 8, 2014.

Area Plan and Secondary Plans do contain more natural heritage data than these older plans (L. McDougall, pers. comm. Sept. 2013). Nonetheless, Section 1.0 of the EMG should be updated to reflect these requirements.

SECTION 2.0: In general, our review of these standards found that they are comprehensive and provide good guidance for the various aspects of data collection that may need to be addressed as part of an environmental study. Opportunities for minor updates identified include:

- Inventory Protocol: The "five-season" breakdown of timing windows for studies that may be required is a useful refinement of the typical "three-season" characterization, but overlooks some timing windows specific to some wildlife groups that may also need to be considered as part of the EIS process. For example, the third timing window for late breeding amphibians and some reptiles (i.e., June) and the winter survey window for owls (late winter / early spring) are not specified.

- Special Requirements for Species at Risk: Mention should also be made of some of the new and evolving protocols from OMNR related to certain endangered and threatened species that go above and beyond the standard survey protocols, and the need to pre-screen specifically for Species at Risk, and then follow-up with OMNR and include applicable species-specific survey protocols if any records arise through the pre-screening process. For example, current draft guidance includes requests for three survey visits to confirm Bobolink habitat use rather than the standard two visits for breeding birds.

- References: A number of the references in this section have been superseded by more current versions of documents / publications and should be updated. These include:
    - NHIC rare plant list by Oldham 1996 has been superceded by Brinker 2009
    - Breeding Bird Atlas by Cadman 1987 has been superceded by a 2005 version
    - OMNR Species at Risk lists under COSSARO are being updated regularly and the reference should simply be the website

SECTION 5.0: Vegetated buffers around natural heritage features identified for protection are one, of many, mitigation tools that can be used to minimize and mitigate impacts related to some of the changes in the adjacent lands associated with development. As part of this study we examined the effectiveness of established buffers in mitigating encroachments, but found that the presence or absence of a buffer, or the width of the buffer, in and of itself, appeared to have no bearing on the number or extent of encroachments from residential lots into the adjacent natural areas. However, this study did find that encroachments (primarily yard waste dumping and mowing, but also other activities such as introduction of structures and other plant materials) were very common and typically extended about 5 to 10 m from the back of rear lot lines. Therefore, where a buffer of 5 to 10 m between the feature edge and the lot line had been implemented, this area was useful in mitigating the impacts of the encroachments to the extent that the impacted area was in the buffer, as opposed to the feature itself.

Based on our experience, and literature reviewed on the topic of ecological buffers, the application of fixed or standardized buffers is not the most scientifically defensible approach because of the number of site-specific variables that should be considered in appropriate buffer determination. These variables include: local hydrology, slopes, soils, size and sensitivities of the protected feature, and size and nature of the proposed development. The current discussion in Section 5.0 that states there

is no definitive word on what is an appropriate and realistic buffer for urban situations is therefore, in our opinion, appropriate.

The findings in this study support the current guidelines of an absolute minimum of 5 m (and would support a buffer of up to 10 m), not so much to allow for variability along ecological edges, but to mitigate for the encroachments anticipated when residential lots abut protected natural areas. However, there are a number of additional considerations in determining appropriate buffer width (e.g., need to protect water quality of a wetland) that may result in a recommendation for a wider buffer. Conversely, there may be cases where the site design or structure of the buffer may justify a slightly narrower buffer. For these reasons, even if it may be more expedient from a planning process perspective to identify and enforce simplified and standardized buffers, from a scientific perspective it remains more defensible to incorporate some flexibility in buffer width determination.

Based on the findings of this study, we do not recommend any changes to the City's buffer guidelines (Section 5.0 of the EMG) at this time.

5.2 Recommendations for Policy and Process

Based on the review and assessments conducted as part of this study, including discussions with City staff and representatives from the development community, we found that, in general, Chapter 15 of the City's Official Plan (2006) provides sound policy direction with respect to natural heritage feature protection, including provision of specific criteria for the identification of Environmentally Significant Areas (ESAs) and Significant Woodlands, two feature categories that need to be defined by the local planning authority (rather than the Province, as is the case with Provincially Significant Wetlands and Areas of Natural and Scientific Interest). In addition to providing sound natural heritage policy direction that is consistent with the Provincial Policy Statement, Sections 15.1 through 15.3.3 of the Official Plan lay out a clear process for verifying the various natural heritage features, both evaluated and unevaluated.

One minor gap identified is that policy Section 15.3.4, Public Ownership / Acquisition, does not specifically mention the possibility of including buffers as part of the natural heritage area acquisition process.

The policies also include:

- a comprehensive list of options for encouraging practices supportive of natural heritage objectives on privately owned lands (in Section 15.3.5)
- ecological buffer policies (Section 15.3.6) that recognize tools other than buffers are often needed to manage and mitigate impacts to protected natural heritage associated with changes in adjacent land uses in urbanizing settings
- a section (Section 15.3.7) that identifies management and rehabilitation priorities, and
- unique descriptions of each Environmentally Significant Area (ESA) in the City (Section 15.4.1), along with the criteria for their identification.

One minor gap identified is the need to consider updating Table 15-1, Areas Subject to Environmental Impact Study Requirements, to be consistent with the most recent Natural Heritage Reference Manual

Guidelines (OMNR 2010), assuming these are all considered appropriate for the City's of London's land use planning context.

In addition, there are also a number of policy-related practices related to natural heritage protection that the Official Plan should continue to support, as follows:

FENCING TO LIMIT ENCROACHMENTS: With respect to the interface between residential rear lots and City-owned natural areas, the City's practice of requiring fences appears to be quite effective at minimizing encroachments (particularly where fences are un-gated) and should be continued.

USE PUBLIC TRAILS TO LIMIT ENCROACHMENTS: Although this study was not designed to assess the role of formal trails in relation to encroachments, very limited data suggests that paved trails between rear lots and City-owned natural areas may limit the incidence of some types of encroachments (e.g., mowing into the natural area), but do not prevent encroachments like dumping of yard waste in the natural area. Further research on this topic is required, but these types of encroachments are likely best addressed through a combination of resident and neighbourhood education, and enforcement of applicable regulations.

To this end, the City may want to consider implementing an encroachment by-law like the one in the City of Mississauga, which regulates unauthorized land uses that extend from private properties into adjacent public natural areas. Proactive enforcement the City's Encroachment By-law (No.0057-2004, available on the City's website), which is intended to regulate unauthorized uses or activities on City lands, has resulted in the reclamation of more than 3 hectares of City-owned natural areas since 2008. This enforcement has included City Forestry staff and By-law staff both enforcing the by-law and working with offending landowners to find mutually agreeable solutions to restoring public natural heritage lands where encroachments have occurred to a natural state.

FOSTER ENGAGEMENT AND STEWARDSHIP TO LIMIT ENCROACHMENTS: There are many tools for increasing awareness among residents and engaging neighbourhoods in the stewardship of the natural areas in their neighbourhoods. The City has already recognized the value in providing pamphlets or brochures tailored to particular areas, but these should be re-circulated periodically. Signs can also be useful, but ultimately to be effective the tools must instill a sense of pride and ownership of the public natural areas, and educate residents on how best to nurture them. Suggestions provided by the development community include providing designated yard waste drop off locations in each neighbourhood, increasing the frequency of yard waste pick-up, and allowing residents who move in prior to 75% completion[12] of a development to landscape their lots (if they desire) as long as they select materials from an approved list of site-appropriate native species.

If possible, additional resources should be targeted to educating and engaging residents on the care of the natural areas in their neighbourhoods, since the long-term sustainability of these features can be significantly impacted, for better or for worse, by their activities within and adjacent to it.

[12] Current practice in the City of London is that subdivisions are not landscaped until the development is at least 75% complete. This is to prevent construction related damage to new landscaping. However, new homeowners sometimes take it upon themselves to landscape.

5.3 Recommendations for the City's Subdivision Approval Process

As discussed in **Section 4**, one of the key gaps identified through the case study assessment was the lack of carry-forward of many of some EIS recommendations to the Subdivision Agreement. This can be addressed by (a) requiring EIS to include a concise summary of all recommendations in their conclusions, and (b) having a City Planner with natural heritage / ecological expertise is involved in the development and finalization of the Subdivision Agreement to ensure that all the appropriate recommendations are carried forward.

In addition, the boundaries of ecological buffers should be outside the rear lot lines. It was evident through this study, and has been verified through our experience elsewhere, that expecting homeowners to voluntarily retain a portion of their rear yards as naturalized space continuous with the adjacent natural area is rarely effective, and creates potential management headaches for the municipality.

5.4 Recommendations for the City's Ecological Monitoring

Another key gap identified by this study is the lack of any type of consistent ecological monitoring being recommended or enforced. This is not unusual as most municipalities lack the resources to undertake or oversee monitoring on various development sites. Nonetheless, immediate follow-up to ensure that the items in the Subdivision Agreement, and the supporting detailed designs, are actually being implemented as approved is an important part of the process, and should be supported to the greatest extent possible. This type of monitoring is fairly straight forward and focuses on items like installation and maintenance of proper silt fencing, as well as tree or vegetation protection.

If the City is interested in developing a better understanding of shifts in species (e.g., breeding birds) composition in response to land use changes, we suggest a carefully designed and well-replicated study with controls be established that allows for systematic data collection over an extended period (e.g., at least five years but ideally more than a decade) on a City-wide scale. The City could consider requiring development proponents to contribute to a monitoring fund as part of their required monitoring through the approval process, and these funds could be dedicated to the establishment of such a study and the subsequent data collection, analysis and reporting. UTRCA may be willing to be a partner in this endeavour, as may others, and it may be possible to secure some funding and/or technical support through organizations such as the Trillium Foundation.

5.5 Summary of Recommendations

Through detailed examination of nine case studies, we found that the policies and practices related to EIS implementation have been effective at ensuring the overall area of natural heritage features identified for protection through the planning process in the City of London. They have also been effective at ensuring that proponents follow established protocols and policies in the execution of their EIS. However, there is some evidence that there are encroachments along the edges of natural areas that may be negatively impacting the ecological functions of these areas. Recommendations to help manage encroachments are provided below.

In addition, there is also evidence suggesting some shifts in the types of ecological communities, in particular the wetland features, possibly as a result of the changes in land uses in the immediate area and/or the broader catchment area. Some shifts are to be expected, and are unavoidable in a context of urbanization, and some shifts may simply be a result of natural successional processes. Assessing if, and to what extent, these shifts are in fact having an overall negative impact on the City's natural areas would require a broader and more comprehensive study at a larger scale (e.g., watershed) rather than a site-specific scale.

At the site-specific scale, the findings of this study indicate that the City's former and ongoing practice of requiring fencing between the backs of lots and public natural areas has been quite successful in minimizing encroachments, and that putting public trails between the backs of lots and public natural areas may limit at least some types of encroachments (e.g., mowing). The establishment of buffers also appears to have been effective in reducing encroachment impacts within the feature itself by effectively "absorbing" these impacts within the buffer. As discussed in the report, for encroachment mitigation, buffers of up to 10 m between the feature edge and the rear lot line seem to be adequate. However, some other gaps and opportunities for improvement have been identified.

Specific recommendations related to the gaps and opportunities identified through this study are provided below.

Based on the findings of this study, it is recommended that the City of London implement the following 12 recommendations related to its policies and by-laws, Environmental Management Guidelines, EIS process and ecological monitoring.

POLICIES, BY-LAWS AND ENVIRONMENTAL MANAGEMENT GUIDELINES

1. **Update the adjacent lands triggers for environmental studies as per the current Natural Heritage Reference Manual (OMNR 2010) in the 2007 Environmental Management Guidelines (EMG) and/or the City's Official Plan.**

2. **Add a requirement in Section 1.0 of the 2007 EMG for a policy compliance section or table that:**
    a. **identifies the applicable policies and legislation from the Provincial Policy Statement, City's Official Plan, UTRCA regulations, Species-at-Risk legislation, and any others**
    b. **specifies which policies and/or legislative clauses are applicable to the given site / study area (e.g., presence or absence of significant wetlands)**
    c. **describes, in brief, how the applicable policies have been addressed through the EIS (e.g., through feature protection and/or mitigation to anticipated impacts);**

3. **Develop more specific guidance in Section 1.0 of the 2007 EMG regarding the level of natural heritage data collection required for Community Plans, Area Plans and Secondary Plans (e.g., vegetation communities mapped and identified to Community Series level, verification of the type and extent of fish habitat in watercourses, etc.).**

4. **Make minor updates and expansions in Section 2.0 of the 2007 EMG with respect to:**

    d. **clarifying the inventory protocol**
    e. **adding guidance with respect to the need to address Species at Risk, and**
    f. **updating references to applicable guidance documents as appropriate, and adding text that cites the most current document but indicates that any superceding documents will apply.**

5. **Specifically mention the possibility of including buffers as part of the natural heritage area acquisition process in Section 15.3.4 of the Official Plan.**

6. **Consider developing and implementing an Encroachment By-law (as in the City of Mississauga) to regulate unauthorized land uses, such as encroachments, into public natural areas, and also be used as a tool for outreach and education.**

ENVIRONMENTAL IMPACT STUDY PROCESS AND IMPLEMENTATION

7. **Through the implementation of natural heritage policies:**

    a. **Continue to require fencing (without gates) as well as public trails between back lots and protected natural areas to limit encroachments, and**
    b. **Keep the boundaries of ecological buffers outside the rear lot line.**

8. **Improve and expand engagement and stewardship related to foster broad support for natural heritage protection and management as resources permit. Specific examples related to reducing encroachments into protected natural areas include:**

    a. **Distribution, and redistribution of clear, colourful pamphlets outlining "how to care for the natural area in your neighborhood" every year**
    b. **Advertisements in local community guides and/or newspapers to raise awareness about local natural area stewardship (e.g., "why your yard waste isn't good for your neighborhood woodland or ravine")**
    c. **Installation of signs at the trail heads of community natural areas clearly identifying uses that are not permitted**
    d. **Holding stewardship events in City-owned natural areas to undertake activities such as garbage removal, removal of invasive species that can be pulled or cut by hand, enhancement plantings with site-appropriate native plants, boardwalk construction, etc.**
    e. **Considering providing designated yard waste drop off locations in each neighbourhood and/or increasing the frequency of yard waste pick-up, and**
    f. **Considering allowing residents who move in prior to 75% completion of a development to landscape their lots (if they desire) as long as they select materials from an approved list of site-appropriate native species.**

9. **Ensure EIS recommendations are carried forward to the Subdivision Agreement, as appropriate, by (a) requiring EIS to include a concise summary of all recommendations in conclusion, and (b) ensuring that a City Planner with natural heritage / ecological expertise is involved in the development and finalization of the Subdivision Agreement.**

10. **Allocate staffing resources to ensure that the items in the Subdivision Agreement, and the supporting detailed designs, are actually being implemented as approved. This type of post-construction monitoring is fairly straight forward and would include items like installation and maintenance of proper silt fencing, as well as tree or vegetation protection.**

CITY-WIDE ECOLOGICAL MONITORING

11. **Seek opportunities to work with the Upper Thames River Conservation Authority, and others, to specifically evaluate the ability of public trails between back lots and protected natural areas to limit encroachments.**

12. **Consider undertaking a carefully designed and well-replicated study (potentially with funding from a development–sponsored long-term monitoring fund as well as with support from other non-governmental organizations, and in collaboration with the UTRCA) over an extended period (e.g., ideally more than a decade) on a City-wide scale that measures the current status of key indicators of natural heritage in the City, and compares it with the status of that those same indicators in, say, a decade, and can be replicated in the future.**

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Appendix A

Maps
for Each of the Nine Case Studies

Stoney Creek Monitoring

Figure A-1

London EIS Monitoring Study

Legend

- Encroachment Monitoring Segments
- Butternut
- Created Wetland

First Base Solutions
Web Mapping Service 2010

UTM Zone 17 N, NAD 83

N W E S

0 25 50 100 Meters

1:3,000

BEACON ENVIRONMENTAL

Project 212242
July 2014

Hunt Club West Riverbend Monitoring

Figure A-2

London EIS Monitoring Study

Legend

- Encroachment Monitoring Segments
- Red-backed Salamander

First Base Solutions
Web Mapping Service 2010

UTM Zone 17 N, NAD 83

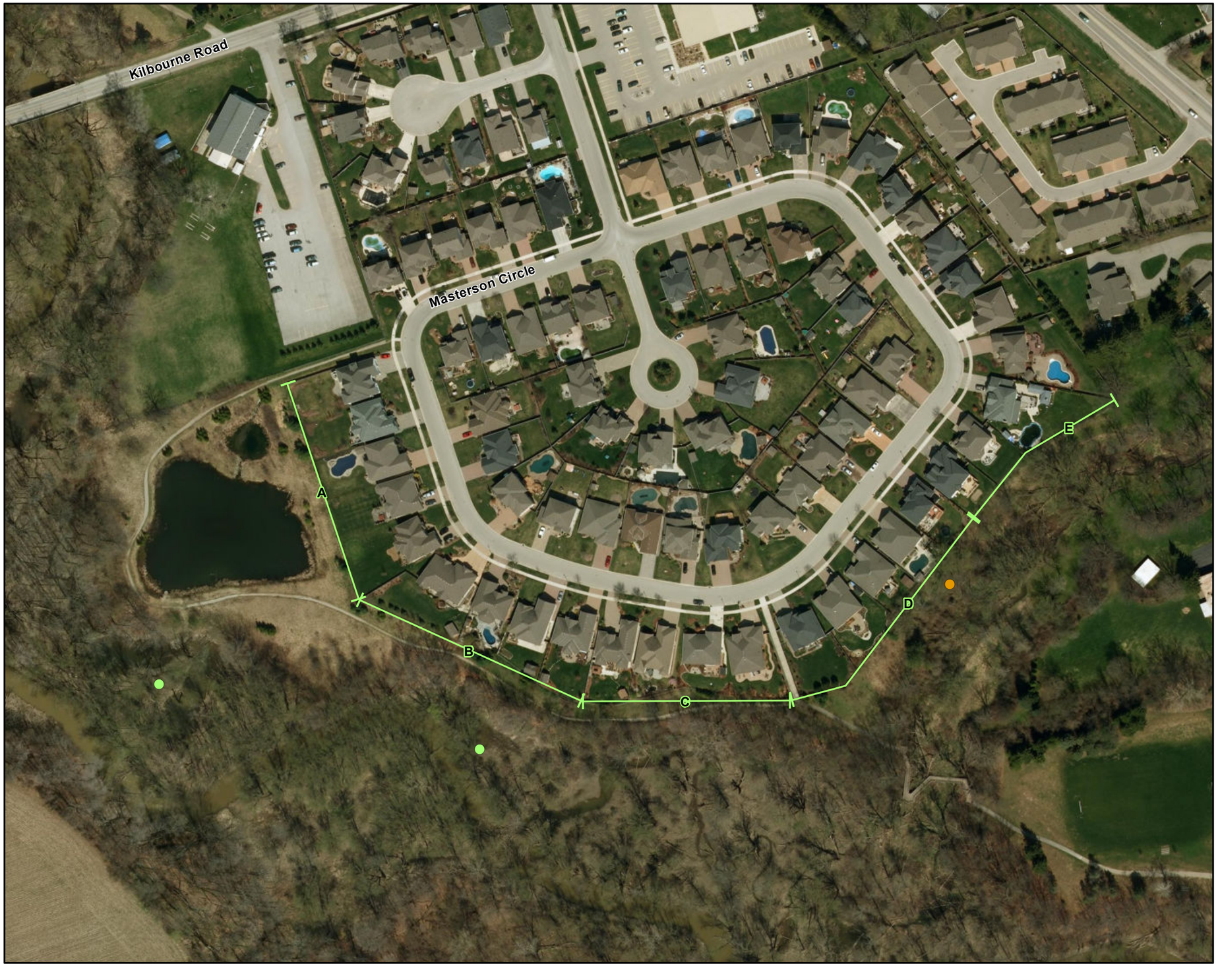
N W E S

0 20 40 80 Meters

1:2,000

BEACON ENVIRONMENTAL

Project 212242
July 2014



Applegate Lambeth Monitoring

Figure A-3

London EIS Monitoring Study

Legend

- Encroachment Monitoring Segments
- Butternut
- Green Dragon

First Base Solutions
Web Mapping Service 2010

UTM Zone 17 N, NAD 83

N
W E
S

0 20 40 80 Meters

1:1,800

BEACON ENVIRONMENTAL

Project 212242
July 2014

Warbler Woods West Riverbend Monitoring

Figure A-4

London EIS Monitoring Study

Legend

Encroachment Monitoring Segments

First Base Solutions
Web Mapping Service 2010

UTM Zone 17 N, NAD 83

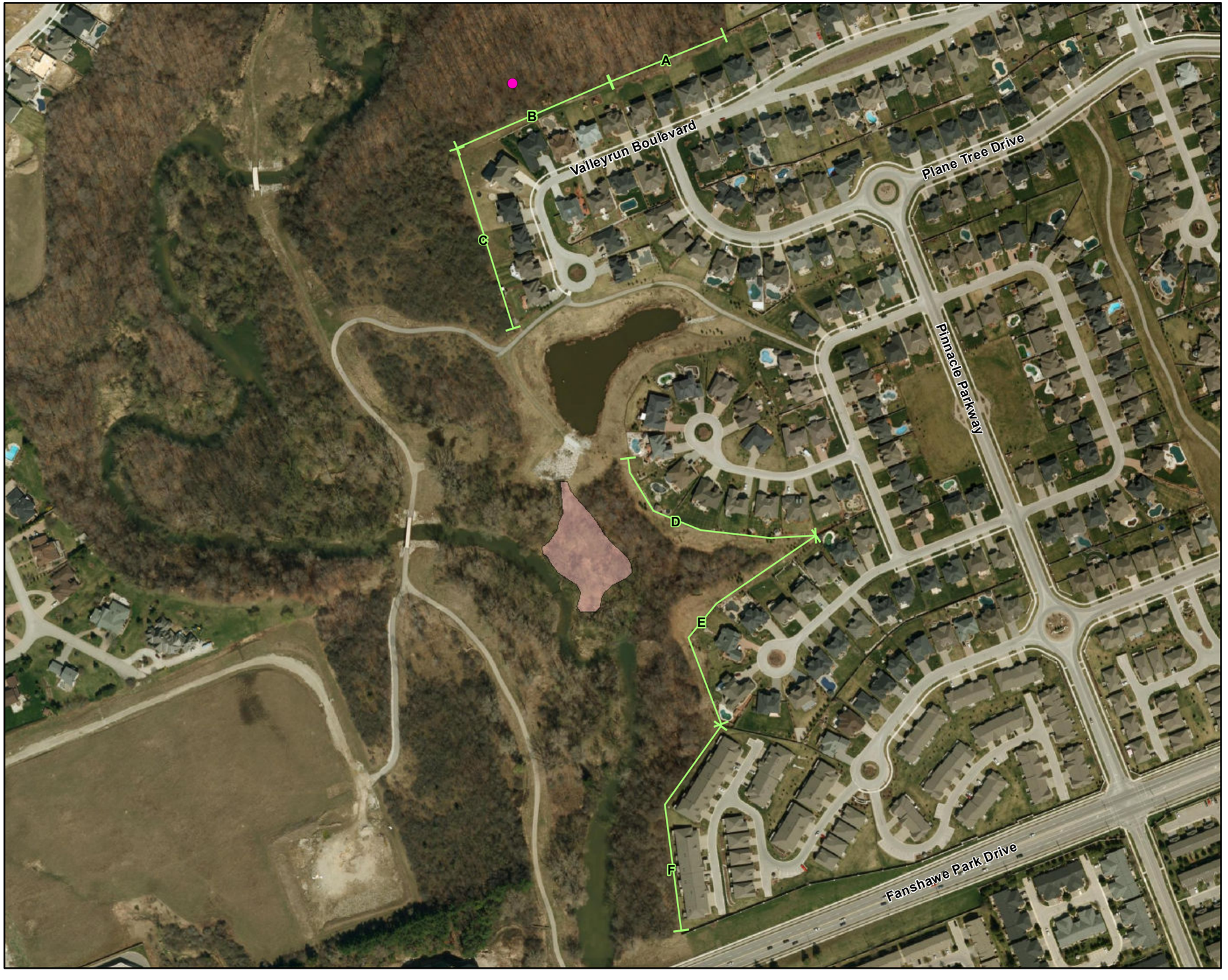
N
W E
S

0 15 30 60 Meters

1:1,700

BEACON ENVIRONMENTAL

Project 212242
July 2014



Sunningdale Corlon Monitoring

Figure A-5

London EIS Monitoring Study

Legend

- Encroachment Monitoring Segments
- Twinleaf
- Riparian Vegetation Downstream of SWM pond

First Base Solutions
Web Mapping Service 2010

UTM Zone 17 N, NAD 83

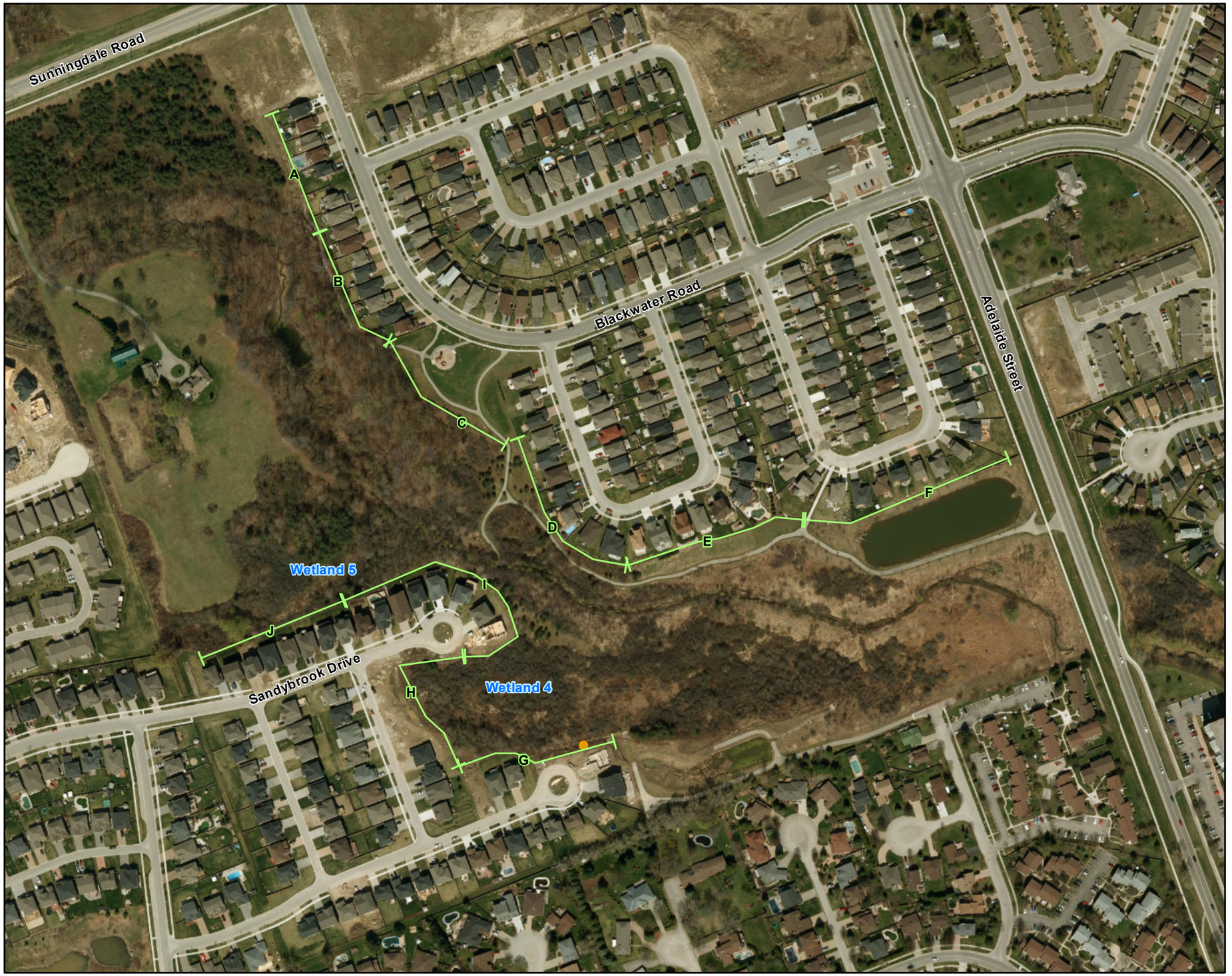
N W E S

0 30 60 120 Meters

1:3,200

BEACON ENVIRONMENTAL

Project 212242
July 2014



Powel Drain Encroachment Monitoring

Figure A-6

London EIS Monitoring Study

Legend

- Encroachment Monitoring Segments
- Butternut

First Base Solutions
Web Mapping Service 2010

UTM Zone 17 N, NAD 83

N W E S

0 25 50 100 Meters

1:3,000

BEACON ENVIRONMENTAL

Project 212242
July 2014

Talbot Village Monitoring

Figure A-7

London EIS Monitoring Study

Legend

- Encroachment Monitoring Segments
- Butternut
- Wetlands

First Base Solutions
Web Mapping Service 2010

UTM Zone 17 N, NAD 83

N
W E
S

0 30 60 120 Meters

1:3,200

BEACON ENVIRONMENTAL

Project 212242
July 2014

Black Maple Monitoring

Figure A-8

London EIS Monitoring Study

Legend

- Encroachment Monitoring Segments
- Black Maple Forest

First Base Solutions
Web Mapping Service 2010

UTM Zone 17 N, NAD 83

N
W E
S

0 25 50 100 Meters

1:2,500

BEACON ENVIRONMENTAL

Project 212242
July 2014

Highland Ridge Crestwood Monitoring

Figure A-9

London EIS Monitoring Study

Legend

- Encroachment Monitoring Segments
- Buttonbush Swamp

First Base Solutions
Web Mapping Service 2010

UTM Zone 17 N, NAD 83

N
W E
S

0 20 40 80 Meters

1:2,250

BEACON ENVIRONMENTAL

Project 212242
July 2014

Appendix B

Data Collection Form for Encroachments Assessment

BEACON ENVIRONMENTAL

GUIDING SOLUTIONS IN THE NATURAL ENVIRONMENT

Natural Area Encroachment Checklist

Developed for the City of London EIS Performance Evaluation Study

Site Name			
Segment in Site (No.)		Photos Taken ☐	
ELC Community Type			
Adjacent Land Use	Residential Yards ☐ City Park / Open Space ☐ Road ☐ Other:		
Natural Area Boundary	Buffer ☐ Fence w Gate ☐ Fence w/out Gate ☐ Other:		
Assessment Date		Time of Assessment	
Name of Assessor		Notes on Weather	
Comments			

ASSESSMENT (to be conducted within 30 m of Natural Area boundary, including the buffer if present, along segments between 80 m and 120 m long)

Formal Access to Natural Area	Open	Trail	Gated Fence	Fence – No Gate	Other
	☐	☐	☐	☐	☐
Comments:					

Structures in Natural Areas	0 – 10 m		11 – 20 m		21 – 30 m	
	Frequency	% Cover	Frequency	% Cover	Frequency	% Cover
readily moveable items (e.g., lawn furniture, vehicle/boat storage, dog house)						
play equipment and/or sand box						
water feature(s) (pond and/or fountain)						
deck(s)						
pool(s)						
retaining wall(s)						
shed(s)						
tree house(s)						
unauthorized fencing						
sprinkler system and/or drainage system						
composter and/or yard waste						
bird feeder(s) and/or salt lick(s)						
stairs						
lighting						
OTHER:						

Site Alteration in Natural Area	0 – 10 m		11 – 20 m		21 – 30 m	
	Frequency	% Cover	Frequency	% Cover	Frequency	% Cover
fill and/or grading						
dumping						

Observable Recreational Impacts in Natural Area	0 – 10 m		11 – 20 m		21 – 30 m	
	Frequency	% Cover	Frequency	% Cover	Frequency	% Cover
informal trail creation from boundary						
informal trail creation within edge						
biking jumps / structures						
OTHER:						

Landscaping in Natural Area	0 – 10 m		11 – 20 m		21 – 30 m	
	Frequency	% Cover	Frequency	% Cover	Frequency	% Cover
mown grass						
introduction of food crop gardening						
introduction of horticultural garden						
introduction of trees and/or shrubs						
introduction of invasive species						
water feature(s) (pond and/or fountain)						
removal of natural vegetation						
OTHER:						

Natural Area Buffer	Recommended	Implemented	Width(s)		
	☐	☐			
Condition (e.g., mown, naturalized):					

Other Notable Features	
Invasive species documented, from most to least abundant	
Presence of Species at Risk	
OTHER:	

Appendix C

Supplementary Data from this Study

Appendix C

List of plants observed in Powell Drain wetland (Case Study #6)

Scientific Name	Common Name	Observed in 2013	Observed prior to 2007
Agrimonia gryposepala	Tall Hairy Agrimony	x	
Alisma plantago-aquatica	Broad-leaved Water-plantain		x
Alliaria petiolata	Garlic Mustard	x	x
Arisaema triphyllum ssp. triphyllum	Jack-in-the-pulpit	x	
Asclepias incarnata ssp. incarnata	Swamp Milkweed		x
Athyrium filix-femina var. angustum	Lady-fern	x	
Bidens cernua	Nodding Beggar's Ticks		x
Bidens frondosa	Devil's Beggar's Ticks		x
Caltha palustris	Marsh Marigold	x	x
Carex flava	Yellow Sedge		x
Carex hystericina	Porcupine Sedge	x	x
Carex interior	Inland Sedge		x
Carex lacustris	Lake-bank Sedge	x	x
Carex laevivaginata	Smooth-sheath Sedge		x
Carex radiata	Stellate Sedge	x	
Carex stipata	Stalk-grain Sedge	x	x
Carex stricta	Tussock Sedge	x	x
Cicuta maculata	Spotted Water-hemlock	x	x
Circaea lutetiana ssp. canadensis	Enchanter's Nightshade	x	
Cirsium arvense	Creeping Thistle	x	
Cornus amomum	Silky Dogwood	x	x
Cornus racemosa	Gray Dogwood	x	x
Cornus sericea ssp. sericea	Red-osier Dogwood	x	x
Crataegus sp	Hawthorn Species	x	
Cuscuta gronovii	Gronovius Dodder		x
Cypripedium parviflorum	Small Yellow Lady's-slipper	x	
Eleocharis erythropoda	Bald Spikerush		x
Epilobium coloratum	Purple-leaf Willow-herb		x
Epilobium sp	Willow-herb Species	x	
Equisetum arvense	Field Horsetail	x	
Equisetum variegatum ssp. variegatum	Variegated Horsetail		x
Erigeron philadelphicus var. philadelphicus	Philadelphia Fleabane	x	

Scientific Name	Common Name	Observed in 2013	Observed prior to 2007
Eupatorium maculatum var. maculatum	Spotted Joe-pye Weed	x	x
Eupatorium perfoliatum	Common Boneset	x	x
Euthamia graminifolia	Grass-leaved Goldenrod		x
Fragaria virginiana	Virginia Stawberry	x	
Frangula alnus	Glossy Buckthorn	x	x
Galium aparine	Cleavers	x	
Gentianopsis crinita	Fringed Gentian		x
Geum sp	Avens Species	x	x
Glyceria grandis	American Manna Grass		x
Glyceria striata	Fowl Manna Grass	x	
Ilex verticillata	Winterberry		x
Impatiens capensis	Spotted Jewel-weed	x	x
Juncus effusus ssp. solutus	Soft Rush		x
Leersia oryzoides	Rice Cutgrass	x	x
Lobelia siphilitica	Great Blue Lobelia		x
Lonicera tatarica	Tartarian Honeysuckle	x	x
Lycopus americanus	American Bugleweed		x
Lycopus sp	Bugleweed Species	x	
Lycopus uniflorus	Northern Bugleweed		x
Lysimachia ciliata	Fringed Loosestrife		x
Lythrum salicaria	Slender-spike Loosestrife	x	x
Maianthemum stellatum	Starry False Solomon's Seal	x	
Mentha arvensis	Corn Mint	x	x
Mentha X piperita	Peppermint		x
Muhlenbergia glomerata	Glomerate Satin Grass		x
Onoclea sensibilis	Sensitive Fern	x	x
Parthenocissus vitacea	Thicket Creeper	x	
Penstemon digitalis	Foxglove Beardtongue	x	
Phalaris arundinacea	Reed Canary Grass	x	x
Phragmites australis	Common Reed	x	x
Poa palustris	Fowl Bluegrass	x	
Poa pratensis ssp. pratensis	Kentucky Bluegrass	x	
Polygonum lapathifolium	Dock-leaf Smartweed		x
Polygonum sp	Smartweed Species	x	
Populus grandidentata	Large-tooth Aspen	x	
Populus tremuloides	Quaking Aspen	x	
Prunella vulgaris ssp. lanceolata	Self-heal		x
Ranunculus abortivus	Kidney-leaved Buttercup		x

Scientific Name	Common Name	Observed in 2013	Observed prior to 2007
Ranunculus acris	Tall Buttercup	x	
Rhamnus cathartica	Buckthorn	x	x
Rheum rhabarbarum	Rhubarb		x
Ribes americanum	Wild Black Currant	x	
Ribes hirtellum	Smooth Gooseberry		x
Ribes rubrum	Northern Red Currant	x	
Ribes sp	Currant Species		x
Rorippa nasturtium-aquaticum	True Watercress		x
Rubus hispidus	Trailing Blackberry		x
Rubus idaeus ssp. strigosus	Wild Red Raspberry	x	x
Rumex crispus	Curly Dock		x
Rumex orbiculatus	Water Dock		x
Sagittaria latifolia	Broadleaf Arrowhead		x
Salix amygdaloides	Peach-leaved Willow		x
Salix bebbiana	Bebb's Willow	x	x
Salix discolor	Pussy Willow	x	x
Salix exigua	Sandbar Willow	x	x
Salix nigra	Black Willow		x
Salix petiolaris	Meadow Willow	x	x
Sambucus nigra ssp. canadensis	Common Elderberry	x	x
Schoenoplectus tabernaemontani	Soft-stemmed Bulrush		x
Scirpus atrovirens	Woolgrass Bulrush		x
Sedum acre	Mossy Stonecrop		x
Sedum album	White Stonecrop		x
Solanum dulcamara	Climbing Nightshade	x	x
Solidago canadensis var. scabra	Tall Goldenrod	x	x
Solidago gigantea	Smooth Goldenrod	x	
Solidago rugosa ssp. rugosa	Rough Goldenrod		x
Symphyotrichum lanceolatum ssp. lanceolatum	Panicled Aster	x	x
Symphyotrichum novae-angliae	New England Aster		x
Symphyotrichum puniceum var. puniceum	Swamp Aster	x	x
Symplocarpus foetidus	Skunk Cabbage	x	x
Taraxacum officinale	Common Dandelion	x	x
Toxicodendron radicans ssp. negundo	Poison Ivy		x
Tussilago farfara	Colt's Foot	x	x
Typha angustifolia	Narrow-leaved Cattail	x	x
Typha latifolia	Broad-leaf Cattail	x	x

Scientific Name	Common Name	Observed in 2013	Observed prior to 2007
Urtica dioica ssp. dioica	Stinging Nettle		x
Urtica dioica ssp. gracilis	Slender Stinging Nettle	x	x
Veronica beccabunga	European Speedwell		x
Viburnum opulus	Guelder-rose Viburnum	x	x
Viola affinis	Lecontes Violet		x
Viola cucullata	Marsh Blue Violet		x
Viola sp	Violet Species	x	
Vitis riparia	Riverbank Grape	x	x