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Brownfield Redevelopment versus Greenfield Development: A Private Sector Perspective on the Costs and Risks Associated with Brownfield Redevelopment in the Greater Toronto Area

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ABSTRACT *This paper examines the nature of the economic costs and risks involved in brownfield versus greenfield redevelopment in the Greater Toronto Area (Ontario, Canada) from a private sector perspective, and assesses the potential effectiveness of different policies and programmes designed to attenuate associated costs and risks. Through interviews, case-studies and an analysis of hypothetical development scenarios, it has been found that the perception that brownfield redevelopment is less cost-effective and entails greater risks than greenfield development, on the part of the private sector, is true for industrial projects in the province, but not for residential ones, which were found to be feasible, given the assumptions of the present study. Furthermore, the study has found that the attractiveness of residential brownfield projects can increase considerably with minor policy changes, but that promoting industrial redevelopment will require a more vigorous approach that employs a variety of environmental policy and economic development measures.*

Introduction

In cities throughout North America and Europe, the legacy of a negligent industrial past has left its scars on the urban landscape in the form of countless underused or abandoned industrial and commercial properties, commonly referred to as 'brownfield' sites. Traditionally, interest on the part of developers, landowners and other private sector stakeholders in putting these sites back into productive use has tended to be minimal because of the fear that they may be contaminated, thus making them too expensive, time-consuming and risky to redevelop profitably. This is compounded by the developers' fear of future liability for any adverse effects that could arise subsequent to redevelopment. By and large, developers are often unwilling to invest in such sites, especially since they can still find many greenfield areas in the urban periphery.

Understandably, policy makers at all levels of government are interested in getting the brownfield sites back into productive use, which could clearly go a long way towards revitalizing urban areas. However, governments cannot at present face the prospect of remediating the plethora of brownfield sites in

urban centres without the assurance of private investment. To attract such investment, governments throughout the USA and Europe have, over the last few years, implemented a variety of innovative environmental and economic policies and programmes designed to lessen the costs and risks associated with brownfield redevelopment (Cairney, 1995; Bartsch *et al.*, 1997; Syms, 1997; Simons, 1998). However, Canada is moving more slowly than the USA and Europe in implementing appropriate policies and programmes, largely because of the deeply ingrained perception among many policy makers that the redevelopment problem is one that can best be solved by the private sector itself without government interference and/or support (De Sousa, 2000). Although a handful of researchers have recently been attempting to combat this mindset, there is still little interest within Canada in resolving the brownfield problem, as the gaps in the relevant literature make conspicuously obvious.

The purpose of this paper, therefore, is to examine the nature of the economic costs and risks involved in brownfield redevelopment in one jurisdiction in Canada, namely the Greater Toronto Area (GTA), and to assess the effectiveness of different types of policies and programmes designed to alleviate costs and risks. Specifically, the paper will seek answers to three primary research questions.

1. Is brownfield redevelopment perceived as being less cost-effective and more risky than greenfield redevelopment for developers, landowners and other private sector stakeholders in Ontario?
2. Do the perceived costs and risks differ significantly from the actual costs and risks for both residential and industrial brownfield redevelopment projects?
3. Which policies and programmes are best able to mitigate the cost and risk factor?

Through interviews, case-studies and an examination of hypothetical development scenarios, the objective here is to flesh out which costs and risks on the part of developers, landowners and other private sector stakeholders continue to be an obstacle to redevelopment and, then, to determine which policies make the most sense for these key stakeholders.

Relevant Background Information

This paper focuses primarily on the situation in the GTA, which includes the city of Toronto and the four surrounding regional municipalities of Durham, Halton, Peel and York. The GTA has a population of over 4.6 million, with the newly amalgamated (in 1998) city of Toronto as its urban core (population 2.3 million). The core includes the former cities of Toronto, North York, Etobicoke, Scarborough and York, and the borough of East York (see Figure 1).

Although the terms 'brownfield site' and 'contaminated site' are often used interchangeably in the scientific literature, a brownfield site is characterized by several key differences with respect to a contaminated site. By definition, a contaminated site is generally one that has soil, groundwater or surface water containing contaminants at levels that exceed those considered safe by regulators. The distinction is often made between known contaminated sites, which have undergone testing, and potentially contaminated sites, which are suspected of being contaminated because of their previous land use (i.e. waste disposal, manufacturing, petroleum based activities or dry cleaning, etc.). On the other

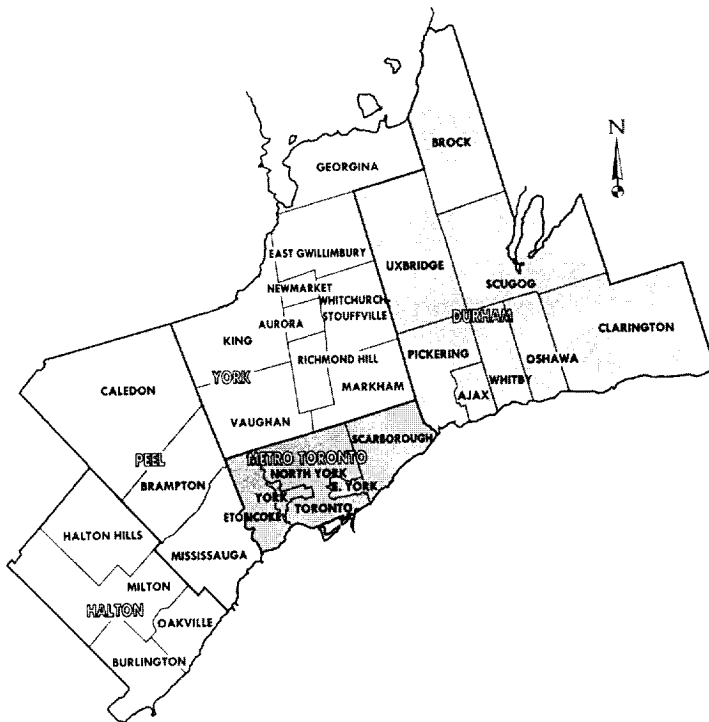


Figure 1. The GTA. Source: GTA Task Force (1996).

hand, brownfields are defined by the US Environmental Protection Agency (1997) as "abandoned, idled, or under-used industrial and commercial facilities where expansion or redevelopment is complicated by real or perceived environmental contamination". Brownfields, therefore, refer to both known and potential contaminated sites. Today, those in the private sector generally prefer the term 'brownfield' because it avoids the negative connotations associated with the word 'contaminated' and it constitutes a semantic counterpart to 'greenfield' (a clean agricultural or open land site located in the periphery).

The brownfield problem exists in virtually every industrialized nation because of the migration of industries from the city to greenfield areas over the last four decades, leaving the inner core typically with innumerable under-utilized or vacant industrial sites. It has been estimated that 25% of the land in major Canadian cities is potentially contaminated from historical industrial use (Benazon, 1995). Unfortunately, as with most Canadian cities, the city of Toronto does not have a brownfield inventory to identify the location and magnitude of the problem. The best brownfield estimate for the city of Toronto comes from a recent study by Hemson Consulting (1998), which concludes that there are 865 acres (350 ha) of brownfield lands, defined as "vacant lands within older employment [industrial] areas (where existing building stock dates from the 1970s or earlier) and where the supply of vacant land is primarily that which was previously developed for employment [industrial] uses".

The reasons for remediating and redeveloping these sites are documented abundantly, and encompass a broad range of environmental, social and econ-

Table 1. 'Sustainable development' objectives pertaining to contaminated/brownfield sites*Environmental benefits*

- Reduction of development pressure on greenfield sites
- Protection of public health and safety
- Protection of groundwater and soil resources
- Restoration of former landscapes and establishment of new areas of ecological value
- Enhancement of environmental quality (land, air, water)

Social benefits

- Renewal of urban cores
- Elimination of the negative social stigmas associated with the affected communities by revitalizing them
- Reduction of the fear of ill health, environmental deterioration and shrinking property values in these communities

Economic benefits

- Attraction of domestic and foreign investment
- Restoration of the tax base of government
- Increased utilization of existing municipal services

omic problems as specified under the theoretical rubric of sustainable development (Table 1) (European Commission, 1996; Bartsch *et al.*, 1997; National Round Table on the Environment and the Economy (NRTEE), 1998).

Currently, the regulation of brownfield redevelopment in Canada is largely the responsibility of the provincial/territorial and local governments. These governments employ an approach whereby clean-up and redevelopment are held to be the responsibility of the private sector, with governments playing primarily a regulatory and advisory role (De Sousa, 2000). In Ontario, the Ministry of the Environment can order the remediation of a brownfield site through the Environmental Protection Act; however, the assessment and remediation of brownfields are largely voluntary processes as laid out by the Ontario Ministry of the Environment's (1996) *Guideline for Use at Contaminated Sites in Ontario*. The guideline advises property owners and other parties on how to assess the environmental conditions of property and whether or not clean-up is required. While not legally enforceable, following the guideline makes it possible to avoid having a development permit or approval denied, to avoid having financing rejected and to decrease liability risks. In general, proponents interested in redeveloping a site are required to: (1) assess soil quality at a site and develop a remedial work plan (wherever applicable); (2) remediate it in accordance with government-approved criteria, which allow for background, generic (end-use based) and site-specific (risk assessment based) clean-up; (3) make provisions for any future liability (given that none of the provincial governments in Canada currently protects those undertaking remediation from it); and (4) finance all or part of the remediation process, whether or not they were responsible for the contamination. In contrast to most US jurisdictions, Ontario does not currently have a permanent funding programme for helping developers rehabilitate urban brownfield sites, nor does it make available any formal incentive mechanisms (e.g. tax incentives or loan pools) for attracting private investment to brownfields. Moreover, there is little technical guidance to private investors and no public protection from future liability.

Literature Review

By and large, the scientific literature on the brownfield issue in Canada is rather scant, especially in the domain of applied (practitioner-oriented) matters. The few studies that do exist have focused primarily on scientific/technical aspects of site remediation (Gaudet *et al.*, 1992; Sheppard *et al.*, 1992; Benazon, 1995; Smith & Stanley, 1995) or, to a lesser extent, on policy making (Ford *et al.*, 1994; Therrien, 1995; De Sousa, 2000). Although the amount of scholarly research on brownfield redevelopment is limited in Canada, government agencies such as the Canadian Council of Ministers for the Environment and the NRTEE have been more active in this field. In 1992, the NRTEE set up a financial services programme with the task of identifying the main barriers to brownfield redevelopment and suggesting practical solutions for overcoming them through a joint effort of the financial services sector, governmental agencies and the business community. The NRTEE has since drafted several reports, three of which constitute pivotal background studies: *The Financial Services Sector and Brownfield Redevelopment* (1996), *Removing Barriers: Redeveloping Contaminated Sites for Housing* (1997) and *State of the Debate: Greening Canada's Brownfield Sites* (1998). The first report explores the opportunities, barriers and solution strategies associated with brownfield redevelopment from a lender's perspective, the second undertakes a similar examination from the perspective of both the government and the developer with regard to housing development and the third is a synthesis of all the research undertaken by the NRTEE on the issue. The main value of these reports lies in the fact that they provide relevant background information, and an exploratory classification of the main issues surrounding brownfield redevelopment in Canada and of the different policy tools available to address the problem. Although both public and private stakeholders throughout Canada associate brownfield redevelopment with a host of benefits, they nevertheless continue to voice concern over a series of key issues (NRTEE, 1998), including:

- the lack of clarity and uncertainty created by different environmental laws throughout the country related to environmental liability and clean-up responsibility;
- the application of joint-and-several liability, whereby one party can be held liable for the entire clean-up, regardless of its specific contribution to the pollution of the site;
- the implementation of complex scientific standards governing clean-up;
- the limited availability of insurance options;
- the lack of information and funding with respect to orphan sites;
- the lack of information on the environmental condition of land;
- the lack of public information and education on brownfield issues;
- limited government funding, incentives, initiatives and partnerships to assist the private sector.

To tackle these problems, the NRTEE has recommended the deployment of various mechanisms for dealing with issues related to regulation, information systems, clean-up policy, legal liability and financial assistance (NRTEE, 1997, 1998). Although useful for providing an understanding of the problem and for putting forward potential solutions, the value of these reports is limited because they simply identify the relevant issues and list the generic solutions in an uncritical way. The present study aims to fill in the gaps left by these reports,

providing the relevant data and drafting a viable framework for identifying and evaluating potential solutions from the interrelated perspectives of developers and others directly involved in carrying out brownfield redevelopment projects.

Although there is a dearth of information on brownfield redevelopment within Canada, this is not the case in the USA and Europe. As in Canada, most of the attention in those jurisdictions has been directed towards technological and policy-making issues (Cairney, 1995; Meyer *et al.*, 1995; Asante-Duah, 1996; Martin *et al.*, 1996; Page, 1997; Rogoff, 1997; Stroup, 1997; Cairney & Hobson, 1998). More recently, however, there has been a greater effort to examine the relevant economic issues to better identify the 'real-world' problems facing developers and to evaluate methods for dealing with them (Bartsch, 1996; Iannone, 1996; Simons, 1998; Center for Urban Economic Development, 1999). Research conducted by Bartsch and others from the Northeast-Midwest Institute, a non-profit public organization working on US public policy making, by Simons (1998) and by the Center for Urban Economic Development (1999) has shed light on the costs and benefits involved in brownfield versus greenfield redevelopment in that country (Bartsch, 1996; Bartsch *et al.*, 1997; Pepper, 1997). These researchers have found, largely through case-study analysis, that brownfield property redevelopment for any use is hampered by a variety of additional direct costs (e.g. remediation and consulting) and by the prospect of low rental or sale revenues. This reduces their attractiveness to investors, making it essential for governments to implement a variety of public initiatives to make them more appealing and ultimately successful.

The primary limitations of the existing brownfield research to date can be synthesized as follows: (1) until recently, the cost data utilized were generally sketchy or insufficient; (2) the case-studies are primarily on large-scale 'show-case' brownfield developments, while few deal with the more typical small-scale brownfield ones; (3) the US and European case-studies often involve a variety of public and private stakeholders and utilize public funds, while these funds are typically not available in Canada; and (4) there is a paucity of relevant research dealing with specifically Canadian brownfield redevelopment issues, and no scholarly research on actual costs and benefits.

With respect to policy mechanisms for dealing with costs, federal, state and local levels of government in the USA have, over the last few years, introduced a broad range of policies and programmes designed to spur interest in brownfield redevelopment. Under its federal Brownfields Action Agenda (1995), for example, the US Environmental Protection Agency has sought to improve conditions for private redevelopment by reducing regulatory overlap among the different levels of government, by providing funds for pilot programmes and by providing tax breaks, grants and other financial incentives. Similar funds and incentives are also being offered by a growing number of state voluntary clean-up programmes (45 as of 2000; Meyer & Lyons, 2000) and municipal government programmes (Bartsch, 1998). In Europe, governments have taken an active role in the brownfield remediation and redevelopment area, deploying such things as area-wide planning approaches or setting up quasi-public agencies to deal with derelict properties. Many European governments have also financed a large portion of the remediation projects in the past (Visser, 1996; Meyer *et al.*, 1995).

Although many policies and programmes have been implemented in the USA and Europe to address the brownfield problem, it is as yet unclear which strategies are universally successful. Research in the USA has been finding that

the critical ingredients for success include: (1) improving the capacity of stakeholders and institutions to deal with the problem; (2) implementing voluntary clean-up programmes which specify clean-up standards and provide liability relief and financial incentives; and (3) implementing clean-up standards tailored to end-use and risk. In Europe, public-private partnerships, quasi-public agencies (such as the British Partnerships in the UK) and planning districts (called 'empowerment/enterprise zones') have met with considerable success. Since few policies exist in Canada, other than the implementing of clean-up standards tailored to end-use and risk, it is necessary, first, to determine which approaches are perceived as most useful to those in the private sector in Canada and to assess the potential effectiveness of various policy-making mechanisms in terms of the Canadian economic situation.

Methodology

In order to answer the research questions posed in the introduction a multi-method/mixed-model approach, combining both qualitative and quantitative dimensions of research, was employed in the present study (Tashakkori & Teddlie, 1998). This approach makes it possible to gather appropriate information on both the perceptions of those directly involved in brownfield redevelopment and on the quantifiable costs and risks that such redevelopment entails. The multi-method approach consisted of: (1) stakeholder interviews; followed by (2) a financial (pro forma) analysis of hypothetical brownfield and greenfield scenarios; and (3) an examination of different environmental and economic development policies designed to encourage brownfield redevelopment.

In the first phase of the research, 18 personal interviews were conducted with key stakeholders involved in land development in Ontario: eight private developers, six landowners (three from the private sector and three from public sector agencies), three stakeholders from brownfield redevelopment consulting firms and one stakeholder who worked for a major realtor. The criteria used for selecting the interviewees were participation in brownfield-oriented working groups in Ontario and involvement in brownfield redevelopment projects. Although a sample size of 18 might be considered relatively small, those interviewed for the present study represented key stakeholders involved in brownfield redevelopment in the GTA and Ontario and, in some cases, across Canada. Indeed, 15 of the interviewees had been involved in between two and 15 brownfield redevelopment projects over the last few years, and three of them had been involved in 100–1100 projects. Respondents were asked 15 questions divided into three general areas: (1) the nature of their involvement in brownfield redevelopment and how they perceived the associated costs, risks and benefits; (2) the obstacles they encountered in getting brownfields remediated and redeveloped; and (3) the comparable effectiveness of the different cost-/risk-reducing policies and programmes.

Second, interviews conducted in the first phase of the research made it possible to identify several typical brownfield and greenfield development projects (see Table 2) that were used as models in the design of four hypothetical industrial and residential development scenarios, including: an eight- to 10-storey residential condominium development constructed on a brownfield site with low- to mid-level contamination in the city of Toronto, versus a greenfield site in the GTA's periphery; and a 26 136 square foot (2429 m²) industrial facility

Table 2. Case-study project characteristics*Brownfield residential*

Ataratiri (parcel A): 1.1 ha of underutilized industrial property located in Toronto. Formerly the site of a coal gasification plant, the property is considered heavily contaminated (e.g. PAH, heavy metals, petroleum hydrocarbons, dioxins). Site is being considered as a proposed Olympic media centre and future neighbourhood, but not redeveloped yet.

Gooderham & Warts: 5.5 ha residential/commercial/retail redevelopment in Toronto. Formerly a liquor production factory, the site contained mid-level contamination (polycyclic aromatic hydrocarbons (PAH), heavy metals, petroleum hydrocarbons).

The Beach: 24 ha residential/commercial redevelopment in Toronto. Formerly a race track, the property contained low-level contamination from past filling activities (heavy metals, petroleum hydrocarbons).

King-West Village: 5.3 ha residential redevelopment in Toronto. Formerly used for manufacturing, the site contained low to mid levels of contamination resulting primarily from past filling activities (heavy metals, petroleum, benzene, toluene, ethylbenzene and xylenes (BTEX) and PAH).

Brownfield industrial

Toronto Port Lands: 405 ha of industrial/commercial/park land. Data obtained for a 0.7 ha industrial project on a site with mid-level contamination.

Greenfield residential

Helyar: information for an 8- to 10-storey residential condominium development.

Greenfield industrial

Bramalea Business Park II: a 2.5 ha industrial development in Brampton.

Helyar: information for an industrial development located outside Toronto.

constructed on a brownfield site with low- to mid-level contamination, versus a greenfield site in the GTA's periphery.

An analysis of the hypothetical scenarios was undertaken, as opposed to one of specific case-studies, because: (1) *identical* residential and industrial developments on brownfield and greenfield properties could be compared; (2) confidential information provided by the interviewees could be kept anonymous, especially given that many of the projects were still ongoing; (3) cost values could be determined by taking an average between two or more case-studies; and (4) generalized real-estate data compiled for the GTA, rather than case-specific data, could be used whenever possible in order to obtain general results.

Using the developers' pro forma, a financial analysis was carried out to estimate and compare the costs and returns of the different hypothetical projects. The pro forma was used for the present purposes, rather than a cost-benefit analysis or another financial analysis method, because it is the method used by developers themselves to determine the potential feasibility of undertaking a development project. The purpose of the pro forma is to provide a concise description of projected cost, income and profitability of a project from its inception to its final sale or leasing. The pro forma calculations used for this study only take into account the returns generated in year 1 of the hypothetical scenarios (i.e. when residential developments are sold and industrial developments are leased). Although this provides a good basis for evaluating the feasibility of residential and industrial projects, it is not sensitive to the costs and benefits that may affect industrial project feasibility over the long term (e.g. rent increases/decreases).

Additional interviews were conducted with those involved in the case-study projects outlined above and with others involved in real-estate development, in order to compile quantitative data related to project costs, revenues and time lines, especially those unique to brownfield redevelopment. The data from the specific projects were then used to set up the respective hypothetical scenarios. Development estimates that are typically the same for both brownfield and greenfield development projects (e.g. building construction costs and administration fees) reflect average values.

Third, the policies and programmes identified as very useful during the interview sessions were examined. Their potential effectiveness was estimated, based on: (1) interviewee rankings of the policies and programmes; and (2) a pro forma analysis of a programme's impact on the feasibility of the hypothetical scenarios.

Results

Interviewee Results: Motivating Factors and Obstacles to Brownfield Redevelopment

In order to determine why private sector stakeholders in particular become involved in brownfield redevelopment, the interviewees were asked to list the factors (economic, environmental and social) that motivated them (responses are given in Table 3).

As these results show, the decision to invest in brownfield redevelopment is motivated primarily by economic factors, which were ranked as most important by the interviewees overall. Although the pattern of responses on the part of landowners was similar to that of developers, the landowners focused more attention on liability attenuation as the most important factor. The interviewees also identified and ranked five environmental factors, of which two turn out, in

Table 3. Interviewee responses: motivating factors for brownfield redevelopment

Motivating factor identified by interviewees	Frequency
<i>Economic</i>	
To maximize profit at the site by building a marketable new project or selling the property to yield a maximum return	15
To divest liability risks/costs	10
To act on the growing popularity of the downtown urban location	9
To take advantage of devalued brownfield property costs	6
To avoid high development charges levied by peripheral municipalities	6
To create jobs	3
To restore the tax base of government	3
<i>Environmental</i>	
To conform with environmental regulations	7
To protect public health and safety	6
To restore the environment	2
To reduce development pressure on greenfield sites	2
To protect soil and groundwater resources	2
<i>Social</i>	
To renew urban cores	4
To remove negative stigmas from affected communities	3

Table 4. Interviewee responses: obstacles to brownfield redevelopment

Category	Potential obstacle	Average
Moderate–severe obstacles (rounded to 4)	Liability concerns	4.3
	High remediation costs	3.7
	Slow regulatory review process	3.7
	Complex municipal land-use policies	3.6
Moderate obstacles (rounded to 3)	Stringent remediation requirements	3.4
	Uncertainty related to the site-specific risk assessment	3.4
	Lack of government incentives	3.2
	Obtaining financing	3.1
	Lack of knowledge/negative attitude on the part of the public	3.0
Low–moderate obstacles (rounded to 2)	Lack of knowledge/negative attitude on the part of stakeholders	3.0
	More contamination than expected	2.4
	Potential impacts to adjacent properties	2.3
	High costs of insurance	2.2
	Lack of information on the history of sites	2.1
	Lack of remediation or disposal options	1.3

effect, to be economically motivated, namely remediating the site to avoid any potential government intervention, and protection of public health and safety so as to limit liability risks. 'Authentic' environmental and social factors were mentioned primarily by interviewees working for the public sector. Overall, when asked how important the consideration of social and environmental factors was, in comparison with that of economic factors, nine out of 18 interviewees ranked it as only somewhat important, four as not important and five as very important.

When asked to examine a list of obstacles to remediation and redevelopment and to rank them according to a suggested scale—as a non-obstacle (1 point), a moderate obstacle (3 points) or a severe obstacle (5 points)—with respect to how they were perceived to affect their own project costs and risks, the interviewees responded as shown in Table 4. It should be noted that the interviewees were asked to discuss the obstacles to remediation and redevelopment on the basis of their own experiences, rather than on the basis of a hypothetical redevelopment scenario.

The liability issue was perceived as the most severe obstacle, adding to project risks and costs both directly (e.g. through higher legal fees) and indirectly (e.g. through reduced land values and time delays during the review process). The interviewees emphasized that regulatory mechanisms continue to constitute serious obstacles to redevelopment projects, despite efforts to streamline them, because they lengthen the redevelopment process.

The moderate obstacles identified and ranked by the interviewees pertained mainly to policy, financing and property perception factors. First, policy obstacles: overly stringent remediation requirements; and uncertainty regarding the application of site-specific risk assessment procedures by government. Second, financing obstacles: lack of governmental redevelopment incentives; and other difficulties obtaining financing. Third, property perception obstacles: negative perception of brownfield properties on the part of both the public and other stakeholders. Interestingly, community opposition to remediation projects

did not seem to pose a significant problem to getting the projects under way, which is in stark contrast to the experience in the USA, where numerous community, labour and environmental organizations tend to keep public awareness of the issue high (National Environmental Justice Advisory Council, 1996).

Overall, developers and the other stakeholders ranked all obstacles as being more significant than did the landowners, particularly the slowness of the regulatory review process, the uncertainty related to the site-specific risk assessment, the related financing problems and the high costs of insurance. Other obstacles identified by the interviewees that emerged during the sessions were generally related to industrial development issues: poor transportation access, high land costs, the limited availability of large parcels of land, encroachment by residential and other land uses and higher industrial taxes in the city of Toronto.

While most of the interviewees expressed interest in pursuing more brownfield redevelopment in the future, the majority strongly agreed with the hypothesis that brownfield redevelopment is less cost-effective and entails greater risk than greenfield development for developers and private investors. Interestingly, a few of the developers and other stakeholders pointed out that residential brownfield redevelopment can be more cost-effective for the knowledgeable and more risk-averse investor, when brownfields are developed in high demand areas and are obtained from the landowner for a devalued price.

Pro Forma Results: Assessment of Hypothetical Development Scenarios

The pro forma analysis of the hypothetical scenarios provides a framework for examining, on a comparative basis, the quantifiable project costs and project returns associated with developing brownfield versus greenfield sites and the impact of the perceived costs and risks described above. These scenarios are intended to provide an example of what is occurring, based on information from actual case-studies (described above) and from real-estate data for the GTA. While the analysis of two hypothetical projects cannot claim to cover the broad range of real-estate transactions that go on in Toronto, it does provide a basis for understanding current trends. As mentioned above, the analysis takes into consideration the development costs for one residential and one industrial brownfield redevelopment in the city of Toronto and one residential and one industrial greenfield development in the GTA's periphery. Each analysis is based on four types of data: property information; development cost information; development sales/lease information; and project returns.

With regard to property information, the scenarios assume that the same residential and industrial projects are undertaken on a small, 1.5 acre (0.61 ha), parcel of land, even though the brownfield and greenfield case-study sites vary with respect to both the characteristics of the buildings and the size of the site (ranging from 1 to 82 acres or 0.4 to 33.2 ha). The condominiums are eight storeys and contain 97 units of 1000 square feet (93 m²) each. The industrial scenario concerns a smaller, 26 136 square foot (2429 m²), building (40% coverage).

Overall, the development costs of the hypothetical development projects examined are higher for all of the brownfield projects than they are for the greenfield ones (see Tables 5 and 6 for a summary of the pro forma results). Development costs in a pro forma analysis typically include the land purchase

Table 5. Pro forma analysis of hypothetical residential scenarios

Factor	Brownfield		Greenfield	
<i>Property information</i>				
Lot size (acres/ha)	1.5 /0.6			
Number of units	97			
Building area	114 119 square feet/10 606 m ²			
<i>Development cost information</i>				
	Cost (\$)	Percentage	Cost (\$)	Percentage
	of total		of total	
<i>Land acquisition cost</i>				
Land purchase price ^a	1 500 000	7.5	600 000	3.3
<i>Site costs</i>				
Demolition	60 000	0.3	0	0.0
Site assessment	90 000	0.4	0	0.0
Remediation ^b	375 000	1.9	0	0.0
Land levies	388 000	1.9	809 590	4.4
<i>Construction costs</i>				
Building hard costs (\$85 PSF + parking)	11 421 478	56.7	11 712 369	63.8
Arch./eng./consulting fees	690 000	3.4	690 000	3.8
<i>Soft costs</i>				
Marketing and sales	1 255 000	6.2	1 255 000	6.8
Warranty and fees	209 000	1.0	209 000	1.1
Legal and admin. fees	685 000	3.4	585 000	3.2
Realty taxes	250 000	1.2	200 000	1.1
Insurance and bonding	200 000	1.0	200 000	1.1
Development fees	580 059	2.9	585 695	3.2
Contingency	750 000	3.7	275 000	1.5
Development financing (9%)	1 678 661	8.3	1 241 902	6.8
<i>Total development costs</i>				
Development sales information	20 132 198	100.0	18 363 557	100.0
Number of units sold	97		97	
Unit sale price (average spring 2000)	239		191	
Revenue from sales				
<i>Project returns</i>	23 183 275		18 527 220	
Revenues (based on avg. yield)	23 183 275		18 527 220	
Total development costs	20 132 198		18 363 557	
<i>Project return (%)</i>	15.2		1	
Revenue required for 10% return (\$ PSF)	228		208	
Revenue required for 15% return (\$ PSF)	239		218	
Site preparation time (months)	25		19	

price, land levies and site preparation costs (site assessment, remediation and demolition). In brownfield transactions in Ontario, developers and other land purchasers typically undertake so-called 'due diligence' to determine whether a site is contaminated or not before purchasing it. If the land is contaminated, then the landowner is expected to reduce the price of the land from its expected 'clean' value to cover the estimated cost of demolition, site assessment studies and remediation, even if the landowner was not responsible for the contamination. Despite reductions, the land purchase price for a residential brownfield is higher than the greenfield price because of the high cost of residential land in Toronto and in the case-study areas. Clearly, such high land prices are optimal

Table 6. Pro forma analysis of hypothetical industrial scenarios

Factor	Brownfield		Greenfield	
<i>Property information</i>				
Lot size (acres/hectares)	1.5/0.6			
Coverage (%)	40			
Building area	26 136 square feet/242 m ²			
<i>Development cost information</i>				
	Cost (\$)	Percentage of total	Cost (\$)	Percentage of total
<i>Land acquisition cost</i>				
Land purchase price	102 000	5.8	360 000	21.8
<i>Site costs</i>				
Demolition	60 000	3.4	0	0.0
Site assessment	63 000	3.6	0	0.0
Remediation	225 000	12.9	0	0.0
Land levies	0	0.0	77 820	4.7
<i>Construction costs</i>				
Building hard costs (\$40 PSF)	1 063 894	60.8	1 061 587	64.2
Arch./eng./consulting fees	21 693	1.2	21 693	1.3
<i>Soft costs</i>				
Leasing fees	35 284	2.0	35 284	2.1
Legal fees	13 000	0.7	6 500	0.4
Realty taxes	21 479	1.2	6 499	0.4
Insurance and bonding	2 500	0.1	2 500	0.2
Contingency	60 000	3.4	20 000	1.2
Development financing cost (9%)	82 630	4.7	62 515	3.8
<i>Total development costs</i>				
Development lease information	1 764 476	100.0	1 654 398	100.0
Market rent (average spring 2000)	5.35		6.45	
Net operating income (NOI)				
Project returns	139 828		168 577	
<i>Levered yield</i>				
Capitalized value (NOI/0.1)	1 398 276		1 685 772	
Loan amount (loan-to-value)	978 793		1 180 040	
Debt service (20 years at 9%)	104 440		125 914	
Cash flow before tax	139 828		168 577	
Equity requirement	978 793		474 357	
Return on equity (ROE) (%)	4.6		9.0	
<i>Unlevered yield</i>				
Capitalized cost	1 749 927		1 654 398	
Cash flow before tax	139 828		168 577	
Yield (%)	8.0		10.2	
Rent required for 8% ROE (\$ PSF net)	6.60		6.25	
Rent required for 12% ROE (\$ PSF net)	7.35		6.95	
Site preparation time (months)	7		12	

for brownfield landowners because they allow them to cover the costs of remediation and still reap a profit from the sale of the land. The same cannot be said of industrial land in the city, which, despite its relatively high value, would have to be discounted significantly to cover the cost of assessment and remediation. It is thus in the best interest of the landowner in such cases to wait until industrial land prices rise, to seek a change in zoning to a more profitable use

or to abandon the site, especially if the site preparation costs exceed the value of the site. With regard to the total property costs, the price of brownfield sites for both residential and industrial scenarios balances with, or even becomes less than, that of greenfield sites because of the high land levies that peripheral municipalities in Ontario are required to charge for servicing-related costs.

Development cost information includes hard construction costs and other soft costs. Construction costs typically include those related to the process of getting building permits, the construction of building structures and parking facilities, and architectural, engineering and consulting services. In the residential development scenarios, construction costs for a greenfield building of the same quality are assumed to be slightly higher because of the planning requirement that condominium properties built on greenfield sites must contain more underground parking facilities than in urban areas. For the industrial scenarios, obtaining a permit, and the realty costs, make the overall construction expenses for the brownfield redevelopments slightly higher than for the greenfield developments.

With regard to soft development costs, discussions with those in charge of the projects used as the basis for the scenarios revealed that the legal costs associated with brownfield projects are generally double those associated with greenfield ones, because of the need for additional legal services to cover costs related to, for instance, property review, consultation with government agencies and communication with prospective purchasers. Brownfield projects also entail higher contingency fees (reflecting the greater risks associated with such projects), higher realty taxes, higher development fees and higher financing costs. It is to be noted that the financing costs involved in the different scenarios are typically higher for brownfield projects than for greenfield ones because the time lines for brownfield project completion are still considerably longer due to the compilation and review of soil research and remediation plans and to the remediation itself during the development process (25 months for a residential brownfield redevelopment versus 19 months for a residential greenfield development; 12 months for an industrial brownfield redevelopment versus 7 months for an industrial greenfield development). Other soft costs, including condominium marketing and sales expenses, industrial leasing fees, condominium warranty fees and insurance/bonding fees, were taken as being the same for both brownfield and greenfield development projects.

Although the process of estimating project costs is straightforward and involves few assumptions, predicting revenues is uncertain because they fluctuate according to location, quality of product, zoning and market variability. For the present analysis, real-estate values and market rents for spring 2000 were obtained from quarterly reports compiled by private industry research. To simplify the analysis, no vacancy was assumed for the newly developed buildings and the residential dwellings were assumed to be sold upon project completion.

Currently, residential real-estate values in the city of Toronto, and in other Canadian cities, have remained high in comparison to peripheral greenfield locations for all types of dwellings.¹ For condominium apartments, the average sale price for a new or converted (loft) property was \$239 per square foot (PSF) ($\$2573 \text{ m}^{-2}$) for the city of Toronto (all prices in Canadian dollars), ranging from a low average of \$178 PSF ($\1916 m^{-2}) in Scarborough to a high average of \$258 PSF ($\2777 m^{-2}) in the central city (N. Barry Lyon Consultants, 2000). According

to the Greater Toronto Homebuilders Association, the high demand is being fuelled by changing demographics in support of urban living, favourable economic conditions, a growing supply of condominium buildings and the presence of many approved development sites left over from the 1980s (Wegler, 2000). While condominium values are also high in the periphery, their average is \$190 PSF (\$2045 m⁻²).

Over the last few years, there has also been a rise in the demand for industrial real estate throughout the country, which has led to an increase in both industrial rents and real-estate values (Colliers International, 1998). Unlike the residential market in Toronto, however, the lease rates for urban locations of industrial sites (averaging \$4.35 PSF net or \$47 m⁻² for buildings between 15 000 and 43 000 square feet, and ranging between \$3.75 and \$5.50 PSF, or \$40 and \$59 m⁻²) are typically lower than they are for greenfield locations (averaging \$5.45 PSF net or \$59 m⁻² for buildings between 15 000 and 43 000 square feet, and ranging between \$4.50 and \$7.35 PSF, or \$48 and \$79 m⁻²), while the property values are similar (Colliers International, 2000). For the present analysis, the lease rate for new industrial space is assumed to be \$1 PSF above the average.

The returns listed in Tables 5 and 6 are meant to reflect those predicted by each of the above development scenarios, according to revenue averages and the assumption that the buildings constructed are of the same quality. For the residential scenarios, the interviewees pointed out that they expected a return of approximately 15% (ranging from 10% to 20%) for a residential project and between 8% and 12% (levered) for an industrial one. In the present analysis, the residential brownfield projects will generate higher returns than the greenfield ones due to the high sale price of residential property. The residential greenfield projects however, would have to be built for less or sell for \$208 PSF (\$2239 m⁻²) to achieve the same yield, which is not outside the range for the periphery, but is well above the average. The opposite is true for industrial projects, with only the greenfield development falling above the normal return expectancy (8%), despite the relatively high rents in the brownfield areas. The industrial returns include an estimate for an unlevered yield, which assumes that the developer pays for the entire project at the end of the development period and then proceeds to lease it, and a levered one, which is more common in that it assumes that the developer will finance the project over time through a lender. While the returns for the brownfield project approach the 8% target for the unlevered yield, they are significantly lower for the levered one and would require a lease rate (\$6.60 PSF, or \$71 m⁻²) significantly higher than the city of Toronto average.

Assessment of Brownfield Cost-/Risk-sharing Mechanisms

Interviewee results. The interviewees were asked to identify what effects different kinds of governmental policies and programmes would have on the developer's costs and risks associated with remediating and redeveloping typical brownfield sites (see Table 7): a large reduction (⬇) (score = 1); a moderate reduction (↕) (score = 2); no change (|) (score = 3); a moderate increase (↕) (score = 4); and a large increase (⬆) (score = 5). They were also asked to list which policies they thought would be the most useful and to distinguish between costs and risks in their evaluation. The policy and programme mechanisms examined involve regulatory, informational, clean-up, legal and financial

Table 7. Interviewee evaluation of potential brownfield policies and programmes

Potential cost-/risk-sharing policies and programmes	Private costs (average)	Private risks (average)	No. of responses (frequency)	Most useful (frequency)
<i>Regulatory mechanisms</i>				
Harmonization of regulatory processes among the different levels of government	↘ (1.9)	↘ (2.0)	10	2
The use of standards as opposed to more flexible guidelines	↗ (3.5)	↘ (2.5)	17	0
Streamlining planning and approvals	↘ (1.8)	↘ (2.0)	15	2
<i>Information system mechanisms</i>				
A simple registry of known contaminated sites	↘ (2.5)	↘ (2.6)	11	
A phase 1 quality historical land-use inventory of known and/or suspected contaminated sites	↘ (2.6)	/ (2.8)	11	
A phase 2 quality inventory of contaminated sites	↘ (2.3)	↘ (2.0)	11	
<i>Clean-up policy mechanisms</i>				
Less stringent clean-up criteria	↘ (2.1)	/ (3.3)	14	2
Greater technical guidance from governmental agencies	↘ (2.5)	↘ (2.4)	13	
Fee for expeditious assistance from government	↗ (3.6)	↘ (2.4)	7	
Better access to remediation/disposal technologies	/ (2.8)	/ (2.7)	7	2
<i>Legal mechanisms</i>				
'Allocated' instead of 'joint-and-several' liability	↘ (2.0)	↘ (1.7)	8	2
Protection from prospective (future) liability	↘ (1.8)	↓ (1.4)	18	9
<i>Financial mechanisms</i>				
Governmental tax incentives (property or income tax)	↓ (1.5)	↘ (1.9)	18	9
Direct governmental funding (clean-up/redevelopment assistance)	↓ (1.5)	↘ (1.9)	18	1
Guaranteed low-interest loans	↘ (1.7)	↘ (1.7)	18	2
Public-private joint venturing opportunities	↘ (1.8)	↘ (1.7)	16	2

issues. Those considered most useful were then analysed in terms of the hypothetical scenarios (using the pro forma) in order to assess their feasibility (Table 8).

As can be seen from Table 7, most of the interviewees felt that financial mechanisms such as tax incentives, funding/subsidies and guaranteed loans would reduce costs associated with remediation significantly, as well as diminishing risks somewhat. Nine of the interviewees identified tax incentives, such as tax abatement, tax increment financing and development charge credits, as specific initiatives that would be particularly beneficial for removing the economic obstacles associated with brownfield redevelopment.² Many developers pointed out that a tax increment financing programme would encourage more

Table 8. Pro forma estimates of potential brownfield policies and programmes

Policies and programmes	New cost (\$)	Return (%)	New cost (\$)	Return on Equity (ROE) (%)
Base project cost and return	20 132 198	15.2	1 749 927	4.6
Site assessment costs subsidized	20 143 054	15.1	1 753 296	4.6
Increase in land value	90 000		63 000	
No increase in land value	20 035 429	15.7	1 684 442	5.0
Demolition site assessment and remediation costs subsidized	19 671 759	17.9	1 726 498	4.7
Land cost required to achieve 8% ROE	—	—	170 000	8.0
Industrial tax abatement (net rent + 50 cents)	—	—	—	5.7
Industrial tax abatement (net rent + \$1)	—	—	—	7.1
Low development finance rate (4.5%)	19 334 707	19.9	1 715 774	4.8
Liability protection (25% reduction in legal costs)	20 070 014	15.9	1 746 375	4.6
Shortened development period (= greenfield time lines)	19 873 560	16.7	1 717 240	4.8
Clean-up cost reduced by 30% (site-specific risk assessment)	20 011 237	15.9	1 679 765	5.0
Combination (subsidized site assessment and shortened development)	19 880 861	16.7	1 718 898	4.8
Combination (subsidized site preparation and tax abatement + \$1)	—	—	1 726 498	7.4
Land cost required to achieve 8% ROE	—	—	415 000	8.0
Combination (subsidized site preparation, tax abatement + \$1, shortened development)	—	—	1 590 368	9.8

industrial landowners to sell their sites or pursue site remediation, whereas at present many tend to hold on to their industrial land in the hope that the climate for redevelopment will improve. Two also felt that development charge credits would be particularly useful in stimulating brownfield redevelopment in municipalities that charge high levies, including municipalities in the periphery, where brownfield redevelopment is perceived to be particularly disadvantageous. Other kinds of financial mechanisms, such as low-interest government loans and public-private partnerships, were identified as useful but considered to be less able to reduce costs and potentially intrusive.

Legal mechanisms, including protection from future liability and allocated liability (instead of joint-and-several liability), were identified as having a moderate impact on cost reduction and a moderate to high impact on risk diminution. Nine of the interviewees felt that protection from future liability would be one of the most useful mechanisms for attracting more redevelopment.

Changes to clean-up policy mechanisms were viewed as leading only slightly to cost reduction, although they would, logically, lead to risk reduction. A fee for more expeditious government assistance, similar to that in place in many US states, was seen as diminishing the risk factor and, most importantly, speeding up the development process. It should be pointed out that many of the interviewees felt that some effort to improve the rules for making clean-up less expensive has already been made over the last few years in Ontario and in other Canadian provinces, with the implementation of risk and end-use based clean-up criteria, although it was also felt that more rigour and consistency were

required in their application. Indeed, as one interviewee put it, "one would not even consider remediating the Ataratiri lands [a highly contaminated site in the city of Toronto included as one of the case-study sites] under the old rules that basically called for lands to be returned to pristine conditions".

Regulatory and information system mechanisms were identified as moderately effective at cost/risk reduction. Changing Ontario's use of less stringent guidelines to more stringent standards was identified as raising project costs, and only as moderately reductive of risk and uncertainty. The harmonization of regulatory processes among different levels of government and a more streamlined development approvals process were considered by four of the interviewees to be essential for reducing the frustration associated with getting brownfield redevelopment off the ground.

Impact of Selected Cost-/Risk-sharing Mechanisms on Project Returns

The economic benefits of those policies and programmes considered most useful by the interviewees were assessed by applying them to the brownfield redevelopment scenario pro formas and calculating their impact on project returns (see Table 8). As it turns out, financial mechanisms such as tax abatement and direct government funding programmes (through direct subsidies or tax increment financing) could each improve the returns of the hypothetical brownfield scenarios. A reduction in municipal taxes charged to industrial operations in Toronto, to equal those charged in the periphery (which are about 50 cents to \$1 less per square foot), would allow net rents to rise while not affecting gross rents, approaching the minimum 8% return target. A subsidy to offset the costs of either site assessment, or demolition, site assessment and remediation,³ would also improve returns, although such cost reductions would probably benefit the landowner, who is no longer required to reduce the land price to pay the full cost of clean-up. The returns for industrial redevelopment, therefore, would only increase significantly if the landowner was still willing to reduce the land costs to cover extraneous costs related to brownfield development and to help offset the lower rental revenues. If development charge credits were put into place, then almost \$400 000 would be freed for the residential brownfield projects examined (these were introduced by the city of Toronto in 1999). A low-interest loan programme offering a construction financing rate of 4.5% for brownfield redevelopment projects would also reduce costs significantly for residential projects, but less so for industrial ones (given their shorter time lines), making it seem much more advantageous than was put forward during the interviews.

Legal mechanisms to protect landowners and developers from future liability would also reduce costs and improve returns slightly for both residential and industrial redevelopments. More significantly, such mechanisms would reduce perceived future risks and limit the need for future liability insurance. Improving the regulatory environment by harmonizing policies and streamlining the approvals process for brownfield redevelopment, in line with the time lines associated with greenfield redevelopment, would significantly reduce the costs associated with the longer residential projects and reduce more moderately those associated with the industrial projects by bringing down financing costs. If the clean-up criteria were reduced or the application of the site-specific risk assessment method was made less risky, as several of the interviewees stated, then the developers would probably be able to save an additional 30% on

clean-up costs. Unlike the direct subsidy programme above, this lower clean-up cost would probably not go to the landowner, given that a developer would probably bargain with the landowner to reduce the land costs to cover a higher end-use based remediation estimate. An examination of the workability of the mechanisms reveals that no single tool has the ability to improve returns enough for industrial brownfield projects to become feasible. Instead, a combination of tools is required to achieve parity with the greenfield returns.

Discussion and Concluding Remarks

The interview results and the pro forma analysis lead to the following conclusions, which provide answers to the research questions set out in the present study. In response to the first research question (Is brownfield redevelopment perceived as being less cost-effective and more risky than greenfield redevelopment for developers, landowners and other private sector stakeholders in Ontario?), brownfield redevelopment is indeed perceived as being less cost-effective and entailing greater risks than greenfield redevelopment by developers, landowners and other stakeholders involved in brownfield redevelopment, and there is a persistent feeling among them that not enough is being done by policy makers to stimulate redevelopment through the implementation of cost/risk reduction measures. The response to the second research question (Do the perceived costs and risks differ significantly from the actual costs and risks for both residential and industrial brownfield redevelopment projects?) is not as straightforward. Despite the higher costs involved in residential brownfield redevelopment projects in the study area, these are more profitable than their greenfield counterparts due to high real-estate values in the city and inner suburbs of Toronto and to the high costs associated with servicing greenfield municipalities, even for sites with relatively high levels of contamination that do not exceed the high land values. Industrial redevelopment projects on contaminated brownfield sites, on the other hand, are clearly unprofitable *vis-à-vis* their greenfield counterparts due to higher costs and lower lease rates, thus requiring assistance in order to make them more attractive to potential investors and developers, and more marketable to landowners.

In response to the third question (Which policies and programme are best able to mitigate the cost and risk factor?), stakeholders would like to see the implementation of cost-/risk-sharing mechanisms related to financing clean-up and redevelopment, reducing project time lines and limiting liability, which would indeed improve the feasibility of brownfield projects overall according to the results of the pro forma analysis. Another important conclusion not directly associated with the research questions is that, in order to stimulate more brownfield redevelopment, more attention must be devoted to addressing the economic problems and fears faced by landowners, who are the ones ultimately making the decision of whether or not to bring their brownfield sites into the marketplace.

Although the climate for redevelopment is obviously improving, the stakeholders interviewed still perceived brownfield redevelopment as less cost-effective and more risk-prone than greenfield redevelopment. Indeed, most felt somewhat neglected by the government in their pursuit to bring brownfield sites back into productive use, especially given the plethora of cost-/risk-sharing mechanisms available in the USA. The findings of this study suggest that the

private sector is motivated to undertake brownfield redevelopment only if it is economically profitable to do so; environmental and social motivations hold very little sway with these stakeholders. Given that the private sector has been left to carry out brownfield redevelopment virtually on its own in Ontario, this raises the controversial question of whether the government should remove itself completely from the picture or else become involved in the process even more directly. For instance, should the government be content with developers undertaking only those residential brownfield redevelopment projects that are profitable on the pro forma, or should it be more active in stimulating activities which may provide more environmental and social benefits to urban areas (e.g. more jobs, urban parks and social housing)?

The first step, as has become clear from the interview sessions and the pro forma analysis, is for developers and landowners to identify those obstacles that they perceive to have the greatest impact on brownfield redevelopment. The pro forma analysis has proved itself to be useful in this regard, since it singles out the most serious obstacles based on their impact on project feasibility. These include high costs associated with site preparation (demolition, site assessment and remediation) and its risks (reflected here through higher contingency costs), complex regulatory mechanisms leading to time delays, low rents for industrial property and uncertain liability risks leading to higher legal costs.

One positive finding of this study is that, despite how they are portrayed in the relevant Canadian and US literature, the economic obstacles to brownfield redevelopment in the central city and inner suburbs of the city of Toronto are not as serious for residential development as they are often thought to be. The growing popularity associated with living in urban areas has raised the value of residential real estate to a level that makes the more costly redevelopment of brownfield sites for residential dwellings potentially feasible, not only in fashionable life-style districts such as the Toronto waterfront, but also in other (less trendy) urban areas. Indeed, the residential brownfield case-studies examined here, alone, added over 1300 condominium units and 1200 other residential units on 91 acres (37 ha) of brownfield land. This reurbanization trend is occurring throughout Canada. As a recent study by Miguelez (1999) has found, there was a considerable increase in the share of housing starts in most of the large urban centres between 1994 and 1998 (in Toronto, from 7.3% to 9.5%; in Montreal, from 12% to 13.7%; and in Vancouver, from 28.4% to 34.5%), relative to their peripheral municipalities, and this trend is increasing. On the other hand, the redevelopment of brownfield land for industrial purposes continues to be unprofitable for the various reasons identified by both the interviewees and the pro forma analysis, a finding that supports the general pattern of findings in the US literature (Bartsch, 1996). Indeed, the city of Toronto saw little new industrial development in 1999 despite high rates of absorption and increasing rents, with over 96% of new industrial land development in the GTA being funnelled towards the periphery, where greenfields are plentiful (Colliers, 2000). Policy makers therefore, will have to consider many of the mechanisms examined in the present study and implemented elsewhere if they wish to deal with the perceived and the actual barriers to industrial brownfield redevelopment.

Another cure for the brownfield problem would be to rezone industrial sites to more profitable land uses. Indeed, a study conducted by Huther (1997) found that between 1972 and 1996 almost 600 000 m² of floor space was constructed or altered for residential use in the original city of Toronto on former industrial

property. Another study conducted by Hemson Consulting (1998) found that since 1987 over 1153 acres of Toronto's industrial land (between almost one-fifth and one-quarter) had been redesignated for other uses, primarily in the downtown area, where industrial job losses have been highest over the last three decades and where the demand for residential and other types of development (commercial and retail) has been strongest. However, with regard to rezoning, this raises the question of whether the government should use the development of profitable residential projects as a cure for brownfield sites, or whether it should involve itself more directly in preserving industrial land for the economic and social benefits it entails.

The findings of this study fill some of the gaps left by the previous Canadian literature by identifying which policies and programmes are considered to be the more effective ones on the part of those involved in redevelopment most directly. Evaluation of the effectiveness of these policies by assessing their potential influence on actual development costs makes it possible to obtain a preliminary understanding of their practicality. Clearly, residential brownfield projects could be made even more attractive with minor changes to existing policies and programmes (e.g. by streamlining the approvals process and providing technical assistance), while industrial brownfields require a more vigorous approach incorporating a variety of mechanisms. At the end of the day, solving the brownfield problem requires a concerted effort among developers, landowners, environmentalists and governmental players. However, in order for this to become a reality, the first step must be to make remediation and redevelopment attractive economically to the primary stakeholders.

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Notes

1. Average new home values for the city of Toronto: single-family dwelling \$300 000; semi-detached dwelling \$250 000; townhouse \$250 000; condominium \$239 000 (assuming 1000 square feet at \$239 per square foot (PSF)). Average new home values in the GTA West: single-family dwelling \$270 000; semi-detached dwelling \$180 000; townhouse \$175 000; condominium \$191 000 (assuming 1000 square feet at \$191 PSF) (Trimart-Trillion Corporation, 1999; N. Barry Lyon Consultants, 2000).
2. Both tax increment financing and development charge credits are currently not permitted in Ontario but are being examined by the provincial government as potential tools.

3. While the government can subsidize demolition, site assessment and remediation costs using a tax increment financing programme, the cost of these is paid back to the developer over time through savings in municipal taxes. Calculating the change in returns using TIF would require a more comprehensive present-value analysis, while the present analysis assumes that the costs are paid during the development period.

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