

MOVING FROM LANDSCAPE CONNECTIVITY THEORY TO LAND USE PLANNING: URBAN PLANNING IN OAKVILLE, ONTARIO

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ABSTRACT

The Provincial Policy Statement published under the Ontario Planning Act states that “The diversity and connectivity of natural features in an area, and the long-term ecological function and biodiversity of natural heritage systems, should be maintained, restored or, where possible, improved, recognizing linkages between and among natural heritage features and areas, surface water features and ground water features. Municipal planning must be consistent with this Policy. This Policy applies the concepts of protecting ecological cores and linkages within land use planning. The Town of Oakville proposed development in an area covering 3,000 hectares of farmland, woodland and wetlands to house 55,000 people. Two planning teams, one working for the Town and one for the area’s land owners, developed competing subwatershed plans for the area, with ecological cores and linkages as a major component. Cores consisted of designated Environmentally Sensitive Areas, large woodlots, and significant wetlands. The two teams presented maps of cores and linkages to be protected from development, with similarities but some important differences in the linkage design. The paper outlines that the similarities and the differences between the two mapping schemes, are related to both landscape connectivity theory and to the conflict resolution processes involved in land use planning in an urbanizing area. Generally, the Town proposed much more land to be reserved as green space, compared

to the landowners. All plans were prepared for defense in a hearing in front of the Ontario Municipal Board, an administrative tribunal dealing with land use matters under dispute. However, negotiation between the parties resulted in the Town’s plan being accepted as the template for development before conflicting positions could be explored in the tribunal room. Our paper explores the limitations that the landscape connectivity literature has for land use planning within urbanizing areas.

INTRODUCTION

Ontario, Canada operates under a policy-led planning system. Land use planning on private land is conducted under the authority of the Planning Act, the provincial legislation that sets the legal structure for municipal and private land use. The Provincial Policy Statement (PPS), created by the provincial government under the authority of the Planning Act, provides the broad policy framework that establishes direction on matters of provincial interest. The PPS provides policy direction in areas such as: land use density, housing, open spaces, infrastructure, energy, and resource use (Penfold 1998). While the province sets the overarching planning policies, planning decisions for private land are made at the municipal level. Municipalities are responsible for implementing the Planning Act via their Official Plans, zoning by-laws, and development application approval processes. The Ministry of Municipal Affairs and Housing (MMAH) is responsible for

provincial-level plan input and review, policy development, and appeals. The Ontario Municipal Board (OMB) is an independent, adjudicative tribunal that is responsible for settling disputes over land use planning and other municipal issues. The OMB hears appeals and applications on land use planning under the Planning Act and other legislation. The OMB makes decisions, unless appealed to the cabinet or the courts. This quasi court is specifically designed to deal with the many technical issues that occur within land use planning. It is also designed to provide a forum for dispute resolution, and therefore to circumvent more costly and awkward court proceedings.

The purpose of this paper is to apply landscape planning theory for landscape connectivity amongst ecological core areas to a practical situation and determine if and how it works. This is done through a review of the application of the PPS policy for natural heritage protection, and specifically the concept of ecological linkages, during land development planning using a case study; the urban expansion of the Town of Oakville in southern Ontario. This is a useful case study because the plan was developed and debated over almost a decade (2000 to 2008), with two teams of ecologists and planners working separately from each other in designing the natural heritage system for a major urban development in a rural area. The case study analysis develops an understanding of how the science of landscape connectivity and linkages was applied within the context of the PPS. It is the authors' opinion that the approach of using two different planning teams insured that the assumptions and scientific bases were fully explored and evaluated.

This is a story of ecologists, municipal planners, and development planners working within current scientific theory and public policy to hammer out an urban development plan through conflict resolution processes. Before outlining the case study, it is necessary

to briefly explain the scientific theory, as well as the legal and policy structure in place at the time.

A Brief History of Landscape Connectivity Planning In Ontario

Within this paper, the urbanizing landscape will be perceived as consisting as cores of environmentally sensitive areas (significant forests and wetlands), connected by linkages (river valleys and other corridors of natural habitat), each buffered by narrow strips of land. Landscape connectivity is a concept that refers to a landscape's structural and functional continuity, allowing for the flow of water, nutrients, energy, organisms, genes, and disturbances at many spatial and temporal scales. The loss of landscape connectivity leads to ecosystem fragmentation, which in turn contributes to a decline in biodiversity and threatens some species. The buffer is a narrow strip of land with compatible ecological features and functions that is placed between the cores and linkage areas and the adjacent developed lands. Over time, the theories of landscape connectivity between and amongst natural areas have increasingly been implemented within land use planning (Bennet et al. 2006; Meyfarth O'Hara 2009).

The concept of landscape connectivity as being important in ecosystem functioning was first recognized in Ontario's land use planning system in the 1970s and by the 1990s was present in a range of government reports, regional and provincial strategies. By 1995, the theory of landscape connectivity using linkages between important areas of core habitat had moved from theory to practice and was well established within Ontario's policies, programs and provincial legislation. For example, in 1995 the Lake Ontario Greenway Strategy called for the need to recognize the importance of habitat connections within the Oak Ridges Moraine (Meyfarth O'Hara 2009). By 2002, provincial policies and land use planning legislation

had been established which recognized and protected the landscape connectivity value of the Oak Ridges Moraine, a massive landscape feature of approximately 200,000 hectares running east-west through southern Ontario north of Toronto (Whitelaw and Eagles 2007; Whitelaw et al. 2008).

There was considerable movement from theory to practice in planning for landscape connectivity in Ontario between 1970 and 2008, as scientific concepts were increasingly adopted by the planning profession and by government policy makers. A suite of stakeholders worked on this movement, including university professors and students, government policy-makers, and influential environmental groups. The movement of conservation biology principles developed by scientists into the larger society, including the concepts of landscape connectivity, was enhanced by a growing public awareness, which in turn contributed to rising pressure on the Ontario government to reform its land use planning policies and its land use planning system. The theory of landscape connectivity was increasingly included in key land use planning legislation and policies and is now an accepted part of planning for natural heritage in Ontario (Meyfarth O'Hara 2009). Landscape connectivity, as a concept, gained acceptance in Ontario to the point that it transcended political change. For example, the change in provincial government from the environmentally-responsible and socialist New Democratic Party, in power from 1990 to 1995, to the pro-business Progressive Conservative Party elected in 1995, led to major changes in policy and legislation but the concept of "natural connections" remained in the revised PPS in 1997. Following the election of the centrist Liberal Party in 2003, the concept of landscape connectivity was again retained, and then further strengthened in the revised PPS of 2005.

The following section will examine the Provincial Policy Statement and its policies on landscape connectivity.

The Provincial Policy Statements of 1996, 1997 And 2005

Section 3 of the Ontario Planning Act gives the provincial government power to create a Provincial Policy Statement (PPS) through a process similar to that for the creation of a Regulation under an Act. Over the time of the planning of the case study area in Oakville Ontario, three different versions of the PPS were in force. For the first period of the case study up to 2005, Section 2 of the Ontario Planning Act required that all land owners, developers and municipalities were required to "have regard to" the policies of the PPS. In the second period after 2005, all plans must "be consistent with" the PPS. In the following section, the development of the natural heritage policies within the PPS over time are outlined.

Section 2.3 of the PPS 1996 (amended 1997) concerned Natural Heritage. Policy 2.3.1 stated that natural heritage features and areas will be protected from incompatible development. The PPS identified seven natural heritage features that were to be protected: 1) significant wetlands, 2) fish habitat, 3) significant woodlands south and east of the Canadian Shield, 4) significant valley lands south and east of the Canadian Shield, 5) significant portions of the habitat of endangered and threatened species, 6) significant wildlife habitat, and 7) significant areas of natural and scientific interest (Table 12.1). The PPS did not permit development and site alteration in significant wetlands south and east of the Canadian Shield or in significant portions of the habitat of endangered and threatened species. Development and site alteration was permitted in fish habitat, significant wetlands in the Canadian Shield, significant woodlands south and east of the Canadian Shield, significant valley lands south and east

of the Canadian Shield, significant wildlife habitat, and significant areas of natural and scientific interest; if it was demonstrated that there would be no negative impacts on the natural features or the ecological functions for which the area was identified. Section 2.1 of the PPS 2005 concerns Natural Heritage. Policy 2.1.1 states that natural features and areas shall be protected for the long term. The PPS 2005 identified eight natural heritage features that are to be protected: 1) significant wetlands; 2) significant coastal wetlands; 3) fish habitat; 4) significant woodlands south and east of the Canadian Shield; 5) significant valley lands south and east of the Canadian Shield; 6) significant portions of the habitat of endangered and threatened species; 7) significant wildlife habitat; and, 8) significant areas of natural and scientific interest. A comparison of these two lists of features is found in Table 12.1. When identified and mapped these 8 natural heritage features are considered to be ecological cores, which are significant lands that will form the core protection areas for a future urban greenspace system. Municipal infrastructure, such as roads, water lines and sewers, was not included in the definition of development and therefore did not have to adhere to the PPS limitations, providing a major loop hole for the intrusion of development into the cores and linkages. Agricultural uses were permitted to continue in all areas designated into any of these 8 categories. The Town of Oakville is located south of the Canadian Shield, and thus subject to the relevant policies for this area.

The Conservative Government in power provincially from 1995 to 2003 changed the PPS so as to weaken the natural heritage policies. The policies were shortened and simplified in order to make development easier (Winfield, 2003). This was part of broader effort by this right wing government to reduce environmental regulation throughout Ontario. Although "significant natural corridors" were removed

from the list of natural heritage features to be protected, the concept of landscape connectivity was retained in the revised PPS. The revised Section 2.3.3 in 1997 stated, "The diversity of natural features in an area, and the natural connections between them should be maintained and improved where possible." This policy statement of "natural connections between them" is important as it suggests that the concept of landscape connectivity was sufficiently well accepted in Ontario and thus was able to withstand a significant change in political power between parties with very different views about land use planning. However, the phrase "natural connections" was not defined in the policy, leaving the application of this important principle to environmental planners and urban planners working on individual land use plans both for governments and private developers.

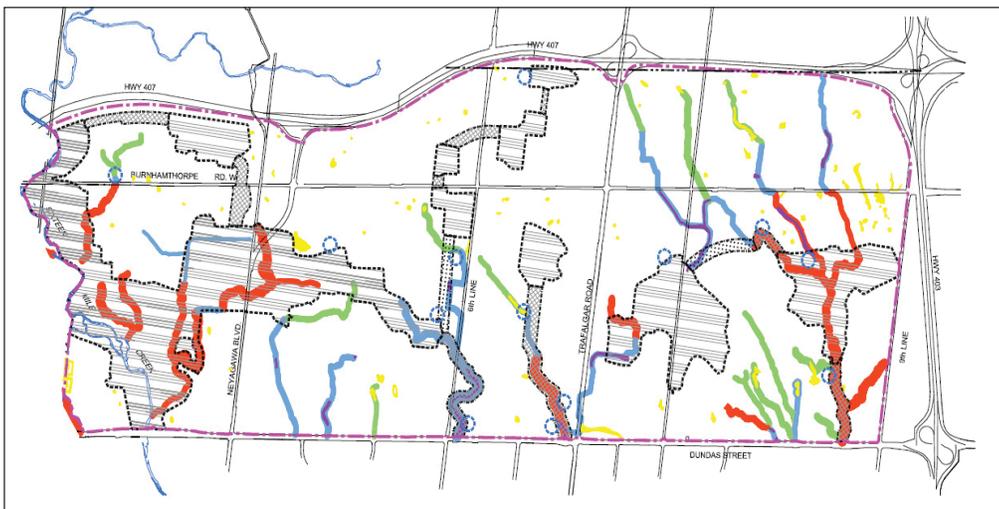
In 2003, the right wing Conservative Government was replaced by the more centrist Liberal Government. This made Ontario unique in Canadian history where three different political parties formed successive majority governments. The importance of land use planning in Ontario politics was highlighted when this new government proposed amendments to the Planning Act very soon after the election. These changes were passed by the Ontario Parliament in 2004. In addition, a new PPS was created in 2005 coinciding with the effective date of the implementation of Section 2 of the amended Planning Act, which required that planning decisions on applications that are subject to the new PPS "shall be consistent with" the new policies (OMMAH, 2007). The new rule that all land use plans "shall be consistent with the PPS" was seen by many to be stronger wording than the older rule that the plans must "have regard to" the PPS. The new policies of the new PPS were intended to "fulfill the government's commitment to provide strong, clear policy direction on land use

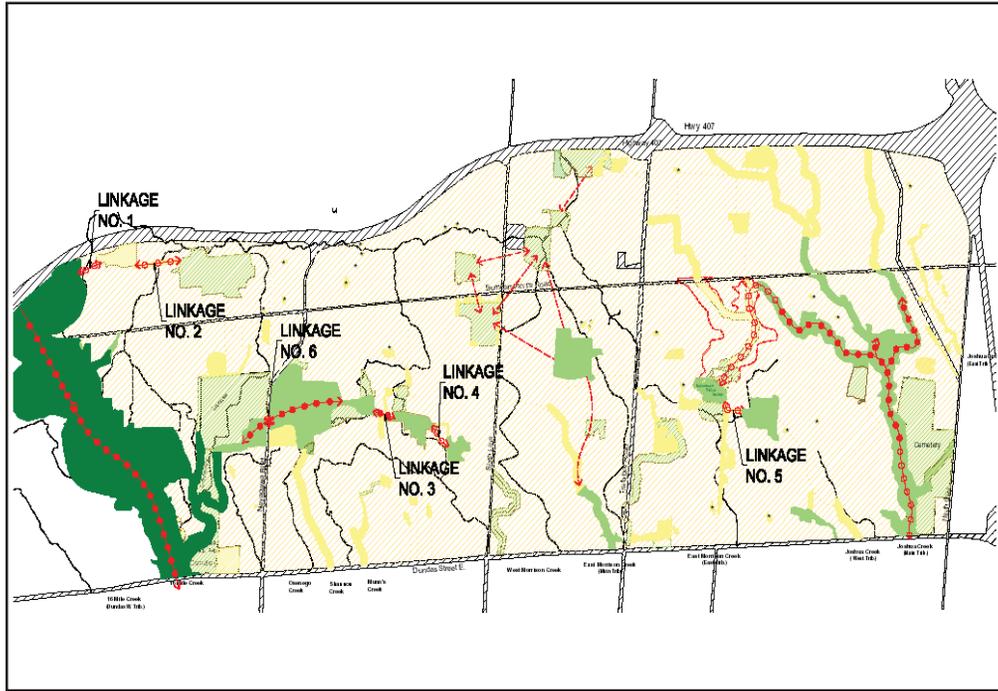


Figure 12.1 Aerial photograph of the North Oakville case study area. The photo shows the entire case study area, consisting of the lands between the roads on 3 sides and the river valley at the bottom of this figure.

The site is composed mostly of farm fields with a few scattered forest areas (Google Maps, 2010).

Figure 12.3 North Oakville cores and linkages proposed by the Town of Oakville. The cores are the large blocks filled with cross lines. The linkages are linear features filled with hatched lines. The watercourses are coloured. The site boundary is a purple hatched line (Town of Oakville, 2008).





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Title: NORTH OAKVILLE LINKAGE LOCATIONS		
Date: April, 2004	Scale: 1:30,000	Figure No.: 1

Legend

- Category A: Protection Areas
- Category B: Primary Retention Areas
- Category C: Environmental Support Areas with some Development Potential
- Category D: Potential Development Areas Exhibiting Minor Environmental Function
- Category E: Development Areas
- Regulatory Floodline Area that may be Engineered
- Feature for relocation /re-establishment to Restoration Areas
- Subwatershed Boundaries
- Infrastructures (Roads, Pipeline, Reservoir, etc.)
- Level 1 Linkage – continuous (defined terrestrial corridor)
- Level 2 Linkage – continuous (defined terrestrial corridor)
- Level 3 Linkage – stepping stone linkage (no terrestrial corridor required)
- Wildlife Crossing

Notes

Base map taken from North Oakville Subwatershed Study, Environmental Screening by North Oakville Management Subwatershed Study Team.

Figure 12.2 North Oakville cores and linkages as proposed by the North Oakville Landowners. The cores are the large blocks of light and dark green, while the linkages are shown in red (NOMI, 2004).

planning to promote strong communities, a clean and healthy environment, and a strong economy (OMMAH 2007).

As noted above, the PPS of 2005 does not permit development and site alteration in 8 categories of natural lands unless it has been demonstrated that there will be no negative impacts on the natural features or their ecological functions. Development and site alteration is not permitted on adjacent lands to the natural heritage features and areas, unless the ecological function of the adjacent lands has been evaluated and it has been demonstrated that there will be no negative impacts on the natural features or on their ecological functions. As mentioned above, infrastructure is allowed and existing agricultural uses are permitted to continue. The identification of these 8 categories leads to the identification of areas for conservation, typically called core areas in planning documents.

The concept of landscape connectivity in the PPS 2005 was expanded so that Section 2.1.2 stated;

The diversity and connectivity of natural features in an area, and the long-term ecological function and biodiversity of natural heritage systems, should be maintained, restored or, where possible, improved, recognizing linkages between and among natural heritage features and areas, surface water features and ground water features.

Section 2.1.2 considerably strengthened the concept of linkages as the phrase: "recognizing linkages between and among natural heritage features and areas, surface water features and ground water features" is more expansive and directive than the previous phrase: "natural connections between them."

Section 2.1.2 requires that "the connectivity of natural features" and the "linkages between and among natural features and areas, surface water features and ground water features" be identified in planning

documents. Importantly, linkages should be "maintained, restored or ... improved" which provides direction to encourage linkage restoration within linkages. This concept of linkage restoration became important in the case study discussed below.

Therefore, for the purpose of urban development planning the natural heritage system consists of core areas, linkages between and amongst the cores, and buffers beside all cores and linkages.

Studies to identify cores and linkages are typically completed by field ecologists. These studies are then used by planners in the overall land use allocation process during urban development planning. However, the 2005 PPS, similar to the 1996 and 1997 PPS did not define connectivity or linkages. The Natural Heritage Reference Manual produced by the Ministry of Natural Resources defines an ecological linkage as a "pathway, connection or relationship between natural features and areas" (OMNR 1999, p. 49). This reference manual is only advisory as it does not have legal or policy standing under Ontario law. The lack of precision in the definitions and the scientific literature led to debate amongst ecologists and planners in regards to the functions, locations, and widths of linkages in many urban planning efforts.

Legally, the 1997 version of the PPS was in force at the time of the onset of planning for North Oakville. However, all parties to the planning effort addressed core, buffer, and linkage provisions meeting the intent of the 2005 PPS, even though it was the developers' legal right to utilize the earlier, weaker version. In the following section we outline how the natural heritage policies were implemented in the case study area.

Case Study: North Oakville East Secondary Planning Process

The North Oakville East Secondary Plan was part of one of the largest planning processes underway in Ontario in the period

from 2000 to 2008. This Secondary Plan, which is an outline of the proposed urban structure for the entire area, was developed for the northward urban expansion of the Town of Oakville. This area was designed to provide residences for 55,000 and workspace for 35,000 people upon completion (Town of Oakville 2008). The planning was the focus of long and intense negotiations between the municipality, many private landowners and developers, as well as community groups. The planning process included two separate subwatershed plans, with each team of planners presenting a different Natural Heritage System for the suburban site. The case provides an interesting example of the challenges of planning for landscape connectivity at the municipal level.

Study Setting

The North Oakville Lands consist of 3,000 hectares in the northern part of the Town of Oakville. The focus of this case study is the North Oakville East Lands, which include the lands east of Sixteen Mile Creek (Figure 12.1). The North Oakville East Lands consist of a predominantly agricultural ecosystem, composed of open fields that have been in this state for almost 200 years. There are also scattered remnants of forest, wetlands and modified stream valleys (NOMI 2004). The remnant vegetation in the North Oakville East Lands displays a typical pattern for Southern Ontario and has significant implications for the identification, delineation and restoration potential of a local Natural Heritage System (Town of Oakville 2006). A few urban land uses are interspersed throughout the area, including retail, institutional (schools and a land fill site), public, and private open space uses (NOMI 2004).

Part of the North Oakville East Lands is located on the Trafalgar Moraine, which forms a defined ridge that separates the East Sixteen Mile Creek from other watersheds in the area (Town of Oakville 2006). Some groups opposing the urban expansion

attempted to equate development on this site with development on the Oak Ridges Moraine and thereby introduce the very strong land use restrictions found on that moraine (Whitelaw and Eagles 2007). Several scientific studies undertaken on the North Oakville portion of the Trafalgar Moraine concluded that it was not geologically unique or scientifically significant and its geology does not pose a constraint on urban land uses and development (Stantec et al. 2004), and this conclusion was accepted by the Town of Oakville and Province of Ontario. Therefore, the importance of the moraine component of the plan area faded and was given little subsequent emphasis.

Planning History

On May 29, 2002, the elected Council of the Town of Oakville approved Official Plan Amendment 198 (OPA 198) to urbanize the 3,000 hectares of countryside in the northern portion of the municipality. Two important targets in OPA 198 for the North Oakville Lands included 55,000 residents and industrial space for 35,000 workers. The Town's plan for the North Oakville Lands proved to be highly controversial. On the same day that OPA 198 was approved, Member of Provincial Parliament Mike Colle introduced a private member's bill in the Ontario Parliament, The Trafalgar Moraine Protection Act, to protect and preserve the Trafalgar Moraine from development. Colle, who previously introduced a successful 1999 bill that called for the protection of the Oak Ridges Moraine, hoped to temporarily freeze the proposed development on the North Oakville Lands. However, as pointed out above, scientific evidence provided by the landowners resulted in a low emphasis being placed on this moraine and this legislation was never passed. Local environmental groups and a coalition of landowners appealed to the Ontario Municipal Board in June 2002 and asked for a hearing.

On August 6, 2003, the Town reached agreement with three Non-Government Organizations, Clear the Air Coalition, Oakville Green Conservation Association Inc. and the Residents Association North of Dundas (Sorensen Gravely Lowes 2004). Accordingly, OPA 198 was modified to reflect the settlement of those parties and the changes were approved by the OMB on September 12, 2003. OPA 198 established a general framework for the preparation of more detailed secondary plans and identified the need to prepare separate secondary plans for the areas west and east of Sixteen Mile Creek (Sorensen Gravely Lowes, 2004). OPA 198 also identified a number of requisite studies to be undertaken prior to approval of a secondary plan, including an analysis of the linkage component of the natural heritage and open space system.

The Town began working towards secondary plans with the initiation of the North Oakville Creeks Subwatershed Study in January 2002. The purpose of the Study was to “develop a subwatershed plan that allows sustainable development while ensuring maximum benefits to the natural and human environments on a watershed basis” (Town of Oakville 2006). The Town had two major goals for their secondary plans: 1) the plans had to ensure the preservation of a sustainable natural heritage system that could maintain a diversity of species and landscapes in an urban context; and, 2) the plans had to provide for a walkable, compact, and diverse community, developed in a New Urbanist form (Town of Oakville, 2006). This first goal when combined with the PPS requirements for a natural heritage system would lead to the identification of a system of core and linkages to be protected from development.

At the same time, a group of landowners and developers, known as the North Oakville Management Inc. (NOMI), worked on their own North Oakville East Subwatershed Study, starting in August 2000. This

company assembled an interdisciplinary team of consultants to address the range of environmental issues in the study area subwatershed, including linkages for the natural heritage system. Although NOMI's subwatershed study was conducted in parallel with the Town's subwatershed study, NOMI participated throughout the Town's subwatershed process by sharing information, providing input on the Town's technical reports, attending public information sessions and participating in the Town's Technical Advisory Committee for their study (Stantec et al. 2004). By 2004 the NOMI planning team had their version of the subwatershed plan completed with attached maps showing the natural heritage system, including linkages (Figure 12.2).

In May 2003, the Town initiated the Inter Agency Review (IAR) to make recommendations regarding a sustainable natural heritage system for North Oakville. The IAR had input during the development of the Secondary Plan from the MMAH, the Region of Halton, the Ministry of Natural Resources, and Conservation Halton. In September 2003, the Town released the IAR report which presented guiding principles and a map of a conceptual natural heritage system for the Town to consider in the next step of developing the North Oakville Secondary Plan. The report recommended the creation of a natural heritage/open space system comprised of core natural areas, following the 8 categories of special lands identified in the PPS, connected by a system of linkages between these core natural areas, all of which was protected by buffer strips of land (Figure 12.3).

The number and extent of the proposed core areas in the IAR developed by the government agencies far exceeded the recommendations from an earlier report in 2000 previously undertaken by consultants retained by the Town to identify a natural heritage/open space system for North Oakville (Sorensen Gravely Lowes 2004).

Neither the landowners (NOMI) nor their consultants were part of the process that led to the completion of the IAR report. While NOMI agreed in principle with the protection and management of “environmental core areas versus isolated, scattered, small environmental pockets,” it did not concur with the “extent and location of the proposed core areas and linkages or allowable uses in the core areas.” NOMI found that:

The IAR Report lacks supporting scientific justification; presents inaccuracies in mapping; and is based to some degree on technical information/analysis with which the Landowners' Subwatershed Study team does not concur. Until scientific rationale for the core area delineations and conceptual linkages is presented and reviewed, the IAR cores and linkages are not supported as appropriate environmental lands for protection in the Subwatershed Study or the Secondary Plan (Stantec et al. 2004).

In addition to concern over the lack of scientific support for the IAR Report's linkage locations and width, NOMI expressed “serious concern over the lack of opportunity for Landowners' input to the IAR Report” (Stantec et al. 2004).

In September 2003, the Town invited a team of new urbanists to conduct a ten-day charrette in which four different new urbanist designs were sketched for North Oakville. NOMI presented its proposed development concept for North Oakville East and the concept formed the basis for one of the four plans carried through the charrette and its numerous public sessions (Sorensen Gravely Lowes, 2004). These plans served as input for the Town's draft North Oakville Secondary Plan (Town of Oakville 2006). From here a secondary plan was developed by the Town using only those reports prepared by the Town's various planning efforts, which laid out in schematic form all major land uses for the area. The Town then completed a draft North Oakville East Secondary Plan to present at the OMB

as the Town's response to the Secondary Plan proposed by NOMI (Town of Oakville 2006). Pre-hearings for the OMB took place in 2005. This meant that at this time in 2005 there were two competing visions of the entire area, one prepared by the Town and another by the consultant team working for the land owners and developers.

It is worth noting that up to this point both teams of planners and consultants were working within the same science base and the same provincial laws and policies. Therefore, the many differences that occurred in the design of a natural heritage plan and strategy occurred within this coherent science and policy structure.

Therefore, by 2006 there were two separate Natural Heritage Plans produced, one by the Town, with support of some government agencies, and one by the landowners. In general the Town's plan outlined much larger cores and much larger linkages, than did NOMI. Exact measurements of all core areas are not available to the authors, but the Town's core areas appeared to be approximately 25% larger than the NOMI core areas. The Town's linkages were typically 233% larger than the NOMI linkages (100 meters wide compared to 30 meters wide). Some of the details are discussed below. At this point in 2006, it appeared that the differences would be explored and choices made through a long hearing, possibly lasting a year or more, in front of the Ontario Municipal Board. Such a hearing would cost several millions of dollars in legal and consulting fees for all parties. Therefore, a negotiated settlement was attempted.

Starting in May of 2006 the Town started a divide-and-conquer strategy amongst the development companies. The town negotiated with the developers individually, rather than through the umbrella NOMI organization. This approach was very successful from the Town's point of view and by August 14, 2007 a comprehensive

settlement was reached between the Town and most of the landowners. It was agreed that the Town's Secondary Plan with the expansive natural heritage system would be put forward as the preferred solution at the OMB hearing. The landowners also agreed to donate to the Town, free of charge, all of their lands in the Town's proposed Natural Heritage System. These concessions by the landowners would significantly decrease both the time and expense of an OMB hearing and would get development started faster, but a considerable cost to the landowners. Further settlements were reached during the subsequent hearing on a few minor issues and the remaining issues were decided upon by the Board. The North Oakville East Secondary Plan was approved by the OMB in February 2008. Therefore, from the start of detailed planning in 2000, it took 9 years to design the layout of the urban expansion.

The Town was ultimately successful in the negotiation because it was broke apart the NOMI structure of many different development companies working together and negotiated with each individually. The Town was able to separately negotiate critical development issues such as the location of high density urban uses, the order of development, the location of infrastructure, the location of school sites and storm water management ponds, and all other urban form issues. Since these issues were critically important to the financial return of each development company, they became more important than the amount of land given to green space. No individual company could afford to not be part of the massive land allocation negotiation. This effort involved political and legal negotiation, the balancing of complex issues by lawyers and politicians with financial, density and timing benefits offered to developers to offset the loss of developable land through greenspace creation.

Therefore, the major differences between the two natural heritage visions were never

tested in front of the OMB. In order to gain an understanding of the differences in the two proposed natural area systems, a comparison is presented in the next section of the paper using an adapted Ahern's framework for landscape ecological planning, modified somewhat for landscape connectivity by other literature (Ahern 1995; Ahern 1999; Ahern 2005; Bennett 2003; Crooks and Sanjayan 2006; Hilty et al. 2006; Kleyer et al. 1996; Linehan and Gross 1998; Opdam et al. 2002). Each of the sections is headed by a question based on Ahern's framework.

Comparison within Analytical Framework

In this section of the paper, comparisons of the planning processes for the Town's Secondary Plan and NOMI's Secondary Plan are presented separately. Documents reviewed include the Town's North Oakville Creeks Subwatershed Studies Draft Analysis Report (Town of Oakville 2003), the Town's North Oakville Creeks Subwatershed Studies (Town of Oakville 2004), the Town's North Oakville Creeks Subwatershed Study (Town of Oakville 2006), the Town's North Oakville East Secondary Plan (Town of Oakville 2008), NOMI's North Oakville East Secondary Plan (NOMI 2004), NOMI's Input to the North Oakville East Secondary Plan (Stantec et al. 2004), the Landowners North Oakville East Secondary Plan Planning Assessment Report (Sorensen Gravely Lowes 2004), and the North Oakville Natural Heritage Inventory and Analysis (LGL 2000).

Was the planning process interdisciplinary and public?

Town of Oakville: The Town's study team included an interdisciplinary roster of consultants, with assistance from staff of the Town of Oakville, the Regional Municipality of Halton, the Halton Region Conservation Authority, and the Ontario Ministry of Natural Resources (Town of Oakville 2006). The Inter Agency Report

(IAR) report made recommendations for a natural heritage system in North Oakville. These data were then fed into The North Oakville Creeks Subwatershed Study which also included input from public participation for the purpose of identifying the key issues, developing a vision and objectives, discussing analysis findings for characterization, and development of a management and greenspace strategy (Town of Oakville 2006). The main process for input was from key stakeholders on the Technical Advisory Committee. Other methods for public participation included public meetings, a Steering Advisory Committee, Council meetings, and a design charette.

North Oakville Management Inc. (NOMI): NOMI's interdisciplinary study team of consultants consisted of experts in surface water, hydrology, hydraulics, natural heritage, natural heritage linkages, geology, hydrogeology, quaternary geology, and fluvial geomorphology (Stantec et al. 2004). This planning process was not public, although public comments raised during the design charette were used to modify the development concept (Sorenson Gravely Lowes 2004). NOMI also participated in the Town's Technical Advisory Committee.

Were landscape connectivity goals and assessments defined?

Town of Oakville: The Town's Subwatershed Study provides the following assessment of ecological linkages on the North Oakville East Lands:

The North Oakville lands contain a variety of habitat types including agricultural fields, pasture, hedgerow, pioneer vegetation, mature woodlands, wetlands, and valleys, and have been described as a remnant agricultural landscape (Gore & Storrie and Ecoplans, 1996; LGL, 2000). The function of these lands has been influenced by urbanization to the immediate south, and by the local road network throughout the

area. These roads have increased the amount of habitat fragmentation and have created barriers to ground travelling wildlife within the area and to areas adjacent to the subject lands. Connectivity between some northern and southern patches of habitat within the site appears to be maintained by the vegetated creek corridors, mainly Sixteen Mile Creek and Joshua's Creek (Town of Oakville 2004, 4E-75).

Thus, the Town's Subwatershed Study indicates that the ecological functions of the study area lands are impaired by urbanization to the south and the local roads have increased habitat fragmentation and block wildlife movement both within the study and from the study area to adjacent area. Existing regional connectivity is maintained by two north-south creek corridors, mainly Sixteen Mile Creek and Joshua's Creek.

The Subwatershed Study identifies, based on field mapping, five types of existing habitat connections:

1. Agricultural fields and open field habitats;
2. Hedgerows – Generally single rows of trees, sometimes double rows, often shrub-dominated or mixed;
3. Riparian habitats associated with watercourses that are primarily meadow and/or marsh habitats;
4. Stepping stones created by proximity of habitat types with little connecting habitat; and,
5. Connectivity created by contiguous woodland habitats (Town of Oakville 2004, p. 4E-76).

Thus, the Town identified a variety of existing linkages in the study area: open fields, hedgerows, riparian corridors, stepping stones, and woodlands.

Landscape connectivity is identified as an important component of the Town's North Oakville East Secondary Plan (NOESP). The Town's NOESP begins with a vision statement. Policy 7.2.2 Vision states:

North Oakville's development as an urban community shall reflect Oakville's distinct historical roots and small-town heritage and Trafalgar Township's village rural heritage, with nodal development, prestige industry, and green linkages continuing to define Oakville's unique landscape...

The character and pattern of the community will be significantly influenced by a planned natural heritage and open space system. This natural heritage and open space system is designed to protect the natural environment, provide a balance between active and passive recreation needs and contribute to the quality of life in North Oakville and the Town as a whole. A key component of the system will be the provision of an opportunity for residents and employees to use an extensive open space trail system.

The vision statement for the Town's NOESP identifies three goals for the natural heritage system: protecting the natural environment; providing recreational opportunities for the human community; and, contributing to overall quality of life in the area. These goals are supported by Policy 7.2.3 General Development Objectives, which are intended to guide future development of the planning area. The first three objectives feature landscape connectivity:

1. To establish as a first priority of the Town, a natural heritage and open space system, within the context of an urban setting, the majority of which is in public ownership.
2. To create a sustainable natural heritage and open space system which provides a balance between active and passive recreational needs and links to the existing open space system within the Town.
3. To identify, protect and preserve natural heritage features within the natural heritage component of the natural heritage and open space system and ensure that their use respects their functional role as natural areas within the ecosystem.

These objectives confirm that the first priority of the Town was the establishment of a natural heritage and open space system, and that this system was also designed to provide recreational needs, and that natural heritage features and functions within the system are to be protected.

Goals for landscape connectivity are found in Policy 7.3.5 Natural Heritage and Open Space System, which identifies Linkage and Optional Linkage Preserve Areas as areas designed to link Core Preserve Areas together to "maintain and enhance their environmental sustainability". These linkages "follow natural features whenever possible and are intended to be of sufficient size and character, including buffers, to ensure the functionality and sustainability of the Natural Heritage component of the System". However, there is no mention of the specific purpose of each linkage, the species it is intended for, or any justification for the proposed widths. "Environmental sustainability" is a vague goal for linkages. Linkages are species-specific, multi-scale and multi-functional, and they can function as conduit, habitat, filter, barrier, source and sink, often simultaneously, depending on the perspective of the target species. Planning for connectivity should therefore be based, at least partially, on the known behaviour of target species (Bowne et al. 2006).

A cultural goal for landscape connectivity in the NOESP is the provision of recreational opportunities for the human community via a trail system. This goal is supported by the General Development Objectives, intended to guide the future urban development of the Planning Area, which lists its second objective as:

To create a sustainable natural heritage and open space system which provides balance between active and passive recreational needs and links to the existing open space system within the Town.

The trail system is thus intended to be part of the natural heritage system. It not clear to

the authors of this paper how the goals for landscape connectivity and recreation trail connectivity were used in the choice of lands identified as linkages. It appears that the ecological justification for linkages was used by the Town to identify land that could later be used for a trail system. If this is true, then part of the justification of the linkages was not ecological but recreational, even though this was not clearly identified in the selection of the linkages or in their width.

North Oakville Management Inc. (NOMI): NOMI's consultants, as part of their subwatershed study team, produced a report on natural heritage linkages. Appendix K of NOMI's Subwatersheds Study is a 93-page report on Linkages and Buffers on the North Oakville East Lands, which provides an assessment of regional and local connectivity of the study:

The North Oakville East ecosystem is now relatively isolated from other ecosystems by barriers that include urbanization to the south and the east as well as major transportation corridors to the south (Dundas Street, also known as Highway 5), east (403 Expressway Link) and north (407 Expressway).

There is some internal, local connectivity from the western portion of the North Oakville East lands to the 16 Mile Creek valley system to the west. Functional regional connectivity occurs only in and through the 16 Mile Creek system. There is no functional regional connectivity elsewhere on the North Oakville East lands. Some opportunities exist to maintain local, on-site connectivity amongst natural ecosystem elements (NOMI 2004 Appendix K, pp. 4-5)

NOMI's assessment is that the study area was too isolated by major roads and urbanization to provide regional connectivity across the North Oakville site to the larger area of the Halton Region, except for the one north-south valley corridor of 16 Mile Creek. NOMI felt that opportunities did exist to maintain local, on-site connectivity within the case study site.

The vision statement for NOMI's secondary plan features landscape connectivity as an important component of the long-term vision for the proposed communities in the study area. Policy 4 states:

The character and pattern of each Community will be highly influenced by a planned natural heritage / open space system which protects the natural flora of the area while providing extensive habitat for native animals and providing areas for passive and active recreational use. This natural heritage / open space system affords residents the opportunity to use an extensive open space trail system, which travels through mature woodlot blocks, around wetlands, through parks, along stream corridors and along safe and enjoyable streetscapes.

The above vision statement identifies three goals for the planned natural heritage/ open space system: protecting natural flora; providing extensive habitat for native animals; and, providing areas for passive and active recreational use via an open space trail system. These goals are supported by the Environment and Open Space policies under the General Development Objectives in the NOMI plan. Among these objectives are:

1. To establish as a first priority, a natural heritage/open space system within the context of an urban setting that protects, preserves and, where appropriate, enhances significant natural heritage features, functions and linkages.
2. To create a sustainable natural heritage/ open space system which provides for both active and passive recreational needs as well as pedestrian connections within the community and to the existing open space system south of Dundas Street.
3. To balance the natural ecological needs with housing and employment needs of the Town, the ability to create compact transit supportive communities and the social,

recreational and economic needs of Oakville residents.

4. To evaluate through the Subwatershed Study the significance of all natural heritage features and functions within the North Oakville East Secondary Plan area and to establish a policy framework for more detailed levels of evaluation at succeeding stages of the planning process.

5. To promote wooded urban squares as special focal points within the community.

6. To protect significant valleys and stream corridors while recognizing that many other stream corridors within the Secondary Plan Area are intermittent and have been modified by agricultural activities and may be further modified, realigned or consolidated.

These objectives confirm that the first priority of the NOESP is the establishment of a natural heritage and open space system that protects, preserves, and, where appropriate, enhances linkages. This system is intended to balance ecological needs with the needs of the human community, including passive and active recreational use. Landscape connectivity is thus identified as an important component of NOMI's NOESP. Like the Town's NOESP, biotic and cultural goals are presented but abiotic goals for landscape connectivity are not presented.

The Greenland Policies of the Land Use Plan for the NOESP include a section on linkages. Policy 1.1.1.2 e) vii Linkages states:

Linkages identify existing Natural Areas and potential Restoration Areas that currently provide a natural linkage function for wildlife species typical of the Secondary Plan Area. The primary function of linkages is to maintain connectivity for wildlife populations and/or habitats that are naturally continuous. Linkages should not be established between areas that previously did not exhibit functional connectivity.

The primary biotic goal of linkages is to maintain connectivity for wildlife

populations and habitats that are naturally continuous.

A cultural goal for landscape connectivity in NOMI's NOESP is the provision of recreational opportunities for the human community via a trail system. Policy 1.11.4 entitled The Transportation and Transit Network includes a section on trails. The policy on cycling and pedestrian trails states:

The Urban Design and Open Space Guidelines establish a potential pedestrian and cycling trail system. This trail system provides connections within Greenland Area designations, along the boulevards of arterial roads, and along portions of collector roads that are critical to the continuity and connectivity of the trail system. Cycling trails are primarily located within open space lands and street boulevards and not located within roadways of high volume arterial roads. Cycling along local roads within neighborhoods will be facilitated by an interconnected street and open space system.

The proposed trail system will connect with Greenland and open space lands. Further in the Subwatersheds Study, the potential for the trail system is expanded upon:

Along with considering the need for wildlife connectivity, it is important at this stage in the design process to consider the need for human connectivity elements on the North Oakville East lands east of 16 Mile Creek. The careful planning that has gone into designing ecological linkages, buffers and natural areas for the site can be used as the groundwork for designing a detailed trails plan for the North Oakville East lands. A trail system can provide opportunities for recreation (e.g. walking, bicycling, roller blading), education (e.g. nature walks for school children) and natural history (e.g. bird-watching, plant identification, wildlife-viewing) (NOMI 2004 Appendix K, p. 80).

Two additional cultural goals for landscape connectivity are identified by NOMI: education and natural history. However, it is clear in the NOMI approach

that the linkages were chosen for their ecological functioning, not for their potential for recreational linkage. The recreational trail design, when it would be designed in the future, would have to fit into the matrix of cores and linkages produced by ecological mapping.

What approach to linkage identification and design was employed?

Both the Town and NOMI employed an intuitive, natural heritage system approach based on a system of core areas, linkages, and buffers. In general, the approaches were similar, but there were significant differences that are outlined below. Each approach is presented separately, and then compared.

Town of Oakville: Existing linkages were identified based on field mapping, aerial surveys, and wildlife observations. The Town's Policy 7.4.7 Natural Heritage Component of the Natural Heritage and Open Space System states that the length, width and general location of the linkages were defined based on factors established through the North Oakville Creeks Subwatershed Study, including:

- Composition of potential linkage feature;
- Character of the surrounding habitats;
- Presence and size of discontinuities; and,
- Required buffers.

It is important to note that these factors do not include a specific purpose of each linkage, target species, or species requirements, all of which are key factors affecting the likelihood of linkage success (Bennett, 2003). Whereas the Town's NOESP presents the process for determining width of stream corridors in detail (see Appendix 7.4 Stream Components), there is no similar rationale given for the widths assigned to the linkages.

The Town's Subwatershed Studies refers to several important linkage design considerations, but does not put them into practice. For example, it states, "Ecological linkages must be designed with an understanding of the species that will use

the connection" (Town of Oakville 2004 p.6-18). However, there is no mention of which species were used for the design of the Town's linkages. It states, "A diversity of linkage types and a measure of redundancy in the linkage network should be considered to provide a range of movement opportunities" (Town of Oakville 2004 p.6-18). It then states that all linkages should be 100 meters wide, except in one case where 70 meters is used. Despite recognizing the importance of having a variety of linkage types and despite previously acknowledging the existence of several types of linkages on site, including stepping stones, the Town predominantly used one type and one width of linkage. The 100 meter width may be excessive and may not be ecologically necessary given the existing low-level of linkage function in some locations on the site. Many of the proposed linkages contain roads, driveways, buildings and fences, all of which are serious barriers to connectivity that the Town does not address. Some of the proposed linkages lead to nowhere (there is no end habitat other than a major road) and two of the proposed linkages do not function in support of any linkage goal. In addition, the Town does not have ecological restoration plans for their proposed linkages, yet their intent is for the linkages to become forested and have linkage functions as per the PPS requirement to explore ecological restoration in linkages.

North Oakville Management Inc. (NOMI): The linkages were determined using aerial photographs, maps, and the habitat requirements of target species selected for the study area. Subsequent field observations "suggest that these linkage sites provide the highest probability of movement for species that require forested ecosystems" (NOMI 2004, Appendix K, p. 8). To deal with the varying degrees of connectivity in the study area, a flexible, three-level system of linkages was employed:

By using a variety of linkage types that includes both strips of forest, wetland and

Provincial Policy Statement 1996	Provincial Policy Statement 2005
<i>Landscape Connectivity is defined as:</i>	
“The diversity of natural features in an area, and the natural connections between them should be maintained, and improved where possible.”	“The diversity and connectivity of natural features in an area, and the long-term ecological function and biodiversity of natural heritage systems, should be maintained, restored or, where possible, improved, recognizing linkages between and among natural heritage features and areas, surface water features and ground water features.”
<i>Natural Heritage Features and Areas protected from incompatible development:</i>	
Significant wetlands Fish habitat Significant woodlands south and east of the Canadian Shield Significant valleylands south and east of the Canadian Shield Significant portions of the habitat of endangered and threatened species Significant wildlife habitat Significant areas of natural and scientific interest	Significant wetlands Significant coastal wetlands Fish habitat Significant woodlands south and east of the Canadian Shield Significant valleylands south and east of the Canadian Shield Significant portions of the habitat of endangered and threatened species Significant wildlife habitat Significant areas of natural and scientific interest
<i>Development and Site Alteration not permitted in:</i>	
Significant wetlands south and east of the Canadian Shield Significant portions of the habitat of endangered and threatened species	Significant wetlands in Ecoregions 5E, 6E and 7E Significant portions of the habitat of endangered and threatened species Fish habitat Significant coastal wetlands
<i>Development and Site Alteration Permitted if it has been demonstrated there will be no negative impacts on the natural features or their ecological functions:</i>	
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 Significant areas of natural and scientific interest	Significant wetlands in the Canadian Shield in Ecoregions 5E, 6E and 7E Significant woodlands south and east of the Canadian Shield Significant valleylands south and east of the Canadian Shield Significant wildlife habitat Significant areas of natural and scientific interest
<i>Agricultural Uses permitted in:</i>	
Agricultural uses permitted to continue in all areas	Existing agricultural uses permitted to continue in all areas
Development and Site Alteration Permitted on Adjacent Lands if it has been demonstrated there will be no negative impacts on the natural features or their ecological functions	
Infrastructure not included in the definition of development	

Table 12.1 Comparison of 1996 and 2005 Provincial Policy Statements

field habitat as well as stepping stones or patches of habitat that provide resources and assist animals in moving across a landscape, planners are better able to maintain connectivity at different spatial scales and take into account the mosaic of habitats now present at the site...Having a variety of linkage types provides options for a wide variety of species (NOMI 2004 Appendix K, pp. 17-18).

NOMI planning for connectivity uses a variety of species at a variety of scales using a three-level system of linkages consisting of:

- Level 1 Linkage is the highest functional connectivity, with existing habitats linked by similar ecosystem communities, for instance, two woodland areas connected via a forested hedgerow. Level 1 linkages are suitable for species intolerant of habitat disturbance and/or with low to moderate dispersal capacities.

- Level 2 Linkage also provides continuous connectivity, but habitats are linked by somewhat different ecosystem communities, for instance, two woodland areas connected via a wetland or a drainage feature. Level 2 linkages are suitable for some species utilizing the protective woodland areas and those with moderate to high dispersal capacities.

- Level 3 Linkages are between patches or stepping stones of habitat that provide resources for some species to move through the landscape. Level 3 linkages are suitable for species tolerant of disturbance in linkage and ones that are mobile with high dispersal capacities, typically birds, squirrels, etc. This level of linkage does not require a defined terrestrial corridor between the stepping stones. This type of linkage will be enhanced as drainage features are naturalized, with the planting of parklands and stormwater ponds, and as the urban woodland canopy develops (Stantec et al. 2004 p.32).

The three-level system of linkages was designed to maintain functional connectivity for a variety of species at a variety of scales,

using two types of ground linkage and one type of aerial linkage, the stepping stone type.

NOMI's plan for linkages also included a 32-page section on planning for new roads, which discussed potential measures to mitigate the impact of new roads on ecological connectivity on the North Oakville East site, including wildlife crossing designs for the six target species of the North Oakville East lands. Therefore, the NOMI linkage plan attempted to deal with the issue of linkage blockage created by new road construction during development and current road operation.

Comparison of the Town's and NOMI's Approach

The Town and NOMI have similar approaches, but with four distinct differences (Table 12.2). First, whereas NOMI assesses each linkage individually and employs a three-level system of linkages with varying widths and types, the Town plans for 100 meter wide linkages at virtually all locations. Second, NOMI's approach protects existing linkages, while the Town protects existing linkages, creates new linkages, and in a few locations, proposes new linkages that are non-functional. Third, NOMI's design is based on six target species, whereas the Town does not specify target species. Fourth, while NOMI's approach is strongly referenced to scientific literature, no clear justification is given for the Town's 100 meter wide linkages. In fact, when the authors cross checked the linkage references used in the Town's Subwatershed Studies, none of the references actually supported the Town's use of 100 meter wide linkages in the study area. For example, the Town states that Henry et al. (1999) "reported that corridors should not be less than 100m wide, as this will not create any 'core' habitat for interior or sensitive species." This is false. Henry et al. (1999, p. 647) actually report that, "Landowners and land managers often ask what the minimum corridor width should be for wildlife.

NOMI	Town of Oakville
Flexible due to three-level system of linkages connecting habitat patches. The linkages were assessed individually. Category 1 and 2 linkages were a minimum of 15 meters. Category 3 was stepping stone linkages. Buffers of 7.5 meters on both sides of Category 1 and 2 linkages.	Inflexible due to 100 m-wide linkages connecting most types of habitat patches irrespective of the patches being connected. No additional buffers to linkages. One linkage 70 m wide.
Protect existing linkages between habitat patches.	Protect existing linkages between habitat patches. New linkages created between currently isolated habitat patches.
Linkage design based on requirements of six target species: white-tailed deer, red fox, deer mouse, Eastern garter snake, American toad and gray squirrel.	No target species specified.
Detailed road redesign proposed to facilitate linkage functions.	No detailed road redesign proposed where linkages abutted roads.

Table 12.2 Comparison of the Approaches to Linkages on North Oakville East Lands.

Although this may seem like a reasonable question, in reality, there is no magic width, above which wildlife thrives and below which they are nonexistent". Therefore, this key reference was misapplied, and, perhaps, misunderstood.

Neither group did detailed field studies to evaluate the actual linkage functions across the entire site, in order to measure wildlife movement over the year.

The NOMI linkages varied in width, with a minimum of 15 meters, plus 7.5 meters of a buffer on both sides, leading to an effective width of 30 meters. The Town proposed 100 meter wide linkages, including the buffer, at virtually all locations. Given the significant reduction in the area available for development, the developers seriously questioned the Town's expansive linkage strategy. However, through negotiation the developers got the Town to agree to use up to half of the width of the linkage area for stormwater management facilities at certain locales. This meant that the developers had

more developable land, thus somewhat reducing their concern about developable land lost to greenspace.

Table 12.2 compares the two approaches to linkages on the North Oakville East Lands. This comparison provides an example of an important issue: landscape connectivity planning faces constraints in terms of interpretation. In this case, planners for the Town and NOMI, using the same scientific literature, background data and maps, came up with two landscape connectivity plans for the study area that are largely similar but have significant differences. These differences would have led to a very interesting debate had both Secondary Plans been submitted to the OMB, which of course never happened.

What types of planning strategies were employed: offensive, defensive, protective, or opportunistic?

Town of Oakville: According to Ahern's typology, the planning strategies employed by the Town's NOESP constitute an offensive

strategy. An offensive strategy is a vision or landscape configuration, which requires restoration or reconstruction to rebuild landscape elements in previously disturbed or fragmented landscapes (Ahern 2005). The Town's emphasis on creating new linkages represents a future landscape for the North Oakville East Lands that must be realized through restoration. The offensive strategy requires the displacement or replacement of intensive land uses (e.g. urbanization, agriculture) with extensive land uses that "put nature back" into the landscape (Ahern 2005). According to Ahern, this strategy is rarely practiced because it is expensive, uncertain, and, politically sensitive. However, it was successfully used here when a phalanx of government agencies placed their support behind the Town's strategy and the Town successfully negotiated with the landowners in a divide-and-conquer strategy.

According to the Town's Subwatersheds Studies Draft Analysis Report:

The current lack of forested connections and gaps between forested blocks indicates that the feasibility of creating forested connections would require considerable plantings. The existing discontinuities created by roadways are also an impediment to creation of a continuous forested connection throughout the Study Area (Town of Oakville 2003 p. 35).

Therefore, the Town's own estimation, their proposed strategy of creating linkages will be expensive and labour-intensive, with uncertain results. Furthermore, no restoration plan was developed, largely due to concern about the cost of the restoration activities.

North Oakville Management Inc. (NOMI): According to Ahern's typology, the planning strategies employed by NOMI's NOESP constituted a defensive strategy. A defensive strategy is employed when the existing landscape is already fragmented and core areas are already limited in area and isolated (Ahern 2005). The defensive strategy seeks to control and stop the negative processes of

fragmentation or urbanization (Ahern 2005). The defensive strategy is often appropriate as a last resort but can also be described as reactionary and ineffective, if the root causes of negative landscape change remain active (Ahern 1995).

Were alternative scenarios for landscape connectivity evaluated?

Ultimately, only the Town's scenario, in the form of the Secondary Plan, was put before the OMB since the NOMI landowners accepted the Town's approach during negotiations. It appears that the NOMI landowners accepted the Town's interpretation in order to gain faster development approvals and higher development density on lands outside the Natural Heritage System. *Is there a landscape connectivity plan?*

Town of Oakville: Yes.

North Oakville Management Inc. (NOMI): Yes.

Is there a policy of adaptive planning and management?

Town of Oakville: The Town's Subwatersheds Studies includes an Implementation Report, which it refers to as a "living document" that can be refined using an Adaptive Environmental Management (AEM) approach:

AEM means making decisions as part of an on-going process. Monitoring the results of actions provides a flow of information that may indicate the need to change a course of action or change the document. The management strategy also includes recommended policies that should be incorporated into Official Planning documents such as the NOE-SP. Over time, government policies on relevant issues, such as terrestrial systems and SWM, will evolve. This strategy should always be applied with reference to the most recent applicable policies (Town of Oakville 2004, pp. 7-1 – 7-2).

However, the Town's NOESP does not mention a policy of Adaptive Environmental

Management or any form of adaptive planning and management.

The planning period for the NOESP is from 2006 to 2021 and it will be reviewed, at a minimum, every 5 years. The NOESP states that a program shall be established by the Town, in consultation with the Region of Halton and Conservation Halton, to monitor the development in the Planning Area on an annual basis, in accordance with directions established in the North Oakville Creeks Subwatershed Study. If it actually occurs, monitoring the proposed linkages will be difficult; however, as there are no specific goals given for the Town's linkages and it will therefore be difficult to establish monitoring protocols in the absence of any goals. Additionally, there was a disagreement amongst the Ministry of Natural Resources, Conservation Halton and the Town of Oakville about who would pay for the long-term monitoring of the linkage functions given its large expense. To our knowledge, no monitoring effort was agreed upon. The documents do not state who would be the manager of these natural heritage lands after development, but it is most likely to be the Parks and Recreation Department of the Town of Oakville. However, comment on how this Department would carry out such management was notably absent in the planning documents. At this point, it appears that the Town was in the process of creating a large greenspace system without stated policies on site management, ecological restoration, or ecological monitoring. Such plans would have to be developed in the future.

North Oakville Management Inc. (NOMI): The Implementation section of NOMI's NOESP included a policy for environmental monitoring;

The Town shall undertake regular monitoring of the health of the natural heritage/open space system within the North Oakville East Secondary Plan Area. The indicators to be monitored and the nature of

the monitoring program (s) will be set out in the Subwatershed Study (NOMI 2004 p.39).

As noted by NOMI's Subwatersheds Study, the implementation of monitoring is initially often the responsibility of development proponents, while in the long term, the local municipality, conservation authority, or Ministry of Natural Resources is responsible for funding and carrying out the monitoring. Ultimately, the management of the Natural Heritage System will be the responsibility of the Town, not NOMI, and while the NOMI documents do make some recommendations for management, ultimately, NOMI indicated it is the Town's responsibility.

SUMMARY

This case study reveals that the urban development process in Ontario contains high levels of emphasis placed on the conservation of cores, buffers, and linkages. Cores are relatively easy to define since they are outlined by identifiable ecological features, such as forests and wetlands. Buffers are placed adjacent to these cores, but there is much debate on the width of these buffers and the land uses that should occur in them after development. This case study shows significant differences amongst planners and ecologists in the interpretation of landscape connectivity theory as applied to ecological linkages within land development. This debate occurred because the scientific literature on linkage design does not provide sufficient information to allow for the precise definitions of linkage functions, locations, and widths that are needed in land use planning. In the absence of scientific precision, political and legal negotiation makes such decisions.

The case study shows that the decision on which approach would be used for linkage location and width largely took place during backroom negotiations between legal counsel, where multiple tradeoffs were made involving development density and timing,

rather than in open discussion or in front of an administrative tribunal on the merit of the competing natural heritage visions. Therefore, it is not possible to understand in detail how and why many aspects of the Town's linkage plan were chosen. In this case, the final decision on the entire open space system, including cores, buffers, and linkages, was made by lawyers representing the various parties, not by ecologists. In fact, throughout the final processes leading to the agreement for the approved outline of the urban form, the ecologists on both planning teams were prohibited by the lawyers from talking with each other.

However, the result was a very substantial natural heritage system composed of cores, linkages, and buffers all owned by the Town and ultimately managed by the Town's Parks and Recreation Department. Significantly, there was little policy developed to guide the long term management of the natural heritage lands by the parks department after transfer from the current land owners to the Town, a common problem in natural heritage planning in Ontario (McWilliam, 2007). This lack of precision in the development of coherent policy for the management of the ecological features in the greenspace system leads to confusion when this management actually takes place, often leading to ecological degradation (McWilliam et al. 2010). This natural heritage system will create a very large open space and park system for the developing community but since the Official Plan goals for residences for 55,000 people and workspace for 35,000 were retained, the developed lands will have much higher urban density than would have occurred with a smaller park system in place. Therefore, the future citizens of this area will see much higher density of development in the areas where they live and work, but very low density in an expansive greenspace system.

The case study also reveals that approved linkage plans may not include all the

necessary elements for long-term linkage success. For example, no ecological restoration plan was prepared for the extensive areas of farmland incorporated in the linkage areas. The lack of target species and specific goals for the linkages in North Oakville will mean that monitoring will be very difficult, as it will not be possible to create a monitoring plan that is based on the approved functions of these linkages. The only statement about ecological monitoring in the Town's Secondary Plan was that monitoring will be done to ensure that: "The health of the Natural Heritage component of the Natural Heritage and Open Space System is being maintained. (Town of Oakville, 2008, p.109)" Stepping stone linkages, which are recognized in the literature (Baum et al. 2004; Bennett 2003; Minor and Urban 2007; Hashimoto 2007; Rahel et al. 2008; Van Langevelde et al. 2002; Williams et al. 2004) were not accepted in this case study as only on the ground linkages were approved.

The case study reveals that in Ontario it is possible for linkages to be approved that go nowhere and thus are not truly linkages. For example, some linkages ended at multilane highways with no plans given for redesigning the highways to improve linkage function across those barriers.

The case study also reveals that the linkage concept can be used by municipalities to gain a considerable amount of open space land during the development process, probably in excess of that actually needed for linkage functions. In the North Oakville case study, some of the land identified by the Town of Oakville as linkages did not have linkage function according to the landowners' consultants. This suggests that the linkage concept under the current Ontario Provincial Policy Statement may be abused so as to gain open space and parkland without the municipality having to buy the land.

This case study is an example of the difficulty of using linkage theory within an adversarial decision-making process. Given

the lack of clarity of the theory as applied to specific situations within urban planning, the final decisions rely on political and legal negotiation involving a wide range of financial, timing, and development options.

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