

Perspectives on the Municipal Role in Effectuating  
Sustainable Industrial Park Development and Operations:  
The Hamilton, Ontario Case

by

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## ABSTRACT

Within the greater movement of sustainable development, industrial practices have been identified as a key area in which much improvement is both necessary and possible. The development and operation of industrial parks have become a focus of these efforts. The basic premise of this thesis is that a sustainable industrial park should function in an economically competitive manner that provides for human needs through market mechanisms while doing so in alliance with the local community, in congruence with the local ecosystem and within the carrying capacity of the planet. From a municipal planning and economic development perspective, this thesis focuses upon the development of a municipal strategy to effectuate sustainable industrial development and operations. Utilizing a blended theoretical approach incorporating general systems theory and planning theories, the proposed industrial park surrounding the Hamilton International Airport, in the City of Hamilton, Ontario, Canada, has been analyzed to develop a viable sustainability vision for the park, identify barriers to implementing and achieving that vision, and formulate a municipal strategy to promote and enable the pursuit and realization of that vision. It was found that there is an important role for the municipality to assume and numerous opportunities for concrete municipal action throughout the planning, development and operational stages of the industrial park. Upon reflection of the research process, the findings were extrapolated to garner wider applicability and relevance to other municipalities provincially, nationally, and internationally, as well as to the professional and academic community involved in industrial sustainability.

*Keywords:* Sustainability, Sustainable industrial park, Eco-industrial park, Eco-industrial development, Industrial ecology, Pollution prevention, Urban planning, Local economic development

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## I INTRODUCTION

Within the greater movement of sustainable development, industrial practices have been highlighted as a key area where much improvement is possible. Sustainable development can be defined as “development that improves the quality of human life while living within the carrying capacity of supporting ecosystems” (IUCN, 1991, p. 10). The implementation of ongoing efforts to improve the efficiency and effectiveness of industrial development standards and operational performance has been propounded as a viable measure towards economic, social and environmental sustainability. The basic premise of such industrial development is that the environmental impact of industrial activities should be mitigated while maintaining or improving economic and social performance. Indeed, environmental performance has become a critical third dimension of industrial development, now closely integrated with the traditional driving factors of technological innovation and economic growth (Marstrand, 1996). There are two main strategies that can be implemented to achieve this end from the initial planning and development stages, through to the ongoing operational activities of the individual firms and the park as a whole. The primary strategies are industrial ecology whereby industrial facilities and activities are considered from a systemic viewpoint and are accordingly designed to function effectively within the natural environment and surrounding community, and pollution prevention whereby sources of waste, pollution or effluent are reduced or eliminated through process and product design.

The fundamental vision of sustainable industrial park development and operation is largely uncontested in the literature. However, due to the exceptional complexity of the systems and subsystems which fall under the umbrella of industrial practices and its interaction with the natural environment and surrounding community, implementation has proved to be significantly problematic, particularly from a planning perspective. The literature does not adequately address this gap be-

tween theory and practice. As noted by Gibbs, Deutz and Proctor (2005), many working on industrial sustainability have approached the problem from a business, management or engineering perspective. Far fewer have analyzed sustainable industrial development from a planning, geography or regional development perspective. Therefore this research will focus upon the implementation of sustainable industrial park development and the realization of sustainable industrial practices, specifically from a municipal planning and economic development perspective.

The purpose of this study is to determine the roles and actions a municipal government should undertake to encourage, and ultimately achieve the built and operational sustainability of industrial activities within the municipality. The overarching research problem centres upon how the local government should effectuate sustainable industrial development and operations within the municipality. It follows that the four underlying research questions are:

- a) What role should a municipal government assume in the pursuit of sustainable industrial park development?
- b) What actions should a municipal government engage in to stimulate and support sustainable forms of industrial park development?
- c) What role should a municipal government assume in the pursuit of the operational sustainability of an industrial park and its constituent enterprises?
- d) What actions should a municipal government engage in to stimulate and support the ongoing pursuit of improved industrial operational sustainability?

An important distinction must be made between two terms; role and action. Role is employed in an abstract sense, and is meant to denote *how* the municipal government should interact and function.



Action is employed in a concrete sense, and is meant to denote *what* measures the municipal government should undertake.

In order to conduct this research, the proposed industrial park surrounding the Hamilton International Airport has been selected as a case study. The research process will focus on the development of a viable, sustainability vision for the proposed industrial park, the identification of the barriers to implementing and achieving that vision, and the creation of a recommended municipal plan of action to promote the pursuit and realization of that vision. The findings and recommendations will then be extrapolated to address the fundamental research questions, garnering wider applicability and relevance to other municipalities, as well as to the professional and academic community involved in industrial sustain-ability.



## **2 REVIEW OF LITERATURE, THEORY AND METHODS**

### **2.1 OVERVIEW**

The review of the literature is broken into several sections which progress logically. The first section, Sustainability focuses upon describing and explaining the concept of sustainability and its implications for development. The second, Industrial Sustainability builds upon the concept of sustainability to explain the application of the key strategies of sustainable industrial development and operation, namely pollution prevention and industrial ecology. In the Sustainable Industrial Parks section, the characteristics of conventional industrial estates are discussed, highlighting the need for a paradigm shift in the development and operation of industrial parks. Two case studies are also reviewed to provide examples as to how and why the eco-industrial concept has been applied to industrial parks. Furthermore, the central concepts and fundamental elements of sustainable industrial parks are detailed, and the barriers to implementing and achieving those outcomes are outlined. Finally, the role and actions municipal government can assume to promote and facilitate sustainable industrial development are reviewed.

The section entitled Epistemological and Methodological Underpinnings reviews the commonly employed approaches to the study of industrial ecology and eco-industrial park development and identifies the strengths and weaknesses of these approaches. Also, in this section, the fundamental assumptions adopted in this study are introduced and justified. In the Blended Theory section, the theories synthesized into this study are linked to the epistemological and methodological approach explained in the previous section. The way in which the systems and planning theories have been applied to inform the research process has also been described. Finally, in Basis of Methods, a review of the context mapping process, an influential research method employed to determine a municipal development policy is outlined.

## 2.2 SUSTAINABILITY

At the core of this thesis is the concept of sustainability, a broad concept that is applicable to every facet of human enterprise, and more fundamentally to human ecology. Below, the concept is reviewed with a particular focus upon that which is relevant to industrial sustainability.

One of the most widely known, as well as broad, definitions of sustainability has stemmed from the report of the Brundtland Commission, *Our Common Future* in which sustainable development was defined as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” While widely applicable and useful, and appropriate as a politically palatable, even agreeable definition at the international scale of the United Nations, its vagueness leaves much open to interpretation. Ehrenfeld (2000) suggested the following, more detailed yet still all-encompassing definition:

Sustainability is a possible way of living or being in which individuals, firms, governments, and other institutions act responsibly in taking care of the future as if it belonged to them today, in equitably sharing the ecological resources on which the survival of human and other species depends, and in assuring that all who live today and in the future will be able to satisfy their needs and human aspirations (p. 233).

Ehrenfeld went on to highlight responsibility as a key element of the definition, whereby responsibility entails that actors would evaluate the foreseen impacts of their current and potential activities upon social, economic and environmental sustainability. Robèrt et al. (2002) provided a further, more tangible definition, by categorizing four ultimate objectives of sustainability. The first objective was the elimination of human induced increases in environmental concentrations of substances extracted from the Earth’s crust through substitution of minerals that are of low concentration in na-

ture with those more abundant, the more efficient use of mined minerals and the reduction of our dependence upon fossil fuels. The second objective identified was the elimination of increases in environmental concentration of substances produced by society, through the substitution of persistent and unnatural compounds with those naturally abundant or that break down more easily in nature and the more efficient use of such substances. The third objective was the elimination of human contribution to the physical degradation of nature through over-harvesting, introductions and other forms of modification by drawing resources only from well-managed eco-systems, the most effective and efficient utilization of both resources and land, and the exercise of caution in all forms of modification to nature. The final objective was the ongoing contribution to fulfilling human needs both locally and worldwide, now and for future generations, by using all resources efficiently, fairly and responsibly (p. 199). This definition is particularly useful as it details the most important areas in which human actions must change in order to progress towards sustainability.

Indeed there are a myriad of sustainability definitions that have been developed to address both specific and broad topics. An unfortunate result of this widespread application of the concept is the considerable ambiguity that now applies to its use. The root of the term sustainability, is of course, the word sustain, which may be characterized as the ability to maintain, support or endure something continuously and for a prolonged period of time. Perhaps it is this root, that has led the concept of sustainability to be interpreted in a diversity of ways, oftentimes leading to its misapplication. The concept of sustainability entails a much different outcome than simply maintaining the means to the standard of living enjoyed by much of the population within the developed world, or even in the globally universal attainment of such a standard. While it is indeed an aim of sustainability that the needs of all individuals are met, and that the good quality of life enjoyed by some today not

regress, and yet become more widely attained, the true concept of sustainability entails that such results be realized differently than they have been to-date.

Glavič and Lukman (2007) indicated that the development of a vision for a sustainable society and the implementation of that vision “will require different thinking patterns and changes in lifestyles to achieve” (p. 1884). Undeniably, sustainability requires change. Change to our manner of resource extraction, our manufacturing processes, our consumption habits, our conception of waste. Change to our patterns of spatial development, our transportation, our food production, our resource allocation. Most fundamentally, sustainability requires change to our evaluation of economic performance, our perception of societal well-being, and most critically to our approach to human ecology. An excerpt from Hill (2006) elaborates upon this last point:

Ecological sustainability affects the survival and well-being of all life. Social and cultural sustainability relates only to human groups, and personal sustainability to individual well-being. Money and economic systems, like politics, technology, and even religion, are human constructions (in a sense, merely tools) that enable us to act on our values. As a result, they should not be accorded the same status as the environment when considering sustainability (p. 33-34).

It is also important to note, that sustainability does not just require change of a static nature. Instead, sustainability is an ongoing and iterative process. This returns to the concept of responsibility. Individuals, firms, governments and other institutions must continuously evaluate the impact of their activities, in order to adapt, progress and improve towards sustainability in light of the current context.

## **2.3 INDUSTRIAL SUSTAINABILITY**

The call for industrial sustainability is founded in the realization that while industrialization has brought countless benefits to humans, both individually and societally, it has also caused or perpetuated considerable environmental degradation and social inequity. As Dunn and Steinemann (1998) noted, “in many communities, economic development has come at the expense of healthy ecosystems and health social systems” (p. 663). Industrialization has served to heighten the material, health and social divide between income classes as well as nations. The location of industrial parks, particularly those which host heavy industry, have indeed brought jobs and spurred local development, yet the environmental impacts of these sites have resulted not only in contamination of the air, water and soil and the destruction of local ecosystems, but have marginalized the local citizens by tarnishing the beauty and vitality of the land upon which they reside, and by increasing their exposure to harmful emissions and effluent. As an example of this reasoning, Graedel (1994) noted that the concept of “industrial ecology arises from the perception that human economic activity is causing unacceptable changes in basic environmental support systems” (p. 23). While much of the literature pertaining to industrial sustainability focuses upon the effective balancing of industrial economic activity with its corresponding environmental impact, it is equally important, from a sustainability perspective, to incorporate the social performance of industrial enterprise into the equation.

### **2.3.1 Key Strategies of Industrial Sustainability**

The two fundamental strategies of industrial sustainability are pollution prevention and industrial ecology, which are complementary in nature. Both strategies encompass specific measures, methods and initiatives designed to enhance the sustainability of industrial practices. Below a description of each strategy is provided, along with a synopsis of the principles that have been developed for its implementation, and a brief history of its adoption.

### *2.3.1.1 Pollution Prevention*

Pollution prevention is an essential strategy in the pursuit of industrial sustainability. It is a multi-media environmental management strategy that emphasizes the reduction, or ideally the elimination of waste and harmful emissions at the source of generation. The fundamental tenet of the strategy is to preempt the production of pollutants, not only through the conservation of natural resources and materials, but also by effectively preventing accidental spills and releases, and avoiding exposure to toxic and dangerous materials (Glavič & Lukman, 2007). An important distinction is that preventative environmental management involves upstream action, before environmental impacts occur. This is in contrast to more traditional environmental management strategies which focused upon environmental endpoints such as end-of-pipe treatment and environmental remediation. While these measures often reduce the environmental and human health impacts of anthropogenic emissions and waste, and consequently remain important within a more comprehensive environmental management strategy, they are expensive to implement effectively and inherently fail to address the root causes of pollution (Jackson, 2002). While pollution prevention strategies are indeed more desirable as they target the root causes of pollution, most pollution prevention initiatives are limited in that many adverse environmental and human health impacts of industrial activity cannot be completely eliminated. To function, most industrial processes necessarily generate wastes or by-products. It has thus been argued that both end-of-pipe and pollution prevention methods should be integrated into a broader systemic approach such as industrial ecology, to further increase the effectiveness and comprehensiveness of the sustainability initiatives of industry (Erkman, 1997). Another important distinguishing feature of pollution prevention, is that most of its actions are developed and implemented more or less autonomously by and within individual firms. Conversely industrial ecology is focused much more upon systemic ecological sustainability outcomes, capitalizing upon exist-



ing and potential horizontal and vertical relationships between firms and other actors to optimize environmental performance.

#### *2.3.1.1.1 Implementation Principles*

There are several principles upon which pollution prevention initiatives are based. The first is the minimization of resource use, including energy, water and material. The term also encompasses natural capital such as forests, watersheds, and habitats among other resources essential to the survival and resiliency of ecosystems. The goal is thus the conservation of resources, to maintain and improve their availability, while a reduction in the usage of materials and energy can concurrently result in significant cost savings (Glavič & Lukman, 2007). One area of specific concern are resources that are now crucial to industrial processes and that are known to be in increasingly short supply, such as copper and petroleum (Graedel, 1994). To effectively achieve this goal, the process of natural resource use minimization is not solely focused upon minimizing the use of a given material. Instead a method has been developed to evaluate the relative environmental harm associated with the extraction or diversion of resources from their natural ecosystemic pathways and the supplementary material and energy necessary to process that natural resource into its useful form (Gianetti, Bonilla, Silva, & Almeida, 2008). The results enable companies pursuing a resource reduction strategy, to select the best material input, from both a relative environmental and economic perspective.

Source reduction is another primary principle of pollution prevention, whereby the volume of material and energy required to fulfill economic functions are reduced, through the redesign of products, the production process or patterns of consumption (Glavič & Lukman, 2007). This concept is related to design for environment, a product development or refinement process in which the

environmental impact of a product is assessed throughout its complete life cycle. The ultimate objective of the process is to design products that render the best environmental impact possible for the product or service provided. Life-cycle assessment (LCA) is an important tool available to assist this process. In LCA, material and energy flows are traced throughout the life-cycle of a product, from cradle-to-grave (raw material extraction, processing, transportation, consumption, and ultimate disposal), or preferably from cradle-to-cradle (cycle concludes with remanufacturing as opposed to disposal). Environmental LCA provides a formal approach to identifying and evaluating the total environmental impact associated with the provision of a product, providing quantitative environmental information to product and process design engineers (Clift and Longley, 1996). The inclusion of environmental dimensions in product design and services contributes to ongoing innovation, which is an important element of the pursuit of sustainability.

A final central principle of pollution prevention, is eco-efficiency. This concept is essentially focused upon the production and delivery of goods and services to meet human needs and contribute to a good quality of life in a cost effective manner, while concurrently improving the environmental impact of those products and services until the estimated carrying capacity of the planet is not exceeded by their provision (Glavič & Lukman, 2007). At the core of this concept is the attainment of a sustainable balance between economic objectives and environmental outcomes. As a result, eco-efficiency can be summarized as the increasingly efficient use of materials and energy in order to generate profit, and created added value in an environmentally responsible manner.

#### *2.3.1.1.2 History of Adoption*

Partially due to the nature of pollution prevention being widely practiced by and within individual firms, the history of its adoption is not as easily tracked as the more collaborative initiatives of

industrial ecology. However it is possible to trace the evolutionary course of environmental strategies. Pollution control, particularly end-of-pipe measures, defined the environmental agenda of industry and regulators in the 1970s, known as the ‘Compliance Era’ (Miller, Burke, McComas & Dick, 2007). By the 1990s proactive pollution prevention strategies came to the forefront, particularly as the economic and environmental benefits of prevention strategies became clear and widely understood (Ochsner & Chess, 1996). Firms were certainly identifying pollution prevention as a key element of their overall environmental compliance strategy by the mid-1990s, as the survey results of Florida’s 1996 study of manufacturing businesses indicated “firms strongly favour source reduction, recycling, and production process improvements over treatment and end-of-the-pipe control technology” (p. 100). To further this point, Lambert and Boons, (2002) indicated that pollution prevention methods such as heat integration, water cascading and recycling of materials have long been adopted as an essential technique by heavy industry beyond traditional end-of-pipe pollution control method, in response not only to the cost savings made possible by such measures, but to public image concerns pertaining to environmental responsibility. In summary, modern pollution prevention strategies have clearly evolved as it became clear that pollution control measures alone were not adequately effective in terms of economic, environmental or public health outcomes.

### *2.3.1.2 Industrial Ecology*

Industrial ecology is concerned primarily with the sustainable management of inputs, by-products and wastes associated with industrial activity. Founded in the development of general systems theory and the trend towards systems thinking in economics and environmental science, the basic premise of industrial ecology is to integrate our understanding of industrial activity into the larger, biophysical context within which it functions, thereby logically leading to the use of the natural world as a model for organizing industrial activities and entire production-consumption struc-

tures (von Malmberg, 2004). This natural model was described by Korhonen (2004), who explained that in natural ecosystems “material cycles and energy cascades are the foundation of the system operation, solar energy being the only external input to this materially closed system” (p. 812). In contrast, the dominant material and energy flow model of modern society, is an inefficient linear throughput model, in that raw materials are extracted from the earth, processed, and ultimately discarded as useless waste. Industrial ecologists have challenged this linearity by proposing an alternative flow model in which materials and energy flow in a cyclical and cascading roundput system (Korhonen, 2007). The industrial ecology concept is rooted in observation of both industrial and natural systems. As Erkman (1997) elaborated, “the idea is to first understand how the industrial system works, how it is regulated, and its interaction with the biosphere; then, on the basis of what we know about ecosystems, to determine how it could be restructured to make it compatible with the way natural ecosystems function” (p. 1). Two core principles thus govern the design and management of industrial ecosystems: approach each level and function of industry “as a living system participating in larger natural systems, and use the principles and dynamics of ecosystems to guide industrial design” (Lowe, Warren & Moran, 1997, p. 19-20). Drawing from this perspective, several features of natural ecosystems have been highlighted as the most important to be mimicked by industrial systems. The first centres upon the minimization of resource use; energy should be conserved and cascaded and generated from sustainable, low-impact sources while the consumption of scarce resources and release of unnatural levels of substances and compounds should be minimized or eliminated. Secondly, industrial and consumer waste streams should be eliminated through reutilization as inputs in new industrial processes, thereby mimicking the cycling of nutrients by various organisms throughout the foodweb of ecosystems. Finally, industrial systems should be diverse and include redundancy of function to establish resilience and the ability to recover from unexpected

shocks and adapt to ongoing change (Frosch & Gallopoulos, 1989). For industry to effectively mimic and integrate with these features of natural ecosystems, the practice of industrial ecology is, in essence, about connections (Cohen-Rosenthal, 2000). Material and energy connections are certainly part of this equation, but of equal importance to the realization of the industrial ecology strategy is the establishment and propagation of organizational and human connections.

#### *2.3.1.2.1 Implementation Principles*

In addition to the implementation principles associated with pollution prevention, industrial ecology adds a unique principle, symbiosis. This principle is fundamental to the fulfillment of the industrial ecology vision as it is the embodiment of the fundamental tenet of the strategy; biomimicry. In an industrial ecosystem, the byproducts of one industrial process, such as materials, water, energy, heat, cooling, and compressed air, serve as inputs to other industrial processes throughout the local or regional industrial network. This industrial symbiosis parallels foodwebs in natural ecosystems (Dunn & Steinemann, 1998). There are several clear benefits of symbiotic industrial exchanges. The first is that it reduces the quantity of raw materials required by industry, which is not only economically beneficial but also environmentally and socially advantageous due to the resulting decline in consumption of the earth's finite resources. The second is that byproduct symbiosis decreases the volume of non-reusable and hazardous waste that is generated, in turn avoiding the environmental pollution caused by landfills and other forms of waste treatment (Fons & Young, 2006). Finally symbiosis increases both the variety and volume of process outputs that have a market value, which often result in new sources of income for existing firms, and promotes the development of new businesses and job opportunities (Cohen-Rosenthal, 1996).

As previously noted, industrial ecology is based not only upon material and energy connections, but those of organizations and individuals. Geography is a significant factor in the establishment of all of these connections. Chertow (2002) elucidated upon this point, explaining that, “the keys to industrial symbiosis are collaboration and the synergistic possibilities offered by geographic proximity...industrial symbiosis consists of place-based exchanges among different entities” (p. 314). It follows that the primary domain of the practice of industrial ecology is the industrial estate, where opportunities for symbiosis and other collaborative sustainability initiatives are fostered by the locational proximity of stakeholders. Furthermore, beyond the borders of industrial parks, regional opportunities for synergies are also commonly viable. As purported by Sterr and Ott (2004), and concluded by Wolf et al. (2007), it is not only possible, but more viable to identify both existing and potential opportunities for new material and energy exchanges through a local and regional analysis of existing industry and potential new industrial actors that together could enhance symbiosis initiatives in the jurisdiction. In summary, the principle of symbiosis engenders a broad range and scope of opportunities for improved industrial sustainability on a systemic scale, beyond those attainable through individual pollution prevention efforts alone.

### *2.3.1.2.2 History of Adoption*

The symbiosis network of industrial byproducts exchange realized in Kalundborg, Denmark is widely cited in the literature as the preeminent modern example of industrial ecology in practice. Five main firms are involved in the exchange, which evolved over twenty-five years, beginning in the 1970s as a series of “separate bilateral deals between companies that searched to reduce waste treatment and disposal costs, on the one hand, and, on the other, to gain access to cheaper materials and energy while generating income from production residue” (Desrochers, 2000, p. 1). By 1994, the industrial ecosystem of Kalundborg had provided to its participants cumulative revenue of \$120 million from sixteen investment projects, which cost approximately \$60 million in total and averaged a payback period of five years. Furthermore the environmental benefits realized by this network included more than 226 000 tons of reused waste products per annum and the reduction of air emissions by more than 185 000 tons annually (Martin, Weitz, Cushman, Sharma, & Lindrooth, 1998). While the network of byproduct exchanges was not planned from the beginning, the example certainly serves as an inspiration for other jurisdictions seeking to develop their own industrial symbiosis networks and optimize their sustainability performance in the process (Schlarb, 2001).

Of note, while Kalundborg is widely acclaimed, it is far from the first historical example of industrial symbiosis. Desrochers (2000) cites numerous historical examples not only of industrial byproduct exchange, but also of entire industries developing in recognition of the input value of an industrial waste stream. Indeed, literature pertaining to the utilization of waste streams dates back to the 19th century (for example, see Simmonds, 1862; Koller, 1918; Spooner, 1918; Talbot, 1920; and Kershaw, 1928). However, in recent decades a shift has occurred in industrial practices and the literature pertaining to the topic, to incorporate an environmental and social tone where economic concerns once dominated. While this modern concept of industrial ecology emerged in the 1970s,

early deliberate and planned attempts to incorporate the concept into practice were generally unsuccessful (Erkman, 1997).

The popular momentum of industrial ecology can be traced to two primary triggers. In 1989, *Scientific American* published an article entitled “Strategies for Manufacturing” in which attention was raised to the prevalent linear system of resource use and disposal in industry (Frosch & Gallopoulos, 1989). Schlarb (2001) contends that “since that time, the concept of industrial ecology has captured the imaginations of a growing number of businesses and communities” (p. 3). The second stimulus could be attributed to the Rio Earth Summit in 1992, during which Agenda 21 was developed; a comprehensive global action plan that addressed human activity impacts on the environment. The principles of sustainability championed in the plan helped stimulate public and private actors to “adopt a comprehensive approach to improving their environmental, economic, and social performance” (Park & Won, 2007, p. 12). Industrial ecology has continued to gain momentum in recent decades, as our understanding of industrial ecosystems has improved, as its principles and tools have been developed and as efforts to implement the strategy have become more common. The challenge now faced now is primarily one of effective incorporation of industrial ecology into holistic, place-based sustainable industrial development strategies.

## **2.4 SUSTAINABLE INDUSTRIAL PARK DEVELOPMENT AND OPERATION**

In the pursuit of industrial sustainability, initiatives have naturally progressed from process specific pollution control and factory specific pollution prevention measures to the more integrated and collaborative place-based strategies of industrial ecology. The logical arena for fostering an environment that both promotes and enables the holistic pursuit of sustainability is the industrial park. Focus has now settled upon the development of sustainable industrial parks, often referred to as eco-



industrial parks in the literature, which are designed to ensure a certain environmental standard is met by all companies throughout the park, to facilitate implementation of the principles of industrial sustainability, and to foster an environment in which collaboration, innovation and community connections can develop to enhance the economic, social and environmental sustainability of the park and the activities of its constituent enterprises.

## 2.4.1 Industrial Parks in Brief

### *2.4.1.1 Definition*

The concept of the industrial park was first developed in the late 1800s in industrializing countries, as a means to promote, plan and manage industrial development, though it was not until the 1970s that industrial estates began to increase significantly in number. By 1996, it was estimated that there were more than 12,000 such industrial parks, alternatively known as estates, zones or districts, worldwide (UNEP, 1996). Industrial zones are developed on relatively large tracts of land, commonly greater than 40 hectares and most often have access to major transportation networks. Industrial estates vary widely in age, size, and organizational structure. They can also be distinguished by the type of industry they house. Some are distinctly characterized by heavy industry, while others feature a mix of companies that range in size, industry and function and also include institutional and commercial uses. In all cases however, industrial parks are formed through the clustering of these uses within a defined geographical area. Of particular note, a management dimension is fundamental to the industrial park concept, as parks are more than simply designated areas in which industry can locate. Such management is commonly exercised by a local authority, such as a municipal government through detailed planning with respect to zoning, land use, site servicing, access, design standards and operational bylaws.

#### *2.4.1.2 Environmental Impacts*

Industrial estates, particularly those that have been in existence for several decades, are infamous for the environmental degradation associated with their development and operation. All of the environmental problems commonly associated with individual industrial production processes are present in traditional industrial parks. These include effluent, hazardous and benign wastes, air emissions, energy use, toxic chemicals, soil contamination, water and groundwater contamination, noise, and industrial accidents among others (UNEP, 1996; Balkau, 2002). However the size and number of manufacturing firms of industrial estates compounds these issues particularly in their cumulative impact upon a local society and ecosystem. These amassed impacts include deterioration of local habitat and biodiversity, water catchment and airshed pollution, urban blight, land-use conflicts, local natural resource depletion such as groundwater sources, and increased demand upon local waste facilities (Balkau, 2002). For these reasons, industrial estates are a prime target for concentrated efforts towards improved sustainability performance.

#### **2.4.2 Sustainable Industrial Park Defined**

Stemming from the objectives of sustainability, the sustainable industrial park should function in an economically competitive manner that provides for human needs through market mechanisms while doing so in alliance with the local community, in congruence with the local ecosystem and within the carrying capacity of the planet. The broad scope of this definition entails the simultaneous and interconnected pursuit of economic, social and environmental sustainability objectives. While this holistic interpretation of industrial park sustainability is propounded by some authors (see for example Cohen-Rosenthal, 2000; Lambert & Boons, 2001; Balkau, 2002; Robert, 2004; Glavič & Lukman, 2007) much of the literature exhibits a distinct genesis in industrial ecology and the principle of symbiosis. Indeed industrial ecology is widely acknowledged as the catalyst for the de-

velopment of eco-industrial parks, a term that has been liberally applied to describe specifically symbiotic industrial ecosystems through to the more comprehensive means of industrial park sustainability.

There has been significant debate as to which elements are the defining features of eco-industrial development (Gibbs & Deutz, 2004). In fact this ambiguity was reflected in a 1996 workshop involving a cross-section of Canadian and American stakeholders coordinated by the Environmental Protection Agency on eco-industrial parks. In this workshop two definitions of the term eco-industrial park were established:

1. An industrial system of planned materials and energy exchanges that seeks to minimise energy and raw materials use, minimise waste, and build sustainable economic, ecological and social relationships.
2. A community of businesses that collaborate with each other and with the local community to efficiently share resources (information, materials, water, energy, infrastructure and natural habitat), leading to economic gains, gains in environmental quality, and equitable enhancement of human resources for the business and local community (Lambert & Boons, 2001, p. 472).

These two definitions were purported to apply to different industrial contexts. The first, focused upon the technical, symbiotic basis of industrial ecology most aptly applies to older heavy industrial estates, where the intensive use of energy, widespread use of chemicals, and the processing of raw materials create an abundance of opportunities for symbiotic exchanges, while ties to the community are considered to be less significant due to land use segregation. The second definition describes a

more comprehensive view of industrial park sustainability while incorporating the importance of connections stressed in industrial ecology. This definition is more applicable to mixed industrial parks in which the majority of firms are small and medium sized enterprises (SMEs) operating in diverse fields, along with institutional and commercial uses. This definition also applies to newer industrial plants that are generally much cleaner than their older homologues due to pollution prevention measures, and therefore offer fewer opportunities for synergies based on byproduct exchange (Balkau, 2002). While it is thus clear that the term eco-industrial park can apply to the more holistic pursuit of sustainability, due to its ambiguity the term sustainable industrial park has been employed throughout this thesis instead.

### 2.4.3 Selected Existing Eco-Industrial Park Initiatives

Two case studies have been selected for review, namely Burnside Eco-Industrial Park and Synergy Park. These two parks have been chosen because they have been developed in contexts that can be related to the City of Hamilton. Burnside Park, a retrofit project, represents the earliest and most established eco-industrial effort in Canada. Synergy Park, a new development was among the first eco-industrial initiatives in Australia. Lessons that can be drawn from these two initiatives are relevant to sustainable industrial development in the City of Hamilton.

#### *2.4.3.1 Burnside Eco-Industrial Park, Halifax, Nova Scotia, Canada*

Burnside is a 1200 hectare eco-industrial park in Halifax, Nova Scotia, in eastern Canada. It was originally built as a traditional industrial park, but efforts to retrofit the operations, revitalize older areas and shape the course of new development have had positive effects upon the environmental and economic performance of the park.

A study was conducted to initiate the eco-industrial retrofit of Burnside Industrial Park. In the summer of 1992, a sample survey was conducted of 278 businesses located within the park. These businesses represented a wide range of industry types and employed over 5 100 full-time and 480 part-time employees, approximately one-third of the workforce at Burnside (Côté & Hall, 1995). While the survey indicated a strong commitment to environment performance and a willingness to institute change, it was found that small and medium sized enterprises (SMEs) required a fair amount of support to implement eco-efficiency measures (Côté & Hall, 1995; Côté, Booth & Louis, 2006). As a result, by 1998 the Eco-Efficiency Centre (EEC) had been established as a non-profit, non-governmental, educational and environmental management support centre for SMEs in Nova Scotia. The EEC is focused upon promoting and supporting SME initiatives to achieve better economic and environmental performance through the application of pollution prevention and industrial ecology principles and environmental management techniques (Côté, Booth & Louis, 2006). The EEC also actively seeks to foster relationships among tenant firms and raise awareness of potential exchange opportunities between firms throughout the area (Schlarb, 2001).

Environmental reviews are a primary service of the EEC. The reviews enhance business awareness of eco-efficiency matters and provide information and advice on actions that they can undertake to improve performance of their operations. The reviews are complimentary for businesses within the geographic area of the EEC, and include a site visit and a comprehensive report outlining opportunities to improve economic and environmental performance (Côté, Booth & Louis, 2006). Another important outreach measure to area businesses is the Burnside newsletter. Each edition includes an eco-efficiency article. Recent titles have included:

- Packaging: a challenge for sustainability;
- Enhancing environment, energy through green logistics;

- Keeping businesses warm and toasty;
- Energy efficient buildings good for environment, bottom line;
- Separating fact from fiction;
- Are you certain you're doing what you should as a business;
- The benefits of greener business;
- Using the power of green; and,
- Made to measure: Calculating your carbon footprint

The initial study conducted by Côté & Hall (1995) also uncovered the need for a redevelopment plan for older sections of the Burnside Industrial Park. The earliest phases of the development were becoming outdated and beginning to show the signs of dilapidation. Abandoned buildings and lots were present, and amenities and services standard in contemporary industrial developments were not available in the older areas (Côté & Hall, 1995). As such, new site planning and design standards were developed to shape the revitalization of the older areas to not only meet modern standards, but to facilitate eco-industrial activity (Eco-Industrial Solutions, 2008).

#### *2.4.3.3 Synergy Park, Brisbane, Queensland, Australia*

In Australia, the decline of large-scale manufacturing and assembly industries as a result of structural economic change, mirrored the experience of Canada, and particularly the City of Hamilton.<sup>2</sup> During the 1980s, the industrial base of Queensland had significantly declined as Australian manufacturing industries closed and/or moved their operations offshore, resulting in little demand for new industrial land for manufacturing purposes and high unemployment amongst blue collar workers (Freestone & Murphy, 1998). In Carole Park an industrial zone on the western edge of the City of Brisbane, demand remained steady, but only for service and storage facilities and some small-scale manufacturing. The Queensland government, which owned over 662 hectares of land

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<sup>1</sup> Retrieved from [www.burnsidenews.com](http://www.burnsidenews.com) on May 5, 2009.

<sup>2</sup> See Chapter 4 Section 4.1 for details on Hamilton's industrial history.

within the park, sought ways to actively promote more balanced industrial development on the site. In 1998, the State in partnership with a private developer and in collaboration with the local government, undertook the planning and development of Synergy Park, a 37 hectare eco-industrial zone within Carole Park (Roberts, 2004).

As the state government owned the land, the Synergy Park Unit Trust was formed, from which end-users could purchase the land to build their own facilities or purchase turnkey buildings directly from the trust. The end-users also had the option to lease a plant from the trust, established to be a long term lessor. An important feature of the park design is a large common use warehouse facility, which provides secure storage space on a fee for usage basis (Roberts, 2004). This facility eliminates the need for individual companies to build their own dry or cold storage space, which may often be below capacity. Another central facility includes a cafeteria, medical centre and training space, and the building has been designed to permit expansion as other uses are needed.

The local government established a Master Plan, designed to ensure that Synergy Park remained dedicated to industrial development in the food and beverage, and pharmaceuticals sectors or service industries closely related to those sectors, as the location was identified to have a competitive advantage in those sectors. Furthermore possible synergies had been identified within and between those sectors, enhancing the eco-industrial potential of the development. The Master Plan also dictated the overall site layout based upon clustering the food and pharmaceutical industries and linking them to nearby supplier and distributor industries in nearby commercial and industrial areas (Roberts, 2004). An interesting benefit of this clustering of industrial sectors is the development and implementation of a logistics management system designed to directly alert food manufacturers when their product has been purchased at the supermarket. This information enables the producer

to tailor manufacturing to daily demand and facilitates just-in-time delivery. Few individual firms can afford to invest in these types of systems, thereby demonstrating a clear benefit of integrated collocation.

As a result of the Master Plan, a cogeneration plant has been developed to provide local businesses with flexible and direct supply of thermal energy, that can be efficiently supplied in any required form. Also as a result of the Master Plan, effluent streams from the factories are segregated at the source. Domestic sewage flows directly to the municipal wastewater treatment plant, while industrial effluent is piped separately to the pre-treatment plant, before entering the municipal plant. High quality wastewater is treated and cascaded back throughout the park for non-potable uses (Roberts, 2004). Water and energy efficiency are thus improved through the infrastructure and site design of the park.

Four key lessons were learned throughout the planning phase of Synergy Park. The first was the importance of bringing together the anchor industries and utilities providers that might be instrumental in the formation of the synergies onsite early in the planning process, to establish potential synergistic opportunities at the onset of the project. The second was the need for flexibility in the planning process to enable mixed industrial development to facilitate symbiosis, rather than more conventional segregated land uses. Thirdly, it was found particularly important to engage the public early in the planning process, as misunderstandings centered around the unfamiliarity of some eco-industrial concepts was found to cause significant opposition and development delays. Finally, it was concluded that government support and direct involvement in sustainable industrial development projects was fundamental to the success of the project (Roberts, 2004).



These case studies are revisited throughout this thesis, as a basis for the municipal strategy and as a means to compare the vision for sustainable industrial development and operations within the City of Hamilton with the initiatives of other jurisdictions. Furthermore, elements of these cases have been incorporated into section 2.4.4 on the methods and measures of industrial park sustainability, and the identification of barriers to such development.

#### 2.4.4 Methods and Measures of Industrial Park Sustainability

The development and operation of a sustainable industrial park must, by nature, incorporate a wide variety of elements. These elements can be broadly classified into three categories; the built environment, the industrial operations, and community interaction. For ease of reference the aforementioned elements are classified and presented below, in chart format.

##### 2.4.4.1 Built Environment

**Compendious Quote:** A sustainable property enhances the health and well-being of its occupants by adopting human compatibility principles and contributing positively to its community and to society while meeting the needs for stewardship of the local and global environments by adopting environmental compatibility principles (UNEP, 1997, p. 18).

#### Park Infrastructure

Details	<ul style="list-style-type: none"> <li>• Designed and built to be adaptable and accessible, such as the use of multi-purpose utilities corridors<sup>1,3</sup></li> <li>• Facilitative of water and energy recovery, cascades and material exchanges<sup>1,2,3</sup></li> <li>• Energy is provided through a variety of smaller scale systems, including on-and off-site solar and wind power, local biofuel and district energy through anchor tenant recovery and distribution<sup>3</sup></li> <li>• Infrastructure maximizes use of existing on-site resources and, where possible, incorporates ‘living machines’ designed to mimic natural ecosystems ie: wastewater system that treats run-off and sewage with micro-organisms and vegetation<sup>3</sup></li> </ul>
Sources	<p>1: Brand &amp; Bruijn, 1999, p. 228</p> <p>2: UNEP, 1997, p. 51</p> <p>3: The Sheltair Group, 2001</p>

## Site Design

Details	<ul style="list-style-type: none"> <li>• Define and work within the site specific carrying capacity<sup>1</sup></li> <li>• Maintain, enhance and utilize natural areas effectively and to the greatest viable extent<sup>1,2,3,4</sup></li> <li>• Preserve existing and landscape with indigenous plants<sup>1,4</sup></li> <li>• Retain natural drainage systems<sup>1,2,4</sup></li> <li>• Increased density of development<sup>1</sup></li> <li>• Situate businesses to facilitate servicing and symbiosis, such as heavier industry located in central ‘utility island’ to enable cascading of energy, heat and water to surrounding users<sup>1,3,6</sup></li> <li>• Landscape architects should assume significant role in site design due to design for environment requirements<sup>5</sup></li> </ul>
Sources	<p>1: UNEP, 1997, p. 51            2: Côté &amp; Hall, 1995, p. 44            3: Balkau, 2002, p. 493</p> <p>4: Lowe, Warren &amp; Moran, 1997            5: Carr, 1998, p. 241            6: Roberts, 2004, p. 1002</p>

## Construction Practices

Details	<ul style="list-style-type: none"> <li>• Emphasis on locally sourced, recycled, reused and Forest Stewardship Council (FSC) certified building materials<sup>1</sup></li> <li>• Significant diversion of construction waste from landfills<sup>1</sup></li> </ul>
Sources	1: Derived from CAGBC, 2004

## Facilities

Details	<ul style="list-style-type: none"> <li>• Shared, collective and coordinated facilities through design foresight, such as utility sharing, procurement, waste treatment, transportation, warehousing, corporate office space, central employee services and amenity space etc.<sup>1,2</sup></li> </ul>
Sources	<p>1: van Leeuwen, Vermeulan, &amp; Glasbergen, 2003            2: Balkau, 2002</p>

## Buildings

Details	<ul style="list-style-type: none"> <li>• Intelligent and adaptable building design and construction<sup>1,2</sup></li> <li>• Utilize tools such as Building for Environmental and Economic Stability (BEES), GreenSpec and Athena to improve the sustainability performance of building products and whole building design<sup>3</sup></li> <li>• Building elements include, but are not limited to:             <ul style="list-style-type: none"> <li>▸ window canopies or light shelves;</li> <li>▸ alternative energy systems;</li> <li>▸ green or cool roofs;</li> <li>▸ efficient, targeted lighting;</li> <li>▸ minimal materials use;</li> <li>▸ flexible layouts (ie: movable walls, raised floors);</li> <li>▸ occupant controls of heat and light;</li> <li>▸ abundant natural light and access to views;</li> <li>▸ good air quality;</li> <li>▸ water use minimizing plumbing fixtures;</li> <li>▸ durable building and highly efficient building envelope;</li> <li>▸ materials and finishes have low volatile organic chemicals (VOCs) content, emissions and low environmental life-cycle impacts;</li> <li>▸ efficient mechanical systems integrated with electrical, structural and architectural elements (ie: stratification fans);</li> <li>▸ efficient lighting systems;</li> <li>▸ geo-thermal heating and cooling system; and,</li> <li>▸ elimination of environmentally damaging mechanical systems (ie: HCFCs in HVAC systems)<sup>4</sup></li> </ul> </li> </ul>
Sources	<p>1: Moulton, 2000, p. 51</p> <p>2: Lister, 2006, p. 21</p> <p>3: Cooper, Fava, &amp; Baer, 2008, p. 8</p> <p>4: Derived from CAGBC, 2004</p>

## Building Maintenance

Details	<ul style="list-style-type: none"> <li>• Layout and facilities of building promote recycling, composting etc.<sup>1</sup></li> <li>• Use of non-toxic, biodegradable, ecologically benign cleaning products<sup>1</sup></li> <li>• Continued measurement and optimization of operations and system performance<sup>1</sup></li> </ul>
Sources	<p>1: Derived from CAGBC, 2004</p>

### 2.4.4.2 Industrial Operations

**Compendious Quote:** The process of sustainable development consists of a continuous stream of smaller cooperative efforts through which a group of actors advances its understanding of how to assess social, economic and ecological aspects of their decisions in an integrated way (Lambert & Boons, 2002, p. 473).

## Human and Environmental Health and Safety

Details	<ul style="list-style-type: none"> <li>• Design that is intrinsically incapable of permitting acute environmental impact, even in event of industrial accident<sup>1</sup></li> <li>• Potential risk associated with symbiosis activities should also be evaluated<sup>2</sup></li> <li>• Inventory control is also a means reducing the risk of accidents<sup>3</sup></li> </ul>
Sources	<p>1: Tibbs, 1993, p. 12</p> <p>2: Ashford, 1997</p> <p>3: Côté and Hall, 1995</p>

## Environmental Performance Monitoring

Details	<ul style="list-style-type: none"> <li>• Monitoring is essential and should include:             <ul style="list-style-type: none"> <li>› ambient environmental quality on and adjacent to the site;</li> <li>› concentrations and qualities of pollutants discharged to sewers and receiving aquatic environments;</li> <li>› concentrations and qualities of pollutants discharged to the atmosphere;</li> <li>› quantities and types of solid waste discarded;</li> <li>› quantities and types of hazardous waste produced;</li> <li>› spillages;</li> <li>› quantities of dangerous goods stored on site; and</li> <li>› adequacy of safety and pollution control procedures<sup>1</sup></li> </ul> </li> <li>• Audits, for example of waste, serve to provide the environmental and economic information required to identify and evaluate opportunities for improved eco-efficiency<sup>2</sup></li> </ul>
Sources	<p>1: UNEP, 1997, p. 40</p> <p>2: Côté &amp; Hall, 1995, p. 45</p>

## Innovation

Details	<ul style="list-style-type: none"> <li>• Ecological modernisation is a key element of the pursuit of sustainability, particularly for industrial practices, and has been applied to areas such as material and energy use intensity, logistics efficiency, land use density, and risk reduction<sup>1</sup></li> <li>• Ongoing improvements should be sought as new processes and technologies are developed, for instance in substituting harmful chemicals or less-abundant resources<sup>2,3</sup></li> <li>• Broader analysis to sustainability challenges should be applied to enable the invention of new approaches<sup>4</sup></li> </ul>
Sources	<p>1: Jänicke, 2008, p. 558</p> <p>2: Côté and Hall, 1995, p. 45</p> <p>3: Graedel, 1994</p> <p>4: Cohen-Rosenthal, 2000, p. 250</p>

## Heat and Energy

Details	<ul style="list-style-type: none"> <li>• Clean energy is inherent to the pursuit of sustainability, in response to the air pollution from power stations, global climate change caused by the emission of carbon dioxide and the depletion of non-renewable resources such as oil and coal<sup>1</sup></li> <li>• Biomass from local agriculture may provide a cleaner energy opportunity for local industrial parks, and it is contended that production of biomass for energy can be conducted in an environmentally and socially beneficial manner, particularly in developed countries<sup>2</sup></li> <li>• District heating and cooling loops, potentially along with the co-generation of electricity are often viable solutions for urban industrial parks, which can also facilitate heat, cooling and energy cascades throughout the park<sup>3,4</sup></li> </ul>
Sources	<p>1: UNEP, 1997, p. 9  2: Williams, 1994, p. 211  3: Andrews, 1999, p. 371  4: Carr, 1998, p. 244</p>

## Environmental Management Techniques

Details	<ul style="list-style-type: none"> <li>• Integrate environmental costs into overall accounting and decision making systems<sup>1</sup></li> <li>• Environmental Management Systems (EMS): <ul style="list-style-type: none"> <li>› promote regulatory compliance;</li> <li>› enhance pollution prevention;</li> <li>› increase environmental awareness and stewardship;</li> <li>› improve operational efficiency and control;</li> <li>› integrate information flows pertaining to several media;</li> <li>› provided a basis for identifying and addressing undesirable life-cycle impacts;</li> <li>› improve environmental cost allocation;</li> <li>› create emergency management plans and containment alternatives;</li> <li>› improve responsiveness and adaptability to change;</li> <li>› can trigger innovation; and</li> <li>› effect environmental change along the supply chain, between business clusters, and among clients<sup>2,3,4,8</sup></li> </ul> </li> <li>• ISO 14000 series certification provides credibility to an EMS<sup>4</sup></li> <li>• Application of ISO 14000 as an overall EMS for industrial estates has been a growing trend in Southeast Asia, and also in Europe, as it has also been in the USA, both at the park and company level<sup>5,6</sup></li> <li>• Environmental accounting and total cost accounting are incremental tools that utilize the economic and monetary system to improve the sustainability performance of human economic activity<sup>7</sup></li> <li>• Environmental accounting for example could be employed not only to calculate the monetary payback period for an investment in green technology, but also the environmental impact savings such as a quantified reduction in carbon dioxide emissions<sup>9</sup></li> </ul>
Sources	<p>1: Gale and Stokoe, 2001  2: Bilodeau, 2000, p. 82  3: Mountford &amp; Pessó, 2000, p. 21  4: Sambasivan &amp; Fei, 2008, p. 1425  5: Balkau, 2002, p. 495  6: Cohen-Rosenthal, 2000, p. 255  7: Hill, 2006, p. 34, 36  8: Linnanen, Boström, &amp; Miettinen, 1995, p. 121  9: Graedel, 1994, p. 37</p>

## Internal Operations

Details	<ul style="list-style-type: none"> <li>• Responsible product stewardship is a critical element of industrial sustainability which requires that industry take responsibility for the life cycle environmental impact of its products without time limitation<sup>1</sup></li> <li>• Responsible product stewardship can yield economic benefit to the company, for instance by creating a reliable, future stream of input materials<sup>1</sup></li> <li>• Materials flow analysis (MFA), life cycle assessment (LCA) and design for the environment (DFE) are all practical tools to improve the operational sustainability of industry<sup>2,3</sup></li> <li>• The principles of pollution prevention, industrial ecology and when necessary, end-point treatment are all essential to improving the internal operations of industrial firms<sup>4,5,6</sup></li> </ul>	
Sources	1: Mandu, 2001 2: den Hond, 2000 3: Allenby, 1999, p. 108	4: Andrews, 1999 5: Fons & Young, 2006 6: Glavič & Lukman, 2007

## External Operations

Details	<ul style="list-style-type: none"> <li>• Industrial symbiosis is perhaps the greatest remaining opportunity for improved eco-efficiency after internal improvements and process optimization have been completed<sup>1</sup></li> <li>• Industrial ecosystems should be both diverse and incorporate redundancy, to provide resilience and stability to the exchange network<sup>2</sup></li> <li>• Industrial symbiosis is based upon collaboration and geographic proximity<sup>3</sup></li> <li>• An industrial park ecosystem should build upon the existing industrial base of the community<sup>4</sup></li> <li>• Minimization and recycling of solid waste relies upon close working relationships with suppliers, recyclers, and marketers<sup>5</sup></li> </ul>	
Sources	1: Balkau, 2002, p. 491-492 2: Côté & Hall, 1995, p. 42 3: Chertow, 2000, p. 314	4: Martin et al. (1996) 5: Graedel, 1994, p. 36-37

## Regional Integration

Details	<ul style="list-style-type: none"> <li>• Opportunities to augment the sustainability performance of the industrial park are often present throughout the geographical region, for example opportunities for new material and energy synergies with industries outside the park<sup>1,2</sup></li> </ul>	
Sources	1: Sterr and Ott, 2004 2: Wolf et al., 2007	

### 2.4.4.3 Community Interaction

**Compendious Quote:** The environment in which industrial ecology operates includes the larger community and social context. These factors can be enabling or inhibiting to achieving broad goals for industrial ecology. In the permeable distinctions between workplaces and their surroundings, each can add value to the other. Transport systems, access to municipal services, and links to educational institutions are all ways that can enhance effective eco-industrial activity. The workplaces also need to have a positive impact on the local area through buying materials locally, sharing facilities, diverting potentially polluting materials from the environment and creating quality jobs (Cohen-Rosenthal, 2000, p. 251-252).

### Public Participation

Details	<ul style="list-style-type: none"> <li>• Projects ‘owned’ by experts or those in a position of power are the least likely to succeed, most likely to experience low participation or low levels of compliance, and over time are likely to be unsustainable. Public participation and stakeholder buy-in are thus central to the success of a successful, sustainable project<sup>1</sup></li> <li>• Public consultation and collaboration early in the development process is critical to facilitate the project approval process.</li> </ul>
Sources	<p>1: Hill, 2006, p. 36</p> <p>2: Roberts, 2004, p. 1008</p>

### Awareness

Details	<ul style="list-style-type: none"> <li>• A key to promoting the effectiveness of environmental initiatives and innovation is diffusion, thus effective communication is essential<sup>1</sup></li> <li>• In Western Australia, multi-stakeholder efforts involving business, public sector, environment, engineering and education professionals, to implement cleaner production and eco-efficiency initiatives led to the formation of the regional Sustainable Industry Group, that involved a bimonthly seminar, two or three site visits annually, an annual roundtable, and an electronic newsletter and website<sup>2</sup></li> <li>• Technology and innovation do not provide the whole answer to sustainability, it also lies in human choices to function sustainably, such as curbing consumption and waste<sup>3,4</sup></li> <li>• Efforts to engage the local business and the public educationally to foster understanding of industrial sustainability principles and methods is important to facilitate the development approval process and bolster participation in operational sustainability initiatives<sup>5</sup></li> </ul>
Sources	<p>1: Jänicke, 2008, p. 558</p> <p>2: van Berkel, 2007, p. 744</p> <p>3: Cohen-Rosenthal, 2000, p. 250</p> <p>4: Lowe, Warren &amp; Moren, 1997, p. 165</p> <p>5: Roberts, 2004, p. 1008</p>

## Economic Development

Details	<ul style="list-style-type: none"> <li>• Industrial ecology should inform local economic development because it can serve to:             <ul style="list-style-type: none"> <li>• build evolutionary potential into the structure of the local economy; and,</li> <li>• frame economic development decisions within an environmental design context<sup>1</sup></li> </ul> </li> </ul>
Sources	1: Andrews, 1999, p. 373

### 2.4.5 Barriers

As with all forms of change, particularly that which involves long-term systemic adjustments, barriers rooted in previous norms will arise. Indeed, numerous barriers to the pursuit of sustainable industrial park development and operation were raised in the literature. These included barriers associated with financial issues, regulatory constraints, legal matters, geographical challenges, the risk of interdependence, and resistance to change. These barriers, as presented in the literature, are presented in chart form below, for ease of reference.

## Financial

Details	<ul style="list-style-type: none"> <li>• Oftentimes, the most impeding barrier is the lack of municipal resources to support proactive environmental strategies<sup>1,2</sup></li> <li>• Capital barriers may result in the postponement or abandonment of environmental initiatives such as the establishment of a symbiotic exchange<sup>3</sup></li> <li>• Low disposal costs may result in companies not realizing a net financial benefit for investing in the utilization of waste streams and byproducts<sup>4</sup></li> <li>• Sustainable industrial parks <i>may</i> cost more to develop than traditional parks, and this increased cost may or may not be offset by operating savings within a payback period acceptable to the developer or by the lease of purchase premium paid by the end-user<sup>5</sup></li> <li>• The financial community may be reluctant to support development of an “unproven” approach to industrial parks<sup>5</sup></li> <li>• Information regarding costs is usually not readily available to individuals who may be able to utilize it for the good of the company<sup>3</sup></li> </ul>
Sources	1: Burström & Korhonen, 2001, p. 44 2: Levett, 1996 3: Fons & Young, 2006, 221 4: Mermer, 2001 5: Lowe, Warren & Moren, 1997, p. 148



## Regulatory

Details	<ul style="list-style-type: none"><li>• Potential regulatory burden in relation to the transport of dangerous goods or hazardous wastes for symbiotic purposes<sup>1</sup></li><li>• Once a substance is classified a hazardous waste, is often more difficult to utilize than a similar raw material, encouraging the use of new materials and the disposal of old materials rather than their reuse<sup>2</sup></li></ul>
Sources	1: Yap, 2006, p. 101 2: Fons & Young, 2006, p. 220

## Legal

Details	<ul style="list-style-type: none"><li>• Liability considerations for hazardous materials can favour disposal over selling and/or transferring the material for reuse<sup>1,2</sup></li></ul>
Sources	1: Fons & Young, 2006, 221 2: Schlarb, 2001, p. 11

## Geographical

Details	<ul style="list-style-type: none"><li>• Trade activities do decay with distance. Transporting byproducts or wastes long distances can be economically (and environmentally) impractical<sup>1</sup></li></ul>
Sources	1: Fons & Young, 2006, 222

## Risk of Interdependence

Details	<ul style="list-style-type: none"><li>• If a symbiotic exchange is interrupted or ceased, the early investments in process changes or transport infrastructure to facilitate the exchange are potentially lost, or industrial processes can be interrupted leading to more economic and environmental issues<sup>1,2</sup></li><li>• Some companies hesitate to participate in symbiosis projects due to confidentiality and trade secrecy concerns. Companies tend to be secretive about their waste streams because if competitors know about their byproducts, they may be able to deduce protected trade secrets<sup>2</sup></li><li>• A lack of redundancy within symbiotic networks causes these industrial systems to be extremely vulnerable towards internal disruptions and external effects, a greater number of industrial actors, on a regional scale contributes to stabilizing the network<sup>3</sup></li></ul>
Sources	1: Schlarb, 2001, p. 10 2: Fons & Young, 2006, p. 220-221 3: Sterr & Ott, 2004, p. 951

## Resistance or Impediments to Change

Details	<ul style="list-style-type: none"> <li>• If a solution to an environmental problem requires an intervention in the established patterns of production, consumption, or transport, it is likely to meet resistance, industrial symbiosis for example requires a significant change to dominant, individualist mental models<sup>1,3</sup></li> <li>• Lack of environmental vision among industrial land developers means that social and environmental factors are still often regarded as constraints rather than opportunities<sup>2</sup></li> <li>• Established pathways, entanglements with others, private incentive vs. public good, a willingness to accept waste as a normal cost of doing business, technological funnels, and organizational inertia all contribute to making effective sustainable industrial park development and operation cumbersome<sup>3,4</sup></li> <li>• Capacity is a significant barrier to implementing measures to enhance industrial sustainability, particularly from a municipal perspective<sup>5</sup></li> <li>• The global framing of some environmental issues, such as GHG emissions make it challenging to address at the local level<sup>6,7</sup></li> </ul>	
Sources	<p>1: Jänicke, 2008, p. 557</p> <p>2: Balkau, 2002, p. 491-492</p> <p>3: Cohen-Rosenthal, 2000, p. 246-247</p> <p>4: DeCanio, 1993</p>	<p>5: Robinson, 2005</p> <p>6: Bai, 2007, p. 18</p> <p>7: Wilbanks &amp; Kates, 1999, p. 603</p>

### 2.4.6 Roles and Actions of the Municipality

The roles and actions of the municipality as presented in the literature, are listed below, while the remainder of this section elaborates upon and synthesizes these points.

- Government is an important driver for change
- Principles of sustainability and industrial sustainability to inform:
  - solid waste disposal
  - recycling
  - composting
  - sewage treatment
  - water treatment
  - electricity distribution
  - natural gas distribution
  - road systems
  - parking requirements
  - mass transportation systems
  - municipal procurement
  - hazardous waste sites
  - land use planning
  - site servicing
  - emergency planning
  - local job creation
  - local economic development
  - etceteras
- For example:
  - *land use planning* should include development requirements informed by sustainability principles and perhaps incentivize desirable, yet non-obligatory measures
  - *local economic development* should be focused upon establishing and augmenting symbiotic opportunities throughout the municipality
- Local government should remain active in collaboratively promoting and supporting industrial sustainability initiatives once the park is operational

Brand and Bruijn (1999) asserted that governments are one of the most important drivers for change, while Chertow (2000) indicated the “transition from unsustainable to sustainable is an evolutionary process most likely to be introduced at the local level” (p. 318). It can then be logically deduced that the municipal government is an important stakeholder in the pursuit of sustainability. Most certainly, the municipality has a significant role to play in the development and ongoing operation of a sustainable industrial park. That role includes the traditional functions of the local government, including the provision of site servicing, waste disposal services and economic development, but also branches into new areas of involvement and support, such as the organization of information and training for sustainability measures. It is important to note however, that even the traditional activities of the municipality must be carried out differently to support and encourage industrial park sustainability. The municipal role in sustainable industrial park development and operation, as propounded in the literature, has been reviewed, with a particular focus upon the recommended actions of local governments.

As a means of implementing sustainability initiatives in political arenas, particularly those with an environmental focus, it has been suggested that local governments address environmental issues through an integrated approach by incorporating other domains such as employment, emergency preparedness, economic development and public health (Rayner & Malone, 1997; Bai, 2007). This approach would be particularly effective as it incorporates the systemic nature of sustainability. There are numerous ways to integrate sustainability principles into the functions of local governments. Those that pertain directly to sustainable industrial park development and operation include, solid waste disposal, recycling, composting, sewage treatment, water treatment, electricity distribution, natural gas distribution, road systems, parking, mass transportation systems, local government procurement policies, hazardous waste sites, land use, emergency planning for industrial accidents,

local job creation, and local economic development (Andrews, 1999). There are numerous way in which these functions can influence sustainability. For example, the pricing of services such as garbage collection, water and sewage treatment can significantly influence individual and corporate environmental decisions (Bai, 2007). Additionally, the design, procurement process and construction of site servicing infrastructure can not only achieve sustainability objectives independently, but also through influencing the behaviour of end-users. The provision of all of these services can benefit from the insights offered by industrial ecology and pollution prevention strategies.

Upon focusing on local economic development as it relates to sustainable industrial development, the municipality could assume a unique role by promoting industrial ecology. While it is commonplace for municipal staff to identify and target certain industry sectors for economic development purposes, based upon the competitive advantages, needs and long term objectives of a city, it is unique that such efforts would be targeted based upon the principles of industrial ecology. However, a land and economic development strategy founded in industrial ecology is suggested in the literature as a means of promoting sustainable local development. While the symbiosis network of Kalundborg developed and evolved without significant government support, some members of the network suggested that a formal planning process to identify possible symbiotic partners, disseminate information and attract network entrants would have improved the process and ultimate stability of the network (Dunn & Steinemann, 1998). Municipal planning and economic development departments are well positioned to provide this formal planning process and provide support to the establishment and ongoing development of a symbiotic network.

From a planning and economic development perspective, centrally planned industrial parks in which potential tenants are carefully selected based upon their environmental merit and potential

for local or regional symbiosis was forwarded in early eco-industrial park development literature. However as Schlarb (2001) indicated, “attracting the appropriate combination of tenants with the resources to invest in the most efficient pollution prevention technologies has not proven to be realistic” (p. 4). Furthermore, Lowe, Moran and Holmes (1997) cautioned that over-planning to create the “right” mix of firms would inevitably constrain recruitment of tenants to an industrial park. Instead, a recruitment strategy focused upon a set of target industries that will integrate well with a region’s existing industrial mix and resources was recommended by Gibbs and Deutz (2007), who concluded a more fruitful approach to the establishment of symbiotic network “is to build upon existing and potential linkages within a locality, assisted by a pro-active policy to encourage interchanges” (p. 1683). Thus a more market based approach, such as that propounded by Desrochers (2000), combined with recruitment initiatives to strengthen opportunities for symbiosis, is a more realistic strategy for supporting the development of a symbiotic network.

A range of such recruitment initiatives are available to the municipality, without crossing into the realm of central planning. First of all, the economic development department should maintain close contact with members of any locally established symbiotic networks, and could recruit companies to the network should a void arise or be identified within the network (Schlarb, 2001). Secondly, the department could serve as a platform where the data regarding material and energy flows in the region is gathered and processed (Burström & Korhonen, 2001). These data should provide the following information: the type of materials and byproducts currently produced by regional firms, the type of materials that are currently used by regional firms as inputs, the type of materials and by-product that could be generated by regional firms, and finally the type of materials and byproducts that could be used by regional firms as inputs. The generation, use, and escape of energy and heat

should also be tracked to identify cascading opportunities.<sup>3</sup> Finally, the municipality could assume a clearinghouse function to facilitate communication and information-sharing with and among companies on resource exchange opportunities as well as potential sources of funding to establish the exchange (Schlarb, 2001). While these municipal initiatives have been forwarded in the literature, they apply narrowly to the establishment of an industrial ecosystem. Indeed there are numerous other measures the municipality could implement to encourage and support the development of a holistically sustainable industrial park.

As previously noted, there are a variety of municipal functions that can be adapted to ensure or encourage the sustainable development of industrial parks. As an example, the Dutch have developed a municipal planning process to implement sustainable industrial park development. One of the key components of the initiative is the ‘environmental grading system’ which consists of three packages. The first package addresses the obligation of the municipality to make the park environmentally friendly. This element of the planning process involves, among other things, the provision of environmentally preferable infrastructure for traffic and energy flows and the design of public space. The second package is assembled for the firm establishing itself within the park. It stipulates all mandatory criteria with which the company must be in accordance in order to locate within the industrial park. The criteria include such things as obligatory purchase of sustainable energy, optimal reuse of wastewater, and application of a transportation management system.

The final package is also provided to the establishing firm, and includes additional park sustainability objectives that the company may implement, such as the adoption of product and process

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<sup>3</sup> The Triangle J Council of Governments, based in North Carolina, USA undertook a project to identify synergistic potential within the region. For a review of the methods, outcomes and most importantly, lessons learned, see Kincaid, 2003.

innovations or certain green building technologies, though these are not obligatory (van Leeuwen et al., 2003, p. 150). As adoption of the recommendations contained in the third package is optional, a municipal incentive program to encourage implementation would be beneficial and promote a desirable outcome for the sustainability of industrial park. In the Dutch case, the municipality is presumed to be the owner, and as such, firms that implement items from package three receive a discount on the purchase price of the land upon carrying out the recommended measures. Of course, other economic incentives are available, such as tax holidays, tax rebates, investment grants, interest rate subsidies, government contracts, and subsidized public services, in cases where the municipality is not the landowner, but still wishes to incentivize certain initiatives (Nordström & Vaughan, 1999).

Indeed, an institutional anchor is fundamental to successful development and implementation of a jurisdictional, multi-stakeholder sustainability strategy. Burström and Korhonen (2001) described “the role of such an actor would be to provide the system with education, information, social and economic infrastructure, a decision-making forum, and institutional and political support” (p. 41). In consideration of the normal functions of a local government, it is clear that the municipality is well equipped to provide this foundation, particularly during the planning stages and at the onset of the development. Overtime, that municipal role as anchor to the development may evolve as new stakeholders assume the lead role in maintaining the momentum towards the sustainability of the industrial park, once operational.

Indeed, an incredibly important measure in successfully implementing industrial park sustainability, both on a park-wide and individual firm scale, is the establishment of an organizational or management team dedicated to encouraging and supporting the ongoing pursuit of sustainability. An organizational team can be employed, either from a hierarchical steering position, as in a regional

government, or a more horizontal coordination perspective, such as a team organized by the partners in the park themselves to ensure park conditions are supportive of sustainable industrial development (Brand & Bruijn, 1999). The more horizontal team would still include representatives from local government in some of its functions, to ensure collaborative dialogue, and would also partner with other community stakeholders, such as quasi-governmental organizations, non-profit organizations, and educational institutions, among others. That multi-stakeholder organization could provide a variety of services, which might include the organization of collective procurement and sale of energy for the site (van Leeuwen et al, 2003), or the provision of assistance to industrial tenants seeking to overcome regulatory barriers posed not only by local but also provincial and federal levels of government (Andrews, 2002).

Of note, outreach was highlighted as one of the key measures to further the adoption of more sustainable industrial practices. In a study of 500 industrial companies in Australia, Scott, Christensen, Krishnamohan and Gabric (2001) found the most common challenge to widespread application of sustainable industrial practices, was a lack of knowledge. While these companies may have practiced some components, such as cleaner production, broader, more holistic concepts such as industrial ecology were not widely known. As such, the municipality certainly has a key role to play in the dissemination of information and knowledge, particularly in the early stages of the planning and development of the park, until the multi-stakeholder association could assume the role once the park is reasonably well established. Brand and Bruijn (1999) advocate for the provision of a governmental office that is responsible for disseminating relevant material such as information on successful sustainable estates, potential partners for projects and subsidy options available. This information would be particularly relevant at the onset of development.



The authors also proposed that a sustainability team could be established, that was responsible for assisting in the identification and initiation of industrial sustainability projects, and acting as a broker of information. A final initiative put forward by the authors was the organization and delivery of workshops, designed to facilitate information exchange and to build a cooperative environment in which industrial ecology and symbiosis might flourish. The latter two initiatives would be best carried out by the horizontal, multi-stakeholder association.

In summary, the municipality certainly has a significant role to play in the pursuit of industrial park sustainability. That role is largely based upon the traditional functions of local government, and is most heavily focused upon the early stages of the development, namely planning, site design, infrastructure and the built environment. However, the municipality also has an important role in the ongoing operational sustainability of the park, by providing economic development support for industrial ecology efforts, through to maintaining an ongoing collaborative partnership with other stakeholders to encourage and support the continuing pursuit of sustainability.

## **2.5 THEORETICAL BACKGROUND**

### **2.5.1 Epistemological and Methodological Underpinnings**

The epistemological foundation of industrial sustainability research is not expressed explicitly in much of the literature reviewed, including that which pertains to industrial ecology and pollution prevention. For instance, as Lifset and Graedel (2002) note, “there is no authoritative epistemology in industrial ecology” (p. 14). However, numerous articles considered and reflected upon the objectivity, and conversely the subjectivity of the science of sustainability; a branch of which industrial sustainability may be considered. By nature of the research problem, all of the studies reviewed employed either qualitative or mixed-methods approaches and most developed normative conclu-

sions. The use of qualitative methods is reflective of the inductive nature of inquiry pertaining to the means and process of sustainable industrial development. Yet despite this approach the normative principles developed have not yet provided sufficient tangible knowledge or understanding to clearly and predictably pursue the sustainable development of an industrial or industrial park. Consequently, the focus of this thesis is upon the implementation of the normative principles of sustainable industrial park development, with a specific focus upon the role of the municipality. Implementation in itself poses epistemological challenges that must be addressed early in the process.

The concept of sustainability is inordinately complex, as reflected in the challenges to implementing and realizing sustainable industrial development and operations. Despite the need for descriptive analysis of the principles of industrial sustainability, many outstanding issues in the field cannot be grounded by the traditional methods of pure science because the assessment of those issues focus upon phenomena that cannot be observed directly. The challenge of complexity in attaining sustainability is rooted in epistemology, as “the question of the environmental friendliness [or social responsibility] of a certain economic activity cannot be unambiguously answered, as there are many competing truths. All of these truths correspond to a certain interpretation of the question,” which in turn determines the scope of inquiry and ultimately the range of potential conclusions of a given study (Heijungs, 1997). Each stakeholder will approach the problem from a unique perspective, and many times just defining the problem under conflicting and often equally important viewpoints is difficult (Haskins, 2007). It is therefore essential to acknowledge and address this ambiguity, inherent to sustainable development, within the epistemological and methodological approach of a study. Furthermore a theoretical approach that can be systematically employed to identify, critically analyze, assess and evaluate each element of the system is considered essential by the author to strengthen the reflectivity and practicality of the results.

### 2.5.2 A Blended Theoretical Approach

A blended theoretical approach has been adopted for this study, which will acknowledge and address the complexity and ambiguity of implementing and realizing sustainable industrial development and operations. As Wallner (1999) purports, the transition to sustainability is not a further development of the current system by means of “increasing efficiency, and at the same time, retaining old structures, but rather it is a transition to a new system state” (p. 50). Therefore, elements of planning theory, including rational comprehensive, collaborative, communicative and incremental planning theory have been incorporated into the research design of this study, however, general systems theory is at the foundation of its theoretical approach. The systems approach according to Gallopín et al. (2001) is “a way of thinking in terms of connectedness, relationships, and context” (p. 223). Epistemologically, systems theory adopts a position well suited to the research problem by acknowledging the constructed nature of knowledge and the possibility of multiple truths as perceived from different perspectives. Such an approach is well suited to address the challenges of sustainable industrial development in a complex, multi-stakeholder environment.

This epistemological foundation is extended to the methodological tenets of systems theory. By applying a systems approach, the process of research seeks to develop a high degree of comprehensiveness and inclusiveness. In order to implement a systems approach to sustainable industrial development, Haskins emphasized the importance of developing a multidisciplinary research design in order to gather all relevant factors for the tradeoff analysis of alternative problem solutions (2006). Comprehensiveness can be achieved through the identification and analysis of the elements of, and the connections within and between, complex systems and subsystems. The industrial system is indeed a complex system, that is in itself a subsystem of the complex meta-system of a city or region (Wallner, 1999). In the realm of industrial development and operations, social, economic and envi-

ronmental systems and subsystems are inextricably linked. For instance, as Heijungs (1997) elucidates “the performance of the economic system is limited by its own structure, by the structure of the environmental system, and by the nature of the interaction” (p. 38). As stakeholders will invariably ascribe to differing viewpoints, the systems approach, which acknowledges the perceived validity of a multiplicity of perspectives, can be utilized to augment the inclusiveness of a study. The application of systems theory enables the researcher to not only observe and analyze tangible social, economic and environmental elements, but to study the connection, dependence, interdependence and interactions of those elements. Perhaps more importantly however, systems theory enables the researcher to incorporate an analysis of context, namely how the viewpoints of the various stakeholders impact the system, its functions, and the current scope and range of opportunities for change.

Indeed, systems theory appears to be best suited to develop a course of action in the quest for sustainability. Experience has shown that, once implemented, decisions can result in unexpected outcomes or cause unintended consequences, particularly if the initial scope of inquiry was defined too narrowly or differing perspectives were arbitrarily discounted. While, as Gallopín et al. (2001) concede, traditional “scientific theory and practice have been historically very successful in solving...problems of simplicity,” a more liberal approach, such as that of systems theory, is better suited to address complex problems and issues (p. 221). The strength of the systems theoretical approach is that the interdependent elements of a complex issue, along with the perspectives of stakeholders are identified, acknowledged and analyzed to develop an “increasingly credible line of tested argument” (Gallopín et al., 2001, p. 221). Korhonen (2007) highlights the applicability of systems theory in addressing the complex issues of sustainable industrial development, stating that “without systems level approaches to planning and analysis, important dimensions of sustainability would be ignored” (p. 52). Systems theory has been applied to this research to serve as a unifying framework, incorpo-

rating analysis of tangible and intangible factors, along with such concepts as industrial ecology, sustainability and cooperation. The systems approach will bolster the reflectivity of findings through its comprehensiveness and inclusiveness, and as such is an important element of the research approach of this thesis.

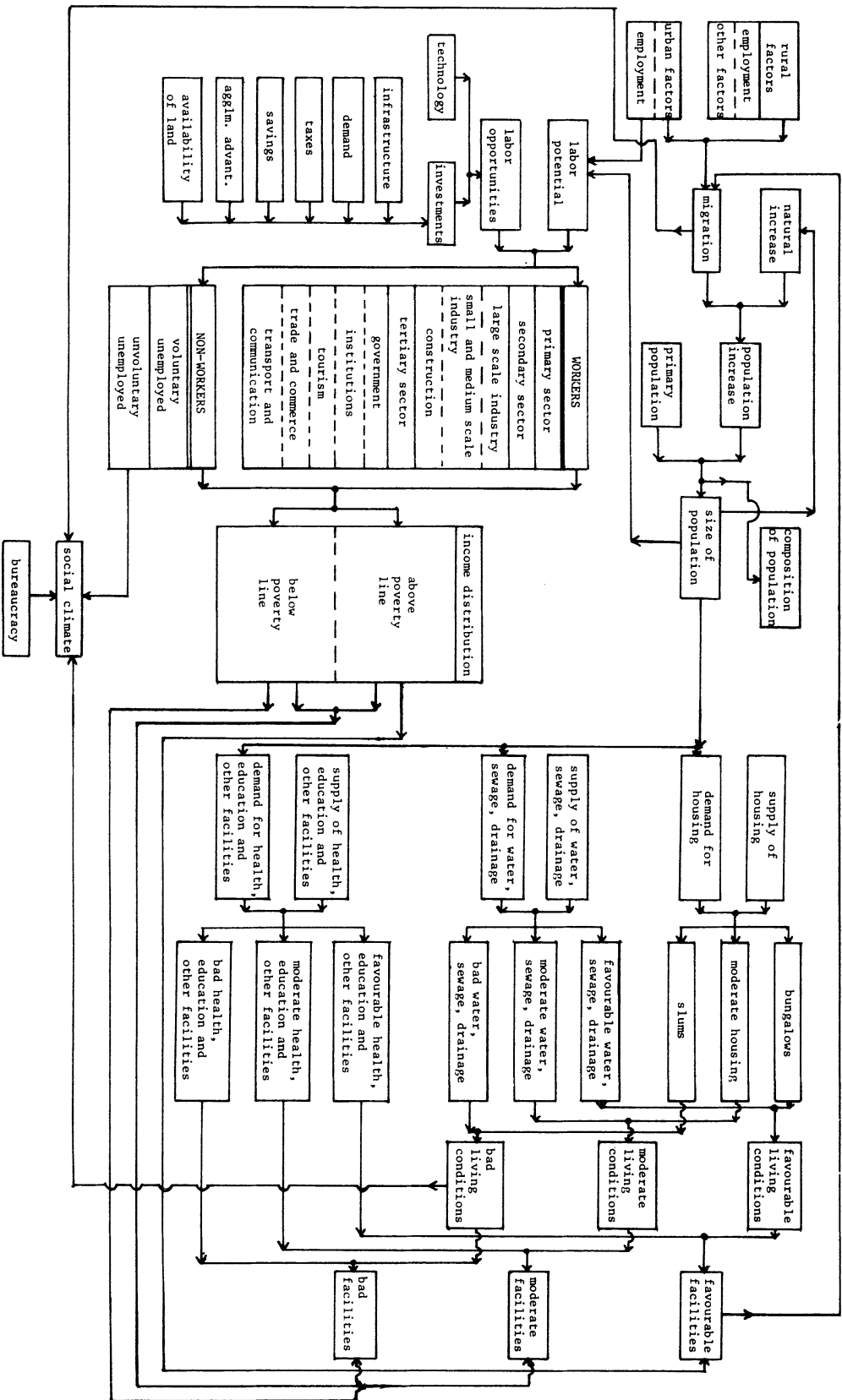
Despite the strengths of systems theory, the approach is not without its pitfalls. There is concern that the subjective and integrative epistemological and methodological approach of systems theorists could generate the “exactly right question but a useless answer” (Gallopín et al., 2001, p. 221). It has been contended that systems theory is not well suited for decision making. Given the epistemological stance of systems theory that acknowledges the validity of multiple perspectives and truths, “there will rarely be unanimity of agreement among peers” (Gallopín et al., 2001, p. 221). Thus, the ultimate determination of a course of action appears problematic from the epistemic perspective of general systems theory. To overcome this challenge a blended theoretical approach, synthesizing planning and systems theory has been developed for this study.

While not epistemologically related to systems theory, the rational comprehensive model of planning is similar in practice, as both approaches seek to comprehensively analyze the context subject to investigation. Rational planning has been “the dominant paradigm in contemporary town planning since the early twentieth century” and is based upon many of the same premises of the scientific method (Grant, 2008, p. 51). Under rational comprehensive planning, the professional practitioner is presumed to be objective, the universe is understood as orderly and predictable, and experts are required to apply previously discovered ‘truth’ or logic to accomplish given objectives. Such assumptions have been widely criticized particularly by constructivist theorists, in that it is impossible for a planner to be rational or comprehensive as defined by the fundamental assumptions of

rational planning. However, Alexander (1986) asserts that rationality is still at the root of most modern planning practice. Indeed, the approach of this research seeks a high degree of comprehensiveness to adequately address the complexity of the situation. As such, while the epistemological foundations of this research are rooted in the constructivist approach, aspects of the methods will resemble the rational planning model.

Along similar lines, incremental planning is also relevant to the research methods adopted in this thesis. The theory of incremental planning contends that decisions are not undertaken in a comprehensive manner, as suggested by the rational comprehensive model, but that only a series of incremental alternatives are developed and considered (Alexander, 1986). For instance, the alternatives developed for a new policy direction, usually conform to existing political and legal structures and work within available resources and current constraints. Therefore, the scope of feasible policy alternatives examined is not likely to be comprehensive, but incremental. This view corresponded to the results of a study by Gibbs and Deutz (2004) which review eight U.S. developments planned from initial concept to implementation as eco-industrial parks founded on symbiosis. Empirical evidence demonstrated that the collocation of firms and subsequent inter-firm networking and collaboration in the form of materials interchange and energy cascading was problematic to plan and establish early in the parks' development, though other elements of sustainable industrial park principles were present, visibly through green infrastructure and architecture and explicitly through park covenants mandating environmental responsibility (2001). It would appear that in practice, the implementation of some principles of sustainable industrial park development assume an incremental approach.

Figure 2.1: Example Context Map  
 AN INTEGRATED SPATIAL IMPACT SYSTEM FOR BHUBANESWAR



(Nijkamp & van Pelt, 1989, p. 222)

Criticism of incremental planning has highlighted that the approach reinforces the status quo of the system (Alexander, 1986). As noted by Lambert and Boons (2002), attaining sustainability is difficult because “change is often incremental and leads to system optimization rather than system change. As change needs to emerge from the existing system, it is not useful to propose radical alternative systems, but on the other hand, incremental change should lead to systems changes rather than system optimization” (p. 474). Thus, in light of the criticism, elements of incremental planning have been incorporated into the process of this research to improve the likelihood of implementation of the recommendations of the study, yet an awareness of the need for systems change will be maintained to promote the ultimate attainment of sustainability. Indeed as Lifset and Graedel explain, “the tension between transformative and incremental change may be overdrawn to the extent that, in many circumstances, the two paths are not mutually exclusive: the more modest changes can be pursued while the more ambitious ones are debated, refined and implemented” (p. 14). This leads one to conclude that by integrating and synthesizing elements of systems theory, rational comprehensive theory and incremental planning theory, the reflectivity, applicability and implementability of the research findings will be strengthened.

However, the legitimacy of the research and conclusions must also be cultivated. Collaborative and communicative planning theory will thus be incorporated into the approach to bolster the legitimacy of the decision making process and ultimate recommendations. Collaborative planning emphasizes the process of planning and the collaboration of stakeholders in defining the public interest. The planner in this role is defined as the facilitator of the public interest and should collaborate with stakeholders to determine planning goals and objectives (Alexander, 1986; Grant, 2008). By empowering stakeholders to become constructively involved in planning decisions, initiatives and policies become more reflective of the public interest and can garner greater public support.



Communicative planning emphasizes the planning practitioner's role as a communicator with the public. In this role, particular attention must be paid to the language and content of communications throughout the planning process (Alexander, 1986). Language should be understandable to all stakeholders, not just those familiar with the field. All communications should also be sincere and expressed truthfully to the knowledge of the planners (Alexander, 1986). By incorporating both collaborative and communicative planning into the research process, legitimacy of findings will be greatly enhanced. In summary, the blended theoretical approach adopted for this research is focused upon developing practical solutions, while empowering all stakeholders to contribute and incorporating those contributions into the decision making process.

## **2.6 BASIS OF METHODS**

Inspiration for the information analysis strategy employed in this study was derived from the methods of multiple criteria analysis, specifically the procedures of spatial impact analysis. Nijkamp, Rietveld and Voogd (1990) propounded that the process of conducting a spatial impact analysis can lead to a systematic inventory of the consequences of public policies, thereby enabling more balanced policy decisions and preventing the neglect or oversight of potentially significant indirect and unintended effects. The first step of a spatial impact analysis, as implemented by Nijkamp and van Pelt (1989), was the context mapping process. Nijkamp and van Pelt, conducted a case study of Bhubaneswar, India, the capital city of the state of Orissa. In the decade 1961-71, the population of Bhubaneswar increased at an extremely high rate of 176.1 percent (p. 217-218). This growth rate caused many challenges for the city, with the most severe problems being housing supply and quality, along with a lack of adequate health and education facilities, sewage infrastructure and employment opportunities.

The authors considered three different policy scenarios, to address the critical needs of the City of Bhubaneswar. To assess the impact of the policy alternatives, a context map was designed to demonstrate the linkages between the various systems and subsystems of the situation. The linkages were of central importance, as “policy impacts are usually multidimensional in nature,” thus impacting numerous systems and subsystems either directly or indirectly (Nijkamp & van Pelt, 1989, p. 214). In the case study of Bhubaneswar, economic, facilities, demographic and social issues were subsystems of the City system. Both qualitative and quantitative elements of the subsystems were identified, however the relationship between elements could not be assessed in a quantitative way, due to a lack of data. As a result, the qualitative relationship between all elements was assessed through analysis of information gathered from reports and interviews with local and regional stakeholders. Figure 2.1 illustrates the context map developed by Nijkamp and van Pelt (1989) for the City of Bhubaneswar. A similar context mapping process was employed as an analysis tool in this thesis, to demonstrate the connections and interdependencies between the elements of the vision, barriers and municipal plan of action.<sup>4</sup>

The context mapping method followed in the study of Bhubaneswar was determined to be directly applicable to the research process of this thesis, particularly in light of the similarities of the two studies. Both studies analyzed primarily qualitative information gathered from stakeholders and reports, sought to determine the most effective policy to address ongoing challenges through the course of development, and both had a distinct spatial boundary. The application of the context mapping process to this research is further described in the methods chapter, specifically in section 3.2.1.3.2.

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<sup>4</sup>The Context Map developed for this thesis can be found in Appendix Five

## **3 METHODS**

### **3.1 QUALITATIVE AND QUANTITATIVE METHODS**

The selection of a qualitative, quantitative or mixed-methods approach to address a research problem is an important decision in the research process, as the approach selected has a significant effect upon the scope of inquiry, the research process and ultimately the results of the study. In the following sections, qualitative and quantitative methods are briefly summarized, along with an explanation justifying the qualitative approach adopted for this study.

#### **3.1.1 Comparison of Qualitative and Quantitative Methods**

Qualitative research is an inductive research process that is used to explore a topic when the variables or theory base are largely unknown (Creswell, 2003). Qualitative research is typically both labour and time intensive and often centres upon interactive research methods such as individual or group interviews (Palys, 1998). As a result of the comparably extensive allocation of time with each subject, qualitative research deals with many fewer cases or subjects but yields a deeper understanding of the topic or research problem than can be derived through quantitative methods (Neuman, 2006). Due to the need to ensure that the research is dependable and credible a qualitative researcher will perform an ongoing and iterative analysis of the information gathered, to ensure the authenticity and accuracy of its interpretation (Neuman, 2006).

Quantitative research examines a problem through research methods that will uncover the factors or variables that influence the given outcome of the problem (Creswell, 2003). The results of social quantitative research are mostly used to provide numerical descriptions that are representative of a population through a sample group. The results generated through quantitative research usually provide the opinions, trends or a population's general attitudes about a specific, quantifiable issue.

Quantitative research most often relies upon aggregate results across a pool of data, thus in social research many contributors are required, though less in-depth information is sought from each participant. As a result, much of the resulting information is statistical, which is then interpreted by the researcher (Neuman, 2006). On a basic level, it is widely considered that quantitative research provides less opportunity for researcher biases to influence the interpretation of the results than allotted by the qualitative approach (Neuman, 2006).

### 3.1.2 Applicability of a Qualitative Approach

Due to the explorative and inductive nature of the research focus to determine the role and corresponding initiatives of a municipality to promote sustainable industrial development and operations, it is clear that the application of qualitative methods would be the only suitable approach. A clear municipal course of action has yet to be established or purported in the literature, significantly limiting the opportunities for quantitative methods to successfully identify or verify the opportunities, barriers and resources pertaining to sustainable industrial development and operations. Indeed a much more interactive and in-depth approach is needed to identify and understand the perspectives, perceptions, attitudes, behaviours and decision making tendencies of key stakeholders that will influence and/or be impacted by the development and ongoing operation of an industrial park. As such, this research has employed qualitative methods solely.

## 3.2 DESCRIPTION OF METHODS

The objective of this thesis is to define the role of the municipality in promoting the realization of local sustainable industrial park development and operations. The future course of development of the Airport Employment Growth District, located within the City of Hamilton, was selected as a case study for this research. Industrial Park development in a multi-stakeholder environment,

particularly as it pertains to the balance between social, economic and environmental performance, exhibits a great deal of complexity. A research model was thus designed to incorporate numerous methods and measures, in order to ensure that, not only were the case study recommendations valid, relevant and viable, but that the overall findings exhibited wider applicability as a resource for the broader community of practitioners and academics. The model and its implementation, was grounded in a blended theoretical approach, incorporating approaches from general systems theory and planning theory. There were several stages of the research process, each with unique emphasis and techniques, yet in combination the steps logically advanced the researcher's comprehension of the situation and ability to reach appropriate recommendations and accurate conclusions.

### 3.2.1 A Chronological Description of the Research Process

#### *3.2.1.1 Definition of the Opportunity*

A primary and fundamental step in the research process was the definition of the research problem or opportunity. Through a review of the literature, it became clear that there was a gap between the theory of industrial sustainability and its comprehensive implementation. At present, the City of Hamilton is faced with an opportunity to realize the development of an industrial park that optimizes the use of energy, material and community resources to the benefit of the economic, environmental and social bottom line. Thus, the City of Hamilton was selected as an ideal case; the research would not only enable the City to capitalize upon its opportunity, but would help to address the lack of comprehensive and pragmatic implementation strategies in the field of industrial sustainability.

Accurately and comprehensively framing the opportunity was fundamentally important to ensuring the recommendations were valid, relevant and viable and that the findings were widely ap-

plicable. As Haskins (2007) suggested, “pressure to apply a quick fix or failure to look systematically at the wholeness of each situation will degrade the eventual outcomes” (p. 92). To more accurately define the opportunity, the fundamental aim of the research was first defined; namely to determine how a municipal government should promote industrial development that ensured social and economic benefit while adhering to and addressing local and global environmental constraints and issues. Secondly, the scope of the research was defined; scaled to the local context and specifically to the role and actions of the municipal government in promoting sustainable industrial development and operations. The research problem was then logically deduced; what roles should the municipal government of the City of Hamilton assume and what actions should it undertake, to ensure that the development and operation of the industrial park surrounding the Hamilton International Airport is socially responsible, economically efficient and environmentally sustainable? By framing the problem as an opportunity, a positive, even proactive light was cast upon the entire process of inquiry. Approaching the problem as an opportunity was also seen as a way to bolster stakeholder interest, enthusiasm and participation in the process by positively emphasizing the potential outcomes of the research and subsequent findings and recommendations.

### *3.2.1.2 Literature Review*

To support the definition of the problem and all subsequent research steps, a thorough review of the literature was undertaken. The review covered a range of topics, from broad subjects such as the sustainability movement and industrial sustainability, through to more narrowly defined research pertaining to specific elements of sustainable industrial park development. The authors of the literature reviewed were from numerous academic and professional backgrounds, including economics, urban planning, engineering and environmental science. Therefore, various perspectives and types of approaches to industrial sustainability were reviewed. Some sources were specific to the

Canadian context, others were rooted in experience elsewhere, while still others were distinctly global in scope and applicability. Peer-reviewed scholarly journal articles were a main source of material, along with published books. Several masters theses were also reviewed. Other sources included guides and research published by governmental and quasi-governmental organizations. Information for the background review of the City of Hamilton and the Airport Employment Growth District included municipal government studies and strategies, staff reports to council, provincial policy documents and plans, and finally local newspaper articles.

### *3.2.1.3 Primary Research Process*

Upon completion of the literature review, the researcher created a preliminary vision, which was a synthesis of the elements of sustainable industrial park development and operations, as described in the literature. The preliminary vision was utilized as a starting point for discussion with participants of the study. Participants were asked to review the preliminary vision, prior to meeting with the researcher for an interview. In the interviews, participants were asked to comment on the vision, as well as provide their perspective on the barriers, constraints and resources that would pertain to its implementation and realization. Subsequently, the researcher constructed a context map, illustrating the information collected in the interviews and depicting the linkages between the elements of the map. Upon finalization of the context map, a municipal plan of action was developed by the researcher, using the context map as a tool, to identify key areas of municipal initiative. The municipal plan of action was then recommended as a course of action for the City of Hamilton in matters pertaining to the Airport Employment Growth District. A final step was to reflect upon the findings in relation to the applicability to other industrial park developments, the general lessons learned, and direction for future research. The following sections contain a more detailed description of the theoretical emphasis and the specific methods utilized during the primary research process.

### *3.2.1.3.1. Stakeholder Identification and Recruitment*

Careful attention was paid to the selection of stakeholders invited to participate in this research, to ensure that a balanced representation of those with a direct social, economic or environmental interest in the development of the industrial park surrounding the Hamilton International Airport were provided an opportunity for input. Numerous individuals, groups and organizations were included from the public and private sector as well as civil society. From the public sector, representatives from Hamilton city council, planning, economic development and public works departments were interviewed. Representatives of several quasi-governmental organizations were contacted for interviews including, the ICLEI Local Governments for Sustainability Canadian Chapter, the Toronto Regional Conservation Authority (TRCA) and Hamilton's Agricultural and Rural Affairs Advisory Committee. From the private sector, residential and industrial land developers with a known interest in the lands surrounding the airport were invited to participate. Also, representatives of the Hamilton International Airport, the Supply Chain and Logistics Association and the Hamilton Industrial Environmental Association were included. Furthermore, the business owners or managers of existing regional industrial operations were contacted to elicit their input. The final private sector interests to be contacted were the consultants currently conducting studies pertaining to the Hamilton International Airport industrial park development. Finally, members of civil society were sought to participate. These included environmental and planning advocacy groups, along with private citizens who have demonstrated an interest in the development of this industrial park.

It is important to note that many of the aforementioned groups were represented on the Community Liaison Committee (CLC), created by the City of Hamilton's Industrial Development Planning Department, for the purposes of community consultation on the subject industrial park surrounding the Hamilton International Airport. All members of the CLC were invited to participate



in this study. Only where certain groups were not adequately represented on the CLC were outside participants sought. These included representatives of industry associations, the ICLEI, and some private development interests.

Once the stakeholders were identified, potential participants were provided a hand delivered information package, which included a letter introducing the study and the preliminary vision document.<sup>5</sup> Those potential participants that were not met by the researcher at the time of the information package delivery, or did not decide whether to participate at first meeting, were then contacted by phone, and invited to participate in the research. The recruitment process was successful, of the thirty-three stakeholders invited to participate in the study, twenty-four were ultimately interviewed during the month of October, 2008. The stakeholders interviewed were broadly categorized and are referenced throughout the paper according to the identification code detailed in the chart below.<sup>6</sup>

#	Stakeholder Type	Organization (if applicable)	Code
1	Public Sector	Hamilton City Council	CC1
2	Public Sector	Hamilton City Council	CC2
3	Public Sector	Hamilton City Council	CC3
4	Public Sector	Hamilton Planning Department	HS1
5	Public Sector	Hamilton Economic Development Department	HS2
6	Public Sector	Hamilton Public Works Department	HS3
7	Quasi-Governmental	ICLEI: Local Governments for Sustainability	QG1
8	Quasi-Governmental	Toronto Regional Conservation Authority	QG2

<sup>5</sup> See Appendix One to view the Letter of Introduction and Appendix Two to view the Preliminary Vision Document

<sup>6</sup> A copy of this chart is included in Appendix Seven, for the readers' ease of reference.

#	Stakeholder Type	Organization (if applicable)	Code
9	Quasi-Governmental	Hamilton Chamber of Commerce	QG3
10	Advocacy Group	Hamiltonians for Progressive Development	AG1
11	Advocacy Group	Environment Hamilton	AG2
12	Industry Association	Supply Chain and Logistics Association	IA1
13	Industry Association	Hamilton Industrial Environmental Association	IA2
14	Industry Association	Real Estate Association of Hamilton-Burlington	IA3
15	New Local Industry	Confidential	LI1
16	Hamilton International Airport	Tradeport International	HI1
17	Planning Consultant	Dillon Consulting	PC1
18	Planning Consultant	CN Watson & Associates	PC2
19	Planning Consultant	Eco-Industrial Solutions	PC3
20	Developer/Builder	Confidential	DB1
21	Developer/Builder	Confidential	DB2
22	Developer/Property Manager	Confidential	DP1
23	Citizen of Hamilton	Confidential	CH1
24	Citizen of Hamilton	Confidential	CH2

As the initial list of thirty-three stakeholders contained a fair amount of overlap in “stakeholder type” the twenty-four participants almost represented the complete range of stakeholders initially identified for this study. The only three major stakeholder groups not represented were Hamilton labour, agricultural and Six Nations interests. This was despite attempts by the author to contact and secure interviews with representatives of each group that had demonstrated an interest in the future development of the Airport Employment Growth District (AEGD). Nevertheless, the vision

and municipal plan of action contain elements that the author believes would represent the interests of these stakeholder groups.

### *3.2.1.3.2 Context Map and Analysis*

The first stage of the primary research was to develop a context map that illustrated the interdependent factors of the industrial park. The context mapping process, which sought to holistically illustrate the interrelated nature of various elements that comprise a given situation, was rooted in systems theory. As such, particular attention was focused upon the epistemology and methodology of general systems theory during this stage of the research process. To reflect the particular circumstances of the Hamilton Airport Employment Growth District, a context map was created to depict the final vision of the industrial park. The context map also illustrated the linkages between real and perceived barriers and the pursuit and realization of the vision. The identified resources were incorporated into the municipal plan of action, which was developed to address the barriers and vision elements illustrated in the context map. The Airport Employment Growth District was considered the system, while the individual factors of the vision, as well as the barriers, constraints and resources, were considered elements of that system. Linkages were demonstrated at the elemental level.

In order to gather information and accurately map the context, one-on-one and small group interviews with all participant stakeholders was of fundamental importance.<sup>7</sup> Small group interviews were only conducted if more than one participant wished to participate from a particular stakeholder organization. Each participant was provided a preliminary vision document, which included a glossary of industrial sustainability terms in reflection of communicative planning principles, to review

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<sup>7</sup> Please see Appendix Three for a copy of a complete interview guide, note that the interview guide was individualized based upon the area of expertise of the stakeholder, see Appendix Four for details.

prior to the interviews. During the first part of these interviews, participants were asked to comment on the preliminary vision. Participants were encouraged to suggest additional elements or point out and explain areas of concern. Of particular importance, interviewees were invited to provide their overall appraisal of the preliminary vision, which yielded strategic comments pertaining to its implementability. Based upon an analysis of stakeholder input, the final vision was developed. Inviting participants to comment on the preliminary vision enhanced the collaborative nature of the research process, and was incorporated to enhance the reflectivity of the research to stakeholder values.

The second part of the interview was focused upon the barriers, resources and constraints pertaining to the implementation and realization of the vision. These could be defined broadly in social, economic or environmental categories (for instance societal will), or more narrowly in regulatory, legal, financial, capacity, technological or site specific terms (for example human resource capacity). These barriers were rooted in the literature, an overview of which can be found in the barriers section of the literature review, section 2.4.5. While all participants were asked to comment on the preliminary vision, questions pertaining to resources, constraints and barriers were directed based upon the type of stakeholder interest the participant represented and their level of expertise.<sup>8</sup> An important distinction to make is that between the definition of barriers, and that of constraints. For the purposes of this research, a constraint was considered a firm limitation or restriction for which attempts to overcome or overrule should not or cannot be made within the foreseeable future. In contrast, a barrier was defined as a condition, real or perceived, that would impede progress towards or realization of an objective, but that should, or must be overcome to enable the project to proceed as envisioned. A resource was considered a tangible or intangible source of supply, support or aid, that would further progress towards the vision.

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<sup>8</sup> Please see Appendix Four for a chart detailing the information sought from and provided by each participant.

Of note, participants were given opportunities to raise other barriers, constraints and resources not identified initially by the researcher. As a result of the natural conversation the interview guide approach enabled, participants often segued into a new topic, while considering or discussing a related topic raised by the researcher. For example, discussions pertaining to financial barriers often transitioned into matters of market demand or economic development. Furthermore, after all researcher identified topics had been discussed, participants were directly asked if, to their knowledge, there were any other pertinent barriers or resources that had not yet been discussed. As this was a concluding question, most often the participants had already raised all the issues they wished to discuss, as described above, however on occasion, an outstanding matter was raised as a result of this all-encompassing inquiry. Stakeholder identification of the resources, constraints and barriers governing the development of the Airport Employment Growth District as envisioned, was used to map the context and inform the generation of a viable, reflective municipal plan of action.

As previously mentioned, an interview guide approach was employed, allowing the conversation to proceed in a more natural manner and enabling the researcher to discuss areas of interest or concern in more detail (Kitchin & Tate, 2000). All interviews were taped, though only particularly telling passages were transcribed, for anonymous quotation purposes. During the interviews, notes were taken by the researcher, under the interview guide headings. More detailed notes were taken later, using the recorded interview as a prompt. Upon completion of all interviews, a methodical content analysis, described in the following paragraphs, was completed to develop the comprehensive context map.

The content analysis of the interviews was conducted in a staged approach, beginning with the description of the interviews, followed by classification and finally connection of the information

(see Kitchin & Tate, 2000). The description stage involved transcription of selected quotes, detailed note-taking and annotation of all resulting materials. Pertinent documents were also incorporated into the analysis at this stage, specifically those that were referenced or that addressed specific issues raised during the interviews. Careful attention was paid during the transcription and note-taking process to ensure accurate documentation of the recorded conversations while the annotations were designed to identify themes, preliminarily connect those themes to the literature reviewed, and to make record of the researcher's ideas about the information being conveyed. These themes formed the foundation for the classification stage.

At this point, the transcripts of the interviews were divided into two separate sections. The first section pertained to the vision, the second to the information about the constraints and barriers. Responses within these two sections was analyzed independently. Data were categorized into the subsections, which provided for the complete categorization of all relevant information.

In analyzing comments pertaining to the vision for industrial park sustainability, all stakeholder opinions were considered equally during the initial analysis and categorization stage. The only comments excluded from the analysis were those that addressed issues outside the scope of this research. Specifically, comments pertaining to site selection were excluded because the basic starting point of this research was that the vision was to apply to the Airport Employment Growth District (AEGD), should its development occur. Upon critical review of the strategic recommendations pertaining to the implementability of the vision, comments pertaining to very specific measures of industrial park sustainability were not ultimately included in the more objectives-based final vision. For example, a suggestion that the LEED certification of buildings be explicitly noted in the vision was not incorporated, however a strategic comment that the economic benefits of the vision should be

highlighted were incorporated into objectives of the final vision. As such, overarching themes were identified and synthesized, based upon the information presented in the literature and stakeholder perspectives garnered through the interview process. These themes were further described in the vision, while avoiding attempts to exhaustively identify the measures that might be implemented to achieve the sustainability of the industrial park.

Analysis of the barriers to implementing or realizing the vision was conducted in a similar manner. Initially, all stakeholder input was recorded based upon the topic the comments addressed. Many of the comments directly addressed questions from the researcher, that were based upon the barriers noted in the literature review. Oftentimes these comments offered additional detail or nuance based upon the stakeholders' experience or perspective that had not been identified in the literature review. These details and nuances were analyzed, and when found to be substantive, were described under the category of barrier that had been identified in the literature. For example, a lack of human resource capacity particularly within municipal governments was identified as a barrier to change in the literature, however this issue was also raised by private sector stakeholders. Upon consideration of the role of government as a driver of change towards sustainability, it was found that the challenge was substantively different for public and private sector actors. As such, two capacity barriers were ultimately identified, one pertaining specifically to local government, and the other to organizations in general.

In some cases, stakeholders identified barriers that had not been explicitly identified in the literature review. Oftentimes when this occurred, the participant began directly addressing a barrier about which the researcher had posed a question, but would actually end up discussing a related, but substantively different barrier. As previously noted, this happened most distinctly in discussions per-

taining to the financial barriers identified in the literature. Upon careful analysis to synthesize such input, it was determined that while many comments did contribute to the confirmation of the financial barriers raised in the literature, they were best categorized as barriers associated with market demand or economic development. Dividing these barriers into separate categories facilitated the development of the municipal plan of action, ensuring that these substantively different barriers, though related, were adequately addressed by the municipal strategy.

A few of the barriers to realizing the vision were not identified in the literature, and could not be directly related to the categories of barriers identified in the literature review. Nevertheless, an overwhelming number of stakeholders raised these barriers, without direct prompting. Two such barriers were the need for consistent municipal leadership and the perceived unpredictability and inefficiency of the City's development approval process. Indeed, an inordinate number of stakeholders interviewed raised both of these issues. Upon critical analysis of these issues and the literature, it was found that both implicitly confirmed important elements of industrial park sustainability as presented in the literature and would indeed pose a significant barrier to the realization of the vision, if left unidentified and unaddressed. For example, the need for a municipal commitment was implicit in the literature that emphasized the importance of the municipal role in sustainable industrial park development and operation. In the second example, the need for an efficient and predictable development approval process could be indirectly linked to financial and capacity barriers noted in the literature, as approval delays could be tied to organizational inertia rooted in established decision making systems and increased financial expense limiting resources available for sustainable built environment features. The implicit links of these barriers to those noted in the literature, paired with the number of stakeholders independently identifying these challenges, led the researcher to incorporate these barriers into the results.



Finally, in some cases a barrier was raised by a stakeholder during the interview process that was specific to the Canadian case. As most of the literature reviewed was written based upon experiences outside of Canada, it followed that certain local challenges to industrial park sustainability would not have been identified by those authors. For example the challenge of establishing an overarching park management organization to effectuate sustainable operations was identified as a relatively unique barrier as a result of decentralized ownership structures and varied tenancy terms that commonly characterize Canadian industrial parks. These types of barrier were raised only by stakeholders with both experience and expertise in industrial park development in Canada. As such, the researcher was confident that these barriers should be identified and considered in the development of the municipal plan of action.

Once this analysis and synthesis process was complete, all information about the vision, as well as the barriers had been adequately defined and categorized to proceed to the first stage of the context mapping process. To begin the context mapping process, all information was linked and connected. This process utilized the categories and subcategories previously developed as elements of the context map, and analyzed the substantive links between them. While explicit links were readily noted, some of these links were external, in that they were contingent. As such, implicit links between categories were sought. Essentially, the researcher asked whether a link could exist between two subcategories of information, and what the nature of that link would be (Kitchin & Tate, 2000). If a link was deemed possible, analysis of the information in both subcategories was conducted to determine if any evidence of such a link was suggested, even if not explicitly recorded. Once analysis of the connections (both explicit and implicit) was complete, a detailed context map was created, visually illustrating the links between the vision and the barriers governing its realization.

At this point, the various elements of the context map were weighted in terms of criticalness. Prioritizing the relative importance of various elements is acknowledged as a crucial tool in assessing policy impacts in multiple objective environments by Nijkamp et al. (1990). The scale was applied to the barriers and assessed two different levels of significance to the fulfillment of the vision; fundamental (f) or secondary (s). The scale was not applied to the final vision, as all elements were considered to be fundamental to its realization. This scale assisted in the development of the municipal plan of action by providing a guide to ensure the most fundamental barriers were addressed.<sup>9</sup>

### *3.2.1.3.3 Municipal Plan of Action Development and Refinement*

The ultimate objective of this research was to determine what roles and actions a municipal government should engage in during the developmental and operational stages of a sustainable industrial park. To fulfill this objective, a municipal strategy for effectuating sustainable industrial park development and operations was developed. Thus upon completion of the context map illustrating the vision and barriers, a municipal plan of action was developed, that defined the roles and actions of the municipality in promoting the realization of a sustainable industrial park. The municipal plan of action reflected information gathered during the literature review and interviews, to employ available resources to address both real and perceived barriers and further realization of the vision. The resources identified by stakeholders during the interview process were categorized, based upon the type of municipal role or action they would help to fulfill. It was found that stakeholders with experience and expertise in industrial park development and operations, or industrial park sustainability were able to suggest or identify specific resources or tools that could be employed to further the vision, while stakeholders without such a background provided suggestions of a much more general nature. Without exception, these general ideas were reinforced by specific recommenda-

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<sup>9</sup> Please see Appendix Five to view the Context Map developed for the case study.

tions, and as such both were incorporated into the development of the municipal plan of action programs. Furthermore, the broadly defined roles and areas of local government initiative propounded in the literature were confirmed through the stakeholder interview process, enabling the municipal plan of action to also be developed in reflection of the ideas presented in the literature.

The incremental planning approach was inherently incorporated into the development of the municipal strategy; the plan of action was designed to be viably implementable given existing systems structures, yet through its fulfillment, promote systems change. Incremental changes most often fell into the category of elements requiring early action, and therefore were assigned a clear municipal action strategy. Transformative changes often required longer timeframes to address, thus certain elements of the vision will take time to implement and achieve. As such, the municipal plan of action was designed to optimize the existing system structure, particularly in the short run, while promoting systems change towards sustainability over time.

Upon completion of the primary research process, the municipal plan of action was outlined and described, the rationale for its programs fully explained, and its expected outcomes were highlighted. Strong emphasis was placed upon the theory of communicative planning in this stage, to ensure the recommendations were clearly and concisely communicated to stakeholders using understandable language (see Alexander, 1986). Careful attention was paid to ensure the recommendations were accurate and that the foundations upon which the recommendations were based were portrayed completely and truthfully. Finally the author reflected upon the recommendations, in order to compare the findings to the literature reviewed, extrapolate the research results into more widely applicable lessons learned, and to suggest areas for future research.

### **3.4 STRENGTHS AND WEAKNESS OF PRIMARY METHODS**

#### **3.4.1 Case Study**

Upon determination of the research question; how should the local government effectuate sustainable industrial development and operations within the municipality; various methods were considered to determine that which was most appropriate to address the research problem. The case study method was selected, as it is most effectively and commonly employed to answer ‘how’ or ‘why’ questions (Yin, 1984). A case study can be defined as an in-depth, multifaceted investigation using qualitative research methods of a single contemporary phenomenon within a real life context (Yin, 1984; Orum, Feagin & Sjoberg, 1991).

The case study method allowed for the subject to be investigated in great detail and depth, which was determined to be necessary to reach recommendations that were reflective, accurate and viable to the local context while enabling valid conclusions to be drawn for wider applicability (Orum et al., 1991). The primary and secondary research methods employed included document analysis, literature review and in-depth, systematic interviews, all procedures that enable in-depth analysis. The interviews in particular provided unique information by confirming and refuting information found in the literature review and document analysis, and by contributing unique perspectives previously unidentified. This holistic perspective took into account social networks, actions and meanings, which would influence the municipality’s role and actions in seeking to effectuate sustainable industrial development and operations (Orum et al., 1991).

Bias is the most commonly raised drawback of the case study method (Yin, 1984). Many case studies have been found to exhibit a lack of rigor in the research and analysis process, which in turn has led to equivocal findings and conclusions. However, bias is a challenge that must be addressed in

other methods as well, qualitative and quantitative alike (Yin, 1984). The preliminary vision section was the most susceptible to researcher bias. To mitigate this issue, a key component to every interview was the discussion, debate and refinement of the preliminary vision. The resulting final vision was the result of analysis and synthesis of this stakeholder input, a process that has been fully elucidated by the researcher in Chapter 5.

The inability to generalize case study findings is another weakness raised in the literature. The intent of primary research is to shed new perspectives on situations and further our understanding in a certain field of study, however Yin (1984) suggested case studies “provide little basis for scientific generalization” (p. 21). Transferability is acknowledged as a limitation in this study. However the in-depth understanding garnered through the individual case study method enabled the finding to be extrapolated into broader, more widely applicable conclusions that provide valuable lessons and insights for municipalities provincially, nationally and internationally, as well as the broader community of practitioners and academics working in the field. The transferability of the findings and conclusions are further explained in Chapter 7.

### 3.4.2 Individual Interviews

The principal method of this research was the individual, in-person interview. This technique was selected because detailed information was required on a wide variety of topics, particularly as they pertained to the barriers, constraints and resources that would impact realization of the vision. As some of the topics were specialized, technical or required expert knowledge, one-on-one interviews were deemed to be the most appropriate approach, enabling the researcher to tailor each interview to the type of information a given stakeholder could impart. An interview guide approach was utilized to allow the interview to flow more naturally as a conversation and enable the researcher

to explore areas of interest or concern more thoroughly (Kitchin & Tate, 2000). This approach was used to create a rich and varied dataset as participants explained their viewpoints in natural conversation and the researcher was able to ensure that these perspectives were explained fully (Creswell, 2003). The natural conversation promoted by the interview guide approach also allowed participants to emphasize the areas of most importance to them and elaborate upon these points.

Caution was exercised by the researcher to keep the interview focused and to ensure that topics of inquiry were not omitted (Creswell, 2003). One concern of the researcher was to ensure that the interview topics discussed remained within the scope of the research. Despite the fact that the Airport Employment Growth District was approved for industrial development by Hamilton City Council, the issue remains controversial due to the existing rural and agricultural character of the area. Therefore, participants were informed at the beginning of the interview, that this research was not about the merits or faults of the employment lands designation, but the sustainable development of those employment lands.

### 3.4.3 Selected Document Analysis

The method of document analysis was used moderately, mainly to supplement, clarify or confirm information provided by participants. It was also employed prior to meeting with stakeholders, to provide background knowledge of the case study to the researcher, particularly in regards to the history and progress of the Airport Employment Growth District. This method has several strengths. The first is that it helped the researcher to obtain the vocabulary of stakeholders, which bolstered communication between the researcher and participants during the interviews and focus group session. Document analysis is also an unobtrusive form of primary research and enabled the researcher to identify areas of interest as interview topics while avoid redundancy in those interviews. Finally,

documents provided written evidence of events, public and private initiatives, legislation and stakeholder perceptions, recorded without prompting by the researcher (Creswell, 2003).

Creswell (2003) also highlighted some drawbacks of document analysis, including the protected or private nature of some documents, limiting the researcher's ability to access or report information therein contained. Furthermore, Creswell (2003) noted that it is difficult to comprehensively review all relevant documents, particularly private documents. This drawback is a minor one for this research as document analysis was treated as supplementary to the direct interviews with stakeholders, therefore information not identified in the document analysis was still apt to be collected.





## **4 HAMILTON AIRPORT EMPLOYMENT GROWTH DISTRICT CASE STUDY**

### **4.1 DESCRIPTION OF CITY OF HAMILTON**

Situated at the head of Lake Ontario, and incorporated as the City of Hamilton in 1846, several decades remained before the industrial character of the City would emerge (Mason, 2006). While a centre of commercial trade had been the original vision of the City's founders, due to Hamilton's protected harbor and position opposite a major discontinuity in the Niagara escarpment, these advantages only enabled regional dominance, while failing to bring it commercial success on a national or international scale. Instead, the physical features of the escarpment discouraged its use as a goods movement corridor, while Hamilton's position on the south side of the harbour resulted in its bypass by the main line of the Great Western Railway which ran west from Toronto (Wood, 1987). Indeed, until shortly before 1891, even a central highlight of Hamilton's infrastructural advantage, its protected harbour, was undermined by frequent dredges, regulations requiring vessels to enter the canal with only a three-quarters load and ongoing construction which rendered the Burlington Canal (the only marine access point to the Hamilton Harbour) largely ineffective and disadvantageous for commercial shipping (Weaver, 1982).

Four factors eventually converged to spawn the longstanding industrial character of the City. Firstly, the Great Western Railway connection, completed in 1854, was routed through Hamilton then passed north of Lake Erie to connect Niagara and Windsor frontiers. Furthermore, the largest railway repair yards in Canada were established by the company near the west end of the Hamilton Harbour, along with facilities to re-roll rails, which were often damaged during winter. These facilities fostered the beginning of a local specialization in metal-working. Secondly, the MacDonalld government in 1879 introduced a national protectionist economic policy designed to stimulate industrial growth in Canada. Thirdly, the Welland Canal was expanded in 1887, providing Hamilton with better

access by rail and water, to both resource suppliers and commercial markets. Finally, seeking to further stimulate domestic production, tariffs were imposed on the import of pig-iron in the late 1880s.

As a result of Hamilton's access to coal from Appalachia and iron ore from the Lake Superior region, it became an ideal site for iron production. Further combined with municipal government financial incentives, such as a 10 year property tax holiday approved in 1890, and the availability of abundant and inexpensive electricity generated by water diverted from the Welland Canal, the City of Hamilton attracted firms in a broad range of industries mostly centred around steel. Over the decades, the steel industry in Hamilton grew in national and global significance, until Hamilton's share of Canadian steel production, dominated by the Steel Company of Canada (Stelco), peaked at over 70% in the early 1970s (Anderson, 1987). The landscape and economy of Hamilton came to be so dominated by the industry that it became known as the Steel City (Weaver, 1982; Manson, 2006).

Perhaps more derogatorily, the City was also characterized as a 'company town' in some regards, owing to the stature of the steel industry in local economic, social and environmental matters. Despite obvious environmental pollution and degradation caused by Hamilton's heavy industry and its effects upon the City's image, reform was slow. Occupational health and safety concerns were also slow to be addressed by industry. While public pressure, along with environmental regulations, did force reluctant companies to abide by environmental standards, an underlying attitude persisted in which steel mill jobs and their associated immediate benefits were held as a priority above environmental and health concerns (Weaver, 1982).

Over time, the dominance of the steel industry in Hamilton declined, in national and international prominence as well as in local employment opportunities. In 1968 Stelco announced that it would construct its new facility outside of its lands in the Hamilton Harbour, and outside the

boundaries of the municipality itself, selecting a site on Lake Erie instead. The company further withdrew from Hamilton that year, moving its corporate headquarters to Toronto (Weaver, 1982). Paired with a lack of investment in contemporary technology in their Hamilton plants, workers in the City became increasingly exposed to economic cycles, as production at the most inefficient facilities was the first to be slowed or halted in times of decreased demand. As Anderson (1987) pointed out, “ultimately, the insecurity induced by frequent lay-offs and call-backs may be as destructive to the regional economy as permanent job loss” (p. 219). Indeed, the author later noted that employment growth in the sector was unlikely and that the future economic health of the City would depend upon substantial diversification.

In subsequent decades, that forecast has become clearly accurate. The importance of the steel industry to the City of Hamilton has been increasingly dwindling. In the wake of the significant economic downturn of 2008-2009, Stelco announced the temporary, but indefinite, shutdown of steel operations in Hamilton, idling 1700 workers, and leading one-third of that workforce to opt for early retirement to-date (Powell, 2009). While it has been a slow decline - the industrial tax base has dropped to only 30% of all municipal tax revenues from 70% in its peak (CC3) - the closure represents a significant change for the City. Indeed, a legacy of environmental pollution, a heavy industrial waterfront, lingering unemployment and diminished municipal revenue will be felt for sometime by the City.

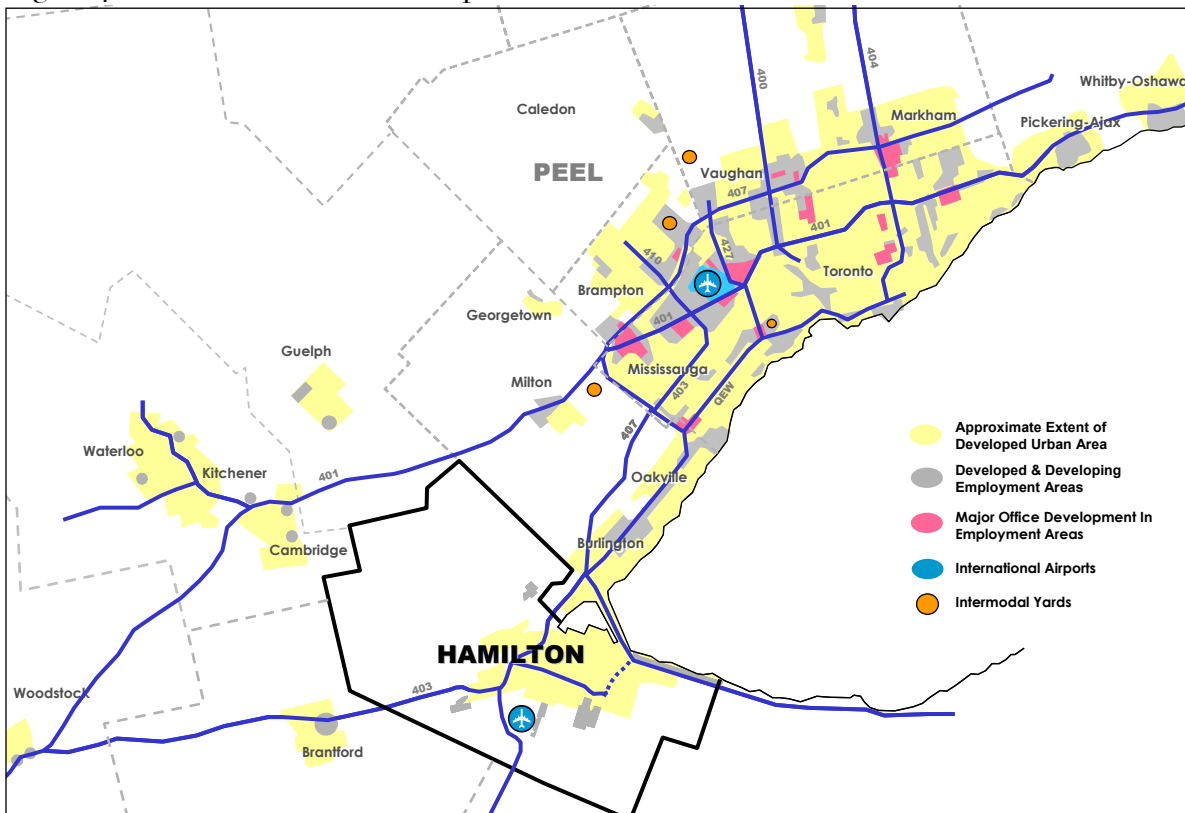
However, many stakeholders interviewed highlighted this legacy and the advantages and challenges it has created, to be opportunities for Hamilton’s reemergence as a leading city. First, there is the opportunity to redevelop with the benefit of lessons learned from the past; those of the importance of economic diversification, environmental protection and enhancement, and community

integration. Speaking directly about the City's image and well-being following the decline, CC3 indicated that "the City needs to recover, not rebrand," and went on to indicate that Hamilton seeks to be the *Best Place to Raise a Child*. CC3 highlighted the potential development surrounding the Hamilton airport as part of the City's recovery, indicating that its development could result in social, economic and environmental benefit. QG2 reasoned that the economic decline of Hamilton is "...another argument actually [to develop the industrial park sustainably], to attract good business, you need to make some changes to your policy, to your infrastructure, design something new so you can get it back. That's the opportunity." Indeed, the lessons garnered from Hamilton's past should indicate that a more holistic and adaptive path of development is necessary. Secondly, the infrastructure and resources accumulated by the City of Hamilton throughout the course of its industrial development, have rendered further opportunities for its recovery. IA2 highlighted that:

Geographically, Hamilton is very very lucky to be located in the middle of Toronto, the GTA [Greater Toronto Area], Niagara, and Buffalo and the balance of the USA...geographically in an ideal position. Secondly, we have transportation infrastructure most other communities would kill for, we have the international airport, the port on the Great Lakes, we have rail infrastructure and highway infrastructure.

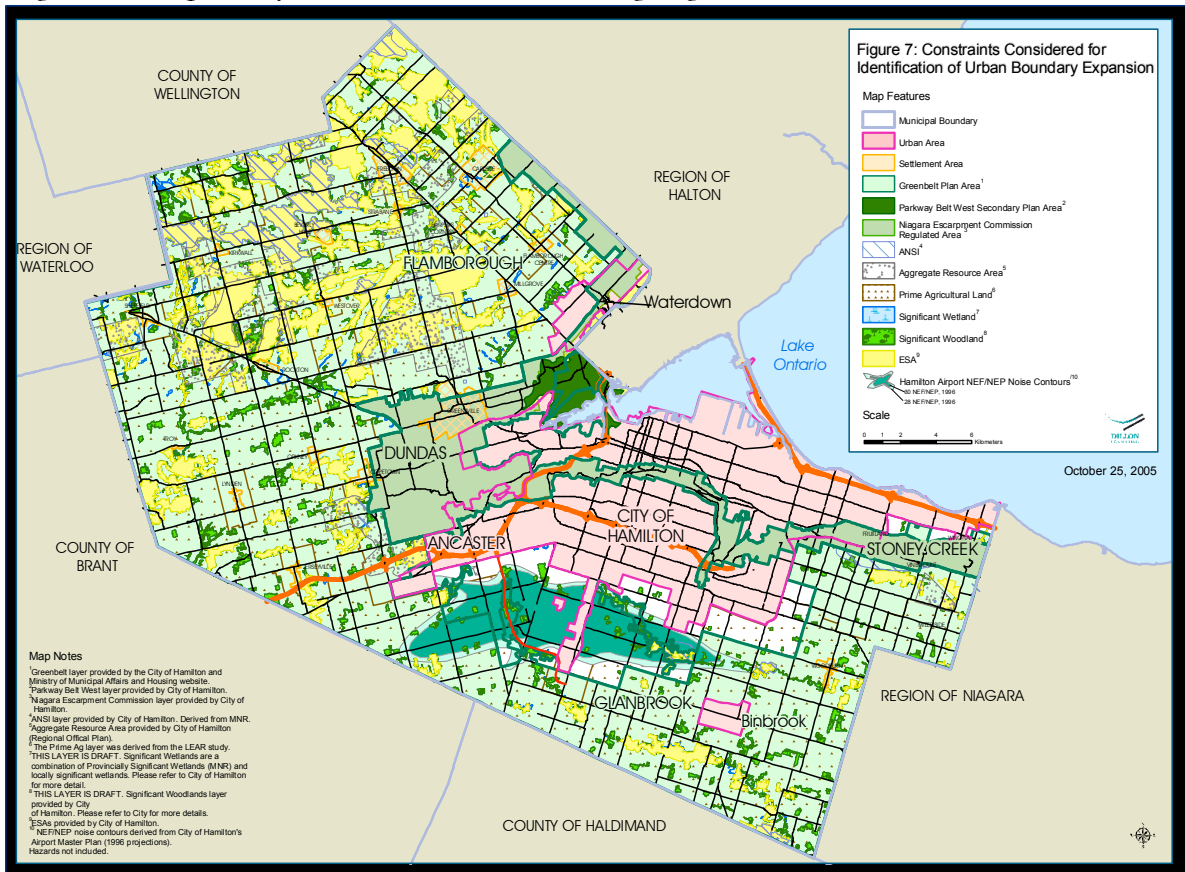
CH1 was positive about the vision for sustainable industrial park development and what it entailed for the reestablishment of the City's thriving economy, noting the local human and knowledge capital developed as a result of the municipality's industrial legacy. "It's time to embrace the new technologies, embrace the green technologies...Hamilton has a chance to be at the forefront of that technology, especially with Hamilton's industrial history." In summary, Hamilton's industrial decline has left a legacy of environmental, economic and social problems, that will only be resolved through its

Figure 4.1: Hamilton International Airport in Greater Toronto Area Context



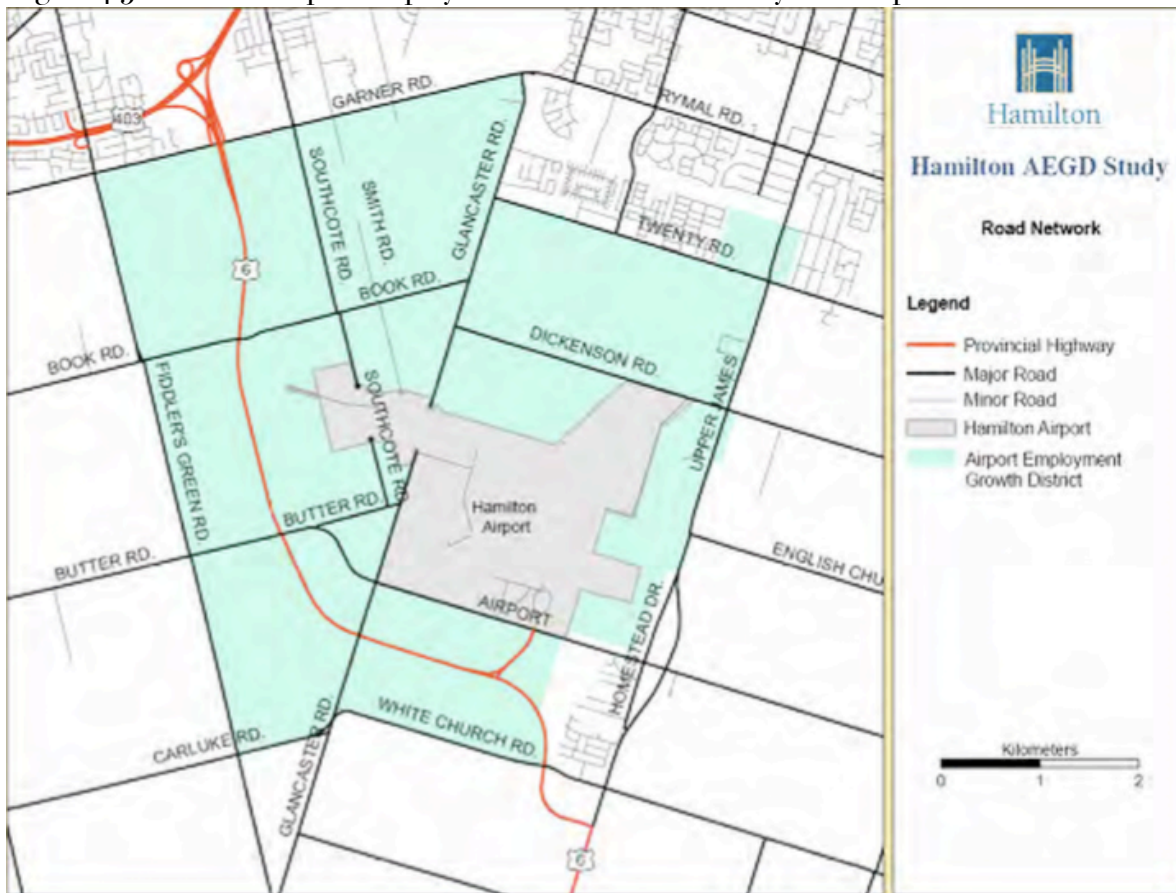
From: The City of Hamilton Employment Opportunities Study, 2006

Figure 4.2: Map of City of Hamilton and Surrounding Regions



From: The Growth Related Integrated Development Strategy (GRIDS) 2006 79

Figure 4.3: Hamilton Airport Employment Growth District Study Area Map



From: The Airport Employment Growth District Secondary Plan Phase 1 Report, 2008

rehabilitation. That same history however, has created opportunities that must not be lost or overlooked in the City's pursuit of recovery.

## 4.2 BACKGROUND OF HIA INDUSTRIAL PARK PROPOSAL

The Airport Employment Growth District (AEGD) is a potential greenfield employment lands development in the City of Hamilton, currently in the initial stages of planning. The AEGD was selected as the case study for this research for several reasons including:

- as a new industrial park development, the scale and scope of the opportunities for sustainable development are generally unbridled, while the constraints normally associated with a similar retrofit initiative of an existing park are eliminated;
- the City of Hamilton has expressed an interest in incorporating eco-industrial principles into the development of the park;

- numerous studies have been conducted, pertaining to the AEGD, providing a wealth of information pertaining to its development;
- a Community Liaison Committee, with representatives from a broad range of stakeholders groups, had already been established, providing a bona fide source of potential study participants; and
- the early stage of the development planning process provides an opportunity for the findings of this research to inform the development of the park.

#### 4.2.1 Location and Maps

The contemporary City of Hamilton is located in the southern portion of the Greater Golden Horseshoe, at a logistical hub between the Toronto, Ontario, Buffalo, New York and Detroit, Michigan. The AEGD is currently situated southeast of the urban boundary of the City. The study area is bounded by Garner Road and Twenty Road West to the north, Upper James Street to the east, White Church Road and Carlisle to the south, and Fiddler's Green to the west. Figures 4.1 and 4.2 illustrate the airport lands in relation to the Greater Toronto Area (GTA), the Region (including the Hamilton Urban Boundary) and respectively. Figure 4.3 maps the Airport Employment Growth District study area, reference the local road system.

#### 4.2.2 Hamilton Airport Employment Growth District Studies

Several studies have been conducted about the potential development of the lands surrounding the Hamilton International Airport, and the development has also been incorporated into the underlying growth strategy for the City of Hamilton. While the vision recommended in this thesis for the sustainable development of the AEGD was often, though not always congruent with the findings and recommendations of these reports, the content of these studies was reflected upon to ensure the

viability of the vision, to identify barriers to its realization and to inform the development of the municipal plan of action strategy. The studies and documents are outlined in the following paragraphs.

#### *4.2.2.1 Hamilton Airport Gateway Opportunities Study*

The Hamilton Airport Gateway Opportunities Study was conducted by PriceWaterhouseCoopers in 2002, for the City of Hamilton in partnership with the Ontario Ministry of Enterprise, Opportunity and Innovation. The purpose of the study was to evaluate the development opportunities of the land surrounding the Hamilton International Airport (HIA). The conclusions of the study were based upon stakeholder and industry expert interviews as well as case studies. The study found that one of the main locational selection considerations for firms within the Greater Golden Horseshoe, is access to an established multi-modal transportation network, and thereby highlighted the proximity of the airport lands to highway, rail, port and of course air facilities. Airport area industrial parks in Ohio, Texas, and North Carolina were reviewed, resulting in the finding that their success was directly related to features such as twenty-four hour, seven day a week airport operations, a lack of airport congestion, direct taxiway access for businesses, the availability of foreign trade zones and a central location to regional and national markets. The HIA was determined to share all of these characteristics. Also through the case studies review, it was determined that significant initial planning was required to establish a clear development vision and to ensure the long-term viability of the development. Significant investment in infrastructure was also noted as a characteristic of such airport developments, often being undertaken through cooperation between federal, state and local governments. The sectors that were attracted to those parks in the United States were determined to be consistent with existing Hamilton Economic Development targets, and included logistics, aviation, manufacturing, information and communications technologies, and biomedical industries. The resulting tone was that the development of the airport lands was viable, and the study concluded by



providing a course of action for the municipality and other key stakeholders to pursue and support the development of the lands surrounding the HIA.

#### *4.2.2.2 Hamilton Goods Movement Study*

The Hamilton Goods Movement Study was conducted by the IBI Group consulting team, and was completed in 2005. The study briefly reviewed the development of the AEGD, then commonly known as the Aerotropolis. It indicated that the airport provided benefits for the healthcare, information communications technology, traditional manufacturing, tourism and distribution industries. The study indicated that the lands surrounding the HIA entailed advantages in terms of air transportation, but remained somewhat weak in terms of highway infrastructure, despite the completion of the Highway 6 bypass in 2004. Once completed, the Red Hill Creek expressway was suggested as a source for further alleviation of this challenge (since opened in 2008). However, the Mid-Peninsula Corridor access route was identified as the last element of the highway infrastructure needed to effectively service the lands for industrial development, though the highway is currently in the planning and assessment stage with no anticipated start date. A lack of employee and visitor transit opportunities to and from the site was also highlighted as a transportation weakness of the area. The section on the Aerotropolis concluded that for the development to be successful, efficient transportation links would be essential.

#### *4.2.2.3 City of Hamilton Employment Opportunities Study*

The City of Hamilton Employment Opportunities Study was completed by Hemson Consulting in late 2006. The purpose of this report was to determine the adequacy of Hamilton's existing employment land supply and to recommend the extent and location of additional land designations. The study highlighted that the Province of Ontario's Growth Plan for the Greater Golden Horseshoe,

Places to Grow had identified the City of Hamilton as one of the fastest growing areas in Ontario between 2005 and 2031. This growth would entail and require the provision for significant employment growth in the City, in the range of 90 000 new jobs, representing an increase from 210 000 to 300 000 employment positions. Hemson forecast that 49 000 of those jobs, or 54% of the total employment growth would occur through employment lands development (as opposed to office, or population service related positions). Furthermore, the consultants identified a likely decrease in existing industrial employment, such as in the steel sector, to represent a loss of approximately 10 000 jobs within the City. As such, a total of 59,000 new employment opportunities in the employment lands sector were deemed necessary to effectively provide for and enable the growth forecast and targeted for the City.

A central challenge to the creation of these jobs was identified, namely that “Hamilton currently has very little employment land that is available for development and significant investments in servicing are required to bring new supply to market” (p. 2). Greenfield employment lands development was purported to be the primary means available to the City to meet the growth projections. In seeking to identify available greenfields land for such development, the report emphasized access to specialized transport infrastructure, such as airports, as increasingly important to a number of industry sectors. The land surrounding the Hamilton International Airport and the new Highway 6, which provides access to Highway 403 and trade corridors to the United States, was determined to be well-suited for employment use because of its locational advantages and existing restrictions on residential development due to the airport operations.

The report went on to suggest that as a result of Hamilton’s location as the edge of a metropolitan area, the more intensive built forms that are found within some employment land areas, such

as major offices, 'flex space' facilities and smaller industrial multiples with a high component of office space, would not be widely built in the City. Instead, Hamilton should expect to realize primarily large, single-storey industrial-type buildings throughout its employment lands developments. As a result, the report estimated that the AEGD would realize in the short term, twenty-one jobs per net developable hectare. To accommodate a higher employment density over time, the consultant suggested the establishment of secondary planning policies to encourage compact built form and minimize surface parking to ensure that land is used as efficiently as possible throughout its development.

#### *4.2.2.5 Growth Related Integrated Development Strategy*

In 2006 the Growth Related Integrated Development Strategy (GRIDS) for the City of Hamilton was finalized, providing land use, infrastructure, economic development and financial information on the possible growth options available to Hamilton over the next thirty years. Based upon the results of the Hamilton Airport Gateway Opportunities Study which highlighted the suitability of the airport lands for local economic development, and the Hamilton Employment Opportunities Study which identified the need for an increase in developable employment lands within the City, Council required that 400-800 hectares of employment lands surrounding the Hamilton International Airport be incorporated into the development and evaluation of each GRIDS growth scenario.

Several issues were raised pertaining to the airport lands development, during the GRIDS consultation process. These included concern that the location of the park would result in continued automobile dependence, and that the unconstrained lands between the proposed airport employment lands and the existing urban boundary would generate pressures for new residential development. As a result, it was recommended that the AEGD boundary be extended to include the unconstrained areas to the north of the current boundary to reduce opportunities for future land use conflict and

land fragmentation. While real opportunities for residential development near the AEGD are limited because of noise levels associated with the airport's operation, the addition of these lands was suggested as a long term means of bringing the job market closer to existing residential areas, thereby increasing the viability of transit and eliminating potential pressure for residential development in the area. However, this recommendation has not been implemented to date, partially due to a provincially imposed limitation on long-range planning beyond 20 years, as the expansion of the AEGD would represent a larger employment lands area than required to meet growth forecasts through to 2031 (QG3). Additionally, the GRIDS report supported the formation of a Community Liaison Committee to steer the secondary planning process of the AEGD, which was later established by the City of Hamilton.

#### *4.2.2.6 Airport Employment Growth District Secondary Plan - Phase I*

Amendments to the relevant official plans to designate a special policy area for the employment use of the lands surrounding the Hamilton International Airport, identified the need for further studies pertaining to the potential development of the area. As such, Phase I of the Airport Employment Growth District Secondary Plan was undertaken by the Dillon Consulting team, to comprehensively review the opportunities and constraints that would affect the overall developable area of the site, the land use configuration of the development, and to identify other relevant issues that should inform the second phase of the secondary planning process. The Phase I report was completed in the spring of 2008.

From a land use perspective, the study found that the area contains a significant terrestrial natural heritage system that should be protected and enhanced through the course of development. Some sensitive aquatic features were also identified, including that the district is part of the headwa-

ters of four watersheds and that a range of warm-water fish species are likely present in the area. As such, development of the area should proceed in a manner consistent with the protection of these aquatic features, though some streams were identified as constraints that would preclude development, while it was determined that others could be altered in terms of location, though still maintained as natural features. It was also found that drainage features of the site are sensitive to water quality and sediment impacts, and were already impacted by the existing airport and agricultural operations area. Thus enhanced stormwater treatment was recommended to preserve and enhance the quality of water and fish habitat for all tributaries through the course of site servicing and development.

In terms of the history and heritage of the district, a cursory review revealed an area rich in buildings, structures and past cultural landscapes of potential heritage interest and value, though it was noted that additional research and on-site observation was needed to evaluate the heritage merit of those findings. Furthermore, much of the area was determined to have the potential to yield sites of archaeological interest, reflecting activity in the area dating from the Early Archaic Period to the historic Neutral occupation, as well as some Euro-Canadian sites as well.

Much attention was paid to the economic development and employment opportunities represented by the development of the AEGD. The report held that Hamilton is poised for significantly increased local population and employment growth in comparison to historical trends thereby creating the need for an increased supply of employment lands, underlining the viability of the AEGD development. Furthermore, a review of the competitive regional locational attributes of Hamilton and the AEGD found that it ranked quite high in comparison to other municipalities within the Greater

Golden Horseshoe, in terms of its proximity to regional transportation infrastructure, the United States border, major post secondary research institutions and access to a labour force pool.

Finally, from a sustainable development perspective the study identified opportunities for synergies between the existing agricultural activities within and surrounding the AEGD and the industrial operations of the park. A review of eco-industrial park best practices and standards was also conducted, which concluded that eco-industrial principles could be pursued for the AEGD. The report highlighted that the pursuit of eco-industrial development would require a concerted implementation effort, utilizing a suite of municipal tools to provide the necessary resources and address land use planning obstacles to enable the successful realization of eco-industrial principles. The overall conclusion of Phase I study was that the development of the AEGD for employment use is appropriate, feasible and justified from a land use planning perspective, and that while this development would serve to meet the need for employment growth within the City, it could also proceed in a manner that protected and enhanced the natural features and maintained the cultural heritage of the area.

#### *4.2.2.7 Airport Employment Growth District Secondary Plan - Phase II*

Phase II of the Airport Employment Growth District Secondary Plan study is currently being conducted, with Dillon Consulting as the team lead. The Phase II report will develop land use options for the AEGD, then evaluate and recommend a preferred option. The remaining focus of the study will be upon the finalization of a Secondary Plan for the preferred development option, and to develop a financing strategy and phasing plan to guide the course of development. Furthermore, a sub-watershed study will be completed, along with a series of infrastructure master plans for transportation, drainage, and water and wastewater. As a means to fulfilling these objectives, background reports will be prepared to enhance the understanding of the AEGD. These include visioning of the

AECD and the creation of development principles, and the development of urban and ecological design guidelines. Furthermore the study will include zoning bylaw recommendations, eco-friendly industrial park design guidelines, an analysis and evaluation of infrastructure needs, and a proposed development marketing strategy.

#### 4.2.3 Summary and Brief Analysis of Studies

The studies sanctioned by the City of Hamilton have unanimously found the development of the Airport Employment Growth District to be a viable opportunity to address the City's need for economic and social growth over the next 20 years. While less attention to date has been afforded to the environmental outcomes of the development, many of the key findings of the studies are congruent with the vision for a sustainable industrial park, as advanced in this thesis.<sup>10</sup>

Firstly, the advantages of the site were emphasized by the studies, including its proximity and access to a major regional, national and international multi-modal transportation network. Its proximity to a growing skilled workforce was also highlighted. The final vision acknowledges these advantages, but also emphasizes opportunities to augment these locational advantages through the application of sustainability principles. For example through economic development efforts informed by industrial ecology insights, the management of the park to foster collaborative and individual eco-efficiency gains, and the integration of the existing economic assets of the community into the functions of the park. The reports also identify a variety of industries likely to find the site advantageous for their operations. Indeed, the importance of economic diversification was noted in this thesis upon critical review of Hamilton's industrial history. Resilience to economic structural change and the provision of a range of employment opportunities for area residents was thus incorporated into

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<sup>10</sup> The vision can be reviewed in Chapter 5, subsection 5.2.1.2 and in Appendix Five

the vision for the AEGD development. Of note, economic development initiatives to enhance symbiotic opportunities, and design measures to increase the adaptability of the site should promote the locational advantage of the site, the diversity of end-users and its viability throughout economic cycles.

Secondly, the importance of efficient and effective goods and personal transportation opportunities was highlighted throughout the studies. For example, the Hamilton Airport Gateway Opportunities Study emphasized access to an established multi-modal transportation network as a key consideration of industry in determining facility location. Furthermore, the GRIDS planning process noted public concern pertaining to the potential car dependence fostered by the development of the site, due to the lack of transit currently servicing the area. These findings were corroborated during the stakeholder interviews. As a result, efficient integrated inter-modal goods movement and viable employee and visitor transportation options were incorporated into the vision for the AEGD.

Thirdly, Employment Opportunities Study concluded that the site would be best suited to more land extensive, low employment density industrial development. Unfortunately, this form of land use is not conducive to a number of sustainability principles, including compact use of urban land, alternative transportation opportunities, or the creation of local jobs for citizens. However, the report does suggest municipal policies to encourage higher density development, which is positive. The vision acknowledges that the site is attractive for land extensive industries, thus it is not exclusionary. In fact a range of land uses are encouraged, including service and recreational facilities. Furthermore, additional measures beyond zoning to encourage the compact development of the park are suggested in the municipal plan of action, including the provision of design guidelines, financial incentives for multi-storey or adaptable buildings and tax incentives for higher employment density



industries to locate within the park. Nevertheless the recommended strategies for improving the density and diversity of land use on the site are acknowledged to be incremental in nature, which is in accordance with the finding of the Employment Opportunities Study, which noted that increased density was likely to be realized over time.

Fourthly, the Airport Employment Growth District Secondary Plan - Phase I report reviewed the environmental features of the site. Significant terrestrial and aquatic natural heritage features were identified. While not deemed to preclude the development potential of the site, many of these features were designated for preservation throughout the course of the park's development and operations. Furthermore, the aquatic characteristics of the site have led the consultants to conclude that more natural onsite stormwater management is necessary, in lieu of more conventional techniques. The stormwater management finding is congruent with sustainable site servicing principles, while the preservation and enhancement of natural heritage features has been explicitly noted in the vision.

Finally, the Phase I report also addressed the incorporation of eco-industrial principles into the development. Naturally this section was positive in that it demonstrates the City of Hamilton's interest in pursuing the sustainable development of the employment lands. The report highlighted a few practical measures that the City could implement to promote and facilitate such development, concluding that concerted effort on the part of the municipality would be necessary to realize a sustainable industrial development. The best practices noted in the study, such as the provision of design guidelines and the institution of zoning bylaws congruent with sustainable land development standards, were incorporated into the recommended municipal plan of action. Furthermore, the need for municipal leadership and commitment to the realization of a sustainable industrial park was

noted in the literature reviewed and raised by stakeholders during the interview process. As such, it was explicitly noted as a fundamental element of the pursuit of the vision and addressed in the municipal plan of action.

While the studies were widely congruent with the sustainability vision created through the research process of this thesis, the aforementioned elements represent a small portion of the holistic vision for the park's sustainability. As the Airport Employment Growth District Secondary Plan - Phase II study has yet to be completed, it is hoped that the findings and recommendations of this thesis will serve to inform the fulfillment of the Phase II objectives. Firstly and most importantly the holistic vision propounded in this thesis should contribute to the creation of the development vision and development principles, as these will fundamentally impact the shape of the development and ultimately its sustainability. It is also expected that elements of the municipal plan of action could inform the zoning bylaw recommendations, provide topics for design guidelines, and portions of the development marketing strategy.<sup>11</sup>

This case study review has detailed the history of the City of Hamilton explaining its need for holistically sustainable development. The chapter has also reviewed the background on the Airport Employment Growth District, and explained how the studies that have been completed to-date have informed the recommendations of this thesis. The following chapters detail the development of the vision for the Airport Employment Growth District, the identification of the barriers to its realization and the strategies of the municipal plan of action to achieve the vision.

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<sup>11</sup> Please see S3: Development Permit System and S5: Built Environment Education, Resources and Outreach of the municipal plan of action

## **5 VISION AND REALIZATION**

### **5.1 PRESENTATION OF PRELIMINARY VISION**

A preliminary vision for the future development of the Airport Employment Growth District was created to illustrate the direction of the research to participating stakeholders and to serve as a starting point for discussion during the interviews. The vision involved a thorough synthesis of the recommendations propounded in the industrial sustainability literature, applied and tailored to the Hamilton context. Three main categories for initiative were identified, namely the built environment, the industrial operations, and the public realm, though there was significant overlap and interdependence between the categories. A copy of the preliminary vision document that was distributed to all participating stakeholders can be found in Appendix Two. The document included a summative description and objective of the preliminary vision, the preliminary vision diagram, and a glossary of terms that may have been unfamiliar to stakeholders.

### **5.2 INTERVIEW RESULTS**

Overall, stakeholder sentiment was supportive of or in agreement with the basic tenet of this study; that the City of Hamilton is in need of more sustainable forms of industrial park development and operation. Local government representatives, both elected officials and staff members, were receptive to the concepts of industrial park sustainability, and had indeed already expressed their interest in incorporating eco-industrial principles into the development of the Airport Employment Growth District. Municipal government stakeholders highlighted the importance of collaborative and cooperative engagement with the private sector to effectively implement the principles of industrial park sustainability. Municipal representatives were also wary of becoming involved in new areas outside the scope of expertise of local government staff. The municipal plan of action has been developed to incorporate sentiments, namely by emphasizing early and ongoing private sector engage-

ment, and the establishment of partnerships to effectuate certain sustainability measures outside the independent scope of municipal capacity.

Private sector stakeholders that were interviewed were similarly positive about the potential viability of the vision for industrial park sustainability. Both industrial actors and representatives of the development community indicated that business was already moving in the direction propounded in the preliminary vision. However, they also noted that in order to effectuate such a vision today, financial incentives would be necessary to bridge the cost gap between market standards and those entailed by the tenets of industrial park sustainability. Furthermore, they emphasized the importance of market demand. Developers highlighted that the industrial end-users needed to be made aware of the benefits of a more sustainable built form, while industrial actors highlighted their customers expectations for environmentally responsible manufacturing as a key driver of investments in operational improvements.

The urban development and environmental advocates that were interviewed were also positive in regards to the vision, though they certainly emphasized the need for a less incremental approach to its achievement. Primarily these stakeholders were concerned with the implementation of the vision, indicating that it could be acknowledged or committed to on paper, but that the tangible results of the development and operations of the park would be the true measure of sustainability.

Finally the professional stakeholders involved in the land use planning for the Airport Employment Growth District, as well as those whom were interviewed as a result of their expertise in sustainability or industrial sustainability provided mostly practical insights into the pursuit of the vision. These stakeholders largely focused upon strategic elements of the vision to enhance its effectiveness and implementability. Furthermore these stakeholders offered specific recommendations

pertaining to the effectuation of the vision from a municipal perspective, drawing upon their experiences developing, coordinating and administering projects with similar sustainability objectives.

The specific results of the interviews, which focused upon the sustainability vision or opportunities for the development of the Airport Employment Growth District, the barriers to the realization of the vision, and resources available to support its implementation, are described and analyzed below. A context map, included in Appendix Five, was developed to depict these elements and illustrate their interconnection.

## 5.2.1 Vision/Opportunities

### *5.2.1.1 Interview Results*

The preliminary vision was generally well received and considered a positive course of employment lands development and operation by the stakeholders interviewed. One of the most incisive comments to this end was made by CH1, who stated that “the next generation of the work force will be thinking in terms of the environment and health. Thus to be viable in the long-term this development needs to incorporate sustainability.” There were numerous comments that addressed specific elements of the preliminary vision, which shall be outlined first. However, there were also some comments that focused upon the vision from a strategic implementation perspective. While all stakeholder input shaped the final vision, it was these more strategic suggestions that led the final vision to be more results-oriented, in contrast to the task-based preliminary vision.

In regards to the overall preliminary vision, several comments were made pertaining to its implementation. One concern, expressed by PC2 was that “a lot of visions are theoretical,” thus regardless of the contents of the final vision, it must be clearly implementable. While financial barriers were often mentioned, IA2 noted that “there isn’t enough economic consideration in the articulation

of the vision. Financial and economic benefits should be clear.” Therefore the final vision indicates that financial resources should be utilized efficiently and effectively, while alluding to the long term economic benefit provided by the implementation of sustainability measures. CH<sub>2</sub> was adamant that “the vision must be in line with what the end-user wants, in order for the development to be successful.” Indeed Heeres, Vermeulen and Walle (2004) indicated that “active company participation in the project is the most important element for success because ultimately companies themselves need to implement the EIP plans” (p. 993). Along similar lines IA<sub>3</sub> indicated that if the vision is treated as if entrenched in stone, it would become a deterrent to development, however if it is treated as a workable path, it should become an economic development solution. Thus, should developers and end-users be provided with the tools to implement the vision, and the flexibility to achieve it in a manner that suits their needs, the development of the area should successfully meet the objectives of both the municipality and the developers and end-users.

There were several comments pertaining to the Built Environment portion of the preliminary vision. Regarding site servicing, it was noted by PC<sub>1</sub> that many of the elements listed on the preliminary vision were already being considered by the consulting team conducting the Phase 1 and Phase 2 reports on the development of the AEGD. For example, entirely onsite infiltration of stormwater has already been deemed necessary instead of ponds, due to the number of watersheds converging in the area. Furthermore, both small, localized wastewater treatment plants and the use of the centralized wastewater treatment plant were being considered, though it is expected that the centralized plant will be the best, most environmentally secure option due to the level of treatment it provides (PC<sub>1</sub>) and the knowledge of environmental impacts and their treatment should the plant fail (HS<sub>3</sub>).

With respect to the site design of the industrial park, the suggestion by QG<sub>2</sub> that green space can provide both environmental and social benefits, if it is “viewed as [an opportunity to provide] both habitat and an improved employee quality of life,” was directly incorporated into the final vision. Land use planning to ensure compatible transition between uses was another point, incorporated into the final vision, as HSI noted that “the edges are the most difficult to plan, as the edge represents a transitional zone between one use and another, which may be in conflict as neighbours,” and both private citizens also indicated concern pertaining to the transition between industrial and residential areas.

It was noted by both DBI and DPI that the course of employment lands development absolutely needs to move towards that which was described in the preliminary vision. In fact all three developers interviewed, along with QG<sub>3</sub> indicated that construction was already moving towards the green building measures indicated under the built environment section of the preliminary vision, and that likely within five years, many of the basic elements would be standard practice. Of further merit, DPI commented that after “reading through the vision, a lot of these things are selling features, so long as you can afford to implement them,” indicating that implementation of the vision should augment the locational advantage of the park, provided that it is realized in a economically competitive manner.

There were a few comments directly pertaining to the preliminary vision for the Industrial Operations of the park. Stakeholders familiar with industrial operations positively responded to this portion of the preliminary vision, and also provided some suggestions and insight for implementation. IA<sub>2</sub> noted that “cleaner production and resource reduction are absolute necessities, and should be incorporated into the design phase of the park and facilities and continue throughout the

operation.” Numerous elements of the final vision speak to this point. AG2 indicated that the Province of Ontario has already made positive strides in this matter through its “Toxics Reduction Strategy that encourages the proactive substitution of toxics with more benign materials.” Thus the operational substitution of hazardous materials as noted in the final vision, will be promoted by the Provincial program, as well as through support mechanisms included in the municipal plan of action.

Another element of the preliminary vision, the environmental management system was discussed with IA2, who noted that companies are required to have an EMS in place to become a member of HIEA, though ISO 14001 certification is not mandatory. However, IA2 believes that third-party verification of the effectiveness of an EMS is highly desirable, which is the value provided by ISO certification. The obvious value of an EMS, demonstrated through its requirement for membership in HIEA, has been acknowledged through its incorporation into a few programs within the municipal plan of action. The preliminary vision also included the ongoing substitution of hazardous materials for less toxic ones, as an element of achieving industrial sustainability. Regarding the establishment of a symbiotic network through clustering, IA2 explained that “companies do naturally locate around their suppliers and customers or where they are easily accessible to their suppliers and customers. [Thus] symbiotic clustering does happen naturally, but it can also be designed and planned, which is an important role for economic development.” As such the final vision directly addresses symbiosis, but also includes the elements necessary to establish a functioning and stable network. Furthermore, several programs within the municipal plan of action are designed to facilitate and promote the establishment of a resilient and effective symbiosis network.

Culture of Sustainability was the final section of the preliminary vision. The economic development of the park was often commented upon, particularly as it related to the augmentation and



development of the existing economy of the City of Hamilton. As AG<sub>2</sub> stated, the “vision should include smaller scale local economic development for local needs.” Agriculture is currently quite prominent in the area surrounding the AEGD, while fringe agriculture such as sod and tree farms are found within the area. As a result several stakeholders suggested opportunities for the local agricultural industry to both benefit from and support the development of the new industrial park. Suggestions ranged from finding ways to incorporate food production within the boundaries of the park (QG<sub>2</sub>), employing biodigestion technology to utilize local agricultural waste (QG<sub>2</sub>), the creation of a local farmers market for employees and local residents within the industrial park (HI<sub>1</sub>, CC<sub>2</sub>), and that local farms could supply airline catering companies and airport restaurants (HI<sub>1</sub>). Another area for collaborative economic development was suggested by HI<sub>1</sub>, namely that “partnership opportunities with the McMaster Innovation Park would make sense, providing local land for the commercialization of those innovations,” was acknowledged as a definite opportunity for collaborative local economic development by other stakeholders interviewed. As such, the augmentation of City-wide economic development has been incorporated in the final vision, particularly through the integration of community economic assets into the features and functions of the new industrial park.

Also included in the final vision is an efficient and effective goods movement system, the importance of which was highlighted by HI<sub>1</sub>, “...transportation is key to economic development. Hamilton is lucky geographically and in terms of fundamental transportation infrastructure. Now it is necessary to develop the transportation network into an integrated, intermodal system that works well.” QG<sub>2</sub> furthered this point regarding both goods movement and alternative opportunities for personal transportation, stating that the City should “look at transportation, [it] needs to be smart, [and] movement needs to be efficient both within the park and outside it.” A transportation study is currently underway according to HS<sub>3</sub>, which will evaluate transit as well as intermodal goods move-

ment throughout the City, including to and from the Hamilton International Airport and surrounding area.

The more strategic comments centred upon the idea of achieving sustainability overall, and ultimately served to form the underlying tone of the final vision. First of all, HSI suggested that the concept of a culture of sustainability, the title of the third section of the preliminary vision, was more of a dynamic objective than a static heading, such as those of the first two sections, the Built Environment and Industrial Operations. Secondly, QGI commented that “sustainability is the process of getting there,” suggesting that the fulfillment of sustainability is an ongoing, incremental and dynamic process. Finally, PC3 noted that “the [preliminary] vision contains a mix of high level and specific things, ...[and that] while a ‘laundry list’ of items is always what people want, it is limiting and nearly impossible to be exhaustive.” Instead, the vision should be more general, enabling objective driven action, as opposed to checklist driven action. Upon reflection of these comments, the final vision was designed to focus upon the ultimate goals and objectives of the development of the industrial park, from an overall sustainability perspective. The titles of all five vision subsections convey an ultimate, yet dynamic objective. The final vision also focuses much less upon the means of achievement than it does upon the ultimate result of initiatives. Thereby, the final vision enables considerable flexibility and encourages innovation in the process of pursuing the fulfillment of its objectives.

#### *5.2.1.2 Final Vision*

The final vision is outlined below, and can also be viewed, in the context map in Appendix Five, which links its realization to the barriers and the municipal plan of action strategies.

#### *5.2.1.2.1 Vision Statement*

An industrial park that optimizes the use of energy, material and human capital while maintaining or enhancing natural, financial and community assets to the benefit of the economic, environmental and social bottom line.

#### *5.2.1.2.2 V1: Waste Redefined*

**V1a)** Resources such as energy, heat, cooling and water are conserved and cascaded and material loops are closed, resulting in mitigated environmental impact, enhanced process efficiency and improved financial performance.

#### *5.2.1.2.3 V2: Health & Well-being*

**V2a)** Community and employee health and well-being are positively impacted by the manner in which the industrial park is developed, built and operated, as well as through opportunities for public enjoyment of natural and recreational amenities available onsite.

#### *5.2.1.2.4 V3: Conservation, Enhancement & Integration*

**V3a)** Development respects the characteristics of the surrounding community, the natural heritage of the land and the environment. Landscape and architecture are attractive and land uses transition well. Site design makes efficient use of the land, works within environmental constraints and ensures significant natural areas are preserved or enhanced and designed for appropriate human interaction. Operationally and strategically, businesses continuously improve environmental performance towards sustainability through the implementation of a range of green business strategies such as pollution prevention and industrial ecology and principles such as dematerialization, hazardous substance reduction, cradle-to-cradle production and byproduct utilization and exchange.

**V3b)** Financial resources are utilized efficiently and effectively in a manner that ensures the short-term economic viability and long-term economic sustainability of the industrial park.

**V3c)** Cultural, economic and demographic assets of the community are integrated into the functions and features of the industrial park in acknowledgment of the interdependent relationship between the success of the park, and that of the surrounding community.

*5.2.1.2.5 V4: Economic Competitiveness & Workforce Attraction & Retention*

**V4a)** As a modern, adaptive industrial park that promotes and enables collaborative innovation and the most effective and efficient utilization of resources, existing advantages of the location are augmented, strengthening the site's economic development and retention potential in light of ongoing local, national and international competition and economic structural change.

**V4b)** Various industry clusters collocated within the industrial park offer a range of quality employment opportunities for area residents.

**V4c)** Quantity and quality of time is considered a resource, with efficient integrated inter-modal goods movement and viable employee and visitor transportation options. Activities onsite are not limited to employment, but include some services, local retail, restaurant, and recreational and fitness opportunities.

**V4d)** The City of Hamilton is positioned as a national and international leader in sustainable employment lands development, creating opportunities for economic and social development throughout the City.

*5.2.1.2.6 V5: Culture of Sustainability*

**V5a)** A foundational culture of sustainability is fostered throughout the community, contributing to the overall recovery and ongoing development of the City of Hamilton.

## 5.2.2 Barriers

Following a review of the literature and analysis of the stakeholder interviews, twelve main categories of barriers were identified. These are leadership, uncertainty and time, stakeholder collaboration and support, resistance to change, human resource capacity, market demand, economic development, financial, regulatory, property management, symbiosis, and site specific barriers. Each category contains a more detailed description of the nature of the barrier, and oftentimes includes several types of challenges. Description, explanation and commentary of each category and type of barrier follows.

### *5.2.2.1 B1: Leadership*

The first and only barrier falling under the leadership category, B1a, is that City must commit to the implementation of the vision, which will require leadership and resolve on the part of the municipal government, along with the provision of financial resources. This barrier is of fundamental importance, because without the steadfast resolve of Council to realize the vision, it simply will not be achieved. This point was first made by Hamilton municipal staff, who indicated that without direction and approval from Council, little could be done by the municipality to promote the development of an industrial park that was more sustainable than a conventional park.

The barrier of political commitment was also identified in the literature. “The long-term nature of global climate change forms a stark contrast with other issues related to the urban environment. The temporal scale of a mayor’s term in office is somewhere between 3 and 5 years...the time-frame for a mayor to hold office is typically shorter than 10 years” (Bai, 2007, p. 19). This results in the ‘not in my term response’ to long-term sustainability issues that are typically accumulated and resolved over decades and even centuries. Despite this temporal discontinuity, the local elected offi-

cials need to understand and appreciate both the short and long-term economic, environmental and social benefits that will be achieved through fulfillment of the vision and commit to support its implementation.

To this end, Robinson (2005) noted that due to the centrality of municipal councils in agenda setting, informational outreach efforts by municipal staff members are a key measure to ensure municipal focus upon important issues, particularly those that are unfamiliar to the general population. Concern also arose from other stakeholders.

AG1 stated that while it would be wonderful if [the vision] could occur anywhere that there is a proposed industrial park, I personally don't think it will work well for a myriad of reasons. The city is desperate right now for new development, and what you have proposed will require a lot of leadership and backbone by the City. Given they are desperate for new development, and that the leadership and backbone doesn't exist now, I don't believe it will exist if this development goes forward.

Supporting this point, PC1 cautioned that the City of Hamilton has suffered a significant economic decline that would lead Council to abandon the vision if it was perceived to equate to more expeditious employment growth. AG2 added to these points, stating that "too often market forces are the driving force of decisions, yet the market does not adequately address environmental concerns and externalities." These concerns are legitimate, in that the initial intentions of Council alone will not ensure that the development proceeds in a sustainable manner. Indeed, those initial intentions must be translated into action, through the establishment of clear development requirements, consistent decisions, municipal leadership initiatives, and other forms of support, all of which are recommended

throughout the municipal plan of action. As LBr aptly stated, “the City of Hamilton needs to exhibit sensible leadership in the political realm to achieve success.”

#### *5.2.2.2 B2: Uncertainty & Time*

There were several barriers identified that pertained to the uncertainty of pursuing the vision, and the potential increase in time its implementation and enforcement might entail. The first concern, B2a centred upon whether unconventional building materials and technologies would be readily available and perhaps more importantly, whether they would be reliable. HSt indicated that there is an

...issue of reliability and quality of unconventional building materials and technologies. Is there actually a company able to provide the material, technology or service? Can they achieve this in a timely manner; is ‘just-in-time’ delivery available? What if the company goes out of business, and service is needed, or there is a warranty issue?

CC3 added to this concern, by questioning whether the new technologies, particularly those pertaining to the servicing of the site would really work.

This barrier is considered a secondary issue, for three main reasons. First of all, as indicated by numerous stakeholders interviewed, the development industry is already moving towards more sustainable construction practices and building design, as a result these technologies and products are becoming more readily available and reliable in response to market demand. Furthermore, many newer green technologies have been employed elsewhere, particularly in industrial parks in Europe and Asia, as well as a few in the United States and Canada, providing a case history of the effectiveness and reliability of the technology. Finally, many of the techniques employ centuries old knowl-

edge that were largely ignored with the advent of inexpensive energy, inorganic materials and global shipping; instead many green building principles rely simply upon smart design, thoughtful construction practices and materials sourcing, such as orientating the building for maximum solar gain, minimizing construction waste and utilizing local and/or reclaimed building products.

The next barrier B2b, is centred upon concern that it is difficult to be the leader because best practices, precedents and proven results have yet to be established. This barrier is also considered to be of secondary importance to the realization of the vision. There is a perception by some stakeholders that the City of Hamilton would be the only municipality in Ontario to be pursuing the eco-industrial concept for its employment lands at this time. However, this perception is not entirely accurate. In fact there are several municipalities within Ontario that are currently seeking to improve the overall sustainability of their new and existing industrial parks, most notably the municipalities of Toronto, York and Mississauga that are involved with the Pearson Eco-Business Zone initiative. Upon broadening the horizon to a national perspective, numerous new and existing industrial parks emerge, including the Taiga Nova and Innovista eco-industrial parks in Alberta and the Burnside Industrial Park in Nova Scotia. In the United States there are other examples, while Europe and Asia are home to more such industrial parks, some of which have been developed or retrofitted several decades ago. In short, while sustainable industrial park development is currently far from conventional, there are certainly forerunners in the field, from which lessons and insight can be drawn.

The fact that all industrial parks are not conventionally developed with sustainability at the forefront also creates an opportunity for the City of Hamilton. As a leader in the field, the risks may be greater due to some degree of uncertainty, but the potential rewards, both short and long term could transcend the potential benefits of a conventional development. QG2 even suggested that



Hamilton's heavy industrial history that has led to economic decline in recent decades, is, in itself a catalyst for more sustainable forms of employment lands development. The initial course of development, carved during the initial economic rise of the City brought great success to the area, however it left a legacy of environmental degradation and upon its decline, urban blight. An alternative path to development, one that emphasizes the triple bottom line, will not only serve to place the industrial park competitively at the global forefront, but will contribute to the overall recovery of the City in an economically adaptive and resilient, socially conscious and environmentally responsible manner.

The third barrier B2c, was raised or acknowledged by a range of stakeholders interviewed and is of fundamental effect upon the realization of the vision. Essentially, the City of Hamilton's development approvals process is unpredictable, difficult and time consuming, and as a result abnormally costly. So serious is this barrier, that it was highlighted as a barrier to *any* development in the City, let alone the more unconventional form as propounded in the vision. Within the local government, this barrier was acknowledged by municipal staff. It was also noted by CCI, who stated that, "the maze of the approvals process is a barrier, companies and developers need help navigating the rezoning and building approvals process. The bureaucracy of the City of Hamilton a significant barrier." AGI stated simply, that the implementation of the vision "cannot make the development process more difficult in Hamilton." Completing the cross-section of stakeholder comments on the matter, DBI pointed out that the City needs to be able to facilitate the approvals process as it is "notoriously difficult to deal with the City of Hamilton." While DPI indicated that "approvals are abnormally unpredictable and time consuming" after citing the recent experience of Maple Leaf Foods, a project proposal that met zoning and other requirements yet was still turned down, to exemplify why the City of Hamilton has a negative reputation and track record in terms of development approv-

als. In reflection of this significant challenge to the implementation and realization of the vision, the municipal plan of action includes several programs designed to facilitate and streamline the development approval process, while ensuring a quality review and evaluation of all applications.

The final barrier within the category, B2d was identified by PC3. In the consultant's experience, if a green feature is expected to delay development or construction process, it is unlikely to be implemented. This is a secondary barrier to the achievement of the vision. First of all, if the development approvals process can be streamlined, particularly for projects adhering to the principles of the vision, the potential increased timeframe for implementing a few green features may be offset. Furthermore, many of the delays are simply a result of the learning curve associated with implementing a new technique. As indicated by DBI, such costs should be internalized by the developer or builder, as they represent an investment in the future capacity of the firm to efficiently incorporate such technologies and techniques. Finally, PC3 indicated that many green features can be incorporated into the design of an industrial park that do not require an increase in time to execute, as was the requirement for all eco-features incorporated into Taiga Nova Eco-Industrial Park. In acknowledgment of this barrier, several features of the municipal plan of action seek to remove the possibility of delay associated with the implementation of the vision, including the provision of guidelines and design standards, the alignment of planning and zoning requirements and a review of engineering standards to ensure congruence with green infrastructure specifications.

#### *5.2.2.3 B3: Stakeholder Collaboration & Support*

Due to the scale, scope and incremental nature of the vision, the barrier B3a is of fundamental consequence to its successful pursuit and realization. This barrier indicates that a wide range of stakeholders such as local elected officials, municipal staff, the development community, area indus-

try and businesses, support professionals and citizens must be on board to realize the vision. Numerous stakeholders raised this issue during the interviews, citing various situations in which a lack of understanding or willingness to support the implementation of the vision would have a detrimental impact upon its realization.

Indeed, without such support, resistance would likely arise at numerous stages of the development process, council may be less inclined to enforce the vision, and fewer green operational practices would be likely to be implemented. While the overall vision is holistic in that its implementation and realization would entail both unique and universal benefits for each stakeholder type, thereby inherently reducing resistance to its pursuit, several elements of the municipal plan of action programs are designed to address this barrier. These include educational and outreach efforts, community consultation and ongoing involvement, financial incentives and support, and collaborative projects. Any specific stakeholder suggestions about overcoming this challenge were duly incorporated into these programs such as the provision of design and technical guidelines (HS<sub>1</sub>, HS<sub>2</sub>), involving community stakeholders early, and earnestly in the planning process (LI<sub>1</sub>, QG<sub>1</sub>), and seeking opportunities for local collaboration and partnership to enhance the viability and quality of projects associated with the vision (QG<sub>2</sub>).

The other barrier B<sub>3b</sub>, focuses upon is the situation that business may not trust or welcome government involvement in new arenas, and thereby may avoid collaboration or voluntary involvement with public sector initiatives. This hindrance was primarily identified by public sector stakeholders, including CC<sub>1</sub> and HS<sub>2</sub>. Interestingly, the private sector was largely mute on this point, with the exception of emphasizing the need for flexibility in the implementation of the vision.

Overall, this challenge is considered a secondary barrier for two main reasons. Firstly, much of the recommended municipal plan of action calls for the local government to encourage and facilitate the realization of the vision by providing the planning framework and resources required for its fulfillment, as opposed to becoming directly involved in the details of its implementation. Such a role is unlikely to generate private sector resistance, on the grounds of mistrust or excessive government interference. Secondly, positive and consistent municipal leadership, over time, should serve to increase the confidence of the private sector in the local government, thereby improving the receptiveness of the business community to public-private collaborative initiatives, such as a City-wide symbiosis opportunities study.

#### *5.2.2.4 B4: Resistance to Change*

B<sub>4a</sub>, the first barrier of this section, was first identified during the literature review, but was found to be applicable following analysis of the stakeholder interviews. The barrier identifies a general lack of environmental vision, which can prevent constraints or externalities from being addressed as opportunities. This barrier is considered a fundamental obstacle because implementation of the vision would entail the reconsideration of constraints as opportunities for improved performance and the internalization of external benefits and costs into the assessment and valuation process of each project. Balkau (2002) elaborates upon this point, asserting that a

...lack of environmental vision among land developers means that social and environmental factors are still often regarded as constraints rather than opportunities.

[For example] there is little evidence that the majority of estate planners at present see much advantage in collective environmental action beyond providing tenant companies with [standard] waste disposal services...This is despite the fact that co-

operative industrial action is one of the remaining untapped sources of further improvement in manufacturing efficiency for enterprises, after internal improvements and process optimization have been completed (p. 491-492).

This situation was exemplified during the interviews, in which numerous stakeholders indicated that the costs for external benefit should not be borne solely by the private sector, or that public sector support would have to provide supplemental financial support to achieve social or environmental benefits, currently commonly considered external to a core development project.

While it is acknowledged that financial incentives will be necessary during the initial phases of the development to achieve the vision, and thereby incorporated into the municipal plan of action, it is also contended that social and environmental benefits or costs should be better incorporated into the performance evaluation of development projects. The underlying approach towards sustainable development needs to shift, from one in which social and environmental benefits are considered auxiliary, to one in which economic, social and environmental outcomes are holistically and inherently integrated into each project. Numerous programs within the municipal plan of action have been designed to address this issue, with the ultimate aim of fostering a underlying culture of sustainability in which triple bottom line outcomes are integrated into the development and operational objectives of each project.

The fact that entrenched thinking is often difficult to overcome is highlighted in B<sub>4</sub>b, due to the uniqueness of the vision and the measures required to achieve it. Resistance often mounts to the unfamiliar, or to change that is perceived to be difficult or risky. This barrier is of fundamental consequence, as without effective remedy, a return to a more conventional path of employment lands development is very likely to be advocated and ultimately implemented by stakeholders unwilling to

adjust their thinking to the envisioned course of development. The barrier of entrenched thinking was first identified in the literature. The most insightful passage on the subject was written by Chertow (2002), who observed that, “even explaining industrial symbiosis - the educational component - is arduous because industrial symbiosis is not business as usual, and requires a significant change to dominant, rugged individualist mental models” (p. 332).

A wide range of stakeholders also identified such resistance to be a challenge to implementing the vision. Notably, HSI stated that “[resistance to change] is a very real barrier. Stakeholders, particularly those in a decision making capacity, need to be made aware of the benefits, for instance that green development can save land and development costs.” HI mirrored this point, indicating that there is a “need to find mechanisms to help people get over their fear or resistance to change,” then went on to provide an example that “for some companies, the concept for the park will be a first,” thus the benefits of pursuing the vision must be clearly demonstrated. On a positive note, HSI observed that “there is a growing trend on getting informed.” Given the fundamental nature of this barrier, several elements of the vision contribute to its remedy. Most notably, the advice of stakeholders to demonstrate the benefits of the vision are incorporated into several programs designed to educate, publish lessons learned and highlight achievements as the development progresses.

It is also fundamentally important to address the next barrier in order to implement the vision. The barrier B<sub>4c</sub> identifies organizational inertia as a contributor to resistance to change. Organizational inertia essentially stems from the established practices, procedures and systems of an organization, which make it difficult to approach a project, process or activity in a new way. In examining the municipal contribution in industrial sustainability, Burström and Korhonen (2001) noted that

...one important barrier [to municipal participation in local industrial ecology efforts] could be the political/institutional resistance to change in one or a group of municipal departments. There is always a risk that some parts of a municipal organization might feel their existing positions in the region threatened by a change of existing municipal activities (p. 44).

Indeed changes to the municipal planning and approval process to emphasize the overall sustainability of the industrial park, as recommended in the municipal plan of action, does have the potential to alienate some municipal staff, particularly those unfamiliar with the means of sustainable development relevant to their department and role in the planning and approvals process. As a result, effective information and educational support needs to be provided to ensure not only the municipalities, but also the developers, professional consultants and end-users are provided with the tools they need to adapt to the new development and operational objectives and requirements associated with the vision.

IA2 emphasized a different, less individualistic aspect of organizational inertia: “understand that resistance to change does exist, but not because individuals or organizations do not want to change, but because there are already systems and procedures in place and resource constraints are a deterrent to change.” One mechanism to address this barrier is the establishment of an Environmental Management System (EMS), which would provide the organization with effective mechanisms not only to cope with change, but to improve the sustainability of its activities. Therefore, the municipal plan of action includes a program designed to support organizations develop and establish an EMS, and also seeks to offset the most common resource constraints, including financial, human resource capacity and time.

The final barrier, B<sub>4d</sub>, of this section was identified by PC<sub>2</sub> who cautioned that resistance will mount if the vision is over-ambiguous or unclear in its implementation, particularly as many of the developers and industrial firms are international, and are unlikely to be familiar with local bureaucratic process. This barrier has been classified as secondary as the vision, and ultimately sustainability is both a process and a goal. As such, implementation of the vision requires flexibility, provision for alternative courses of action and opportunity for innovation. However, upon reflection of this barrier, it is clear that the most important means of overcoming it is to provide a clear path to pursuing the vision. While it is impossible to predetermine a course of action that will ultimately fulfill the vision, due to the ongoing and incremental nature of sustainability, the recommended municipal plan of action serves to provide not only the municipality, but also all other stakeholders including the development community, professional consultants, park occupants, and the public at large with a clear understanding of the vision and how each group can contribute to its pursuit. Over time, the role of the municipality and other stakeholders will change, but it is hoped that an underlying culture of sustainability will have been fostered, that will serve to carry pursuit of the vision forward beyond that which has been mapped in the municipal plan of action.

#### *5.2.2.5 B<sub>5</sub>: Human Resource Capacity*

One of the most straightforward, yet fundamental barriers to the realization of the vision is B<sub>5a</sub>, which notes that adequate municipal staff must be allocated to implement the municipal plan of action effectively. Capacity is a significant barrier to implementing measures to enhance industrial sustainability, particularly from a municipal perspective. Robinson (2005) found that Canadian municipal governments require appropriate capacity in the form of funding, allocation of staff time and staff training to address sustainability concerns. HSI noted that this was currently an issue, indicating that there are only two people within the Planning Department of the City of Hamilton dedicated



to industrial development. Indeed, much of the success of the municipal plan of action will rest upon the municipal staff, and as such, sufficient human resource capacity must be dedicated to the task, not only to develop the programs, but to carry-out their day to day administration efficiently and effectively. The resolution of this issue should stem from a municipal commitment to implement the vision, as discussed in B1: Leadership, however it is also addressed in the municipal plan of action.

The only other barrier of this section, B5b, is also fundamental to the implementation of the vision. The barrier pertains to the organizational resources that must be dedicated to the adoption of a new technology, practice or management system, and the learning curve associated with that adoption. While much if not all of the resource costs associated with the implementation of a more sustainable practice should be recovered over time, the initial burden paired with potentially uncertain results could prove to be a significant deterrent to many organizations, both public and private. Indeed, numerous stakeholders including IA2 and DB1 noted this challenge as an initial barrier to the uptake of the vision. To mitigate the effects of this barrier, the municipal plan of action includes initiatives designed to offset the initial investment of time or money for key sustainability measures, such as green building, the establishment of an EMS, and the identification of local symbiosis opportunities.

#### *5.2.2.6 B6: Market Demand*

The first barrier of this section B6a, notes that buildings will be constructed to end-user's specifications, thus if tenants or buyers are not demanding sustainable building features, green buildings will not be constructed. As DB1 explained, the developer or builder "will not recommend to the client how to build...it is challenging enough to secure a client, we are not in a position to dic-

tate how the building is designed and constructed.” IA<sub>3</sub> also indicated that green features would only be incorporated by a developer or builder if such features were demanded by the client.

Along very similar lines, the second barrier B6b notes that buildings constructed on speculation are very likely to be constructed to conventional standards, or with only a few green features. This barrier was first raised by IA<sub>3</sub>, who questioned whether a developer could reliably realize a return on the increased investment for green features if the building was constructed on speculation. DBI concurred that most developers and builders would be unwilling to assume the increased cost of building green without a secured major tenant or purchaser. As financial concerns are at the root of each of these barriers, both are considered secondary issues that essentially fall under B8a. The municipal plan of action programs that address B8a will therefore also mitigate the impact of these barriers. Furthermore, education, resource and outreach initiatives incorporated into the municipal plan of action should also serve to provide both developers and end-users with easily accessible information and knowledge about the benefits of building green, thereby serving to increase demand.

One element of the vision is the efficient use of land, however one challenge is noted in B6c, namely that the availability of land in the Greater Golden Horseshoe region does provide an economic justification for multi-storey industrial or warehousing buildings. As there are many measures by which land can be used more efficiently, this barrier is considered secondary due to the narrow scope of its impact upon that element of the vision, and upon the vision as a whole. PC<sub>1</sub> and PC<sub>2</sub> both noted this situation, while PC<sub>3</sub> added that oftentimes even when a developer or end-user is willing to consider a multi-storey building, the zoning bylaw does not permit the requisite building height which would entail a time consuming and potential costly zoning variance. In reflection of the fact that there is currently little economic justification for multi-storey buildings in the region, it has

not been proposed that the municipality require multi-floor buildings in its zoning bylaw. Indeed such a policy would be highly exclusionary and would likely cause development to locate elsewhere in the region. Instead the municipal plan of action includes incentives for the construction of multi-storey buildings, and recommends a zoning bylaw in which taller buildings are permitted.

#### *5.2.2.7 B7: Economic Development*

The first barrier pertaining to economic development is B7a which indicates that the implementation of the vision must not be too rigidly enforced, so as to avoid the development of the industrial park from being stifled. Numerous stakeholders raised this issue. For example CCI concisely stated that, “there can’t be too many restrictions because restrictions act as a disincentive to development.” This is considered a fundamental issue, because strict enforcement of the vision will not only stifle innovation and the collaborative environment required for its fulfillment, but will also serve to drive development away from the site.

While a clear path to implement the vision needs to be established, companies must also be allotted the flexibility they need to pursue the vision according to their needs and unique circumstances. IA2 aptly explained that there is a “need to build in flexibility for companies locating at the park to determine the best site location, design of their operations etcetera, while not straying from the fundamental principles and aim of an eco-industrial park.” Indeed, there is a fine distinction to make. Flexibility must not apply to the objectives of the vision itself, rather it should be applied to the means and measures by which it is pursued. The municipal plan of action addresses this balance by both inherently incorporating the incremental and ongoing nature of the pursuit of sustainability into its programs, and directly through planning initiatives designed to both encourage and incentivize uptake of the vision, while providing flexibility of implementation.

The next barrier B7b, pertains to the perception that the municipality is not in a position to selectively attract or enable certain industries or companies to locate within the City. This point was echoed by several stakeholders, many of whom also indicated that the vision must not deter traditional users. For example, PC2 cautioned that, “if the City targets only higher order employment development, it runs the risk of not realizing any development whatsoever.” CC2 spoke from a different perspective on the same issue, stating that the Economic Development Department “has claimed that it is not wise to be choosy with the companies the City attracts...but doesn’t the City want to attract triple bottom line companies?” While concerns about the types of companies the City might recruit to fulfill the vision, and the impact that might have upon the viability of the development itself were common, the issue is considered to be secondary. This is due to a common interpretation that only certain types of companies or industries would be suitable to fulfill the vision. While it is true that triple bottom line companies should be attracted to the sustainable industrial park, a positive outcome for the City of Hamilton, the intent of the vision is not to exclude or discourage certain companies or industries from locating within the park. Doing so would only result in those businesses locating in a more conventional park, where the infrastructure and resources to conduct business more sustainably would be lacking.

This result would be counterintuitive to the goal of improving industrial sustainability, as companies deemed ‘less desirable’ would continue business as usual elsewhere. Instead, the implementation of the vision should ensure that the underlying infrastructure, current resources and constructive support needed by all types of companies and industries to build and operate in a more sustainable manner are available on an ongoing basis. The municipal plan of action outlines the programs and initiatives that would foster such an environment, though over time the content and scope

of each program will need to be updated to remain relevant and effective in supporting the pursuit of the vision.

One of the more contentious issues surrounding the Airport Employment Growth District is the level of employment density that is likely to be achieved by its development. The challenge of attaining a higher employment density, particularly in industrial parks was explained by PC2 and became the barrier B7c, namely that employment trends, including those of the advanced manufacturing sector, are moving away from employment density. Indeed, as PC2 described, the efficient use of land is not an objective of industry, which is instead most concerned with operational efficiency and reliability. Thus many businesses, both traditional such as the logistics industry and contemporary such as biofuel production, can be quite land extensive, while creating relatively few jobs per hectare.

This issue is considered secondary for three main reasons. Firstly, the vision is for an industrial park, where a range of employment opportunities are available. As such, numerous types of businesses and industries should be encouraged to locate within the park, not all of which will be land extensive and entail low employment densities. Secondly, as Heeres et al. (2004) noted, approaching the project from a job creation perspective can be detrimental. For example, “the project approach taken by local politicians in the Fairfield case did not help convince industries to participate in the project...Baltimore and Maryland state politicians mainly considered the project as a job creation initiative and not as an economic program designed to help the economic and environmental performance of the companies involved” (p. 993). As such, the objectives of the vision must be approached from a more holistic perspective, which stems into the final point.

Indeed, many elements of the vision could be achieved by a company that yields a low employment density. For example, that company may build a LEED Gold facility, contribute to the

maintenance of trails near its property, and manufacture according to pollution prevention principles, in addition to creating several quality jobs within the City of Hamilton and contributing to the municipal tax base. That said, the City should encourage higher density employers to locate within the sustainable industrial park, to provide more local jobs for citizens, contribute to the viability of service providing businesses onsite, and to increase the demand for public transit to and from the park. The municipal plan of action contains two programs to address this issue. Needless to say, the Official Plan under the Development Permit System should permit the uses commonly associated with higher employment densities. Secondly the award criteria and disbursement formula of the Community Improvement Plan incentive programs could serve to encourage companies that will provide a high job density to locate within the park.

#### *5.2.2.8 B8: Financial*

Unquestionably, the most commonly raised barrier, both in the literature and the interviews, focused upon the challenge of maintaining the economic attractiveness and competitiveness of the industrial park while developing it in accordance to the vision. The barrier B8a specifically states that the cost of implementing the vision cannot be economically prohibitive. In their executive briefing on industrial ecology, Lowe, Warren and Moran (1997) acknowledged that “eco-industrial parks may cost more to develop than traditional parks, depending upon the design choices in a project” (p. 148). They go on to note that when this occurs, the additional costs may or may not be offset by the subsequent operational savings, within a payback period acceptable to the developer. While this specific example is less applicable in Canada, where most developers that continue to own and manage the property enter into agreements that require the tenant to pay all utility fees, thereby transferring the benefit of operational savings to the tenant, it remains uncertain whether such savings can

consistently be translated into premium lease rates that would enable the developer to recover the costs of the green features.

DP1 spoke directly to this point, stating, “there is a definite cost to implementing the vision. The question is can the market sustain it?” The stakeholder then went on to provide an example, explaining that the cost of LEED silver certification can be supported in Oakville (a nearby city between Hamilton and Toronto), where people and companies are willing to pay the rent premium, however the market viability of that premium in Hamilton, by the airport is uncertain. DP1 then questioned, “who is going to bridge the gap between the price the end-user is willing to pay and the cost of these initiatives [outlined in the preliminary vision]?” HI1 stated simply that both developers and industry need to be on board from the onset of the development. To achieve their support, the implementation of the vision must make financial sense, otherwise the park development won’t move forward as envisioned. Other stakeholders also expressed similar concerns. QG3 and CH2 indicated that a concern of some Community Liaison Committee members is whether the environmental features already under consideration by the City of Hamilton, and those outlined in the preliminary vision, would significantly increase the value of the land, thereby inhibiting the development potential of the area. In supplement to this point, IA1 stated “cost is everything” after noting that airfreight is already expensive and that Hamilton’s advantage is that it provides a low cost option for air cargo. IA1 went on to explain that cost advantage should not be offset by other costs, such as those that may be associated with implementing the vision. A final comment, highlighting this barrier was provided by AG1, who stated that some companies will be willing to pay the premium for sustainability, but “I can tell you, that’s a very small percentage of the companies that are out there.” While this barrier is definitely a fundamental issue, it most certainly can be addressed.

First and foremost, many green features, widely perceived to be more costly, are in fact competitive with traditional forms of industrial park development. As highlighted by PC<sub>3</sub>, some features are less expensive, for example natural stormwater management as opposed to curb and gutter, while other will cost more, such as trails, and many others save money over their operational life cycle. It is possible to design and build a business or industrial park sustainably with no net increase in cost above that of a traditional development. It is imperative that this reality be demonstrated and communicated to all stakeholders, so as to remove a major barrier to the pursuit of the vision. It is possible for a financial model to be developed that outlines the financial pro forma for a conventional development in comparison to the financial model for a more sustainable industrial park. A Canadian example, is the Taiga Nova Eco-Industrial Park in Fort McMurray where a municipal requirement was that none of the eco-features could negatively impact profitability or the time the park took to develop. Furthermore, in acknowledgement of the fact that there is an initial incremental cost to achieve LEED certification that may not be fully recouped by the developer through the lease-rate or sale value of the property, financial incentives have also been incorporated into the municipal plan of action.

B8b, the second barrier indicates that the municipality has limited financial resources to invest in the implementation of the vision. Emphasizing the commonplaceness of this challenge, Burström and Korhonen (2001), writing about the European experience, found that the most significant barrier for industrial sustainability initiatives is commonly a lack of municipal financial resources. Following the stakeholder interviews, it appears as though the City of Hamilton is also faced with this prevalent obstacle. From the perspective of AG<sub>1</sub>, “the City is in dire straits financially.” PC<sub>1</sub> constructively acknowledged the issue, indicating that “the City of Hamilton is really cash strapped, [thus] solutions need to involve a wise, efficient use of financial resources.” Finally,



HSI provided a municipal perspective, explaining that, “there are funding limitations, particularly for intangible activities, such as economic development, which deals with potential, in contrast to tangible services, such as garbage removal, which are considered a core function of the municipality.” This barrier is considered to be of fundamental consequence because public sector investment will be needed to fulfill the vision, both for municipal leadership activities and staffing needs and for incentives and support to the private sector.

However it is important to note that municipal funds should serve to lay the foundation for the realization of the vision and leverage other sources of funding and investment. The municipal plan of action was developed with cognizance of the limited availability of municipal financial resources. In fact, the vision advocates the efficient and effective use of financial resources, which certainly applies to municipal investments as well as those of the private sector. The municipal plan of action programs not only advocate an early political commitment and investment in the envisioned economic, environmental and social potential of the industrial park, but also focus upon leveraging municipal monetary resources with other sources of investment and financial support, utilizing municipal revenue generated by the development itself, establishing collaborative and mutually beneficial partnerships to ease the economic burden of some sustainability initiatives, and finally the provision of non-monetary forms of support.

The final barrier of this section, B8c, identifies the negative bias that arises towards environmental measures, particularly if an increased cost is associated with the initiative. This barrier was directly raised by CC2, who complained of “an overall dinosaur pattern of thinking that permeates council and staff, especially if there is cost involved in more sustainably minded initiatives.” This barrier was inadvertently reinforced by many of the stakeholders interviewed, who suggested in one

way or another that economic performance was paramount. While it is not denied that the development of this park must make economic sense, this barrier is of fundamental consequence because it exposes a flawed underlying perspective on matters of sustainability. Heijungs (1997) best elucidated this point, explaining that “a healthy environment may be achieved by an absence of production and consumption. A sound economy needs in contrast a healthy environment. There is hence no full similarity...sustainable production and consumption must be seen in the context of sustainable environmental quality” (p. 38). This point was furthered by AG2 who stated “assessing costs in economic terms only has severe limitations, [business and government] can no longer ignore externalities and long term costs.” This is a difficult barrier to overcome, but the municipal plan of action does seek to address it, beginning with its call for municipal leadership. The City of Hamilton is in a position to become a national and international leader in industrial sustainability, but to successfully achieve this position, the development must integrate environmental, social and economic objectives effectively.

#### *5.2.2.9 Bg: Regulatory*

The most foundational barrier, Bga, addresses the fact that the Official Plan and zoning bylaw do not specifically support the vision and are in some cases contrary to sustainable industrial park principles. This is absolutely a fundamental barrier, as it would be highly counterproductive and counterintuitive to have a regulatory framework in place, that would require Official Plan amendments or zoning bylaw variances to permit the implementation of the vision. For example, to encourage greater land use efficiency, the Innovista Industrial Park in Hinton, Alberta, which has custom eco-industrial zoning, permits a minimum front yard setback of the smallest of 7.5% or 7.5 metres, no minimum side yard requirement, and a minimum 2 metre rear yard setback. This compares to Hamilton’s Glanbrook Prestige Industrial Park zoning, which requires a minimum 15 metre front

yard setback, 7.5 metre side yard, and 9 metre rear yard setback (Eco-Industrial Solutions, 2008). In reflection of this important barrier, it is recommended in the municipal plan of action that a Development Permit System be established for the Airport Employment Growth District, which would ensure that both the Official Plan and zoning bylaw not only permit, but explain, facilitate and encourage the fulfillment of the vision.

The second barrier of this section, B9b raised by PC2 is that there is not any mechanism to enforce an employment vision, with the exception of the Official Plan. While this is considered a secondary barrier because the vision is not intended to be exclusionary of certain types of industries, it does impact the ability of the municipality to guide the establishment of industry clusters with the aim of facilitating knowledge exchange, innovation and symbiotic relationships. Upon review of the literature, it appears as though this may be a common challenge, and in fact, one that is unavoidable, as governmental attempts in free market economies to plan and mandate industrial clustering have commonly stifled development. As Gibbs and Deutz (2007) reported, one U.S. respondent involved in the planning of an eco-industrial park stated “what we are trying to do is mandate co-operation and you really can’t do that” (p. 1691). In fact they went on to note that in some cases (notably the Cape Charles Eco-Industrial Park), the difficulties involved in translating planned industrial clusters to a recruitment reality had led to the abandonment of any attempt at EIP activities. Moran and Holmes (1997) caution that over-planning to create the ‘right’ mix of firms will inevitably constrain recruitment of tenants to an industrial park and therefore purport that the recruitment strategy should focus upon a set of target industries that will integrate well with an area’s existing industrial mix and resources.

Thus, while it appears unwise to strictly enforce an employment vision centred upon carefully planned industrial clusters, the implementation of the development should not only focus upon the provision of facilitative infrastructure paired with the underlying assumption that knowledge exchange, innovation and symbiotic relationships will emerge with time, but upon encouraging those relational assets to develop and thrive. Heeres et al. (2004) contrasted Dutch planned eco-industrial experiences to those of the United States. Upon review of the more successful planned Dutch parks, Moerdijk, RiVu and INES, they suggested that the initial focus of an eco-industrial project should not be upon the establishment of physical energy, water, and material waste exchanges but upon the creation of utility sharing projects, such as combined cogeneration of heat and power. These sorts of projects, which were perceived by firms to be of low risk and both economically and environmentally beneficial, then encouraged their participation in further symbiotic activities.

The underlying message of Heeres et al. is that the development of relational assets between companies “is a long-term process [and] in order to stimulate development, it is important to focus on the establishment of low cost, high benefit utility sharing projects and ‘simple’ exchanges” (p. 994). As a result, the municipal plan of action recommends the establishment of utility sharing projects throughout the Municipal Leadership Program, and the ongoing stimulus and support for the establishment of energy, water and materials exchanges through the initiatives of the Park Eco-Affairs Association. In addition, the vision is much more comprehensive than the narrow focus of industrial ecology, whereby the establishment of symbiotic relationships is paramount, thus firm level sustainability performance improvement is also emphasized and supported through the municipal plan of action programs.

B9c is a fairly straightforward barrier that highlights the common situation whereby existing municipal engineering standards cause delays to, or even the abandonment of, the incorporation of green technology into the infrastructure of a park. PC3 indicated that engineering standards are often problematic, noting a case where one of the main reasons plans to install a district energy system were abandoned, was that the engineering standards of the municipality were not in place for the type of pipe required, compounded with the fact that past experience had demonstrated that the municipal public works department was not equipped to deal with similar unconventional technologies in a timely manner. Indeed, the abandonment of a project that would further progress towards the vision, based upon an engineering standard issue, or the municipality's inability to address the matter efficiently and effectively, would be detrimental to the potential level of fulfillment of the vision. Such an experience may even have a ripple effect, whereby other initiatives are not pursued due to the perceived difficulty of incorporating unconventional technologies into development and construction projects.

Thus this issue is considered to be of fundamental consequence to the realization of the vision. PC3 emphasized that better interdepartmental communication as a key element of overcoming this barrier, specifically to ensure that staff of the Public Works Department are aware of any upcoming infrastructure or development projects that intend to incorporate unconventional technologies and techniques, and are thereby equipped early in the process to address potential engineering standards conflicts. Furthermore, the municipal plan of action recommends the proactive review of municipal engineering standards to ensure the regulatory framework enables more sustainable forms of infrastructure.

#### *5.2.2.10 Bio: Property Management*

Bioa highlights the lack of overarching park-wide management structures due to the various types of ownership arrangements in most Canadian industrial parks as a barrier to achieving the operational elements of the vision. As the UNEP (1996) outlined, the ideal would be an estate that is centrally controlled and managed at all stages of its existence, thereby creating “opportunities for coordinated and coherent application of environmental management principles” (p. 4). While such central management is common in some areas of the world, such as Asia where the government often owns the land, it is very uncommon in Canada (PC3). Firstly there may be numerous developers involved in the park’s development, ranging from small family owned businesses to large multi-national firms and real estate investment trusts. Secondly, some of those developers will maintain ownership of the property and lease the space to end-users, in those cases, some developers will assume property management duties in-house, others will outsource to property management firms, and others still will leave the tenant responsible for most maintenance matters. Furthermore, some developers will sell the property to the end-user, who would then assume responsibility for the property’s management.

These varied ownership and management structures combine to make it difficult to implement cohesive and effective social and environmental management practices and initiatives. This barrier is of fundamental significance, as it must be addressed to enable the successful implementation of the vision. That said, there are mechanisms to unify the management practices of an industrial estate. Education and outreach, which have been incorporated into the municipal plan of action, are important elements of achieving a high property management standards park-wide. Secondly, as Brand and Bruijn (1999) indicated, an organizational team can be employed, either from a hierarchical steering position, as in a regional government, or a more horizontal coordination perspective,

such as a team organized by the partners in the park themselves to ensure park conditions are supportive of sustainable industrial development and practices. The latter solution precisely describes one of the recommendations of the municipal plan of action.

#### *5.2.2.11 B11: Symbiosis*

The establishment of symbiotic relationships between companies, whereby energy, water and material resources and byproducts are shared and exchanged, is an integral part of industrial sustainability, particularly after company level economic and environmental performance has been optimized. The first barrier to the achievement of symbiotic relationships, B11a is that the stability and reliability of symbiotic networks are challenging to establish and ensure. This is considered a fundamental barrier because the stability and reliability of a symbiotic relationship is integral to the initial decision to enter into an exchange or resource sharing venture. IA2 acknowledge this consideration, indicating that companies will “analyze the sustainability of the supply base and take a long term view of the issues to determine the risk profile of setting up a symbiotic relationship.” That risk could be associated with “operational problems that can lead to unstable byproduct or waste streams, jeopardizing the facility utilizing that byproduct or waste as an input into their process” (Fons & Young, 2006, p. 220). Alternatively, the fact that investment in additional process and transport infrastructure is often needed to facilitate an exchange, the result of a failed or unsustainable relationship could be the loss of those investments” is another source of risk (Schlarb, 2001, p. 10). The main cause of the risk of instability and unreliability is a lack of redundancy in both the supply of energy, heat, water and cooling that can be cascaded, and materials and byproducts that can be reutilized and the corresponding demand to make such ventures worthwhile. Sterr and Ott, (2004) commented upon this issue, indicating that “this lack of redundancy contrasts sharply with natural eco-

systems, in which the number of organisms of each species is plentiful, even in relatively small sub-systems.”

Indeed such a lack of redundancy is rather common within sophisticated EIP approaches and this makes these industrial systems extremely vulnerable to internal disruptions and external effects” (p. 951). Therefore, the encouragement of symbiotic redundancy, particularly on a regional as opposed to park-wide scale, is purported to be a means of reducing the risk of interdependence of participating firms. Sterr and Ott (2004) go on to explain that “the rise in the number of actors is accompanied by a rise in the redundancy of companies carrying out a specific roundput function, which can contribute considerably to system stabilization” (p. 955). In combination with other recommendations pertaining to the establishment of relational assets (see B9b), the municipal plan of action incorporates measures to develop a regional symbiotic network overtime. While initially it is expected that low risk relationships will be established, such as utility sharing and symbiotic exchanges requiring little initial investment in process or transportation infrastructure, the strategy is designed to identify symbiotic opportunities, first at a park level, then at a regional scale, and quantify the economic, environmental and social benefits the relationship would entail. As the network of information grows, redundancy should follow in two ways. Firstly, existing opportunities for symbiosis will be identified. Secondly, the City’s Economic Development Department will be endowed with an additional recruitment tool, which should serve to attract certain companies and industries that fit well within the existing resource mix of the region.

The next barrier, B11b is that companies may be reluctant to allow a central organization to collect quantified information about their inputs and byproducts with the aim of identifying potential symbiotic matches, due to concern about the confidentiality of trade secrets and process information.



This barrier was identified in the literature, as Fons and Young (2006) indicated that “some companies hesitate to participate in [symbiosis] projects due to confidentiality and trade secrecy concerns. Companies tend to be secretive about their waste streams because if competitors know about their byproducts, they may be able to deduce protected trade secrets” (p. 221). While this could be a hindrance to the establishment of a symbiotic network, it is considered a secondary barrier for two main reasons.

Firstly, the initial municipal initiative recommended in the municipal plan of action has been successfully implemented elsewhere in Canada, and only collects and disseminates high level information that would not constitute an exposure risk of trade secrets. Secondly, IA2 commented directly to this point, indicating that “there shouldn’t be objections on these grounds for the municipality to compile data, but there will be issues of who controls the data and who has access to it. There needs to be appropriate legal instruments in place to ensure confidentiality.” Indeed, tailored confidentiality agreements can and should be formed to protect the interests of both participant companies and the central organization gathering, quantifying and analyzing the information, and should serve to alleviate such concerns while enabling the more advanced symbiotic opportunities to be identified.

The final barrier B11c, was raised in the literature and verified by PC3, who indicated that it is almost impossible in Canada to quantify waste streams, as such information is not required by regulatory bodies, and thus is not tracked by individual companies. Fons and Young (2006) found that “information regarding costs [associated with byproduct and waste streams] is usually not readily available to individuals who may be able to utilize it for the good of the company” (p. 221). PC3 provided examples of this difficulty, indicating that “both the TRCA [the Toronto Regional Conservation

Authority] and the City of Sudbury have funded studies to identify potential synergies, [but in both cases] it was found almost impossible to identify actual type and amount of waste, including hazardous waste.” This is considered a fundamental barrier as such information is absolutely critical to the establishment of symbiotic relationships. However there are a few measures that can contribute to overcoming this challenge.

First of all, the adoption of environmental accounting methods that track the cost of handling, transporting and disposing of wastes may alleviate some of these problems. The municipal plan of action includes an educational program that could include the provision of information and assistance to companies wishing to incorporate environmental accounting into their management system. Secondly, the municipal plan of action recommends partnerships with local educational institutions and other relevant organizations to provide affordable services to companies wishing to participate in the symbiosis opportunities identification initiative. These partners could assist companies in tracking the quantity and monetary costs of their resource inputs, byproducts and waste streams, thereby providing sound information from which to establish viable symbiotic relationships.

#### *5.2.2.12 B12: Site Specific*

One site specific challenge, B12a, is that the City of Hamilton does not own the land within the Airport Employment Growth District, limiting scope of municipal influence over the shape of its future development. This barrier was directly raised by HS2, though CH2 added a similar concern, questioning how the City would stage and market the development in light of the fact that the land is owned by various private sector interests. This barrier is secondary to the implementation of the vision due to the myriad of resources and tools the municipality has at its disposal to influence the course of development. The municipal plan of action outlines many of these opportunities, demon-

strating how the City of Hamilton can shape the future development of the industrial park without owning the land.

The final barrier, B12b, was raised by HS3 who indicated that the site is an environmentally sensitive area, which in turn minimizes the threshold for risk associated with the utilization of unproven technologies and techniques. As such, some unconventional means of site servicing or building design, that are generally considered more sustainable, may not be suitable for the site, due to the uncertainty regarding the performance and reliability of the technology or technique. For example, local wastewater treatment has been suggested both in the literature and by stakeholders such as QG3 as a means of not only mitigating the environmental impact of the park but of providing a more cost effective treatment service. However, HS3 had a different perspective on the matter, questioning whether the City could account for the risk of a private wastewater treatment plant. “If it fails, what will happen? The responsibility will ultimately lie with the municipality. Furthermore, the environmental sensitivity of the area compounds that risk. There is knowledge about the impact of a system failure with the existing wastewater treatment facility by Lake Ontario, but not if there are problems at a local facility.” This barrier is considered to be secondary to the overall achievement of the vision as the underlying objective is to ensure environmental protection and enhancement.

As such, it is noted in the municipal plan of action that any capital projects, particularly those associated with infrastructure, should be carefully evaluated to assess the environmental benefit an unconventional approach might yield in comparison to relative risk. Should the benefits outweigh the likelihood and severity of the risks, the unconventional approach should be implemented. In absence of this balance, more traditional servicing techniques, where the risks and corresponding re-

sponses are well understood, should be implemented in the most environmentally conscious manner possible from a life-cycle perspective.

#### *5.2.2.13 Inapplicable Barriers*

There were several legal and regulatory barriers that were raised in the literature, but were either determined to be insignificant or otherwise not barriers to the underlying objectives of sustainable industrial park development. Both legal and regulatory issues were raised as barriers to the establishment of byproduct exchange networks. Andrews (2002) cautioned that the classification of secondary materials as hazardous wastes often results in the use and transport of those materials to be much more difficult and expensive. Furthermore legal concerns often arise pertaining to the liability associated with using secondary materials that have been classified as hazardous wastes, thereby reducing the willingness of companies to accept such materials for their manufacturing processes (p. 484). Fons and Young, (2006) added another legal obstacle to the use of byproducts, indicating that “under current legal practice, liability considerations for hazardous materials can favour disposal over selling and/or transferring the material for reuse” (p. 221).

However IA2 dispelled these barriers, first by indicating that the classification of hazardous wastes in Canada should not widely cause use or transport challenges over and above those associated with disposal. Correspondingly, AG2 indicated that existing environmental regulations pertaining to the transportation and processing of byproducts would not serve as barriers to the establishment of symbiotic exchanges. In fact, IA2 suggested that current regulations and the costs of hazardous waste disposal would actually encourage the reutilization of such byproducts in lieu of disposal.

Secondly, IA2 indicated that legal liability issues should not be identified as a barrier. Instead “legal issues are things you need to learn, know, and work within,” particularly as contracts can be written to protect the interests of all parties involved in the symbiotic exchange and ensure that the material is handled and used with appropriate environmental care. As the stakeholder interviews indicated the lack of significance of these legal and regulatory barriers raised in the literature, the municipal plan of action does not actively seek to address them. However, should a regulatory issue arise for symbiotic or other sustainability matters, the partners involved in Park Eco-Affairs Association are in a position to act as a liaison between regulatory bodies and business to aid in the resolution of the issue.

### 5.2.3 Resources

The resources identified through the literature review and interview process have been incorporated into the municipal plan of action and have been attributed and explained in the following chapter, which details the initiatives of each program of the municipal strategy.

### 5.2.4 Constraints

Once a few interviews had been conducted, it became clear that identifying constraints that fit within the definition of “a firm limitation or restriction for which attempts to overcome or overrule should not or cannot be made within the foreseeable future” would be difficult, if not impossible to accurately identify. This was due to several reasons, including the fact the most of the stakeholders did not have such detailed knowledge of the Airport Employment Growth District or the resources available for its development as to provide quantifiable constraints, or the very fact that the AEGD is currently in the early phases of a feasibility study, thus site specific constraints have yet to be identified. Moreover, few constraints were identified because most potential constraints were instead

identified as barriers. For example, the fact that limited municipal financial resources are available to promote the vision was widely considered a barrier to be overcome, as opposed to a constraint to work within. Furthermore, as the analysis progressed, it became clear that adherence to the objectives of the vision would entail that the implementation of the recommended municipal plan of action would inherently work within any constraints encountered throughout the course of development, including, but not limited to environmental and financial constraints. As such, no constraints were formally identified in the context mapping process, for the purposes of developing the municipal plan of action.

## 6 MUNICIPAL PLAN OF ACTION

This chapter details the complete recommended municipal plan of action for the development of a sustainable industrial park within the City of Hamilton as described in the vision. These recommendations have been formulated to work within the scope of municipal powers granted by the Province of Ontario legislature (see Duncan, 2007). Those powers include those conferred under the relevant sections of the Municipal Act, 2001 the Planning Act, and the Provincial Policy Statement, 2005.

Further information on the recommended strategies is available in Appendix Six, including a full explanation of the rationale behind each strategy, as well as a description of the actors roles and program performance monitoring.

### 6.1 SI: COMMUNITY IMPROVEMENT PLAN

#### Vision Elements and Barriers Addressed:

V2a	B6a	B8a
V3a	B6b	B8b
V3b	B6c	B8c
	B6d	B8d
	B7a	B8e
	B7b	B8f
	B7c	B12a

#### Lead Actors:

Planning Department  
Finance Department

#### Potential Partners:

None foreseen

## **Program Description:**

The explicit purpose of the Community Improvement Plan (CIP) would be to directly support the fulfillment of elements of the vision for the sustainable industrial park while also addressing some of the barriers to its realization.

This program would be designed, through financial mechanisms, to provide encouragement and support to the private and non-governmental sector for the construction of a more sustainable built environment than would otherwise be realized. This program should be administered in close conjunction with S5: Built Environment Education, Resources & Outreach and S6: Municipal Leadership. S3: Development Permit System should also factor into furthering the sustainability of the built environment constructed by the private and non-governmental sectors.

The legislative authority for a municipality to prepare and adopt a Community Improvement Plan is found in Section 28 of the Planning Act. Under Section 28 of the Planning Act municipalities with provisions in their official plans relating to community improvement are allowed to designate by bylaw a “community improvement project area” and prepare and adopt a community improvement plan for that area. According to Section 28(1) of the Planning Act, a community improvement project area may be defined within the municipality when the community improvement of that area is, in the opinion of the council, desirable because of “...any...environmental, social or community economic development reason.” As realization of the vision pertains to all three aforementioned pillars, the final boundaries of the Airport Employment Growth District could and should be defined as the eligible project area for this program.

Of relevance to the financial incentives element of the Community Improvement Program, once a CIP has come into effect, the municipality may make grants or loans, in conformity with the



community improvement plan, to registered owners, assessed owners and tenants of land and buildings within the community improvement project area, or to their designate 28(7).

Financial support programs should be designed to directly address the barriers to green building while promoting realization of the overall vision as defined in the Community Improvement Plan. Financial incentives should include a Tax Increment Based Grant (TIBG) to promote green building. The City of Hamilton has recently adopted a CIP entitled LEEDing the Way which provides a TIBG for LEED certified buildings within the City's Industrial Parks and the Bayfront and East Hamilton Industrial Areas which includes the small but existing Airport Industrial Park, which is located within the AEGD study area. Should the AEGD be approved for development, the existing LEEDing the Way CIP may be amended to include the area, however it may be advantageous to develop an independent CIP specific to the area as recommended above. This is due to additional CIP initiatives recommended for the development of a sustainable industrial park that would not necessarily be feasible to apply to other parks under the same program or before the municipality has garnered experience in promoting comprehensive sustainable industrial industrial park development.

In reviewing the LEEDing the Way CIP, the tying of the tax increment based grant or TIBG to the LEED certification process is positive, as certification provides a means of third party verification of the green features successfully achieved during the construction process and in the building itself. It is also positive that the grant is assignable by the grantee, potentially improving the marketability of the grant. Currently the grant, available for up to 5 years and up to 75% of the tax increment realized following development, is intended to split the incremental cost of LEED certification between the developer/builder and the City. The maximum grant is calculated based upon the level of certification achieved and the total capital cost of the building. Thus 1% of the capital cost of a certi-

fied building is considered to be attributable to LEED certification and the City will therefore award a tax increment grant of up to 0.5%. Silver = 3%, municipal portion 1.5%, Gold = 5%, municipal portion 2.5% and Platinum = 8%, municipal portion 4%. However, there is a significant change that could be adopted to encourage builders to strive for higher levels of certification; namely, a greater percentage of the increased cost associated with LEED certification could be provided through the TIBG, the higher the level of certification achieved. Thus the grant structure could instead be calculated as such: Certified = 1%, municipal portion of 0.4% (40%), Silver = 3%, municipal portion 1.5% (50%), Gold = 5%, municipal portion 3.25% (65%), Platinum = 8%, municipal portion 6% (75%). It would also be wise to include an additional incentive to promote the development of multi-story commercial and especially industrial buildings, as current market conditions do not support the construction of such buildings from an economic perspective. To incorporate this incentive into the program, the costs associated with building additional storeys on a LEED certified warehousing or industrial building could be included in the eligible costs for the TIBG, with the municipality sharing up to 50% of the capital cost increase attributable to the additional floors. To ensure this incentive is viable, multi-storey buildings should qualify for an extended TIBG period, from 5 years to 10 years. The crux of the matter is that the sustainable industrial park will become more truly reflective of the vision the more pervasive green building principles are throughout the built environment of park.

Another financial incentive that could be included in the Community Improvement Plan for the AEGD would be a low interest loan program to bridge the potential gap between sustainable construction costs, and the amount that may otherwise be approved for financing by risk-adverse financial institutions. Financial institutions may perceive buildings incorporating unconventional technology, techniques or architecture as posing increased risk due to uncertainty. The low interest loan program would be designed to address the potential financing issues a project incorporating extraor-

dinary green features may encounter. This element of the CIP would essentially provide a percentage of the total development cost, namely that which is directly attributable to green features, thereby removing a financial barrier to more sustainable buildings. An added advantage would be the built-in incentive to developers provided by the below market rate interest rate. It is unlikely that a project pursuing LEED Gold or a lower level of certification would encounter any exceptional financing barriers, as such forms of development are already becoming more commonplace and therefore less risky. However, projects pursuing LEED Platinum, or those going beyond the requirements of the LEED certification process may very well encounter such financing barriers, at which point the low interest loan program would be of significant value. Of note, repayment of the loan could be tied to the tax increment based grant program, in that qualifying projects could make principle payments utilizing the tax increment grant based upon LEED certification level achieved. This arrangement is commonly known as Tax Increment Based Financing.

In administering the program, close attention should be paid to the program eligibility criteria to ensure the types of projects supported conform to the vision. A means of further promoting the realization of elements of the vision would be to tailor the disbursement criteria to provide additional opportunities for performance-based financial incentives. For example, the achievement of a certain level of employment density, or a certain number of jobs meeting a certain wage criteria may be eligible for a percentage of the municipally granted loan to be forgiven, or for the percentage of the tax increment to be returned as a grant to be increased.

## **6.2 S2: STREAMLINED MUNICIPAL APPROVAL PROCESS**

### **Vision Elements and Barriers Addressed:**

Vx: N/A                      B2b

### **Lead Actors:**

Economic Development Department  
Planning Department

### **Potential Partners:**

Not Applicable

### **Program Description:**

This program would ensure that the process to receive approval for new employment lands development is efficient and predictable. While the applicant certainly has a significant responsibility to provide complete, timely information, the municipality should also adopt a strategy to promote the effectiveness of the approval process.

Efficiency could be incorporated directly into the approval process itself. The streamlined process should be triggered at the first bona fide inquiry to the municipality from a proponent. A commonly employed municipal strategy is to implement a one window approach, thereby assigning the proponent to one point of contact within the municipality for all matters pertaining to the application, review and approval process. That contact would then be responsible for broadly discussing the viability of the application with the proponent, assembling representatives from all relevant departments for a meeting with the proponent to determine the information and studies required for application review, and for identifying any municipal resources or incentives that would be pertinent

to the project.<sup>12</sup> Finally, proposed projects that meet certain eco-development criteria could be reviewed on a priority basis, reducing the time taken by staff to issue a recommendation to council, thereby providing a subtle, yet valuable incentive for the development community to incorporate sustainability features into its projects.

Predictability is perhaps a more difficult factor to entrench into the approvals process, as such decisions are often based upon political considerations. However planning tools such as the official plan, zoning bylaw and area or neighbourhood plans should serve to reduce uncertainty. S3: Development Permit System of this strategy, should serve to provide the necessary framework for consistent decision making. To further promote predictability, the overall vision for a given employment area should be clearly communicated to all stakeholders, thus development proponents should have a basis for evaluating the desirability of their proposal, based upon the expectations of the municipality. A clear understanding of the vision is also required by municipal staff and city councilors, to help ensure recommendations and decisions remain in conformity. Of note, the vision is not intended to preclude certain industries considered less green from locating within the park. Instead, it is in the spirit of the vision that all companies, whether specifically green or not, may locate within the park with the expectation that they will seek to consistently improve their operations towards sustainability, within the supportive and enabling environment provided by the municipality and the amenities and culture of the park itself. Ultimately the establishment of predictability will rest upon the elected officials, who must vote in accordance with the *intent* of the approved official plan, zoning bylaw and area plans and that of the overall vision for the employment area in general.

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<sup>12</sup> The City of Hamilton implemented a similar initiative in January 2009, that requires applicants to consult with municipal staff prior to making an application for an official plan amendment, rezoning, draft plan of subdivision or site plan. A Formal Consultation Process has been established, designed to identify the studies, plans and/or reports that must be submitted with the application. Applicants must submit a Formal Consultation Request Form, at which point it is circulated to all relevant departments and agencies and a formal consultation meeting is scheduled.  
See: <http://www.myhamilton.ca/myhamilton/cityandgovernment/citydepartments/planningecdev/development/feesapplications>

### **6.3 S3: DEVELOPMENT PERMIT SYSTEM**

#### **Vision Elements and Barriers Addressed:**

V1a	B2c	B9a
V2a	B2d	B9b
V3a	B4a	B11a
V4b	B4d	B12a
V4c	B6c	
V5a	B7a	

#### **Lead Actors:**

Planning Department  
City Council

#### **Potential Partners:**

Economic Development Department

#### **Program Description:**

The object of this program is to utilize the development permit system to further streamline the development approvals process while concurrently promoting the incorporation of sustainable industrial park principles into all new development projects within the Airport Employment Growth District.

Having come into effect on January, 1 2007, Ontario Regulation 608/06 enables local government to establish a Development Permit System (DPS) for all or part of their municipality. A DPS is a land use approval framework that better enables municipalities to address local planning issues, by incorporating land use and development objectives into the approval process. As such, the DPS can be utilized to help achieve a development vision that might include urban design standards, energy conservation, green building, efficient use of land, environmental protection or enhancement, streetscape amenities and alternative transportation and pedestrian-oriented development as well as other variables. The DPS also serves to streamline the approval process, by delineating the require-

ments for application and approval, by integrating zoning, site plan control and minor variance processes into one application and approval, and finally by establishing a shorter timeline for decisions (MMAH, 2008). To institute a DPS, the municipality must amend its official plan to define the area to which the DPS applies, outline the vision and goals for the area, and provide the policy requirements enabling the DPS to function. Secondly, a development permit bylaw must be passed for the DPS area, which is similar to a zoning bylaw, to dictate the land use and urban form of future development in the area.

As noted above, an official plan amendment is required to establish the policies necessary to enable and govern the implementation of the DPS. The official plan must be amended to include the goals, objectives and policies that will govern how the DPS is to be used to achieve the vision for the area. This is a collaborative process, during which stakeholders will be consulted in order to refine the land use vision for the area. Utilizing the vision established for the AEGD in this thesis, numerous goals, objectives and policies pertaining to the development approval process may be deduced. These policy objectives might include among others:

- that the use of resources such as energy, heat, cooling, water and materials are conserved (V1a);
- that green building measures are widely incorporated into the built environment of the park (V2a);
- that opportunities for employee and public enjoyment of natural and recreational amenities are available onsite (V2a);
- that natural heritage features be conserved or enhanced (V3a);
- that land is used efficiently through compact urban design (V3a)
- that ecologically sound landscaping practices be implemented (V3a);
- that building architecture and materials are consistent with design standards (V3a);
- that various industry clusters are permitted to collocate within the industrial park to offer a range of quality employment opportunities (V4b); and,

- that infrastructure and site design enables alternative transportation and inter-modal goods movement (V<sub>4c</sub>).

Objectives can be incorporated into the DPS process in several ways, including the criteria by which applications are evaluated, the studies or information required for application submission, the permitted uses and minimum and maximum standards for development included in the development permit bylaw, and the conditions of development permit or those attached to the issuance of the permit. Another tool that could be incorporated into the development approval process, would be that of the development hold-back, to ensure certain required sustainable building or site design measures are implemented (PC<sub>1</sub>). The following diagrams provide just two of the many tangible examples of how the aforementioned measures might be employed to further the development objectives.

Diagram A: Evaluation Criteria, Required Studies, Conditions of Permit Issuance

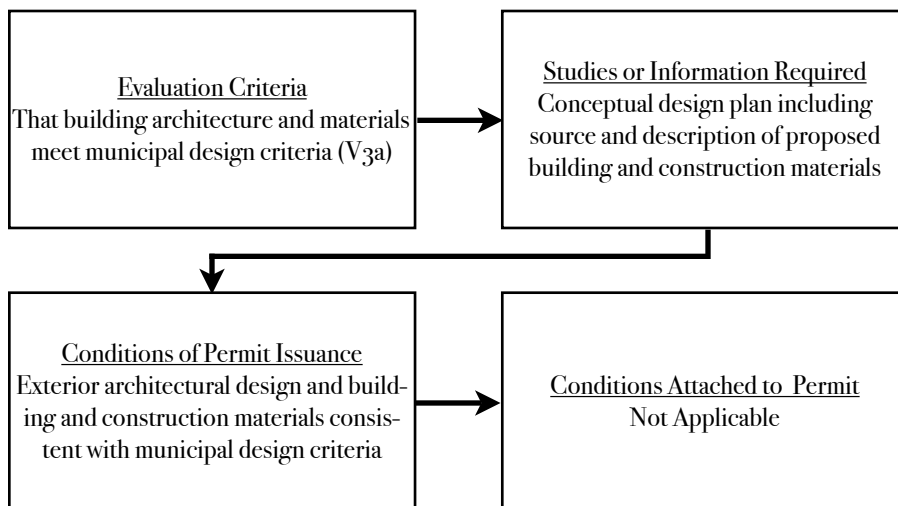
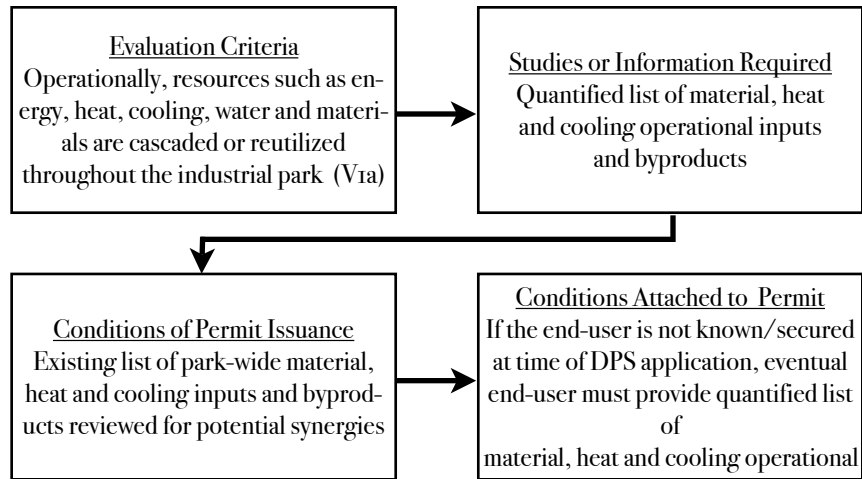




Diagram B: Evaluation Criteria, Required Information, Conditions of Permit Issuance, Conditions Attached to Permit

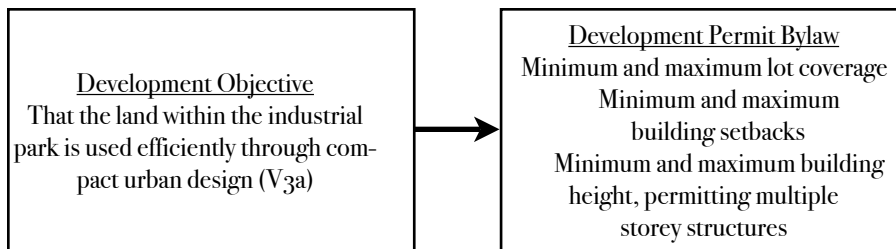


While most of the evaluation criteria that could be deduced from the bulleted development objectives could be clearly addressed through the DPS, the example in Diagram B warrants more in-depth discussion due to its unconventionality. It is recommended that a condition of permit issuance, or a condition attached to permit issuance require all companies seeking to locate within the sustainable industrial park to submit a list, in confidentiality, of all inputs and byproducts of their operations to the municipality. The company would also be required to review the existing list, to determine if any opportunities for local symbiosis might exist. Such a requirement has already been implemented in other Canadian municipalities seeking to promote sustainable industrial park development. As noted by PC3, “both Taiga Nova [Eco-industrial Park in Fort McMurray] and Innovista [Eco-industrial Park in Hinton] have adjusted their development permit application process so that businesses applying for a development permit within the industrial parks have to provide a list of materials that they are using and must have to at least review a list of existing materials” utilized within the park to see if there are any opportunities for symbiosis. Should a potential opportunity be identified, the municipality would then contact the business which would form the other half of the symbiotic partnership, to arrange a meeting between the two companies. At that point, the local govern-

ment would cease to be involved in establishing the exchange, leaving the private sector parties to determine the viability of the partnership.

The second step of establishing a DPS requires the municipality to pass a development permit bylaw, which puts the DPS official plan policies into effect, clearly informs the administration of the system and provides specificity and certainty regarding the requirements for development within the designated area. The bylaw must provide a range of specific information including the area to which the bylaw applies. In this case, in order to promote the sustainable development of the industrial park, the final boundaries of the AEGD should be defined as the DPS area. The bylaw would also include the permitted and perhaps the conditionally permitted uses, set minimum and maximum standards and perhaps conditionally permitted variances, outline any conditions of approval that may be imposed and set out the procedure for decisions on development permit applications and may set out the criteria that will be used to evaluate applications (MMAH, 2008). Like the official plan amendment process, the development permit bylaw may also be employed to promote the fulfillment of the vision. Diagram C, below, provides an example of how elements of the development permit bylaw could be employed to achieve a development objective, as outlined in the bulleted list above.

Diagram C: Development Objective, Development Permit Bylaw



## 6.4 S4: MUNICIPAL ENGINEERING STANDARDS REVIEW

### Vision Elements and Barriers Addressed:

V1a            B2d  
V3a            B9e  
V3b

### Lead Actors:

Public Works Department  
Planning Department

### Potential Partners:

Professional consultants  
Private sector industry representatives

### Program Description:

This is a straightforward program, intended to ensure that municipal engineering standards permit the industrial park to be serviced utilizing the most environmentally sound technologies and techniques. These standards would pertain to the design of watermains, sanitary sewers, stormwater management systems, and roadworks.

A wide range of issues should be considered in the standard specifications study. The following provides a few of the many specific issues that may be incorporated into the study to facilitate more sustainable forms of site servicing. The first example would be to modify the specifications pertaining to utility location criteria, in order to permit or require the creation of utilidors, which are described in S6: Municipal Leadership. Watermain and sanitary sewer capacity guidelines should be adjusted, due to development requirements to reclaim greywater and reduce water use. If a localized onsite wastewater treatment is installed, sanitary sewer specifications may be further altered. Stormwater management is another clear area in which significant environmental gains could be achieved. Infiltration basins and trenches for example, encourage the infiltration of stormwater runoff from

impervious surfaces, and wetlands and constructed wetlands reduce and treat urban stormwater runoff while providing environmental benefits such as habitat for flora and fauna and increased aesthetic appeal. Curb and gutter specifications should also enable the design to correspond to the onsite stormwater management techniques selected. Finally, roadway and parking standards should be altered to enable pervious paving techniques to be implemented along with the use of alternative, more sustainable materials, whenever feasible in accordance with the expected use of the surface.

## **6.5 S5: BUILT ENVIRONMENT EDUCATION, RESOURCES & OUTREACH**

### **Vision Elements and Barriers Addressed:**

V2a	B2a	B5b
V3a	B2b	B6a
V4a	B2c	B6b
V4d	B2d	B6c
V5a	B3a	B6d
	B4b	B8b
	B4c	B8c
	B4d	B12a

### **Lead Actors:**

Planning Department  
Sustainability Department  
Economic Development Department

### **Potential Partners:**

Canada Green Building Council (CaGBC)  
Toronto Regional Conservation Authority (TRCA)  
Experienced Private Sector Actors  
Professional Associations such as the Real Estate Association of Hamilton-Burlington (RABH)

### **Program Description:**

A comprehensive program spearheaded by the municipality, designed to provide key stakeholders with the resources and knowledge they require to build and maintain the industrial park as envisioned. Key stakeholders should include municipal staff, potential park occupants, developers,

builders, real estate professionals, planning, architecture and engineering firms and property management companies.

As this program will be implemented during the early stages of the development, the municipality should develop and maintain a website for the sustainable industrial park, that includes explanation of the overall vision, its benefits, and the municipal programs and measures, along with other incentives, in place to support its attainment. Over time, the website will serve to communicate information pertaining to other elements of the park's development and operations, and responsibility for the site's content and maintenance may be shared with other stakeholders such as SIO: Park Eco-Affairs Association.

Resources pertaining to the built environment should be available in print and online. Information should explain the quantitative and qualitative benefits of each new building technology or technique, pertain directly to the park, and should be pertinent to the development approval process. For example, xeriscape landscaping using indigenous flora or noninvasive plants should be required throughout the development. Therefore a guidebook about xeriscape landscaping tailored to the site would be a valuable resource, particularly if a list of municipally approved species of plants was provided, thereby avoiding ambiguity, reducing individual landscape design costs and streamlining the development approval process. Similar guidebooks, again tailored to the site, should be provided on a range of other topics pertaining to the built environment, including but not limited to: green building materials, energy efficient buildings, local solar and wind power generation, stormwater management, and building maintenance. A further resource would be a directory of businesses that provide products and services consistent with sustainable industrial park principles.

Topics for educational and informational workshops should be developed as need and demand are determined. Very early in the development process the following topics would likely be of value to stakeholders:

- Leadership in Energy and Environmental Design (LEED) for New Construction (NC) Technical Review Workshop; for support professionals, developers, builders and municipal staff.
- LEED NC for Construction; for support professionals, developers and builders.
- LEED in practice (roundtable of experienced developers/builders/consultants); for support professionals, developers, builders and municipal staff.
- Understanding the AEGD Vision; for real estate professionals, support professionals, developers and builders (potential webinar or online course).

Municipal outreach to stakeholders and the public should be considered a part of this program. Information made available and distributed should include marketing material to present the vision, development milestones, municipal plan of action implementation updates and success stories. The most critical element of the outreach component however, is the promotion of municipal programs in place to support implementation of the vision, especially those that are designed to support the private sector. Indeed one of the main objectives of this program should be to lay the foundation for the implementation of the vision through the cultivation of demand amongst potential park occupants to locate in an industrial park characterized by the pursuit of sustainability (DBt). Widespread private sector awareness of municipal initiatives and available support will be of central importance to stimulating development to occur as envisioned.

## **6.6 S6: MUNICIPAL LEADERSHIP PROGRAM**

### **Vision Elements and Barriers Addressed:**

V1a	B1a
V2a	B3b
V3a	B4a
V3b	B4b
V3c	B7b
V4c	B12a
V4d	B12b

### **Lead Actors:**

City Council  
Planning Department  
Public Works

### **Potential Partners:**

Hamilton Regional Conservation Authority  
Development and Construction Industry  
Property Management Companies  
Private Companies

### **Program Description:**

The Municipal Leadership Program should be designed and carried out in a manner which clearly advances the course of the industrial park development towards the vision.

Through municipal leadership, the initiatives of this program should continuously contribute to the ongoing development of a sustainable industrial park while tangibly demonstrating the municipality's commitment to the vision. The municipal initiatives carried out under this program would be primarily capital project based, and would pertain to the built environment and physical operations of the sustainable industrial park. Falling under the parameters of this program would also be lower profile measures to reinforce the municipality's commitment to the vision, such as dedicating sufficient municipal staff to effectively and efficiently fulfill the municipality's role in im-

plementing the vision. It should be noted that the municipality's collaborative leadership and commitment to the vision would also be demonstrated in other municipal plan of action programs, however these will be more initiative based as opposed to capital project based.

It is of central importance that the municipality lay the foundations for a sustainable industrial park, if the vision is to be realized. As such, servicing of the site, whether undertaken entirely by the municipality, or via a public private partnership (P3), must be designed in such a way as to promote eco-principles once further development occurs. There are numerous means of achieving this, and much rests upon the unique characteristics of the site. More eco-friendly, though somewhat unconventional technologies should be evaluated, such as localized wastewater treatment, alternative paving techniques and materials, onsite stormwater management and a district energy, heating and cooling system. In fact, it was noted by PC3, that "one of the biggest potential delivery agents on the operations side is utility companies because they generate heat, and energy and could also generate and sell compressed air. Municipalities could help broker the partnership between utility companies and developers" to secure one of the operational aspects of a sustainable industrial park. Needless to say, each individual technology must be assessed according to the risks and benefits, both general and site specific, its implementation would entail. Another appropriate servicing technique is the multi-purpose utility corridor or the utilidor with standardized connections, enabling all flows, including people and goods, information and resources, to be accounted for in one corridor and creating loops for the sharing, reclaiming and recycling of resources. Thus infrastructure for potable water, hot/cool water, reclaimed water, black water, electricity, fiber optics voice and internet cable would all be laid together, in an easily accessible location beside sidewalks and roadways.<sup>13</sup>

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<sup>13</sup> For a basic overview of green infrastructure see: Sheltair Group, The. (2001). *A Guide to Green Infrastructure for Canadian Municipalities*. Federation of Canadian Municipalities (FCM), Centre for Sustainable Community Development, Ottawa, ON.



Viable public transportation options are a key component of a successful sustainable industrial park. The early establishment of such services is important to provide employees with the option as they are beginning to work onsite, so transportation decisions can be made with public transit in mind. Once habits and investments have been made in individual vehicle travel, they will be difficult to change, particularly in the short-term.

Part of this program should also include public realm improvements that will directly fulfill a portion of the vision. These should include the development of natural paths and parks throughout the park, connecting to natural areas where non-invasive or non-detrimental human interaction is possible. Areas of natural significance or sensitivity should be protected or enhanced by the development. Recreational facilities might also be appropriate, particularly in transitional areas of the park. The municipality should ensure that, in addition to the above, streetscaping, municipal signage and public gardens are designed, constructed and maintained in an environmentally sound manner.

Finally, the municipality should consider the site for its own operations and as an opportunity to partner with private sector developers to provide a unique feature of the park. Essentially there are numerous opportunities in centralized park services, that will provide for efficiencies, cost savings and increased employee services. A centralized building, the cost of which could be partially offset if the municipality was to become an anchor tenant, could also provide office space for the Park Eco-Affairs Association, make available boardroom space for all park tenants, serve as a centralized shipping centre, provide onsite services to employees such as restaurants, daycare, fitness facilities, showers for bike commuters, and even a site for a local farmers market as suggested by HIR. Of course, the facility should be a leading example of green building.

There is significant opportunity in this program for innovative capital projects and collaborative initiatives with other stakeholders. Numerous opportunities for municipal leadership will undoubtedly arise, and should be pursued to the extent deemed feasible and worthwhile by council.

## **6.7 S7: FUNDING SEARCH & SOLICITATION**

### **Vision Elements and Barriers Addressed:**

Vx: Indeterminable      B8b  
   B8c  
   B8d  
   B8e

### **Lead Actors:**

Economic Development Department  
Park Eco-Affairs Association

### **Potential Partners:**

Indirect:            Funding agencies  
                                 Private sector companies

### **Program Description:**

This program would be specifically focused upon identifying sources of financial support that could be used to stimulate the adoption and implementation of eco-development measures and green business practices. For certain initiatives the program coordinators could also assist in the process of securing financial support by finding and/or providing basic information to private sector companies about their eligibility and applications to a program, or by developing proposals or applications for municipal initiatives seeking funding from outside sources.

The primary deliverable of this program would be a publicly accessible, online database of all sources of funding that are available to support initiatives that would further the realization of the vision. Thus funding pertaining to green economic development, practices and innovation, jobs

creation and retention and ecological restoration and enhancement among other targets, would be relevant. There are numerous Canadian organizations currently providing such funding including, but not limited to: the Ontario Power Authority, Industry Canada, Canadian Manufacturers and Exporters, the Ontario Ministry of Economic Development and Trade, the Ontario Centre for Environmental Technology Advancement, Natural Resources Canada, the National Research Council, Sustainable Development Technology Canada, the Ontario Ministry of Energy, Conservation and Strategic Policy, the Ontario Ministry of Agriculture, Food and Rural Affairs, Hydro One, and Transport Canada. The Canada Revenue Agency also has tax incentives that would apply to some private sector investments in eco-efficiency. All of the financial incentive programs from each of the supporting organizations, that are determined to be available to support the vision of a sustainable industrial park in the City of Hamilton should be included in the database. Of key importance, the database must be maintained and updated regularly, to ensure the accuracy and exhaustiveness of information presented. Outdated or incomplete information would compromise the value of the database and potentially undermine the progress of initiatives for which funding is required. The database should be one feature of the sustainable industrial park's website, as described in S5: Built Environment Education, Resources & Outreach and S10: Park Eco-Affairs Association, and may also be available on the Municipality's Economic Development site.

Part of this program should also be focused on the development of creative financing arrangements. For example, public private partnerships may be an ideal way to implement some initiatives such as green site servicing, as noted in S6: Municipal Leadership. Such an arrangement could prove financially advantageous to both the municipality and the private sector partner, while also providing other social, economic or environmental benefits. For example, it was suggested by QG2 that a private sector company may be interested in championing the development of such a leading

sustainable industrial park, not only based upon company ethics and principles, but for the opportunity to be associated with a prestigious, innovative development. Along similar lines of reasoning, some companies may wish to support the development and maintenance of public elements of the park. Thus, for example, costs associated with the establishment and upkeep of trails or ecological restoration and protection may in part be raised through private sector sponsorship in exchange for public acknowledgment of the donation.

## **6.8 S8: TAX-INCREMENT & PERMIT FEE EARMARKING**

### **Vision Elements and Barriers Addressed:**

V2a            B8b  
V3c  
V3b  
V4c

### **Lead Actors:**

City Council  
Planning Department  
Sustainability Department  
Finance Department

### **Potential Partners:**

Parks and Recreation Department  
Hamilton Conservation Authority  
Agricultural and Rural Affairs Advisory Committee

### **Program Description:**

A program that is designed to populate a fund for specific, pre-determined ecological or agricultural projects, using municipal income generated through the development of the AEGD.

The fund could be dedicated to feedback into other programs associated with the AEGD, such as the Municipal Leadership Program, or for outside initiatives indirectly related to the devel-

opment. An oft-raised issue was the loss of agricultural land, thus the funds could be dedicated to initiatives that would improve the economic viability of the remaining farm businesses within the municipality or securing additional local farmland in perpetuity. It is essential that prior to the fund's establishment, recipient projects are designated to ensure the funds are employed as intended.

Should the fund be created using incremental property tax revenue, the community improvement plan would be the ideal mechanism to earmark revenues for a designated period of time. For example, 20% of the incremental tax revenue, resulting from the new development, could be directed to the fund for a period of 5-10 years. On an ongoing basis, a portion of revenue generated through the issuance of permits, such as tree removal or building permits, could also be directed to the fund.

## **6.9 S9: OPERATIONAL EDUCATION, RESOURCES & OUTREACH**

### **Vision Elements and Barriers Addressed:**

V1a	B3a
V2a	B4b
V3a	B4c
V3b	B4d
V4a	B5b
V4d	B8b
V5a	B12a

### **Lead Actors:**

Economic Development Department  
Sustainability Department  
Park Eco-Affairs Association

### **Potential Partners:**

Toronto Regional Conservation Authority (TRCA)  
Private Sector Consultants i.e.: Eco-Industrial Solutions  
Industrial Representatives

**Program Description:**

A program administered by municipal staff and the Park Eco-Affairs Association designed to promote the adoption of operational eco-business principles and to provide assistance to companies undertaking such initiatives.

Resources should be readily available to companies through the website or in print if requested. Guideline documents tailored to the local context would be of value to provide basic and intermediate level information about the tenets of the topic, its adoption benefits, implementation strategies, and a directory of companies providing products or professional services related to the subject. For example, green procurement is an important element of the operations of a sustainable industrial park. Thus, a guideline about green procurement would be of value, that could use the City of Hamilton's existing green procurement program as a case study and explain the Park Management Group's green purchasing bloc to encourage companies to join. Other topics might include: alternative energy production, life cycle management, total cost accounting, environmental management systems, resource recovery, cleaner production, cradle to cradle production, and symbiosis or byproduct exchange networks. A newsletter, such as that contributed to by the Eco-Efficiency Centre of Burnside Industrial Park, addressing practical sustainable business matters would also be a valuable tool to reach industrial stakeholders.

Educational support should be available to companies early in the development process, so that businesses seeking to locate within the park have resources readily available to them to incorporate sustainability principles into their site selection, industrial process design and management systems. Support should continue at a minimum for the first 5 years of full scale park operation, with the aim of laying the foundations for a park-wide commitment to ongoing economic and environmental operational improvement. Furthermore, while educational initiatives should indeed be de-

signed to support companies aiming to take the first steps towards sustainable operations, support should also be available for more advanced undertakings to help companies seeking to implement more difficult, time consuming and perhaps more innovative sustainability measures (QGI). Event formats might include workshops, specialized seminars for individual companies upon request, and informal networking events. Examples of topics well suited to be offered as workshops or individualized presentations would include:

- Developing and Implementing an Environmental Management System
- Making Sense of Industrial Sustainability: A Review of Key Concepts and Their Application
- Cradle to Cradle Production: Product Evaluation, Process Design and Implementation Strategies

Informal networking events should also be organized on a fairly regular basis for park occupants and area companies, to provide an environment where personal business relationships can develop, knowledge and experiences can be transferred, and opportunities for symbiosis and waste recovery can be identified.

The outreach component of this program should primarily focus upon ensuring companies located within the industrial park are aware of upcoming educational events, existing and new resources, and new or ongoing initiatives. Secondly, it should be geared towards recognizing the successes and achievements of the companies located within the park, as well as those of the municipality, thereby promoting support for existing Hamilton businesses and enhancing economic development opportunities throughout remaining phases of the AEGD's development and elsewhere in the City. Media for outreach could include a website dedicated to the sustainable industrial park, annual economic development reports, annual achievement awards for eco-industrial performance, and perhaps newspaper coverage of such achievements.

## **6.10 S10: PARK ECO-AFFAIRS ASSOCIATION**

### **Vision Elements and Barriers Addressed:**

V1a	B3a	B11a
V2a	B3b	B11b
V3a	B4b	B11c
V3b	B4c	B11e
V4a	B5b	B12a
V4c	B8b	
V5a	B10a	

### **Lead Actors:**

Park Companies  
Public Sector Champion  
Economic Development Department

### **Potential Partners:**

Municipal Departments  
Hamilton Conservation Authority  
Hamilton Labour Council  
Jobs Prosperity Collaborative  
Economic Development Advisory Committee  
Toronto Regional Conservation Authority  
Local Universities and Colleges

### **Program Description:**

This association would play an absolutely pivotal role in the ultimate outcome of the industrial park, as it would be central to the realization of many operational goals. It would serve to create momentum and provide support for a wide range of eco-initiatives that would serve to increase the sustainability of the park, and its constituent businesses, environmentally, socially and economically.

Once established, the association should assume joint responsibility in managing the park's website, originally established by the municipality as described in S5: Built Environment Education, Resources & Outreach. This website would include information about the association and its programs, provide resources for eco-development and green business initiatives, publish progress re-



ports on the park's development and operations and announce the attainment of significant park-wide milestones and individual company achievements.

The initiatives of the association would support realization of the vision, while being reflective of the needs of park tenants and stakeholders. One basic, yet effective program would be the formation of a green procurement bloc, functioning to first source, then negotiate volume discounts for commonly purchased supplies and services. The key would be to ensure each product or service is more environmentally sustainable and where applicable healthier in its use or application, than its conventional counterpart. The products could range from 100% post-consumer recycled paper to green electricity to bridge any gaps between onsite power generation and demand. It could also negotiate a special rate for green landscaping and cleaning services for park occupants. Finally, of further benefit, the procurement bloc could make arrangements with professional consultants to provide their services to tenant companies at a discounted rate. A primary example would be a management systems consultant who would be available to assist businesses to develop and establish an environmental management system. Another grassroots program that would be well suited for the association, would be one centred around employee transportation issues. Options might include promoting commuting by transit or other alternative modes of travel. The association could also work to establish a carpooling or ride-share network that would help to pair commuters traveling from the same area, or along the same route. The success of this program could be furthered by supplying onsite shared vehicles for those needing to make special trips during the day.

The association would be well suited to become an ambassador to the community through various initiatives. The exact form of this outreach would be determined by the member companies, however it is important from a sustainable business practices perspective, that the wider community

receive consideration and a venue for input. As there will be numerous businesses located within the park, a one window forum for community involvement would be a practical way to enable area residents and the wider community to submit their ideas or concerns. Outreach to the community should also remain true to the principles of the vision, perhaps through the organizing of tree planting or ecological restoration events, the enhancement of public natural areas or schoolyards in the area, the opportunities for such ambassadorship are endless.

Similarly, the association should also work to foster a collaborative atmosphere between businesses within the park and those located throughout the surrounding area. This could be furthered simply through the activities of the association that would, in and of themselves, serve to develop relationships between the representatives of each member company. However, more opportunities could be created through the organization of themed networking and roundtable events that would enable ideas to be shared and collaborative innovations to flourish over time.

Furthermore, this association could serve as a liaison to regulatory and governmental bodies regarding matters pertaining to the realization of the vision. Thus, if a regulatory barrier arises as a challenge to a business' initiative to improve the sustainability of its operations, the association would serve to communicate with the various levels or departments of government about the issue of aligning regulation with the practical implementation of green business practices.

A crucial element of measuring the environmental sustainability of an industrial park and its operations is to establish a baseline state of affairs for benchmarking purposes, then to continuously monitor the performance of the park, both on an individual company basis, and for the park as a whole. The association should play a lead role in monitoring the overall performance of the park, and in publishing or otherwise communicating the results to both companies within the park, and to the

wider community of stakeholders. As QG<sub>2</sub> noted, "...because there is no profit to be made from performance monitoring...it makes sense that a body that has a mandate of promoting the greater good be responsible for that. This is a role that the TRCA will be assuming [for the Pearson Eco-Business Zone]." Individual companies would be responsible for providing their own environmental impact statistics, the details of which could be standardized to enable the development of accurate results for the park-wide report. IA<sub>2</sub> explained that performance monitoring is "absolutely already a common industrial practice." IA<sub>2</sub> went on to indicate that an environmental impact baseline must be established then performance must be continually monitored and reported, "for example, HIEA produces an annual environmental performance report card, complete with explicatory comments that is available to the public." Indicators that should be monitored on both a company and park-wide basis include, but may not be limited to: renewable and nonrenewable resource use, air, water and soil quality, air emissions, water and soil discharges, type and volume of waste generation and waste diversion/reclamation, and energy consumption.

Lastly, though perhaps most central to realizing the social, economic and environmental gains propounded by industrial ecology literature, the association should work towards the establishment of a synergistic byproduct exchange network throughout the park and surrounding area. While it was forwarded in the literature that the municipality could assume the role of assembling and analyzing park-wide and regional material and energy flows information (Burström & Korhonen, 2001), HS<sub>2</sub> indicated that the local government did not have the capacity or the expertise to effectively manage and utilize such a database. Therefore, the association may seek to partner with a local university and/or college such as McMaster University or Mohawk College. The partnership would likely involve a collaboration of a few supervisory faculty members and a team of upper-year students. It could take the form of a research partnership, or an elective course. The students would be tasked

with identifying and quantifying the input and waste streams of participating companies, within the park. This information, in turn, could be analyzed, perhaps by graduate research assistants, to identify and quantify symbiotic opportunities. Finally, the findings would be provided directly to the participating companies and could also remain in a confidential database maintained for future reference by the association. By partnering with educational institutions, the costs of such an endeavor would be lessened, potentially provide greater access to research funding, and would create a valuable and practical educational opportunity for students, helping to prepare them to advance sustainable business practices upon their graduation. A similar collaboration has been in place since 1997 in the State of Nebraska. The University of Nebraska-Lincoln (UNL) has offered P<sub>2</sub> technical assistance to small-to-medium sized businesses (SMB) throughout the State through the Partners in Pollution Prevention (P<sub>3</sub>) program. The P<sub>3</sub> program has student interns to assist businesses by conducting assessments of waste streams and then developing suggestions to minimize waste generation (Youngblood, Dvorak, Woldt, Hawkey, & Hygnstrom, 2008, p. 761). Direct savings realized by the beneficiary companies, has been estimated to be an average of 7.8% greater than the total cost of funding the program. Secondly, indirect savings have also realized, such as savings associated with research assistance performed by interns, operational costs reduced, regulatory burdens reduced and future liabilities reduced. Indirect savings were approximately 20% higher than direct savings, leading to an average indirect savings of 9.4% greater than total program funding. In total, each dollar spent to fund the program leveraged \$17.20 in direct and indirect savings (see Youngblood et al., 2008; Youngblood, Dvorak, & Hawkey, 2008). The Nebraska experience demonstrates the significant

benefits that can be realized through collaborations between private sector actors and educational institutions.<sup>14</sup>

## **6.II MUNICIPAL PLAN OF ACTION IMPLEMENTATION NEXT STEPS**

### **6.II.I Chronology of Program Implementation**

Implementation of the municipal action plan strategies can be broadly categorized into three stages; preparation, development, and operation. The preparation stage encompasses all of the recommended actions the municipality should implement before the land is made available for development to commence. First and foremost, though not explicitly addressed by a specific strategy, the City Council must make a long-term commitment to stimulate and support the pursuit of the vision. This will require leadership and resolve on the part of the local government, as well as the provision or allocation of municipal resources. Once that commitment has been established, several strategies within the municipal plan of action should be undertaken. S<sub>2</sub>: Streamlined Municipal Approval Process should be implemented early-on, to ensure that the development review and decision-making process is conducive to attracting development to the City. S<sub>3</sub>: Development Permit System should also be one of the first strategies implemented for several reasons. The process will not only further streamline the development approval process, thereby reducing private sector development costs and freeing investment capital for sustainability measures, but will ensure that clear standards for the development are established prior to the onset of the development process. Thirdly, S<sub>4</sub>: Municipal Engineering Standards Review should be carried out early in the implementation process, as this review will ensure the regulatory framework is permissive of more sustainable infrastructure, despite its unconventionality. Two of the financial strategies should also be established during the

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<sup>14</sup> Two excellent models for the Park Eco-Affairs Association are:

- Hamilton Industrial Environmental Association (HIEA) <http://www.hica.org>
- GTAA Partners in Project Green <http://www.partnersinprojectgreen.com>

preparatory stage. The policies associated with S8: Tax-Increment & Permit Fee Earmarking, which should be adopted prior to the onset of development to secure all allocated funds generated through the course of the park's development for the earmarked projects. S1: Community Improvement Plan should also be established (or augmented as the City of Hamilton has already adopted an applicable Community Improvement Plan) during the preparatory stage, to promote the implementation of green development principles from the onset of development. It is particularly important that early projects incorporate these principles, as they will be a tangible exemplar of the type of development envisioned and will help to set the standard for future development within the park. Furthermore, it is important that the incentive programs are available for projects occurring early in the development, as green building practices need the most financial support today, while it is commonly expected that many green building measures will become the market standard within 5-10 years. Finally, the foundation for S5: Built Environment Education, Resources & Outreach should be composed during the preparatory stage. The foundation of this strategy primarily includes the resources to be made available to developers and end-users, to inform the course of development, and the website designed to facilitate the outreach efforts of the municipality. Educational workshops may also be organized at this time. S5 will continue to be implemented throughout the development stage, as resources, educational events and outreach information will continue to be updated and made available.

The development stage begins once the land is made available for development, through to the complete build-out of the park. The key strategy to be implemented during this stage is S6: Municipal Leadership, as it is designed to tangibly demonstrate the municipality's commitment to the vision, which will have a positive impact upon the decisions of other actors. The predominant focus of this program are the investment opportunities the municipality should capitalize upon such as

more sustainable site servicing and infrastructure which will influence the environmental behaviour of end-users, the development of paths and other public amenities to help integrate the park with the natural environment and the surrounding community, as well as the the exploration of opportunities to partner with the private sector in creating a shared facility for streamlining the functions common amongst all firms. The second strategy the municipality should begin during the development stage is S7: Funding Search and Solicitation. This initiative could begin as a general search for sources of funding, but as specific development projects are proposed, it will become possible to formally seek financial support. This program should continue throughout the operational stage, as funding will also be available for eco-business initiatives, such as the establishment of a symbiotic exchange.

Finally, there are two strategies that should be implemented during the operational stage of the development. The first is S9: Operational Education, Resources and Outreach, the programs of which should be made available as soon as the first bona-fide end-users become known. Specifically the resources should be available to companies early-on, to promote the incorporation of sustainable industrial practices during the operational design process. Educational workshops may be well received at this point as well, so long as they were offered to companies throughout the City. However it is likely that only established firms would have the capacity to attend such sessions, thus they should continue well into the operational stage of the park. Finally, outreach initiatives should begin once a number of firms have established themselves within the park. The other strategy that should be implemented during this stages is S10: Park Eco-Affairs Association. As this association will primarily comprise of representatives from firms located within the park, it follows that its formation should occur after a number of companies have established their operations. In summary, the initiation timing of each recommended municipal action is fairly intuitive upon reflection of the focus and objectives of each strategy and its constituent programs and initiatives. The continuance, adaptation

or phasing out of the programs over time should be based upon critical assessment of the strategies' implementation progress towards its objectives. The monitoring programs outlined in the description of each strategy should provide a basis for this assessment.



## **7 CONCLUSIONS**

### **7.1 TRANSFERABILITY**

While the recommendations of this thesis are unequivocally focused upon a municipal strategy to effectuate sustainable industrial development and operation of the Hamilton Airport Employment Growth District, the research methods, analysis and recommendations have been designed to yield broader relevancy. First of all, the research process led to the establishment of a fundamental vision for the development and operation of a sustainable industrial park. While this vision is tailored to the Airport Employment Growth District, through adaptation, its applicability to other industrial parks seeking to incorporate sustainability principles is inherent. Secondly, the primary research identified the main barriers to the realization of the vision, which not only verified or in some cases refuted the existing literature on the topic, but concretely identified the challenges to industrial park sustainability through a case study analysis of a current development. Upon establishment of the vision and the barriers to its fulfillment, the final outcome of this research was the development of the municipal plan of action, a strategy which has been designed to guide the local government in capitalizing upon its opportunities to support, encourage and facilitate the realization of the vision.

As a case study, these research outcomes are naturally directly applicable and beneficial to the development and operations of the Airport Employment Growth District. However, the findings are almost equally applicable to any other employment lands development site within the City of Hamilton, and in the interests of overall sustainability, should also be incorporated into other such developments throughout the City. Furthermore the findings and recommendations of this study are comparably applicable to any other municipality within Ontario, as the planning regime and available municipal tools are the same throughout the Province. Nationally and even internationally, the results of this thesis are also relevant on a high level as many of the barriers identified in this study will

be common to other sustainable industrial park initiatives throughout the world. Furthermore, while the available tools, countervailing restrictions or general scope of authority of local governments nationally and internationally differ, the implementation strategy developed in this study should provide a tangible framework for municipalities seeking to effectuate sustainable industrial park development and operations. Finally, the results of this research will contribute to and advance the state of academic knowledge and understanding pertaining to industrial sustainability and the municipal roles and actions in promoting, enabling and supporting sustainable industrial outcomes. The remaining sections of this chapter detail the generalized conclusions that have been extrapolated from the research process and results of this case study.

## **7.2 RESEARCH QUESTIONS REVISITED**

The purpose of this study was to determine how a municipal government should effectuate the built and operational sustainability of industrial activities within the municipality. Through the analysis of a case study, the proposed industrial park surrounding the Hamilton International Airport, four central research questions have been answered to provide generalized conclusions:

- a) What role should a municipal government assume in the pursuit of sustainable industrial park development?
- b) What actions should a municipal government engage in to stimulate and support sustainable forms of industrial park development?
- c) What role should a municipal government assume in the pursuit of the operational sustainability of an industrial park and its constituent enterprises?
- d) What actions should a municipal government engage in to stimulate and support the ongoing pursuit of improved industrial operational sustainability?

The answers to these questions were developed based upon a critical analysis of the municipal role and suggested actions forwarded in the literature, the case study vision for a sustainable industrial park, the identified barriers to its pursuit and realization, and the specific input in this regard from the stakeholders interviewed.

### 7.2.1 Sustainable Industrial Park Development: Municipal Role

One of the most fundamental lessons to be gained from this study is the influence of the local government in effectuating change towards sustainability. This finding mirrors that which was reached by Roberts (2004), who upon evaluating the lessons learned from the planning and development process of Synergy Park in Australia emphasized the need for government support and direct involvement. Several nouns can be employed to describe the role of the municipal government in the pursuit of sustainable industrial park development. The most apposite of these are leader, anchor, facilitator and educator. These roles are described in the paragraphs below.

As Brand and Bruijn (1999) indicated, governments are one of the most important drivers for change, and the course of development of a sustainable industrial park certainly entails change. In order to realize that change, the municipality must adopt a leadership position, particularly during the planning and development stages of the park. Local government is well positioned to be the catalyst of sustainable industrial park development, through consistent, coherent and inspiring leadership. That leadership must first be founded in a clear commitment from city council to enable and support the pursuit of sustainable industrial park development and operations within the municipality. The need for leadership from the municipal government was raised by numerous stakeholders during the interview process. These comments served to further emphasize the importance of municipal leadership.

The role of leader closely coincides with that of anchor. Burström and Korhonen (2001) found that the presence of an institutional anchor was a central factor in the success of multi-stakeholder, place-based sustainability strategies. The role of anchor is to provide stability and instill confidence in an otherwise uncertain situation, such as that posed by the pursuit of sustainable industrial development. The need for this role was reinforced by stakeholder sentiment, which exhibited concern over the municipal government's willingness or ability to render decisions and actions true to the vision when faced with challenges to its implementation. The role of anchor could be fulfilled through the exhibition of resolve and endurance, not only through advocacy and the championing of ideals, but in finding workable solutions without wavering from the intent of the objectives.

A key responsibility of the municipality is to facilitate the course of sustainable industrial development, as a means of encouraging and enabling the implementation of the principles of such development. The role of facilitator is one primarily focused upon the removal of barriers. This is an important role because the initial cost, dedication of time and uncertainty associated with addressing barriers to sustainable development often leads to the postponement or abandonment of these types of initiatives by the development community, despite their overall benefits. In many cases, the municipality has the ability or the authority to remove, address or counteract these barriers proactively, thereby circumventing the problem in advance of commencement of development.

Finally the municipality has a key educational role to fulfill in order to stimulate and support sustainable industrial development. The consequence of this function was emphasized in the study by Scott, et al. (2001) that found the most common challenge to widespread application of sustainable industrial practices, to be a lack of knowledge. The municipality's role is one of actively informing stakeholders about sustainability measures and initiatives. It is a communicatory role, that

should focus upon spreading awareness, knowledge and understanding about sustainable industrial development and the technologies, techniques and principles of its implementation.

### 7.2.2 Sustainable Industrial Operations: Municipal Role

It is arguable that the roles of the municipality remain constant, even after the industrial park has been fully built-out. Indeed the initiatives that were put in place during the development stage will need to be maintained. For the most part, the role of the municipality in that maintenance does not change. For example, the municipality must continue to demonstrate leadership by ensuring that its decisions and actions are conducive to, or in support of the sustainability of the industrial park and the surrounding community. It must also remain an institutional anchor for the ongoing pursuit of sustainability, by consistently and predictably providing appropriate support for both existing and new sustainability initiatives. The role of facilitator is indeed diminished, however circumstances may arise whereby municipal leverage may serve to alleviate a barrier to improved operational sustainability. Finally, the role of educator certainly remains an important aspect of the municipal function.

However, despite these similarities, the municipal role does perceptibly shift in the pursuit of the operational sustainability of the industrial park and its constituent firms. The two nouns that most accurately describe this transformed role are collaborator and contributor. As propounded by Desrochers (2000), in matters pertaining to the practices of the industrial park, the industrial actors bear primary responsibility for the sustainability performance of their operations. While during the development phase the municipality would lay the groundwork for the ongoing pursuit of sustainability, it would assume more of a collaborative role with the established industries and other stakeholders in operational sustainability matters. The importance of collaborative operational initiatives

was highlighted during the interview process, in which it was suggested that private sector businesses were more likely to participate if such initiatives were endorsed or championed by other local private sector actors. The municipal role would be to encourage and stimulate initiatives towards improved operational sustainability, in collaboration with the other actors. Depending on the initiative, the municipality might enter into a form of partnership, but more often, it is likely that the municipality would perform a contributory role.

As a contributor, the municipality would essentially fulfill a support role. As noted above, operational sustainability matters largely fall under the responsibility of the industrial actors themselves. However, the municipality does have an important role in encouraging and bolstering the sustainability initiatives of those actors. As a contributor, the municipality would make available and employ its resources and organizational capacity to support the sustainability measures and initiatives of the industrial park. The adoption of this role is important because the municipal government is best positioned to carry out certain functions that are key to the success of many industrial sustainability initiatives, such as jurisdictional economic development and communicatory matters. Dunn and Steinemann (1998) found that private sector sustainability initiatives could benefit from these types of municipal contribution.

### 7.2.3 Sustainable Industrial Park Development & Operations: Municipal Actions

The actions in which a municipality should engage to stimulate and support sustainable industrial park development and operations fall clearly within the roles identified for the municipality above. The chart below illustrates these actions, in relation to the municipal role they contribute to fulfilling. Bear in mind that these actions are high-level recommendations and may not fully encom-

pass the specific actions a given municipality may undertake to stimulate and support the built and operational sustainability of an industrial park.

	<b>Development</b>	<b>Operations</b>
<b>Leader</b>	<ul style="list-style-type: none"> <li>• Establish a bona fide municipal commitment to the pursuit of the vision for sustainable industrial park development</li> <li>• Ensure that commitment is reflected in all municipal actions pertaining to the development of the park, including:               <ul style="list-style-type: none"> <li>▸ council decisions;</li> <li>▸ municipal policy and bylaw development;</li> <li>▸ design and construction of infrastructure, public amenities and municipal buildings</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Continue that municipal commitment to the pursuit of the vision from an operational standpoint</li> <li>• Implement new municipal sustainability initiatives throughout the community (especially those funded through revenue generated as a result of the industrial park)</li> <li>• Maintain existing municipal sustainability measures, such as transit service, public realm amenities etc.</li> <li>• Maintain and operate municipal facilities sustainably, particularly those onsite</li> </ul>
<b>Anchor</b>	<ul style="list-style-type: none"> <li>• Establish a consistent development decision-making framework</li> <li>• Clearly establish development expectations, both required and preferred</li> <li>• Link development requirements and preference to informational resources</li> </ul>	<ul style="list-style-type: none"> <li>• Support operational sustainability initiatives consistently and reliably</li> <li>• Enforce bylaws related to the sustainability performance of the park</li> </ul>
<b>Facilitator</b>	<ul style="list-style-type: none"> <li>• Remove planning, zoning and other local regulatory barriers</li> <li>• Provide municipal financial support for preferred development features</li> <li>• Search and solicit external sources of funding</li> </ul>	<ul style="list-style-type: none"> <li>• Act as liaison between local stakeholders and upper levels of government</li> </ul>
<b>Educator</b>	<ul style="list-style-type: none"> <li>• Communicate information effectively through a variety of media</li> <li>• Inform stakeholders about development sustainability objectives</li> <li>• Assemble resources on basic and advanced topics</li> <li>• Organize workshops</li> </ul>	<ul style="list-style-type: none"> <li>• Communicate information effectively through a variety of media</li> <li>• Inform stakeholders about operational sustainability objectives</li> </ul>

	Development	Operations
<b>Collaborator</b>		<ul style="list-style-type: none"> <li>• Participate as an active member in the industrial park management association</li> <li>• Partner in sustainability initiatives as appropriate</li> </ul>
<b>Contributor</b>		<ul style="list-style-type: none"> <li>• Utilize municipal resources to support to initiatives of park management association by (for example): <ul style="list-style-type: none"> <li>▸ focusing economic development efforts upon filling voids in industrial symbiotic network</li> <li>▸ analysing environmental performance data</li> </ul> </li> </ul>

### 7.3 IMPLICATIONS FOR PLANNING PRACTICE

The above analysis describes not only the role of the municipal government in sustainable industrial park development and operations, but indicates the ongoing and sustained nature of that municipal commitment to sustainability. For planners, this finding entails an important implication; that the role of the practitioner does not end once land use plans have been established, once a development proposal have been approved, or even once a project has been fully built out. Instead the local government should continue to be involved in promoting and supporting the maintenance and improvement of a project’s sustainability performance post-development. This role is particularly important when the municipality has instigated the inclusion of sustainability features into the project, for example through planning, economic development or tax mechanisms. As a result, planners need to be concerned with the ongoing operational sustainability of development projects.

The implication of this concern is not that urban planning should expand into new domains, beyond the traditional scope of its influence or the conventional areas of a practitioner’s involvement. Instead, the practice of planning for sustainable development should involve enhanced col-



laboration and integrated awareness of the roles and actions to be undertaken by other municipal departments as well as other stakeholders, throughout the development and operation of the project. Planners may continue to be primarily concerned with land use, transportation, environmental and social planning, but the policies, procedures and support mechanisms they devise to effect sustainable outcomes must be informed by the current and future initiatives of all stakeholders directly involved with the project. Conversely, other municipal departments and stakeholders must be involved collaboratively in sustainable development initiatives early in the planning process. As Hill (2006) described, “projects ‘owned’ by experts or those in a position of power are the least likely to succeed, most likely to experience low participation or low levels of compliance, and over time are likely to be unsustainable” (p. 36). Multi-stakeholder involvement serves to enhance the sustainability of a project by garnering a broad base of support for the initiative through collaborative discussion, debate and refinement of the plan.

Collaboration can also identify key areas in which individual stakeholders might contribute to the outcome of the project and may garner important partnerships to effectuate the ongoing sustainability of the project. As Roberts (2004) noted, it is important to identify a potential industry catalyst, and to bring together key industry and utility stakeholders early in the planning process. Such early involvement would also enable the planning process to be integrative. An integrative plan would ensure that concurrent stakeholder initiatives, such as those of the planner, economic development officer and developer, are compatible and complimentary. An integrative plan would also facilitate effective transitions over time, so that as the role of the planning practitioner recedes, other stakeholders can seamlessly continue or assume their role in fulfilling the project objectives.

In summary, it is important for planning practitioners to consider their role as an integral component of local sustainable development which occurs within a broader context governed by social interactions over time. As such the roles and actions of other stakeholders, both concurrent and subsequent to the planners involvement, must be integrated into the planning process, to facilitate the success of sustainable development projects over time.

#### **7.4 SIGNIFICANCE FOR PLANNING EDUCATION**

The implications of this study on planning practice, translate directly to those for planning education. Firstly planning students should be introduced to the ongoing nature of the municipal role in achieving sustainability objectives, particularly until the pursuit of sustainability becomes a standard societal practice. However, in reflection of the recommended role of the municipality derived from this thesis, students should also understand that this municipal role does not entail the overbearing management or meddlesome intervention of private decisions and behaviour. Instead, the municipality has a contributory role to play in the ongoing pursuit of sustainability, in collaboration with other stakeholders. Beyond detailing the types of roles and actions a municipality might undertake to effectuate sustainability, it is important for students to understand the implications for planning practice that result from this extended municipal role, namely the need for collaborative and integrative planning.

#### **7.5 REFLECTION ON METHODS**

The context mapping process employed to illustrate the interdependent factors effecting the realization of a sustainable industrial park, was a very effective analysis tool. The method was instrumental in developing a systematic municipal strategy to effectuate sustainable industrial development and operation, as it explicitly depicted how each barrier impacted the various elements of the

vision. Upon analysis of those impacts and their relative consequence upon the realization of the vision, a municipal plan of action was developed to effectively address each barrier and advance specific elements of the vision. The illustration visually depicted the comprehensiveness of the municipal strategy, demonstrating that its full implementation would ensure every barrier to the vision was addressed, and that progress toward every element of the vision was forwarded.<sup>15</sup> The results garnered through the application of the context mapping process exhibited the benefits of the method propounded by Nijkamp, Rietveld and Voogd (1990), in that the process led to a systematic inventory of the consequences of public policy, which enabled the development of a more balanced municipal strategy to promote and support the development of a sustainable industrial park. Furthermore the researcher believes that the analysis process has mitigated the opportunity for neglect or oversight of potentially significant indirect and unintended effects of that strategy.

Inspiration for the context mapping process employed in this study was derived from the methods of multiple criteria analysis, specifically the procedures of spatial impact analysis. This method provided an excellent analysis tool and yielded sufficient information to develop a comprehensive municipal strategy to address the research problem. However it is important to note that the context mapping process is only the first step in spatial impact analysis. In the Nijkamp and van Pelt (1989) study from which inspiration for the context mapping method was drawn, the authors considered three different policy scenarios to address the critical needs of the City of Bhubaneswar, a rapidly growing Indian city facing many social, economic and environmental challenges. To assess the impact of the policy alternatives, a context map was first designed to demonstrate the causal and effectual linkages among the various challenges facing the city utilizing qualitative data gathered from local and regional stakeholder interviews. A spatial impact analysis of the three policy scenarios was

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<sup>15</sup> Please see Appendix Five to view the Context Map developed for this thesis.

then performed. Nijkamp et al. (1990) explained that an “impact assessment aims at gauging the expected of foreseeable relevant consequences of a policy decision or plan” (p. 38). Upon review of the Nijkamp and van Pelt (1989) study, the usefulness of spatial impact analysis techniques was demonstrated.

Following completion of the context map and the development of three policy alternatives to address the pressures of population growth on the city, Nijkamp and van Pelt (1989) conducted a spatial impact analysis to determine the most effective and desirable policy scenario.<sup>16</sup> The time sensitive impact the implementation of the policy scenario would have upon each element of the context map was considered. The average size of the impact table produced was 55 x 40, representing all 55 elements of the context map, and the number of steps analyzed (10 steps in each 5 year period, with 4 periods included). At each junction, the impact of the policy scenario was evaluated. Given the qualitative nature of most of the information, impact evaluation was conducted using ad hoc methods or expert knowledge. Impacts were indicated using symbols such as ++, +, o, -, --, and ? to indicate a relatively large positive impact, a relatively small positive impact, a neutral or negligible impact, a relatively small negative impact, a relatively large negative impact and an unknown impact, respectively (p. 216). It was also noted that an ordinal scale could also be used to represent relative impacts. Given the extensive size of the impact tables, Figure 7.1 is a representative example, illustrating the impact assessment of one policy scenario on several elements over a condensed time.

In the case of the Bhubaneswar research, the objective of study was to determine the best policy scenario to address the problems afflicting the city associated with population growth. As such, the impact assessment was used to evaluate the three policy alternatives, comparing the scenar-

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<sup>16</sup> Please see page 49 to see a copy of the context map developed by Nijkamp and van Pelt (1989).

Figure 7.1: Example Spatial Impact Analysis Table

Element	1981-1986				1986-1991				1991-1996				1996-2001			
	Period Step I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
Migration/Population	> 6000	+++			> 6000	+++				++				++		
Employment:																
Industry		++				++				+				+		
Construction		+				0/+				0/+				0		
Government	+ 1500				+ 1500								+			
Institutions		++				++				+				+		
Tourism		+				0/+				0/+				0		
Commerce		++				0/+				0/+				0		
Transport		++				+				+				0/+		
% Involuntary Unemployment						0/+				+				+		
% Below Poverty Line										+				+		
Supply of Housing/Facilities		+				+				+				+		
Demand for Housing/Facilities		+++				+++				+++				+++		
Housing Gap																
% Slums										+++				+++		
Adequacy Facilities										+++				+++		
Social Climate										-				-		

(Nijkamp & van Pelt, 1989, p. 223)

ios to determine which had the highest positive impact (3), the moderate positive impact (2) and the lowest positive impact (1) on each element of the context map. Once policy makers had prioritized elements of the context map and analyzed how each policy scenario impacted those elements, it became clear which policy scenario would best achieve the objectives of the city.

In the case of this thesis, the impact analysis was not used to evaluate alternative municipal plans of action as it was found that the context mapping process alone provided sufficient information to effectively develop a municipal strategy to effectuate sustainable industrial park development within the city. However, an impact analysis could be employed for further research was used to evaluate how well the municipal plan of action addressed each barrier and vision element depicted on the context map. The study of the municipal plan of action utilizing the impact analysis process could lead to its refinement, through the use of hindsight to assess impacts accurately. It is important to note that the spatial impact analysis technique could also be employed to assess municipal policy prior to implementation, utilizing a combination of expert knowledge and extensive stakeholder interviews to predict the impacts of policy initiatives.

In summary, the techniques of spatial impact analysis were found to be an extremely valuable analysis tool, enabling comprehensive evaluation of qualitative information. The method of context mapping was found to be sufficiently detailed to develop a comprehensive municipal plan of action that clearly addressed the interdependent factors governing the realization of a sustainable industrial park. Impact analysis could be employed in two ways, The first would be to assess the impact of a municipal strategy prior to its implementation. A weakness of this method was found to be the subjectiveness of the impact assessment. While expert knowledge and collaborative stakeholder input would lead to a fairly accurate assessment of the impacts, it is not possible to anticipate exact conse-

quences. For that reason, an impact analysis was not deemed necessary to reinforce the recommendations already garnered from the context mapping process, which enabled the rationale for each municipal action to be systematically traced throughout the map, and impacts to be assessed inherently to that process of rationalization.

An impact analysis prior to the implementation of a policy would likely be most effective when more than one policy direction was being considered. For example, if several sites were available for an industrial park, spatial impact analysis would provide an excellent tool to evaluate each site, to determine that which is most advantageous for the objectives of the city. Another example relevant to sustainable industrial park development might be the selection of anchor industries to target for economic development efforts, particularly if numerous factors had to be taken into account including the relative locational advantage of the site for different industries, the potential synergies among types of industry, and the skills of the local workforce.

The second application of spatial impact analysis, namely one of hindsight, is expected to be an extremely valuable tool in evaluating the effectiveness of municipal policies to effectuate a desired outcome. This method has wide applicability, and would be valuable in that it would enable the grounded refinement of policies, thereby improving the effectiveness of those already implemented and providing tangible lessons that could be applied in future policy development and decision making. In relation to the municipal plan of action recommended in this thesis, an impact analysis of each municipal strategy to determine its effectiveness and identify areas of improvement would be of value not only to the City of Hamilton, but would enable new municipal efforts to effectuate sustainable industrial park development to be more efficient and effective.

In conclusion, the methods of spatial impact analysis offer valuable techniques for designing comprehensive and systematic municipal policies and for assessing the effectiveness of those policies. Furthermore, as the method is rooted in systems theory, it is particularly effective for sustainability initiatives, as such plans require a comprehensive understanding and evaluation of a myriad of interrelated and interdependent issues. As such the methods of spatial impact analysis should be included in the range of techniques employed by planning practitioners to develop and evaluate integrated plans.

## **7.6 THEORETICAL LESSONS LEARNED**

A blended theoretical approach was adopted for this thesis. The approach was rooted in general systems theory and informed by the rational comprehensive, incremental, collaborative and communicative theories of planning. Upon critical reflection of the research process and the results, three theories emerged as particularly relevant to industrial park sustainability; general systems theory and the theories of incremental and collaborative planning. The lessons and findings garnered from the application of these three theories are outlined in the following paragraphs.

### **7.6.1 Collaborative Planning Theory**

Interesting collaborative planning insights were garnered through the course of this research. First of all the central tenet of the theory, which emphasizes the process of planning in collaboration with stakeholders to define the public interest, was raised both in the literature and the interview process. In the Roberts (2004) analysis of the planning process for Synergy Park, the importance of early stakeholder engagement was highlighted as a key lesson to be drawn from the Australian experience. In the Synergy Park case, a lack of stakeholder engagement led to wariness by businesses and opposition by members of the community, considered to be largely a result of misun-



derstanding of the concept caused by a lack of early engagement. Roberts (2004) concluded that earlier community engagement and business educational efforts would have bolstered support for the plans, as resistance was largely mounted when the eco-industrial ideas for the park were first being formulated. Furthermore, the importance of this collaboration was emphasized during the stakeholder interviews conducted for this study.

While the City of Hamilton has already formed a Community Liaison Committee to collaborate with planners on matters pertaining to the Airport Employment Growth District, several committee members highlighted the need for the City to directly consult industry, the potential end-users of the park, to ensure the plans, eco-industrial or otherwise, reflected their business needs. Of note, Roberts (2004) also highlighted industry consultation early in the planning process, particularly to garner private sector support for eco-industrial principles and to establish collaboration with anchor industries to establish viable symbiotic opportunities.

An interesting finding however, was that in matters of industrial park sustainability municipal collaboration with stakeholders should continue well beyond the planning phase. While governments are one of the most important drivers for change (Brand & Bruijn, 1999), municipal government has little authority relative to the planning and development periods, to influence the behaviours and decisions of private enterprise. Furthermore, private firms are often resistant to government involvement in private matters (QG2), and local government councillors and staff alike are wary of intervening in matters outside the scope of municipal expertise (HS2, CC1). However the literature and the results of this study both indicated that local government has a significant collaborative role to assume in the pursuit of industrial sustainability. Brand and Bruijn (1999) suggested the local or regional government has a role in establishing an organizational team, either from a hierarchical

steering position, or a more horizontal coordination perspective, dedicated to establishing and maintaining conditions supportive of the ongoing pursuit of industrial sustainability.

The experiences of the Burnside Eco-Industrial park also indicate the need for ongoing support for eco-efficiency initiatives. While Côté et al. (2006) indicated that the Eco-Efficiency Center (EEC) created to support green business initiatives within the Burnside Industrial Park, is a non-governmental organization, a municipal government could be involved in the clearinghouse role that it fulfills, in collaboration with other organizations such as local universities, conservation authorities and private sector companies (QG2). Indeed the recommended municipal strategy developed in this thesis suggests municipal involvement in support for operational sustainability measures.

In summary, to bolster the likelihood of success in fulfilling the objectives of industrial sustainability, the ongoing collaborative atmosphere amongst governmental, institutional and private sector actors should be fostered early in the planning process of a sustainable industrial park. To do so, planners should not only engage stakeholders outside the local government, but should also involve other municipal actors that will remain involved in the project after the role of planning has receded.

### 7.6.2 Incremental Planning Theory

QG1 offered one of the most incisive comments garnered during the stakeholder interview process, stating “sustainability is the process of getting there.” The comment suggests that the fulfillment of sustainability is an ongoing, incremental and dynamic process. This opinion was confirmed in the literature. For example, Jänicke (2008) highlighted ecological modernisation is a key element of the pursuit of sustainability, particularly for industrial practices, where focus is currently directed toward improved material and energy use intensity, logistics efficiency, land use density,

and risk exposure. Furthermore, the assertion was reflected in the recommended municipal strategy, which emphasized the ongoing pursuit of improved sustainability performance throughout the planning, development and operational phases of the park, and the regular evaluation of that performance to foster adaptation, progress and innovation towards sustainability in light of the current context.

The theory of incremental planning was particularly relevant to these findings, as it holds that generally, in addressing a problem or opportunity, only incremental alternatives are developed and considered (Alexander, 1986). For instance, the alternatives developed for a new policy direction, usually conform to existing political and legal structures and work within available resources and current constraints. In other words, change happens within the current context. As social norms shift, technological innovations advance, economic trends cycle and environmental conditions adapt, the pursuit of sustainability will evolve. The fundamental lesson to be drawn from incremental planning theory is that in the pursuit of sustainability, that which can be accomplished today should be implemented, with the understanding that the pursuit of sustainability will change over time but will never be definitively achieved.

### 7.6.3 General Systems Theory

A primary purpose of applying general systems theory was to inform the context mapping process. The tenets of systems theory enable the researcher to not only observe and analyze tangible social, economic and environmental elements of sustainable industrial park development, but to study the connection, dependence, interdependence and interactions of those elements. Furthermore, systems theory emphasizes the inclusion of context in the analysis process, such as how the viewpoints of the various stakeholders impact the system, its functions, and the current scope and range of opportunities for change, thereby leading to the formulation of more effective policies. In-

deed, the insights provided by general systems theory were valuable in developing the context map. The systems approach, which emphasizes the plausibility of multiple stakeholder perspectives, contributed to the accurate identification of barriers to sustainable industrial park development and operations. Of particular note however, the application of the systems approach also yielded interesting results pertaining to the definition of and vision for industrial park sustainability.

Over the course of reviewing the literature, it became apparent that the scope of sustainability was quite narrowly defined by many eco-industrial practitioners. Most eco-industrial park literature is founded in the concept of industrial ecology, which has led to a distinct focus upon the establishment an industrial ecosystem as the defining feature of eco-industrial parks. While the literature regularly makes reference to other elements and measures of industrial park sustainability, the emphasis has remained upon the symbiotic interactions amongst businesses and between the businesses and the natural environment (Lowe & Warren, 1996).<sup>17</sup>

However, by applying the tenets of systems theory to this concept, it became clear that a more holistic understanding of industrial park sustainability was necessary. The systems approach was first employed to consider the underlying meaning of sustainability, which was determined to be one of systemic societal change in order to improve the quality of human life while doing so within the carrying capacity of supporting ecosystems. An important dimension that must be added to the sustainability concept for industrial sustainability, is that of place-based sustainability, namely the need to achieve social, economic and environmental sustainability locally, as well as globally. Upon reflection of this concept, it became clear that a sustainable industrial park entails much more than a

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<sup>17</sup> Please refer to Chapter 2, Section 2.4.4 to review the elements of a sustainable industrial park as forwarded in the literature.

collection of green buildings, or clean tech firms, or a network of businesses engaging in symbiotic activities.

Instead, the fundamental definition proposed in this thesis is that a sustainable industrial park should function in an economically competitive manner that provides for human needs through market mechanisms while doing so in alliance with the local community, in congruence with the local ecosystem and within the carrying capacity of the planet. While certainly broad, this definition encompasses the pursuit of a wide range of sustainability measures, that include those conventionally emphasized in eco-industrial park literature as well as those that were widely presented as secondary. The essential meaning of holistic is that each measure is considered integral and interdependently related to the pursuit of industrial park sustainability. The application of systems theory influenced this conclusion, as the research problem was approached with an awareness that social, economic and environmental systems and subsystems are inextricably linked. The vision developed for this thesis provides a description of how individual sustainability measures, such as green building, community interaction, industrial symbiosis, renewable energy, land stewardship and urban well-being, can be combined to create a holistically sustainable industrial park.<sup>18</sup>

## **7.7 DIRECTIONS FOR FUTURE RESEARCH**

A key area of further research would be to examine the actual implementation of the municipal strategy recommended in this thesis. Should a municipality, such as the City of Hamilton, elect to pursue the sustainable industrial park development and operation by employing the plan of action detailed in this thesis, a study to evaluate the effectiveness of the plan, over time would be beneficial. Particular focus upon the specific details of how the plan was implemented would be valuable, espe-

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<sup>18</sup> Please see Chapter 5, page 93 to review the vision.

cially to detail those elements of the plan that were successful, those that required revision or augmentation to work, and those that did not effectuate the intended results. Furthermore the context mapping method undertaken in this study could be extended to include an impact analysis utilizing the knowledge garnered by hindsight. The findings of such a study could be used to refine the roles and actions a municipality should undertake to effectuate sustainable industrial development and operations, in reflection of practical experience.

On another note, the exclusive focus of this thesis was upon the roles a municipal government should assume and the actions it should implement to stimulate and support sustainable industrial park development and operations. Given the influence of upper levels of government upon local outcomes, an important contribution to the pursuit of industrial sustainability could be made through a similar study to investigate the appropriate roles and actions of the provincial and federal levels of government. In culmination, research to vertically coordinate the policies and initiatives to effectuate industrial sustainability throughout all three levels government would serve to enhance the effectiveness of those efforts.

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## APPENDIX ONE: LETTER OF INTRODUCTION

Dear Stakeholder Name,

As O.W. Holmes once aptly stated, “the greatest thing in this world is not so much where we are, but in what direction we are moving.” The Airport Employment Growth District is moving forward. Your contribution is requested to a study that will help direct this development to success. Indeed, a unique opportunity exists at the inception of this development that will:

- Advance the locational advantage of the development area for industrial and commercial investment;
- Ensure the efficient and effective use of energy, material and community resources;
- Enhance the conservation of natural and financial resources;
- Promote environmental protection and enhancement;
- Improve human health, well-being and workplace productivity; and
- Position the City of Hamilton as an international leader in sustainable industrial development.

This study will focus firstly upon the creation of a vision of industrial sustainability. The Preliminary Vision document, included in this package, will serve as a starting point for discussion. Upon finalization of the vision, this study will then focus upon the development of a municipal plan of action that will stimulate, support and remove barriers to the realization of the vision. In order to develop a vision reflective of the values of the community and an effective municipal plan of action, the input of key stakeholders is essential. As you are actively involved as a business or civic community representative with an interest in the Airport Employment Growth District, your input is of considerable value. Your participation will enhance the vision, while helping to identify the barriers, constraints and resources that will impact its realization.

Participation in this study is voluntary. It will involve a one-on-one interview of approximately 30 to 90 minutes in length, to take place at a mutually agreed upon location. This interview will focus upon the vision as well as the barriers, constraints and resources that will pertain to its realization. Your input will contribute to the development of a recommended municipal plan of action that will define the potential role of the City of Hamilton in promoting and facilitating realization of the vision. You may decline to answer any of the interview questions if you so wish. Furthermore, you may decide to withdraw from this study at any time without any negative consequences by advising the researcher. With your permission, the interview will be audio recorded to facilitate collection of information, and portions will be transcribed for analysis. All information you provide will be considered completely confidential.

Your name will not appear in any thesis or report resulting from this study. However, with your permission anonymous quotations may be used. Data collected during this study will be retained for 5 years in a locked filing cabinet in the researcher's office. Only the researcher and supervising professor associated with this project will have access. There are no known or anticipated risks to you as a participant.

This study is being conducted as part of my Master's degree in the School of Planning at the University of Waterloo, under the supervision of Professor Mark Seasons. It is my belief, that the results of this study will benefit the City of Hamilton, its business and civic community members, and of course the local environment, as it pursues the development of the Airport Employment Growth District. Furthermore, while the fundamental vision of sustainable industrial development is largely uncontested in the literature, a clear path to comprehensively implement this vision has not been widely studied. As this research focuses upon implementation, I believe that this study will have wider applicability by providing a replicable framework for sustainable industrial development, thereby advancing the state of both practical and academic knowledge in this field.

Please be advised that any information prepared for this study, such as the Preliminary Vision document, is prepared for the explicit purpose of this study and does not necessarily represent the views of the City of Hamilton (the City). Furthermore, the recommendations developed as a result of this study will be made available to, but will not necessarily be implemented by the City.

If you have any questions regarding this study, or would like additional information to assist you in reaching a decision about participation, please contact me at 905.399.8865 or by email at kbryer@envmail.uwaterloo.ca. You can also contact my supervisor, Professor Mark Seasons at 519-888-4567 ext. 35922 or email mseasons@envmail.uwaterloo.ca.

I would like to assure you that this study has been reviewed and received ethics clearance through the Office of Research Ethics at the University of Waterloo. However, the final decision about participation is yours. If you have any comments or concerns resulting from your participation in this study, please contact Dr. Susan Sykes of this office at 519-888-4567 Ext. 36005.

I look forward to speaking with you and thank you in advance for your assistance in this research.

Sincerely,

Katie Bryer

# APPENDIX TWO: PRELIMINARY VISION DOCUMENT

## Glossary

### BUILT ENVIRONMENT

**Multiple Utilities Corridor:** interconnected, clustered delivery and transportation of utilities such as black, reclaimed and potable water, power, fibre optics and voice/data cable between areas of supply, demand, storage and treatment; ideally in close proximity to human and vehicular traffic corridors.

**Adaptable Design:** design that seeks to provide a building with the ability to positively and adeptly accommodate change, both internal (i.e. expansion, diversification) and external (i.e. climate change, security) throughout the course of its life-span.

**Cool Roof:** roof mainly bright white in colour, constructed of highly reflective and emissive materials, allowing it to reflect the sun's energy and emit infrared energy, thereby keeping the building cool and reducing the heat island effect in the area surrounding the structure.

**Green Roof:** an extension of the existing roof that allows plants, trees and shrubs to grow in a light-weight growing medium, thereby reducing stormwater runoff and the heat island effect and insulating the building from temperature changes.

**Durable Building Envelope:** design that minimizes materials use and construction waste over a building's life-span resulting from premature failure of the structure or its components and assemblies.

**INDUSTRIAL OPERATIONS**

**Life Cycle Management (LCM):** an integrated concept to assist businesses in managing the total life cycle of products and services towards more sustainable production and consumption cycles.

**Total Cost Accounting:** a financial tool used to provide a more complete assessment of the true profitability of an entity by taking into account a wider range of direct and indirect costs and savings.

**ISO 14001:** international standards for environmental auditing and performance evaluation, product labelling and declarations, life cycle assessment, greenhouse gas emission reporting etc. designed to enable organizations to communicate about and improve their environmental performance.

**Resource Recovery:** the recovery of materials and energy resources from waste.

**Waste Production:** the continual effort to prevent pollution, reduce the use of energy, water and material resources, and minimize waste in the production process.

**Cradle to Cradle Production:** a manufacturing process that moves beyond the mitigation of negative environmental impacts to the optimization and enhancement of economic, environmental and social sustainability within its scope of influence.

**Industrial Symbiosis:** the manufacturing by-product of one company is directed to one or several area companies for use as an input in their manufacturing process(es) to reduce consumption of resources, generate income from 'waste' and reduce environmental strain.

**Euro-Collodolite:** the clustering of industrial, institutional and commercial operations to take advantage of local and regional opportunities for symbiosis and resource recovery.

**BUILT ENVIRONMENT/INDUSTRIAL OPERATIONS**

**First Generation Biofuels:** an alternative fuel derived from biological sources, mainly crops.

**Next Generation Biofuels:** fuel derived from biological non-food sources, such as crop wastes and algae.

**District Heating:** a system for distributing heat generated in a centralized location by a cogeneration plant or from geothermal, solar power and surplus heat from industrial processes, to neighbouring buildings.

**Heat Recovery:** a form of district heating that captures and redirects heat initially generated for industrial uses that would otherwise be wasted at the end of the industrial process.

**CULTURE OF SUSTAINABILITY**

**Secondary Sector:** the sector of the economy that manufactures finished goods; all manufacturing, processing, and construction is considered part of this sector.

**Tertiary Sector:** the sector of the economy devoted to providing services to the general population, businesses and institutions; activities associated with this sector include retail and wholesale sales, transportation and distribution, entertainment (movies, television, radio, music, theatre, etc.), restaurants, clerical services, media, tourism, insurance, banking, healthcare, and law.

**Quaternary Sector:** the sector of the economy that consists of intellectual activities; organizations and activities in this sector include government, culture, libraries, scientific research, education, and information technology.

## Promoting Efficient, Responsible and Sustainable Industrial Development and Practices: The Municipal Role

A Case Study of Hamilton, Ontario



### Vision Statement:

To realize the development of an industrial park that optimizes the use of energy, material and community resources to the benefit of the economic, environmental and social bottom line.

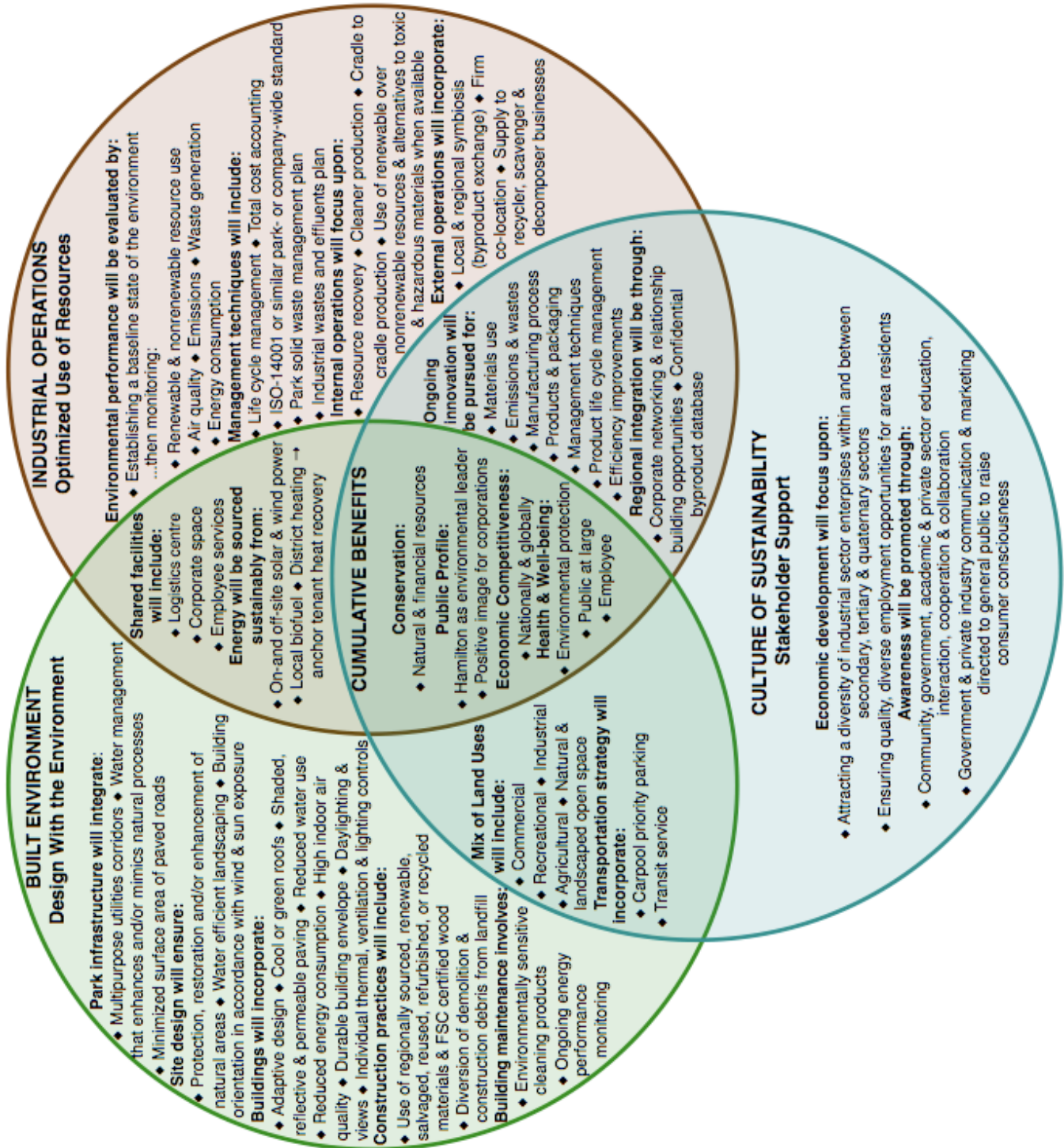
### Purpose Statement:

To develop a municipal plan of action that will stimulate, support and remove real and perceived barriers to the realization of economically efficient, socially responsible and environmentally sustainable industrial development and practices throughout the City of Hamilton, Ontario.



**Katie Bryer**  
Candidate, Master of Arts - Planning  
University of Waterloo  
Faculty of Environmental Sciences  
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905.399.8965

# PRELIMINARY VISION



## APPENDIX THREE: COMPLETE INTERVIEW GUIDE

### THE VISION

a) Do you have any questions regarding the content of the Vision?

b) Do you have any suggestions or ideas for the improvement of the vision pertaining to:

#### **Built Environment:**

- Park Infrastructure (VB1)
- Site Design (VB2)
- Buildings (VB3)
- Construction Practices (VB4)
- Building & Site Maintenance (VB5)
- Facilities (VB6)

#### **Industrial Operations:**

- Environmental Performance Monitoring (VI1)
- External Operations (VI2)
- Environmental Management Techniques (VI3)
- Internal Operations (VI4)
- Heat & Energy (VI5)
- Human & Environmental Health & Safety (VI6)
- Regional Integration (VI7)
- Innovation (VI8)

#### **Public Realm:**

- Land Use Planning (VP1)
- Economic Development (VP2)
- Transportation (VP3)
- Public Participation (VP4)
- Awareness (VP5)

b) Are any of the elements of the vision problematic or counter to how you envision the future of the Airport Employment Growth District?

## **BARRIERS AND CONSTRAINTS**

For the purposes of this study, a barrier is defined as a condition, real or perceived, that would impede progress towards or realization of an element of the vision, but that should, or must be overcome to enable the project to proceed as envisioned. A constraint is defined as a firm limitation or restriction for which attempts to overcome or overrule should not or cannot be made within the foreseeable future.

a) Through a review of the literature, numerous potential barriers and constraints were identified, the applicability and extent of which I believe you could comment:

### **Financial:**

- Local Government (BF<sub>1</sub>)
- Builders and Developers (BF<sub>2</sub>)
- Park Occupants (BF<sub>3</sub>)
- Regional Industry (BF<sub>4</sub>)

### **Regulatory:**

- Building Code (BR<sub>1</sub>)
- Airport specific (BR<sub>2</sub>)
- Hazardous Substance Designation (BR<sub>3</sub>)
- Byproduct Utilization Restrictions (Transport, Processing) (BR<sub>4</sub>)

### **Legal:**

- Liability for Use of Hazardous Secondary Material (BL<sub>1</sub>)
- Liability = disposal vs. selling/ transferring byproducts (BL<sub>2</sub>)

### **Risk of Interdependence:**

- Network Stability (BI<sub>1</sub>)
- Confidentiality and Trade Secrets (BI<sub>2</sub>)

### **Change:**

- Resistance To (BC<sub>1</sub>)
- Lack of Human Resource Capacity (BC<sub>2</sub>)
- Technological (BC<sub>3</sub>)

### **Site Specific:**

- Geographical (Distance Between Firms Transportation, Mix of Land Uses) (BS<sub>1</sub>)
- Park Servicing, Site Design & Buildings (BS<sub>2</sub>)
- External Operations (BS<sub>3</sub>)
- Park Management (BS<sub>4</sub>)



b) Are there any other barriers or constraints you foresee, that we have not covered?

## **RESOURCES**

a) Through a review of the literature, numerous potential resources were identified, the applicability and availability of which I believe you could comment:

### **Financial:**

- Government (RF<sub>1</sub>)
- Builders and Developers (RF<sub>2</sub>)
- Park Occupants (RF<sub>3</sub>)
- Regional Industry (RF<sub>4</sub>)

### **Regulatory:**

- Design Guidelines (RR<sub>1</sub>)
- Zoning (RR<sub>2</sub>)

### **Legal:**

- Liability Protection (RL<sub>1</sub>)
- Confidentiality Agreements (RL<sub>2</sub>)
- Property Management Standards Bylaws (RL<sub>3</sub>)

### **Change:**

- Community Will, Non-profits, Associations (RC<sub>1</sub>)
- Economic Development Role (Champion, Database) (RC<sub>2</sub>)

### **Site Specific:**

- Geographical (Mix of Land Uses, Distance Between Firms Transportation, Infrastructure) (RS<sub>1</sub>)
- Park Servicing, Site Design & Buildings (RS<sub>2</sub>)
- External Operations (RS<sub>3</sub>)
- Heat & Energy (RS<sub>4</sub>)
- Park Management (RS<sub>5</sub>)

b) Are there any other resources you foresee, that we have not covered?







# APPENDIX FIVE: CONTEXT MAP





## **APPENDIX SIX: MUNICIPAL PLAN OF ACTION SUPPLEMENTARY INFORMATION**

### **SI: Community Improvement Plan**

#### **Rationale:**

The Financial Incentives portion Community Improvement Plan is an essential component of the municipal strategy to promote realization of the sustainable industrial park as envisioned. The program will directly address several elements of the vision and numerous barriers of fundamental concern.

The first element of the vision to be promoted by this program is V<sub>2</sub>: Health & Well-being as both community and employee health and well-being would be positively impacted by the green construction techniques and buildings that would be encouraged through the financial incentives available through the CIP. Furthermore, elements of V<sub>4</sub>: Economic Competitiveness & Workforce Attraction & Retention would be realized through the development of a more sustainable built environment, as employee productivity has been shown to improve in green buildings that promote inhabitant comfort and enjoyment within the space and thereby enhance the quality of time that employees spend in their workspace. This in turn would contribute to both business recruitment and retention from an economic development perspective, and to the ability of companies located within the park to attract and maintain a quality workforce.

This program would also positively contribute to the realization of V<sub>3</sub>: Conservation, Enhancement & Integration, by providing incentive to ensure that the course development respects the characteristics of the surrounding community, the natural heritage of the land and the environment. The principles of sustainable building, the adoption of which is encouraged through this program, would also ensure that the site design would make efficient use of the land, work within environ-

mental constraints and that significant natural areas are preserved or even enhanced. Moreover, as results of the incentives are highly verifiable, municipal financial resources would be employed effectively to promote the vision. Furthermore, as the main financial incentive would involve a tax increment based grant, the municipality would be able to provide the incentive viably and sustainably, by utilizing property tax income generated by the development itself.

Despite the clear case for green buildings from both an environmental impact and life-cycle cost perspective, there are several barriers to such development. As noted above, the CIP program will address many of these barriers.

The first set of barriers, addressed by this program fall under B6: Market Demand. First of all, the financial incentives would lower the upfront capital costs of constructing green, thus more companies should be willing to pay the remaining premium. In addition, as the life-cycle cost of green buildings is verifiably less than conventional buildings, an increased demand for such buildings should develop, particularly as the payback period for the green building premium would be significantly reduced by the municipal incentives. This demand, paired with the reduced risk for speculative builders provided by the financial incentives, would also serve to increase the number of green buildings constructed on spec. Finally, by including the cost of constructing additional storeys on warehousing and industrial buildings as an eligible cost and increasing the grant period, the economic justification for multi-storey buildings should also become much more compelling.

Barriers to B7: Economic Development would also be mitigated by this program. First of all, the program would allow a fair degree of flexibility, enabling the private sector to determine for instance which level of LEED certification would best suit the comfort level of the company or builder, the market conditions of the day and the end use of the structure. Secondly, the incentives would



help the Municipality to attract certain types of companies to the City, namely those concerned about the sustainability of their operations. The incentive to build multi-storey buildings should help to increase the number of employees working per hectare. Similarly, a disbursement criteria based upon employment density per square metre may help to attract companies that rely upon labour as opposed to machines to provide their product or service.

Most apparently addressed by this program is B8: Financial barriers. First of all, this program would clearly mitigate arguments that adopting green building principles is economically prohibitive, by providing offsetting grants to ensure green buildings are competitive in the marketplace. Furthermore, the program is also financially feasible for the municipality as it utilizes funds generated after the development occurs. For similar reasons, it should limit any negative bias that may be associated with the increased cost of some green building technologies and techniques. Finally, as an additional benefit, the program would share the initial premium for green buildings, shifting some of the cost associated with creating an ‘external benefit’ from the private sector.

**Lead Actor Role(s):**

The Planning Department would have the primary role in developing and administering this program. Planning would be responsible for writing the Community Improvement Plan, submitting and presenting it to council, and administering it, once approved. The administration would include meeting with potential program applicants, guiding and advising applicants through the application process, providing recommendations to council on program application approvals, and verifying each project has fulfilled disbursement requirements. Once the project is complete and verified, the Finance Department would be responsible for administering and accounting for all disbursements.

**Potential Partner Role(s):**

Not applicable

**Monitoring:**

Monitoring of this program should be fairly straightforward. Anecdotal accounts of how the program has supported a project would be of great value, once it has been in effect for a few years. Other metrics of a quantitative nature would also be important to monitor, to gauge the uptake and effectiveness of the program. Statistics might include the number of approved projects, the number of candidate and certified buildings at each level of LEED, the number of multi-storey buildings, and the amount of money disbursed. Other information that would likely be of interest might include the type of companies locating within the industrial park that are located within supported buildings and whether any projects have achieved the employment density bonus.

**S2: Streamlined Municipal Approval Process****Rationale:**

This program would not directly enhance the fulfillment of any specific elements of the vision, however its implementation would remove a significant barrier to the development proceeding as envisioned, thereby facilitating the vision to be realized. Indeed, the sustainable industrial park, as envisioned, does not represent the conventional form of employment lands development. Consequently, development of the park will require both the private and public sector to address new and different issues, potentially entailing an increased investment in time, education and/or money. While other programs in this strategy are designed to alleviate those increased investments, current barriers to conventional development in the City should be removed, to provide support to the development community that will undertake construction of the park. Thus, this program is designed

to directly address B2: Uncertainty & Time, by specifically reducing the unpredictability and difficulty of the City's development approval process.

**Lead Actor Role(s):**

The Economic Development and Planning Departments would assume the lead role in providing the one-window approach to applicants. Staff from each department should be made available to assume responsibility as the prime contact for project proponents. On a high level, responsibility may be divided between the Economic Development and Planning Departments based upon the proponent. Namely, if the proponent is a business seeking to locate with the City of Hamilton, a representative from the Economic Development Department would assume responsibility as the primary contact. Conversely, if the proponent is from the land development industry, seeking to construct a project on speculation, or without a firm commitment from an end-user, a Planning Department representative would become the point of contact. Of importance, there should be more than one staff member familiar with the files of a primary contact, thus in the event of a staffing change, the files are not delayed mid-process.

**Potential Partner Role(s):**

Not applicable

**Monitoring:**

The best monitoring for this program would be based upon proponent or applicant feedback, following the approval process. Responses should be reviewed, perhaps on an annual or biannual basis, and the program adjusted accordingly, if necessary.

### **S3: Development Permit System**

#### **Rationale:**

The implementation of a DPS directly addresses the concerns of several stakeholders. According to QG<sub>2</sub>, planning and zoning to lay the framework for a new industrial park is the most important of the initial municipal actions to promote sustainable industrial park development. Moreover, IA<sub>3</sub> indicated that expectations must be made clear at the onset of the development, and early in the approvals process for individual projects, so as to ensure that development is not delayed or deterred. The DPS will address this issue by ensuring that the requirements for development are clear and readily accessible, at the onset of each individual project. PC<sub>2</sub> also noted that the vision needs to be implemented in a certain and not “overly dramatic manner, because anything done that will shift or augment the way business is done will have an impact on the development of the park, and the implications of such decisions needs to be understood. For example, if a higher density is required, it must be considered what that will do to restrict or turn away certain users.” who furthered this point, stating that policies pertaining to the park’s development “should not be exclusionary,” but incentivize or support desired forms of development. Firstly, the vision is not designed or intended to be exclusionary, but instead to encourage and support a range of industries to adopt green business practices. Moreover, the manner in which the DPS is recommended to be established should also address these concerns. Furthermore, the DPS enables flexibility in implementation, through the establishment of permitted and conditionally permitted uses, the setting of minimum and maximum zoning standards, and the establishment of conditional variances from those set standards. Other stakeholders indicated very specific concerns. AG<sub>2</sub> for example stated that “there is not a lot of attention being paid to building footprint,” and questioned how to promote the more efficient use of land. The DPS would serve to, at the very least, remove a barrier to multi-storey buildings within the

industrial park, by permitting such uses in the zoning bylaw. It could also promote more efficient land use by incorporating land efficiency into the evaluation criteria of an application. Due to these features of the DPS, these types of stakeholder concerns would be addressed by its establishment.

As highlighted in the program description, the Development Permit System has been explicitly designed by the Provincial Government to enable municipalities to achieve community visions through the development application and approval process. In respect to the vision for the AEGD, it was demonstrated that all vision elements pertaining to the built environment could be readily achieved, or at least promoted, through the DPS process. Furthermore, some elements pertaining to the ongoing operations and functions of the park could also be influenced by the DPS. Thus, the establishment of a DPS could be designed to further V<sub>1</sub>: Waste Redefined, V<sub>2</sub>: Health & Well-being, V<sub>3</sub>: Conservation, Enhancement & Integration, and V<sub>4</sub>: Economic Competitiveness & Workforce Attraction & Retention. It would provide the foundation for the attainment of V<sub>5</sub>: Culture of Sustainability. Thus, the institution of a DPS for the AEGD should be considered a fundamental component of the overall municipal strategy to realize the development vision.

The implementation of a Development Permit System would also address a number of barriers to the vision. Plainly, the DPS would mitigate issues related to B<sub>2</sub>: Uncertainty & Time by ensuring the development approval process is predictable and straightforward from the onset of the process. Furthermore, by combining three processes into one approval, the DPS ensures that municipal decisions are rendered faster, within 45 days compared to 120 days for a rezoning, 30 days for site plan approval and 30 days for minor variances. Additionally, as the official plan and zoning bylaw would include provisions for sustainable development, it is highly unlikely that a green feature of a proposed project would cause an approval delay.

B<sub>4</sub>: Resistance to Change would be assuaged through the implementation of a DPS, by ensuring that the vision is clearly elucidated and incorporated into municipal policies and bylaws. The policies, which would emphasize the overall sustainability of the development, would also provide regulatory support for innovative project proposals.

B<sub>6</sub>: Market Demand would be addressed by the DPS as the process would strongly emphasize the incorporation of green building and site design measures, and the inclusion of such features could be contained in the evaluation criteria for each application. Thus, even private sector developers building on speculation could be compelled to include green features into their projects.

The variance provisions in the development permit bylaw would provide some degree of development flexibility, mitigating the B<sub>7</sub>: Economic Development barrier that rigid enforcement of the vision would stifle development. Barriers identified under B<sub>9</sub>: Regulatory would also be directly addressed by the process of establishing the DPS, as both the official plan and zoning documents would be amended to reflect the vision, and thereby sustainable industrial park principles. Additionally, while a secondary issue, the DPS process could be tailored to augment the employment vision established in the official plan, through permit application evaluation criteria and permit conditions, thereby encouraging companies locating within the park to implement green construction and business practices.

Finally, B<sub>11</sub>: Symbiosis would be addressed, as the DPS process could require the information to compile a database of each company's inputs and byproducts, that would in turn serve to facilitate the establishment of symbiotic exchanges throughout the park. The database would serve a further purpose, by cataloguing the redundancy and quantity of each resource, thereby quantifying the stability and reliability of a given exchange.

**Lead Actor Role(s):**

The planning department would be largely responsible for the establishment of the Development Permit System, its implementation and administration. Council would need to approve the creation of a project coordinator position and allocate the necessary municipal staff required to develop the DPS. Furthermore, Council would need to approve a budgetary allowance for costs associated with the establishment of the DPS, including staffing, public consultation and professional consulting costs.

**Potential Partner Role(s):**

The Economic Development Department would be well suited to manage the database of inputs and byproducts and to act as an initial liaison between businesses when potential matches are identified.

**Monitoring:**

The effectiveness of the Development Permit System should be monitored from two perspectives. Firstly, the efficiency of the system should be tracked, to ensure decisions are being rendered in a consistent and timely manner. Secondly, over the long-term, the effectiveness of the DPS in achieving the development objectives should be monitored. Due to the specificity of the DPS, quantitative indicators should be utilized, such as the frequency a range of green building measures are fulfilled throughout the park, such as vegetated roofs or the use of locally sourced and reclaimed building material. Another indicator might be the number and significance of symbiotic exchanges facilitated by the database submission and review process. Should negative discrepancies be noted between the vision outlined in the official plan and the actual outcome of development, the DPS should be amended to address any identified areas of shortfall.

## **S4: Municipal Engineering Standards Review**

### **Rationale:**

While relatively indirect compared to other programs within this strategy, changes to the municipal engineering standards specifications will serve to further several elements of the vision. First of all, permitting smaller pipe capacity for watermains and sanitary sewers would help to ensure that V1: Waste Redefined is fulfilled, as potable water consumption and wastewater discharge would need to be reduced by the enduser.

Realization of V3: Conservation, Enhancement & Integration would also be advanced through this program, as initiatives such as the creation of wet ponds or wetlands could actually enhance elements of the local natural environment. Furthermore, many of the servicing techniques that are more environmentally sound are also less costly to install. For example, reducing the capacity of watermains and sanitary sewers would entail smaller diameter pipes, which are consequently less expensive.

The program would also mitigate B2: Uncertainty & Time, as the regulatory framework for site servicing would enable green servicing features to be implemented without costly and/or time-consuming regulatory hurdles to overcome. Similarly, a significant impediment to the implementation of more sustainable forms of servicing, noted in B9: Regulatory would be directly removed, as the possibility of development delays would be eliminated for projects incorporating green servicing technology or techniques.

### **Lead Actor Role(s):**

The Public Works Department would assume primary responsibility for overseeing the review of the municipal engineering standards specifications to identify areas in which more sustainable



technologies and techniques may be permitted or required. The Planning Department would assist in the process, particularly by ensuring that the study is congruent with the development vision for the AEGD.

**Potential Partner Role(s):**

Professional consultants would likely be hired to complete the study and recommendations. Private sector industry representatives should be consulted during the course of the study, to ensure that the new specifications meet industrial needs, while promoting realization of the vision.

**Monitoring:**

Actual site servicing should be monitored to ensure that the intent of the changes to municipal engineering standards are achieved, that more sustainable forms of site servicing are not encountering regulatory barriers, and that the infrastructure is functioning in accordance with sustainability principles. Any noted discrepancies should be addressed accordingly.

**S5: Built Environment Education, Resources & Outreach**

**Rationale:**

Stakeholder feedback during the interview process made it clear that useful resources, targeted education and ongoing communication and outreach were essential to realizing the vision. Many sustainable industrial park principles for the built environment require unconventional technologies and techniques to be implemented effectively. Furthermore, successful realization of the vision will require collaboratively coordinated development, thus all stakeholders need to have a strong understanding of the vision as well as the resources and knowledge they require to implement it. This program is designed to address these challenges on an ongoing basis, and to adapt to stakeholder needs as the development progresses.

This program would directly apply to the realization of several elements of the vision such as V<sub>2</sub>: Health & Well-Being by helping to ensure the park is developed, built and operated in a manner that positively impacts employee and community health and well-being. This program would also directly apply to V<sub>3</sub>: Conservation, Enhancement & Integration and V<sub>4</sub>: Economic Competitiveness & Workforce Attraction & Retention as the program should focus upon promoting a modern, adaptive development that respects the natural heritage of the environment and makes efficient use of the land. Finally, municipal initiatives to raise awareness about the sustainable industrial park should help to foster a culture of sustainability as described in V<sub>5</sub>.

Further demonstrating this program's importance, it would directly address numerous barriers to the vision. Each of the three main components of this program, namely education, resources and outreach, are essential, as they aid in overcoming different barriers or address the same barriers in different ways.

The first barrier addressed by this programs would be B<sub>2</sub>: Uncertainty & Time. The educational initiatives should be designed to address elements of this barrier by providing best practices pertaining to the built environment of sustainable industrial parks and by reducing the likelihood of construction delays pertaining to green features by providing information and knowledge about green building processes such as LEED certification. Resources such as guidelines will also reduce the likelihood of delays and uncertainty, particularly pertaining to the development approval process. Finally, as the development progresses, the outreach component of the program may help to reduce uncertainty as success stories are publicized and lessons learned are critically analyzed and applied constructively to future phases of the development.

The second barrier to be addressed would be B3: Stakeholder Collaboration and Support, namely that this program, particularly through the educational workshops such as “Understanding the Vision” and outreach and public communication efforts, should reach a wide range of stakeholders, this will help to build a broad-base of awareness of the vision and the support mechanisms in place for its practical implementation.

The third barrier that would be attended to by this program would be B4: Resistance to Change. Educational courses and workshops would help to overcome entrenched thinking by providing practical and accessible information about unconventional building designs, technologies and techniques that improve the environmental, social and economic performance of the construct over its life-cycle. For the same reason, though to a lesser extent, these same courses and workshops should help to overcome organizational inertia, however political will and strong management strategies would be of equal or greater importance to overcoming this barrier. Finally, the courses and workshops should help quell resistance by ensuring the vision is unambiguous and a clear path to its implementation is communicated.

An element of B5: Human Resource Capacity would be the fourth barrier this program would address. The resources and educational support needed for organizations to overcome the learning curve associated with unconventional building and construction technologies and practices.

Several elements of B6: Market Demand would also be addressed by this program, especially through outreach initiatives designed to market the vision, and through the guidelines. These components of the program should increase the number of companies willing to pay a premium, if necessary, for green features and increase the demand for development in a sustainable industrial park, by elucidating the benefit both economic and otherwise, of incorporating such principles. For the same

reason, in combination with the resource and outreach initiatives, the educational workshops would also address an element of B8: Financial by helping to reduce the negative bias towards sustainability initiatives that may initially cost more than conventional means of building.

**Lead Actor Role(s):**

The Planning, Sustainability and Economic Development Departments of the City should be responsible for determining which topics should be addressed and what content should be included in the three components of this program, namely education, resource and outreach initiatives. Planning and Sustainability would likely assume primary responsibility for the education and resource components, ensuring these initiatives are aligned with the vision for the sustainable industrial park and integrated with other programs within the municipal plan of action such as the Eco-Principles Development Approval Process and the Community Improvement Program. All three departments should be involved in the outreach component of this program, however Economic Development should take the lead on this aspect.

**Potential Partner Role(s):**

There are two types of partners. The first are those that could provide assistance in the development of or that have already created educational courses and workshops that are pertinent to the sustainable industrial park. An example is the CaGBC, an organization that offers workshops pertaining to LEED certification. Another example is the TRCA, a quasi-governmental organization that has been a lead partner in the development and implementation of the Pearson Eco-Business Zone strategy, and has expressed a willingness to present that experience, including lessons learned, to elected officials and staff of the City of Hamilton. Other partners that may assist in this manner might include experienced developers, builders and support professionals. The second type of part-

ner involve those organizations that could help the municipality disseminate information pertaining to the sustainable industrial park development. For example the RAHB would be able to reach commercial realtors to inform them of upcoming workshops pertinent to the future development of the park, or to provide them with updates on the progress of the development. These avenues of communication should enhance the success of this program.

### **Monitoring:**

The success of this program may be difficult to monitor. On the one hand, it should be simple to quantify the number of workshops offered, attendance at those workshops, the size of any e-mail distribution lists for development updates. However, these measures will not indicate the effectiveness of the program's initiatives. Thus the best means of evaluating this program would likely be to seek feedback about the program initiatives from participants in workshops and periodically from active stakeholders directly involved with the development and construction of the sustainable industrial park. This feedback should indicate if the scope, focus or detail of the program content needs to be changed or adjusted.

## **S6: Municipal Leadership Program**

### **Rationale:**

Once fully implemented, the municipal leadership program should advance a wide range of vision objectives. Firstly, the way in which the municipality services the site should address V1: Waste Redefined, by providing for the looping of resources. Furthermore, should the municipality deem a district energy, heating and cooling system is viable, such a system would also serve to mitigate environmental impact, enhance process efficiency and provide a relatively inexpensive source of energy, heating and cooling for consumers.

Realization of V<sub>2</sub>: Health & Well-being is the second part of the vision to be advanced by the recommended initiatives of this program, primarily through the creation of natural and recreational amenities for both employees and the wider community to enjoy. Additionally, should the central services building be constructed, the fitness as well as healthy commute opportunities it would provide would have a positive impact upon employee health.

Thirdly, this program will comprehensively address V<sub>3</sub>: Conservation, Enhancement & Integration by helping to preserve and enhance significant natural areas and by providing appropriate opportunities for the community to access those areas. The municipality's investment in providing the foundation for a sustainable industrial park should augment the long-term economic sustainability of the park as demand for corporate environmentally sound and economically efficient services is likely to increase over time. The municipality's financial resources may also be leveraged by private sector partnerships, which should positively contribute to the short-term viability of some municipal eco-initiatives. Finally, this program offers an opportunity to integrate some of the cultural and economic assets of the City, for instance by providing a venue for a local farmers market.

Finally this program would further V<sub>4</sub>: Economic Development & Workforce Attraction & Retention by providing facilities and amenities that would improve the quality of time spent onsite by employees. Alternative transit infrastructure and healthy commute facilities should provide for viable employee and visitor transportation options. Additionally, municipal efforts to evaluate and implement an integrated multi-modal goods movement system will improve the efficiency of goods movement to and from the site. Furthermore, the City's commitment to sustainable employment lands development would be tangibly demonstrated through this program's undertakings, thereby helping

to position the City as a national and even global leader sustainable industrial park development and potentially creating greater economic development opportunities for the municipality.

The municipal leadership program would also be instrumental to overcoming a number of barriers. First and foremost, this program would require commitment on the part of the council and staff, its adoption and implementation would not only inherently address the barrier B1: Leadership, but would also tangibly demonstrate the City's commitment and resolve. Municipal capital projects undertaken collaboratively with the private sector that contribute to the realization of the vision should help to assuage potential mistrust or wariness of government involvement in other matters of the park's development and operations, thereby addressing B3: Stakeholder Collaboration & Support.

This program would be well structured to contribute to the surmounting of B4: Resistance to Change. Firstly, municipal leadership should help to overcome entrenched thinking, particularly amongst other stakeholders, through the demonstration of tangible projects incorporating eco-development principles. On another note, the environmental sensitivity of the area has been highlighted as a major constraint to development, resulting in numerous swaths of land being deemed inappropriate for development within the Airport Employment Growth District (AEGD). However municipal initiatives focused upon environmental protection and enhancement could capitalize upon this situation as an opportunity to ensure development proceeds compatibly with the natural environment and provides natural amenity space for employees, ensuring that this industrial park will be unique amongst many of its predecessors and contemporary counterparts. This should, in turn, help the municipality attract sought after industries to locate within the City, noted as an uncertain municipal capability in B7: Economic Development.

Finally, the projects undertaken for this program will work within a B12: Site Specific constraint, namely that as a result of the environmental sensitivity of the area, the threshold of risk for new technologies and techniques is limited. An assessment and evaluation of the environment impact of each alternative method of site servicing or building design should be undertaken to determine the best technology or technique to employ, whether traditional or unconventional, given the specific conditions of the site.

**Lead Actor Role(s):**

Municipal staff in the planning and public works departments would be responsible for bringing opportunities for municipal leadership projects and initiatives to the attention of council and for providing an explanation and rationale for their pursuit. Council would be responsible for evaluating the opportunities, enabling staff or consultants to fully assess the viability of pursuing the opportunity, and finally voting to undertake or abandon the initiative. The successful realization of the vision largely depends upon the leadership and resolve demonstrated by City Council, thus the municipality should capitalize upon opportunities to lay the foundations for the park to develop as envisioned.

**Potential Partner Role(s):**

The Hamilton Regional Conservation Authority may be an ideal partner for projects that are focused upon protecting and enhancing significant natural areas, and also for the development of natural trails and walkways. Public private partnerships may be established with the development and construction industry to undertake some of the capital projects. Property management companies may partner with the municipality in the administration and maintenance of the centralized park



amenity building, and there should be one or more private sector companies that could locate within the building, providing services to park employees and visitors.

### **Monitoring:**

Monitoring of this program would be largely subjective, as projects undertaken by the municipality will be at the discretion of Council. Qualitative accounts of the initiatives pursued and their outcomes will likely serve as the main standard of evaluation. Indeed the success of this program, and ultimately the realization of the vision as a whole, will firstly rest upon the decisions of Council, then upon the effective execution of the approved projects.

## **S7: Funding Search & Solicitation**

### **Rationale:**

The receipt of outside sources of funding for eco-development measures and green business practices will undoubtedly enhance efforts to fulfill the vision. However the specific elements of the vision that will be furthered by the funding are difficult to accurately identify as that will largely depend upon the objectives of each fund. From a broad perspective, each element of the vision should be addressed by the range of funds available. A review of one program that is currently available, namely the Canadian Manufacturers and Exporters SMART Assessment and Funding program provides an example of how these funds would enhance realization of different elements of the vision.

The Canadian Manufacturers and Exporters SMART Assessment program subsidizes a narrowly focused assessment conducted by an expert consultant in one area of potential business improvement within the recipient company. The expert could focus the assessment upon strategies for lean manufacturing, quality improvement, energy efficiency, or environmental impact reduction, amongst other topics. The expert would quantify the opportunities for improvement, design a cor-

rective program and forecast the benefits that should be realized through the implementation of the corrective program. Of further benefit the company may then qualify for funding from the SMART Program, which would provide up to \$50,000 (or 50%) of the implementation costs of the corrective program.<sup>19</sup> Thus this funding program could further several elements of the vision. This would include V1: Waste Redefined as the assessment might focus upon energy efficiency which would increase the amount of energy conserved or cascaded, or lean manufacturing which would seek to minimize inputs required and waste generated by the production process, or the improved environmental impact of an area the company's business practices.

The funding program would also enhance V3: Conservation, Enhancement & Integration, by providing support to businesses seeking to continuously improve their operational business practices towards sustainability. Applying similar reasoning, it would provide support for V4: Economic Competitiveness & Workforces Attraction & Retention by providing funding to identify and implement measures by which resources would be most effectively and efficiently employed.

The initiative to identify and secure sources of funding for the eco-initiatives associated with the park would address one of the most significant barriers to the realization of the vision, namely B8: Financial. First of all, some funding may be available to local levels of government, augmenting municipal investment in implementing the vision. Further addressing the barrier of limited municipal financial resources would be the objective of this program to develop a public private partnership, or to secure private sector sponsorship of certain public projects. The funding would also effectively reduce any negative bias that might arise in response to an increased cost associated with a green initiative, as the cost would be significantly offset by financial stimulus. Comparably, some funding

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<sup>19</sup> More information on this program is available at <http://www.cme-smart.ca>

programs would likely apply to elements of green building, such as energy efficiently, effectively offsetting the upfront increase in cost and augmenting the existing financial case for the incorporation of such measures in the construction and retrofit of buildings. Finally, the perspective that the private sector should not bear responsibility for the costs of all external benefit would be addressed as many of the funds would effectively subsidize the cost of private sector green initiatives.

**Lead Actor Role(s):**

The Economic Development Department would likely be best suited to assume initial responsibility for the creation and maintenance of the online funding database. It would also be well positioned to provide basic support to private sector funding applicants and to coordinate municipal proposals for financial assistance. Over time, the leading organizers of the Park Eco-Affairs Association could share or completely assume the above mentioned responsibilities. The Economic Development Department would likely also coordinate efforts to secure private sector partnership or sponsorship, though other relevant municipal departments would also be significantly involved in the development and solidification of these types of agreements.

**Potential Partner Role(s):**

In terms of the administration of this program, there would not be any partners. Indirectly however, partnerships are inherent to the program in the form of funding agencies or private sector partnership or sponsoring companies.

**Monitoring:**

This program should be monitored in several ways. First of all, a minimum time-span should be set for the review and update of the database, such as every four months to ensure the information is complete, accurate and that all associated URLs are in working order. The date of the last review

and update should also be noted online to reassure stakeholders of its accuracy and relevance. It would also be of value to note how much funding has been secured, the amount of investment leveraged, and the types of projects enabled by the support. This will help to develop a sense as to the success of the funding database. If it is determined that awards and disbursements are low, a review can be conducted to determine if supplementary initiatives, such as advertising the database to relevant stakeholders, or providing more support for the application process, would increase the number of projects receiving funding, and thereby being implemented.

## **S8: Tax-Increment & Permit Fee Earmarking**

### **Rationale:**

This program is primarily recommended as a result of stakeholder input during the interview process, through which concern was expressed pertaining to the loss of agricultural land, and the environmental integrity of the AEGD, post-development. For example, adamant that the viability of farm must be maintained, as Hamiltonians may need to feed themselves locally at some point in the future, CC2 posed the question; “if we are losing agricultural land, how do we compensate for that? Through the conservation of other land?” This program is intended to earmark funds raised as a result of the development to address these concerns. Moreover, this program would directly address elements of the vision. One such element falls under V2: Health & Well-being, namely that opportunities for public enjoyment of natural amenities are available onsite. As such, the fund could support the Municipal Leadership Program initiative focused upon providing natural trails and areas in which both environmental and social benefits are realized. A second element of the vision lies under V3: Conservation, Enhancement & Integration, stating that cultural, economic and demographic assets of the community are integrated into the functions and features of the industrial park in acknowledgment of the interdependent relationship between the success of the park, and that of the

surrounding community. To meet this goal, funds could be directed to integrating the agricultural community with the industrial park. Opportunities to this end include holding a farmers market on-site, supplying catering companies, airlines and airport restaurants with local produce, onsite bio-digestion for energy production, and potentially select crop production on rooftops and building walls. Finally this program would also address the vision element pertaining to the efficient use of financial resources, and the often cited barrier that the municipality has very limited financial resources to pursue the vision, as the fund shall be populated with municipal revenues generated from the development itself.

**Lead Actor Role(s):**

City Council would ultimately be responsible for approving the program and determining which projects would receive funding. The Planning Department would play a lead role, particularly in establishing the Community Improvement Plan whereby the tax-increment could be allocated to the fund. The ideal partner to the Planning Department for development and administration of the funded projects may be the Sustainability Department. Finally, the Finance Department would responsible not only for ensuring the appropriate percentage of tax incremental revenues and permit fees are directed to the fund, but also for managing and disbursing the fund.

**Potential Partner Role(s):**

The Parks and Recreation Department and the Hamilton Conservation Authority should be involved in planning any projects pertaining to the development of natural paths and areas to ensure the optimal balance between ecological and social outcomes. Projects pertaining to the agricultural community should be developed and perhaps implemented in partnership with the Agricultural and Rural Affairs Advisory Committee.

## **Monitoring:**

The fund, and the mechanism to populate the fund, should be created at an early stage of the development, to ensure the designated percentage of all tax incremental revenue and/or permit fees associated with the development are allocated to the fund. Projects to be funded should also be determined early in the process, however the fund may take several years to grow to a point where disbursement may be possible. Quantitative indicators of the program's viability and effectiveness should include:

- Total dollar value within the fund
- Total dollar value/amount to be awarded to projects
- Annual percentage dollar value increase of the fund
- Annual disbursements

Qualitative indicators should include:

- Progress of funded projects
- Results of funded projects

## **S9: Operational Education, Resources & Outreach**

### **Rationale:**

Interview results from stakeholders in the manufacturing industry indicated that businesses are becoming increasingly concerned about the sustainability of their operations, from several perspectives including their economic competitiveness and environmental performance. Indeed all industry representatives interviewed indicated that their company had implemented numerous sustainability initiatives including resource recovery, closing material loops and environmental management systems. However they were quick to note that large companies are better equipped in many ways to implement such measures, as they have greater human and financial resources to dedicate to the matter. For example, IA2 described the development of an EMS as a significant undertaking that requires the dedication of a lot of employee hours. Furthermore, it was noted that most initiatives were

conducted in isolation, at a plant level basis and that collaborative park-wide initiatives such as by-product exchange between companies, or green property management standards, were lacking. Therefore, this program should aim to address both of these issues, specifically by providing support for company sustainability initiatives, particularly to small and medium sized enterprises, and by creating an avenue whereby opportunities for integrated sustainability measures might be identified collaboratively amongst park occupants. For example, an EMS might be established for specific park management activities such as groundskeeping, building maintenance, and snow and ice removal.

Several elements of the vision will be furthered by the implementation of this program. First of all V<sub>1</sub>: Waste Redefined will be directly addressed by this program, as it will be primarily focused upon providing support to companies to conserve and cascade resources such as energy, heat and water and to close material loops, with the goal of mitigating the environmental impact, enhancing the process efficiency and improving the financial performance of operations located within the park. Secondly, this program will promote operations to be conducted in a manner that protects community and employee health and well-being, thereby addressing an element under V<sub>2</sub>: Health & Well-Being. Thirdly, the realization of several elements of V<sub>3</sub>: Conservation, Enhancement & Integration will be promoted through this program, as both educational and resource components focus upon encouraging businesses to continuously improve their environmental performance towards sustainability while also ensuring financial resources are optimally employed. As a result, the economic development of the site, and ultimately that of the City of Hamilton should be augmented, thereby furthering V<sub>4</sub>: Economic Competitiveness and Workforce Attraction and Retention. Finally, this program's design to promote collaboration amongst park occupants should help to foster a Culture of Sustainability as envisioned in V<sub>5</sub>.

Beyond advancing the realization of all five elements of the vision, this program would positively contribute to overcoming numerous barriers. The program would be particularly important in promoting continued momentum towards attaining the vision after the initial development has been completed.

B<sub>3</sub>: Stakeholder Collaboration and Support is the first barrier to be directly addressed by this program. Primarily outreach measures to inform businesses of support available to them should promote program uptake. Furthermore outreach initiatives to highlight and publicize progress towards the vision and outstanding success stories should bolster community stakeholder support. Educational initiatives such as the informal networking events should promote business collaboration, thereby enhancing opportunities for integrated sustainability initiatives to be put into practice.

Secondly, this program would address B<sub>4</sub>: Resistance to Change. All three components of this program would help to overcome entrenched thinking and organizational inertia by providing the necessary information, resources, education and justification to encourage and better enable individuals and organizations to adopt new initiatives to improve the sustainability of their operations. Of particular note, educational initiatives pertaining to developing and implementing an Environmental Management System will directly target organizational inertia by instilling new management objectives, techniques and evaluation criteria that will affect the way in which the organization functions. This program will also serve to mitigate potential resistance to the vision, as it will provide clear strategies and techniques to promote its realization from an operational perspective.

A final barrier this program would apply to would be B<sub>5</sub>: Human Resource Capacity, as it is explicitly created to reach out, educate and provide the necessary resources individuals and companies require to identify and act upon opportunities to improve the sustainability of their operations.



Strategies to implement new technologies or adopt new management systems will be provided through this program, thereby easing the learning curve associated with change.

**Lead Actor Role(s):**

Initially the Economic Development and Sustainability Departments of the City of Hamilton should take the lead role in developing and promoting the educational events and resources available to local companies. As much of the subject-matter would be outside the area of expertise of municipal staff, partnerships should be developed to ensure the program's content is accurate, relevant and delivered effectively. As the sustainable industrial park develops and the Park Eco-Affairs Association is established, this group should assume increasing responsibility in organizing educational events and providing resources. The Economic Development Department should remain involved in the outreach component of this program indefinitely.

**Potential Partner Role(s):**

Private sector consultants and representatives of various companies that have undertaken sustainability initiatives would primarily be involved in ensuring the information provided through this program is in-depth, viable and up-to-date, while being relevant and accessible to the audience, whether technical or non-technical. The TRCA could present its experiences and lessons learned from the Pearson Eco-Business Zone, a project which is focused upon improving the sustainability of the operational aspects of the business located within the area.

**Monitoring:**

Monitoring attendance and demand for this program quantitatively will not likely yield meaningful results. Thus feedback from program participants and businesses located within the sustainable industrial park should be solicited to identify whether the program's content is sufficient and

effective, or whether changes or augmentation are considered necessary or desirable by stakeholders. Statistics and qualitative accounts of operational progress towards the vision should indirectly indicate whether this program is having an effect, however only feedback from stakeholders will indicate if this program has led or enabled them to make changes to their operations.

## **Sto: Park Eco-Affairs Association**

### **Rationale:**

As this program is quite broad in its scope, yet unique in its implementation from other programs in this strategy, it would be requisite to the achievement of numerous features of the vision. Firstly, the association would be instrumental in championing initiatives to meet V1: Waste Redefined, particularly through their partnership with local educational institutions to identify opportunities for symbiosis whereby energy, heat, cooling and water would be conserved and cascaded and material loops could be closed. The adoption of the recommended initiatives would aid in the fulfillment of V2: Health & Well-being by promoting a healthier environment for employees, visitors and the community, through the procurement of low volatile organic compound (VOC) products and eco-friendly landscaping and cleaning services through the green purchasing bloc, the reduction of emissions and discharges through the promotion of green business practices, and potentially through community outreach initiatives.

The symbiosis opportunities initiative alone would help to ensure that elements of V3: Conservation, Enhancement and Integration are furthered, by continuously identifying new opportunities for waste reduction through symbiosis, and by improving the financial efficiency of firms by reducing virgin resource inputs and finding markets for previously unexploited byproducts. The association's efforts to build collaborative relationships amongst companies, and to involve outside

stakeholders through communication and outreach initiatives would also contribute to the continuous improvement of the sustainability of business practices.

The inherent nature of the association mandated to enhance the sustainability of the park operations, will contribute to the attainment of V<sub>4</sub>: Economic Competitiveness and Workforce Attraction and Retention by working to ensure the operations of the park are modern, adaptive and make the most effective and efficient use of resources. Initiatives to create opportunities for networking and relationship building between companies will further enhance the likelihood of collaborative innovation occurring, escalating the locational advantages of the industrial park on the national and global scale. Furthermore, the ride-share and alternative transportation strategies program will promote a wide-scale adoption of a more efficient, healthy and environmentally friendly commute.

Finally, the existence of the association itself, along with its activities such as those to reach out to the community and foster collaborative relationships amongst park businesses will help to establish V<sub>5</sub>: a Culture of Sustainability. The association's initiatives should be of broad scope, and permeate all collective, or potentially collective aspects of the park's functions and operations, thereby serving as a continued momentum towards its overall sustainability.

The functions of the association would also address numerous barriers to the actualization of the vision. Through the various roles of the association, as collaborator, partner, organizer, liaison and ambassador, a wide range of stakeholders would be encouraged to become involved in working towards attaining the vision. In addition as noted in B<sub>3</sub>: Stakeholder Collaboration & Support businesses may not trust or welcome government involvement in new arenas, thus the association, led in partnership between private sector representatives and a public sector champion, would assume an important role in overcoming this barrier. Indeed, it was noted in the interview with QG<sub>2</sub>

that many private companies were hesitant to become involved with the public agency project to create the Pearson Eco-Business Zone, but that many were convinced the partnership could work by the endorsement and involvement of the Greater Toronto Airport Authority, which is the not-for-profit corporation that manages, operates and maintains the Toronto Pearson Airport.

Secondly, the initiatives of the association should help to mitigate B<sub>4</sub>: Resistance to Change and offset B<sub>5</sub>: Human Resource Capacity challenges. Entrenched thinking and organizational inertia should be attenuated by not only the general culture of sustainability promoted by the association's actions, but through specific programs designed to provide organizational and practical support to companies seeking to adopt greener business practices. For example, the liaison role between businesses and the public sector is important to the ultimate realization of a sustainable industrial park, as many companies, particularly SMEs lack the resources or time to pursue the matter individually.

One of the most important functions of the association would be that of quasi-property management for the park as a whole. This significant barrier to the realization of the vision was noted in B<sub>10</sub>: Property Management as most industrial parks in Canada lack a park-wide management structure, due to varied ownership structures within the park. As such, the association would play a unifying role in encouraging and facilitating sustainable property management techniques. Furthermore, the association would act with a comprehensive view of the entire park, thus larger-scale initiatives could be coordinated, that might otherwise not be identified, assessed or undertaken, by park businesses or management firms with a smaller scope of concern.

Finally, the association would clearly address B<sub>11</sub>: Symbiosis through its partnership initiative with companies within the park and local educational institutions. The research conducted by students would serve to identify and quantify the inputs and waste streams of each participating com-

pany, and to calculate cost estimates associated with that resource consumption and waste. This information in turn, would be valuable in the identification of potential byproduct synergies, the economic viability of the exchange. Furthermore, the research would serve as an indicator as to the relative stability and reliability of the symbiotic network by categorizing the quality, quantity, reliability the redundancy of the resource within the system. Finally, this information could and should be managed in such a way as to ensure the confidentiality of company identified trade secrets and process information. By involving a third party, such as the educational sector, this information could be maintained at arms-length from participating companies and other stakeholders, and only acted upon with the agreement of all parties involved in the potential symbiotic relationship.

**Lead Actor Role(s):**

The composition of the association would be twofold, namely involving the collaboration of a public sector champion and a private sector proponent, along with the membership of other companies located within the sustainable industrial park. Over time, the role of the private sector proponent would likely become more diffused, as leadership could be rotated amongst member companies. The public sector champion would likely become involved in initiatives pertaining to the economic and environmental sustainability of the park itself, thus participating in the development and administration of programs designed, for example, to establish a symbiotic network. The private sector proponent would assume several roles which would include building a practical, collaborative relationship with the public sector champion, partnering in the implementation of eco-initiatives, particularly those in the early stages of the association, and serving to recruit companies to join the association. An potential partnership that may prove effective for the AEGD would be the Hamilton Conservation Authority and TradePort International Corporation, the private company that holds a long-term lease to operate the Hamilton International Airport. This arrangement would closely mir-

ror the primary actors in Partners in Project Green, the proponents of the Pearson Eco-Business Zone. To ensure the Park Eco-Affairs Association comes into being, the Economic Development Department of the City of Hamilton may have an important advocacy and liaison role to bring partners together to form this beneficial group. In the event that another public agency is not able to undertake a leading partnership role, the Economic Development Department may indeed assume the role of public sector champion.

**Potential Partner Role(s):**

The potential partnerships are broad in number and responsibility. Each partnership would depend entirely upon the nature and objectives of each eco-initiative. Partners might offer human or financial resources, expertise and advice, or influence or authority to remove a barrier to the implementation or fulfillment of an initiative.

**Monitoring:**

From a municipal perspective, the basic level of monitoring would be to ensure that an association with the objective of improving the sustainability of park practices has been established and is active. Should key initiatives not be undertaken by the association within a reasonable time period, such as one to establish a symbiotic network, the municipality should investigate how to stimulate fulfillment of this element of the vision and act accordingly to the findings of that inquiry.

## APPENDIX SEVEN: STAKEHOLDER PARTICIPANT CODES

#	Stakeholder Type	Organization (if applicable)	Code
1	Public Sector	Hamilton City Council	CC1
2	Public Sector	Hamilton City Council	CC2
3	Public Sector	Hamilton City Council	CC3
4	Public Sector	Hamilton Planning Department	HS1
5	Public Sector	Hamilton Economic Development Department	HS2
6	Public Sector	Hamilton Public Works Department	HS3
7	Quasi-Governmental	ICLEI: Local Governments for Sustainability	QG1
8	Quasi-Governmental	Toronto Regional Conservation Authority	QG2
9	Quasi-Governmental	Hamilton Chamber of Commerce	QG3
10	Advocacy Group	Hamiltonians for Progressive Development	AG1
11	Advocacy Group	Environment Hamilton	AG2
12	Industry Association	Supply Chain and Logistics Association	IA1
13	Industry Association	Hamilton Industrial Environmental Association	IA2
14	Industry Association	Real Estate Association of Hamilton-Burlington	IA3
15	New Local Industry	Confidential	LI1
16	Hamilton International Airport	Tradeport International	HI1
17	Planning Consultant	Dillon Consulting	PC1
18	Planning Consultant	CN Watson & Associates	PC2
19	Planning Consultant	Eco-Industrial Solutions	PC3
20	Developer/Builder	Confidential	DB1
21	Developer/Builder	Confidential	DB2
22	Developer/Property Manager	Confidential	DP1
23	Citizen of Hamilton	Confidential	CH1
24	Citizen of Hamilton	Confidential	CH2