

Environmental Protocols



Infrastructure and Land Use Planning

This document is the sixth in a series of best practices that focus on the interaction of natural systems and their effects on human quality of life in relation to municipal infrastructure delivery. For titles of other best practices in this and other series, please refer to <www.infraguide.ca>.



Infrastructure and Land Use Planning

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INTRODUCTION

InfraGuide® — Innovations and Best Practices

Introduction

InfraGuide —
Innovations and
Best Practices

Why Canada Needs InfraGuide

InfraGuide is a national network of experts and a growing collection of best practice publications for core infrastructure, offering the best in Canadian experience and knowledge of core infrastructure. With our founders — the Federation of Canadian Municipalities, the National Research Council and Infrastructure Canada, and our founding member, the Canadian Public Works Association — we help municipalities make informed, smart decisions that sustain our quality of life.

This is what the *National Guide to Sustainable Municipal Infrastructure (InfraGuide)* seeks to accomplish.

In 2001, the federal government, through its Infrastructure Canada Program (IC) and the National Research Council (NRC), joined forces with the Federation of Canadian Municipalities (FCM) to create the National Guide to Sustainable Municipal Infrastructure (InfraGuide). InfraGuide is both a new, national network of people and a growing collection of published best practice documents for use by decision makers and technical personnel in the public and private sectors. Based on Canadian experience and research, the reports set out the best practices to support sustainable municipal infrastructure decisions and actions in six key areas: decision making and investment planning, potable water, storm and wastewater, municipal roads and sidewalks, environmental protocols, and transit. The best practices are available online and in hard copy.

A Knowledge Network of Excellence

InfraGuide's creation is made possible through \$12.5 million from Infrastructure Canada, in-kind contributions from various facets of the industry, technical resources, the collaborative effort of municipal practitioners, researchers and other experts, and a host of volunteers throughout the country. By gathering and synthesizing the best

Canadian experience and knowledge, InfraGuide helps municipalities get the maximum return on every dollar they spend on infrastructure—while being

mindful of the social and environmental implications of their decisions.

Volunteer technical committees and working groups—with the assistance of consultants and other stakeholders—are responsible for the research and publication of the best practices. This is a system of shared knowledge, shared responsibility and shared benefits. We urge you to become a part of the InfraGuide Network of Excellence. Whether you are a municipal plant operator, a planner or a municipal councillor, your input is critical to the quality of our work.

Please join us.

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The InfraGuide® Best Practices Focus



Environmental Protocols

Municipal infrastructure decisions, particularly those related to potable water, municipal roads, and storm and wastewater can have a significant impact on the natural environment. Environmental protocols focus on the interaction of natural systems and their effects on human quality of life in relation to municipal infrastructure delivery. Environmental elements and systems include land (including flora), water, air (including noise and light) and soil. Example practices include how to factor in environmental considerations in establishing the desired level of municipal infrastructure service; and definition of local environmental conditions, challenges and opportunities with respect to municipal infrastructure.



Decision Making and Investment Planning

Elected officials and senior municipal administrators need a framework for articulating the value of infrastructure planning and maintenance, while balancing social, environmental and economic factors. Decision making and investment planning best practices transform complex and technical material into non-technical principles and guidelines for decision making, and facilitate the realization of adequate funding over the life cycle of the infrastructure. Examples include protocols for determining costs and benefits associated with desired levels of service; and strategic benchmarks, indicators or reference points for investment policy and planning decisions.



Municipal Roads and Sidewalks

Sound decision making and preventive maintenance are essential to managing municipal pavement infrastructure cost effectively. Municipal roads and sidewalks best practices address two priorities: front-end planning and decision making to identify and manage pavement infrastructures as a component of the infrastructure system; and a preventive approach to slow the deterioration of existing roadways. Example topics include timely preventative maintenance of municipal roads; construction and rehabilitation of utility boxes; and progressive improvement of asphalt and concrete pavement repair practices.



Potable Water

Potable water best practices address various approaches to enhance a municipality's or water utility's ability to manage drinking water delivery in a way that ensures public health and safety at best value and on a sustainable basis. Issues such as water accountability, water use and loss, deterioration and inspection of distribution systems, renewal planning and technologies for rehabilitation of potable water systems and water quality in the distribution systems are examined.



Transit

Urbanization places pressure on an eroding, ageing infrastructure, and raises concerns about declining air and water quality. Transit systems contribute to reducing traffic gridlock and improving road safety. Transit best practices address the need to improve supply, influence demand and make operational improvements with the least environmental impact, while meeting social and business needs.



Storm and Wastewater

Ageing buried infrastructure, diminishing financial resources, stricter legislation for effluents, increasing public awareness of environmental impacts due to wastewater and contaminated stormwater are challenges that municipalities have to deal with. Storm and wastewater best practices deal with buried linear infrastructure as well as end of pipe treatment and management issues. Examples include ways to control and reduce inflow and infiltration; how to secure relevant and consistent data sets; how to inspect and assess condition and performance of collections systems; treatment plant optimization; and management of biosolids.

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EXECUTIVE SUMMARY

Traditionally, municipal planners and engineers have had few opportunities to collaborate on the long-term sustainability of infrastructure systems. The result is a disconnect between infrastructure capital planning and development planning processes. The integration of municipal infrastructure and land use planning can result in improved services that benefit residents, and the environment in which they live. Of utmost importance to municipalities is the assurance that infrastructure and land use planning and operations occur in a manner that ensures the health, security and functionality of its communities. Infrastructure

decisions made early on in the land use planning process, allows greater opportunity for municipalities to achieve this important objective.

This document has as a primary theme a “best process” for the integration of municipal land use and infrastructure planning. The risks and benefits of practising this integration will be of particular interest to the reader. The municipal conditions and capacity, which support this specific kind of integration, are highlighted. In addition, the document outlines the tools and considerations needed to implement a more integrated approach to planning at the policy and operational levels.

Executive Summary

Of utmost importance to municipalities is the assurance that infrastructure and land use planning and operations occur in a manner that ensures the health, security and functionality of its communities.

1. General

1.1 Introduction

The goal of this best practice is to assist municipalities with management of all components of municipal infrastructure and provide a road map for the Canadian network of practitioners, researchers, and municipal officials to solve today's municipal infrastructure challenges.

This document has been produced under the Environmental Protocols Committee and targets other best practices produced by this Committee.

The information to produce this best process came from a review of literature, and ten case studies based on interviews conducted with key informants known to have success with integrating infrastructure systems planning with land use planning.

Historically, municipalities managed their responsibilities by compartmentalizing functions, which has led to inefficiencies, poor planning, and dissatisfaction by the public with the livability of their communities and efficiency of their infrastructure.

A community that adopts an integrated planning approach is more likely to be well planned and more efficient, resulting in reduced costs for its infrastructure.

1.2 Purpose and Scope

This guide is not about the best community design practices, but rather focuses on the *best processes*. It is about how town planners, engineers, landscape architects, administrators, elected officials, financial people and developers work together at both the policy and operational levels to achieve more efficient land use planning.

The goal is to assist participants in land use planning to understand the process of integration of land use planning and municipal infrastructure and how the land use planning

process influences municipal infrastructure. The land use planning process occurs at two fundamental levels: the policy and implementation levels.

In recent years, more complex and sophisticated decision making processes have evolved that use a variety of tools as instruments to coordinate and develop solutions and affect change. This best practice examines examples of contemporary processes, tools, and instruments used by local governments to better integrate infrastructure solutions into the land use planning process.

1.3 How to Use this Document

The contents of this document should be applied with a clear understanding and appreciation that the practices and methodologies are intended to provide guidance towards the achievement of best practice. The methodologies and practices should not be construed as definitive best practices. A number of other InfraGuide best practices have presented the idea of integration with respect to other areas of municipal infrastructure (such as decision making and investment planning, storm and wastewater systems, roads and sidewalks, and environmental protocols). It is recommended that this document be used in conjunction with these other related best practices (see **Appendix C**).

Section 1 — General provides a description of the issues surrounding the topic of this best practice, including an overview of the key concepts.

Section 2 — Rationale gives justification for this best practice and describes benefits that can be achieved by following it. A theoretical framework underlying this best practice is given.

1. General

1.1 Introduction

1.2 Purpose and Scope

1.3 How to Use This Document

A community that adopts an integrated planning approach is more likely to be well planned and more efficient, resulting in reduced costs for its infrastructure.

1. General

1.3 How to Use This Document

1.4 Glossary of Terms

Section 3 — Implementation contains tools and instruments for integrating infrastructure and land use planning.

Section 4 — Applications of Land Use and Infrastructure Integration summarizes the case studies and lessons learned.

Section 5 — Gauging the Path to Integration provides indicators to evaluate how the process of integration is progressing.

1.4 Glossary of Terms

Climate change — Climate includes temperature, atmospheric pressure, precipitation, wind, humidity and sunshine. Climate change is attributed directly or indirectly to human activity that alters the composition of the global atmosphere.

Density — A measure of the number of people or housing units occupying a given area of land. The measure reflects the general character of the housing types in a neighbourhood. Low density generally refers to a neighbourhood that would result from an area developed as one and two unit housing; medium density generally applies to townhouses or apartment buildings no higher than three stories; and high density generally refers to taller apartment buildings resulting in more people per hectare.

Environmental stewardship — Supervising or managing something entrusted to one's care is called stewardship. In the case of environmental stewardship, this means taking responsibility to care for the natural environment, especially recognizing that it is not owned, but is passed onto future generations.

Functional plan — The functional plan addresses important elements of a municipality's physical structure that require more detail than what can be provided in the comprehensive community plan. Examples of elements for which functional plans may be prepared are transportation and circulation systems, parks and recreation facilities, and infrastructure.

Integration — A process and an outcome whereby two or more components previously regarded as separate combine to function as one unit.

Land use — The human use of a piece of land for a certain purpose (such as irrigated agriculture or recreation).

Land use plan — A systematic process and outcome for determining the current and future use and management of land.

Life cycle costing — A method of expressing cost, in which both capital costs and operations and maintenance costs are considered, to compare alternatives. *Present worth* is one way to express life cycle costs. The present worth represents the current investment that would have to be made at a specific discount (or interest) rate to pay for the initial and future cost of the works.

Master plan — The result of a formal process to coordinate the long term development on a large area of land with land owners, community residents, and public agencies.

Municipal master plan — The comprehensive community plan is called by various names—the official plan in Ontario, “le plan d’urbanisme” in Québec, the general municipal plan in Alberta, and the official community plan in British Columbia for example—and is the cornerstone of local planning throughout Canada. The municipal master plan focuses on the main issues in physical development and the major proposals for future development.

Neighbourhood — A group of dwellings usually including other uses such as community centres and businesses that have similar characteristics and which can be identified as distinctive from other groups nearby. While neighbourhoods vary in size, they are usually several blocks in area.

Operational tools — Resources or instruments that assist in the implementation of policies, programs, regulations or laws.

Policy tools — Resources or instruments that assist in the development of policies or programs.

Public transportation — Transportation by bus, rail, or other conveyance, either publicly or privately owned, that provides general or special service to the public on a regular and continuing basis.

Reserve funds — Assets (cash, investments, etc.) set aside for specific purposes.

Residential infilling or intensification — The process of adding new dwellings to a neighbourhood by building on vacant lots, or redeveloping existing housing or other buildings.

Risk — The probability or chance that an unfavourable event (e.g., disease, low birth weight) will occur. Risk factor: an attribute or determinant that may increase the probability of the unfavourable event.

Risk Factor — An attribute or determinant that may increase the probability of the unfavourable event.

Site plan — The site plan involves development on a single parcel of land that is usually either vacant, or about to be made vacant by the demolition of existing structures. This site plan is carried out in preparation or evaluation for new development in a municipality. The site plan contains information relative to existing elements in a particular area including topography, existing services, construction, and rights of way.

Special area plans — These plans address areas in the municipality that require more detailed planning. Such areas include inner city neighbourhoods and the central business district. Special area plans provide a more detailed view of land uses, traffic, and facilities for the district for which the plan was developed. An example of a special area plan is the secondary plan (Ontario), or the “plan particulier d’un urbanisme” (Quebec).

Sprawl — Generally unplanned, scattered development characterized by low density, haphazard, and disorganized settlement patterns and by being inefficient to service.

Stewardship — the concept of an individual, company or institution taking responsibility for, and reducing the impact of, its actions on the environment

Subdivision plan — The subdivision plan involves dividing a large parcel of usually vacant land into numerous building lots. As in the case of the site plan, the subdivision plan is carried out in preparation or as an evaluation for new development in a municipality.

Transit oriented development (TOD) — A mix of residential, retail, and office uses with a supporting network of roads, bicycle ways, and pedestrian ways focused around a major transit stop designed to support a high level of transit use.

Zoning (Zonage) — The division of land by legislative regulation into areas (zones), specifying the allowable uses for the real property in these areas.

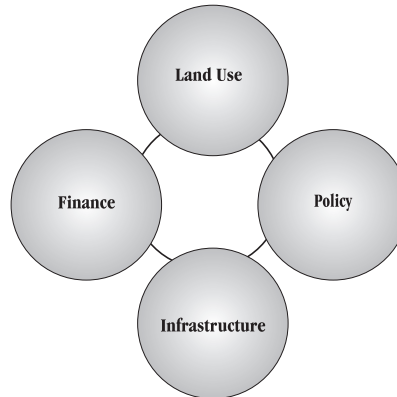
2. Rationale

2.1 Background

Many contemporary problems with municipal infrastructure and the associated “built form” stem from a general lack of integration of professional perspectives. The result is a disconnection between infrastructure capital planning and development planning processes. A number of factors contribute to the lack of integration. In general, the nature of the problem can be characterized as follows:

- **Human behaviour** — The community focus is often on planning and implementing the land development vision, while the integration of disciplines, optimization of land use, and infrastructure provision too often are seen as secondary. Furthermore, the institutional structures in many Canadian municipalities typically reflect an outdated and compartmentalized silo approach to management.
- **Use of space** — Suburban land use patterns that characterize the last 60 years of development have consumed large amounts of land, with correspondingly large quantities of linear infrastructure. The infrastructure to support such low-density development is relatively expensive to install and maintain.

Figure 2-1: An unintegrated approach to Land Use and Infrastructure Planning



Looking back, land use planners tended to debate how best to manage growth and shape the communities, while infrastructure engineers tended to consider infrastructure efficiency and cost. Because these discussions occurred at different tables, opportunities for integration and positive synergies have too often been lost. Integration of perspectives through a roundtable sharing of knowledge and experience is a relatively new way of doing business.

2. Rationale

2.1 Background

Figure 2-1

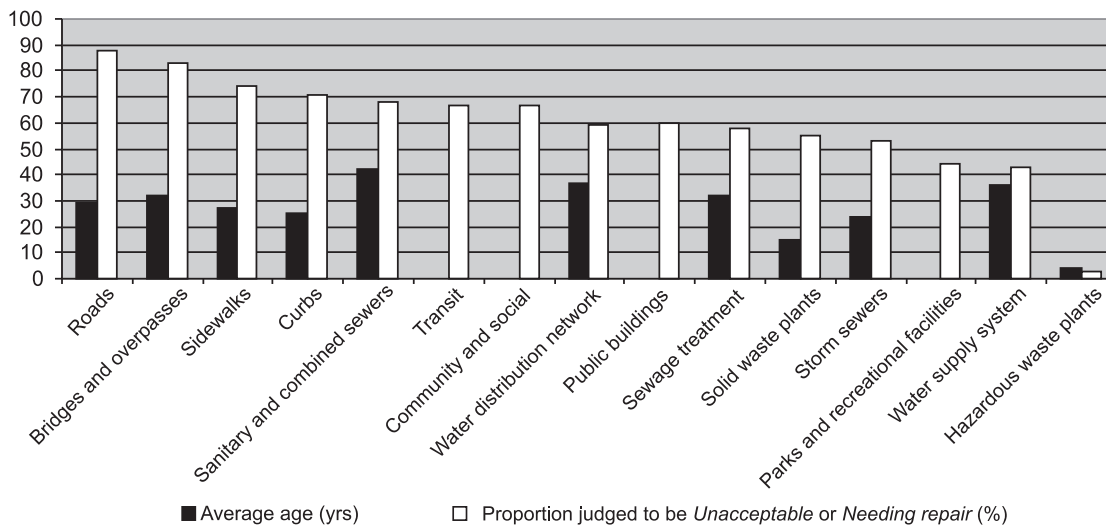
An unintegrated approach to Land Use and Infrastructure Planning

Figure 2-2

Condition of Infrastructure in Canada in 1995

Integration of perspectives through a roundtable sharing of knowledge and experience is a relatively new way of doing business.

Figure 2-2: Condition of Infrastructure in Canada in 1995*



* Mirza, M. Saeed and Murtaza Haider. 2003. *The State of Infrastructure in Canada: Implications for Infrastructure Planning and Policy*. Montreal: Infrastructure Canada

2. Rationale

2.1 Background

2.2 A Better Understanding of Issues

Since all costs and revenues are generated from land uses, it is necessary to complete a fiscal analysis before land use plans or strategies are approved.

This disconnect among professionals is exacerbated when the priority for voters and decision-makers is on how to allocate funds for short-term capital infrastructure, and new community facilities and programs. A fundamental problem is that decisions about land use (e.g., revenue generation and life cycle cost of infrastructure) are not linked.

While land development has traditionally served as a source of revenue generation, infrastructure systems represent a revenue sink and a host of new demands for community services that compete for revenues for basic infrastructure. Related issues include the following.

- Uncontrolled suburban development, or sprawl, demands that municipalities invest upfront dollars in infrastructure with limited access to immediate revenue streams.
- Changes in senior government funding have increased responsibilities and costs for many municipalities.
- As environmental regulations change, control and treatment costs rise—for example, *soft engineered*¹ solutions are recommended to reduce impacts of rainwater runoff on the environment (ditches, retention ponds, etc.).
- As suburban infrastructure systems age, their maintenance and replacement budgets rise.

It is estimated that in 2003, the cost to replace ageing infrastructure in Canadian municipalities was \$57 billion (Mirza and Murtaza, 2003), and this amount is growing. Some solutions however, such as reserve funds for infrastructure, do not appeal to voters and elected officials. The net effect is a fiscal crisis that requires a new way of operating.

2.2 A Better Understanding of Issues

Major investments in infrastructure capacity are in some cases, made 15 to 30 years in advance of the developable land supply. The infrastructure capacity then drives land use development patterns, by virtue of pre-defining the location of major roads, utilities rights-of-way, and trunk sewer and transmission water lines. For these reasons, **a better understanding of the relationship between land use and the cost of infrastructure is needed.** For example:

- The density of development is not the key generator of the cost of infrastructure. Density is a tool that can help municipalities manage demand for conditions or services, such as public safety, or access to green space, because the cost is related
- There may be some savings because the pipes are shorter but the capacity of the pipe needs to be sized to accommodate population growth.

An improved understanding of revenue generation from different land uses is also required. This can help determine if there will be sufficient revenues to support life cycle costs. For example:

- Where value-based assessment is used to calculate property taxes, revenues generated from higher density uses are less because the units have lower assessed values.
- Revenues generated from lower density uses have higher assessed values and therefore generate higher values.

Since all costs and revenues are generated from land uses, it is necessary to complete a fiscal analysis before land use plans or strategies are approved. Each time a planning committee or council makes a land use decision without knowing if revenues will support infrastructure life cycle costs, it is gambling on its fiscal health.

1. In appropriate areas, the use of native plants, boulders, and other local resources can replace traditional engineering methods to prevent erosion, and to enhance and protect environmental quality along stream banks and shorelines. These modifications are known as “soft engineering”. This approach uses ecological principles and practices that work with nature by manipulating natural systems. Soft engineering methods usually have a lesser impact on the environment and completed projects may require less maintenance.

The dynamic relationship between land use and infrastructure demand can be confusing. The sequence does not always allow infrastructure concerns to influence land use. Nor does it guarantee that infrastructure plans will be aligned with land use plans.

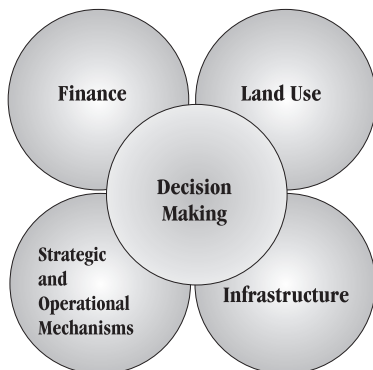
Nevertheless, the relationship can be reversed. The challenge is great, and probably requires changes both in how issues are considered, and how decisions are made. The incremental evolution of municipal governance has resulted in a management structure similar to silos, where disciplines are isolated into distinct groups focused on a singular purpose.

The inefficiencies are evident in the wasted dollars. Solutions are developed in isolation that work at cross purposes and are counter productive, resulting in dissatisfaction by the public and elected officials, and frustration within the administration.

The management structure needs to change by breaking down the silos, and planning with multi-purpose objectives, thereby fostering better integration of land use and infrastructure planning. The change needs to occur at both the policy and implementation levels. The greatest void currently exists at the policy level, where there is a need to integrate the planning of infrastructure during the preparation of the general municipal policy plan.

The fiscal crisis, public dissatisfaction and other triggers provide a window of opportunity to break down the silos of independent thinking.

Figure 2–3: The Integrated Silos of Land Use and Infrastructure Planning



As the silos merge, a greater number of actors must be accommodated in the planning process. Some of the most influential actors in the land use planning process include the following.

- **The public and planning committees** — Contribute to the vision and goals, and establish what is possible and acceptable in decision-making. For example, as the public needs to see that decisions reflect the kind of community residents want to live in, taking into account key factors like density, affordability, and diversity.
- **Municipal councils** — React primarily to the public’s desires and set the vision, the strategic direction and objectives. As the directors of a public corporation, they are also responsible for public expenditures. They set formal direction by passing by-laws, adopting land use policies and controlling land use through zoning, and development standards. They may also delegate authority to officers of the corporation to execute agreements.
- **The city manager or chief administrative officer (CAO)** — Reports to council and is primarily responsible for implementing the direction of council and has delegated authority to execute agreements. He or she is the head of staff and responsible for overall coordination of human resources to deliver the mandate of council.
- **Municipal departments** — Contribute to the management of assets and delivery of programs. Staff makes recommendations to the city manager and council regarding all aspects of municipal business.
- **The developer** — Provides the means to construct most of the local municipal infrastructure. The developer’s challenge is to build communities within the context of market forces, and municipal land use policies, in conformity with standards prescribed by the municipality and other public agencies.
- **Land use planners** — Provide the expertise to organize land use and infrastructure based on physical, human and fiscal constraints and potentials.

2. Rationale

2.2 A Better Understanding of Issues

Figure 2–3

The Integrated Silos of Land Use and Infrastructure Planning

The management structure needs to change by breaking down the silos, and planning with multi-purpose objectives, thereby fostering better integration of land use and infrastructure planning.

2. Rationale

2.3 Summary of Issues

2.4 Risks and Benefits

2.3 Summary of Issues

The central focus is the fundamental disconnect between land use and infrastructure planning, and the resulting fiscal problems. A more effective process of land use and infrastructure planning that will support development plans is recommended. The disconnect is characterized by the following:

- Infrastructure requirements and fiscal analysis are not linked and integrated into the land use planning process.
- Land use plans are prepared and approved without an understanding of the long-term implications of constructing and maintaining infrastructure and sources of financing.
- Competing interests for limited funds at the municipal level make it difficult to put aside reserve funds essential for underwriting the maintenance, upgrading, and replacement cost of infrastructure.
- Capacity issues challenge a municipality's ability to access the tools necessary for effective integration of land use and infrastructure planning at both the policy and implementation levels.

2.4 Risks and Benefits

The main risks of not breaking down silo thinking and not integrating land use planning and infrastructure are summarized below:

- **Growing infrastructure deficit** — Municipalities will continue to struggle to meet their growing infrastructure demands with limited resources. The gap to replace ageing infrastructure will grow and costs will continue to rise.
- **Inappropriate growth management** — Infrastructure decisions can dictate how and where the community grows. If these decisions have not been integrated with the community's land use vision, growth might occur in ways that contradict the community vision.

- **Infrastructure vulnerability** — Municipal infrastructure and municipal services are increasingly vulnerable to the impacts of natural hazards/disasters and other public health, security, and safety threats.

Many benefits result for municipalities that successfully integrate infrastructure and land use planning. The most substantial short-term benefits are financial, some of which are summarized below.

- **Financial management and growth of reserve funds** — Awareness of the need for long-term revenues is increased, and revenues from land use can be properly allocated to the essential costs of maintenance and replacement.
- **More comprehensive cost benefit analysis** — Integrated planning processes allow for a more comprehensive and accurate impact analysis of land use plans and development proposals, which in turn lead to better decision-making.
- **Land use planning that optimizes infrastructure investments** — For example, mixed-use developments typically make better use of infrastructure because residential and commercial land uses generate demand for water consumption and discharge wastewater at different times of the day.
- **Improved cash flow and use of staff time** — By shortening the approvals process and handling development applications more quickly, municipalities can provide improved service to the development industry and realize earlier investment with less delay.
- **Reductions in the proportion of new infrastructure systems covered by the municipality** — By examining demand characteristics, and encouraging design features that reduce infrastructure demand, municipalities can help developers reduce their demand for infrastructure services, by means of conservation, efficiency, and investment in on-site facilities.

Benefits from integration go well beyond financial returns to the municipality. A more complete rationale for integration includes:

- **Long-term sustainability** — A commitment to sustainable development means, at its most basic, a concern for the rights and opportunities of future generations. Integrating infrastructure plans into land use planning can provide foresight on such things as life cycle costs, ensuring that our children don't have an even greater infrastructure deficit to manage.
- **Creative solutions that support synergy** — Integration makes visible options that would otherwise be overlooked by more constrained and single-purpose planning. Whole-system solutions become possible, simultaneously achieving economic, social, and environmental goals that support community values and preferences. Everyone benefits from the greater efficiencies and improvements to the quality of life.
- **Community economic development** — Lower municipal costs often translate into lower fees and taxes, and increase the opportunities for residents and the competitiveness for local businesses.
- **Improved negotiations and consultations** — Citizens and developers can understand the full costs and trade-offs associated with alternative development scenarios. They will be in a better position to work together, with the municipality, on creative solutions. Understanding the interaction between land use and infrastructure needs is a key part of allowing people to choose the future they want.
- **Flexibility** — The pace of change in urban areas is increasing, and land use is no exception. As land use changes, so too does the demand for infrastructure services. An integrated planning process should sensitize infrastructure planners to such possibilities—leading to adaptable

designs that can accommodate a range of plausible land use scenarios, some of which may reduce the vulnerability of infrastructure to natural hazard and public security threats.

- **Monitoring and continuous improvement** — By assessing traditional approaches to planning infrastructure and encouraging alternative thinking about land use, the potential increases for achieving secondary benefits not normally included in system designs. For example, infrastructure corridors can function as greenways, infrastructure facilities can serve multiple purposes, and infrastructure construction can be aesthetically designed to complement the local culture and tastes.
- **Environmental stewardship** — The financial costs of infrastructure are often directly correlated to the use of scarce materials, energy, and water. By optimizing the infrastructure systems, the ecological footprint of the town or city is reduced. This allows more opportunities for natural resource conservation, land restoration, and the intensification of existing urban areas. Environmental stewardship also allows for the use of nature as a helping hand instead of an enemy. Taking watershed basins into consideration at the planning stage may reduce the need for storm drains.
- **Protection of public health** — Integration of infrastructure and land use planning can result in the effective management of public health risks. Drinking water contamination, source water contamination, air pollution, and soil contamination can all benefit from effective integration of land use and infrastructure planning.

2. Rationale

2.4 Risks and Benefits

3. Methodology

3. Methodology

3.1 The Approach

3.1 The Approach

What does it take to achieve full and lasting integration of land use and infrastructure planning? This section explores the question, drawing lessons from a series of case studies summarized at the end of the guide. The case studies in **Section 5** provide real-life examples of Canadian municipalities that moved beyond the norm. They reveal patterns that help to define the process, and offer a variety of strategies for managing change. They expose the inherent challenges and benefits of integrating infrastructure and land use planning.

Integrated planning requires **institutional change**. Such change does not occur easily or quickly. It is human nature to resist such change, a phenomenon sometimes referred to as human inertia. Even with cooperation from all parties, it will be necessary to work within the natural pace of change for key policies and structures, making changes as they come up for review.

The **motivation** for institutional change can present itself however in different forms. Change can come from the recognition of new environmental, population, economic, or social trends involving risk management, maintaining levels of services, or demand management. Other motivators may include the life cycle and the declining condition of municipal infrastructure systems. Institutional changes may also be opportunity driven, because of new federal, provincial, or municipal policies to improve municipal capacity. Official plans or community plans can also create opportunities to look at infrastructure and land use planning differently. Some or a combination of these factors may be enough to affect a proactive approach to the process of integration.

Ideally, senior managers directed by a clear vision or by a statement of intent by council, initiate institutional changes toward integration. In reality, the changes are more likely to occur in response to a crisis or trigger. The trigger creates a window of opportunity that allows individuals at any level within the municipality to **take leadership** and promote greater integration as a solution. However, their success will ultimately depend on support from an executive that endorses and implements the process of change.

Successful **integration** also depends on adopting innovative tools at the policy and implementation levels. New tools make integrated planning practical and cost effective. In fact, one way to visualize the integration process is to imagine a coordinated effort to adopt new policy and implementation tools.

A **coordinated effort** can begin with discussions that focus on *revisoning* infrastructure that meets the needs of today while not compromising the ability of future generations to meet their needs. Specific discussions about tools that enable integration can be facilitated when drawing together the “bubbles” of land use and infrastructure planning. The case studies suggest that some policy tools are especially helpful in addressing financial issues.

Because integration is a slow process involving many actors, success also depends on systems that promote learning and accountability. Municipalities may benefit from feedback systems that measure progress towards integrated planning, reward successes, and provide opportunities for continuous learning and improvement.

The case studies provide real-life examples of Canadian municipalities that moved beyond the norm. They reveal patterns that help to define the process, and offer a variety of strategies for managing change.

3. Methodology

3.2 A Framework for Integration

Municipal councils represent the general public and business community. Some municipal councils conduct regular surveys to gauge public opinion on important issues. The results of the surveys are used to guide broad direction of municipal councils.

3.2 A Framework for Integration

This framework for integration is more about an institutional process rather than a technical or exacting step-by-step road map that leads to change. The framework is presented in the context of a new way of thinking to affect change and needs to be adapted to suit a municipality's local situation.

3.2.1 Triggers that Initiate Change

Integration occurs in municipalities that are motivated to take action. Often there is not an overt choice to pursue a new direction but rather change motivated by an urgent need to address a *pain* or *fear* issue.

In most cases the trigger is financial pain of some sort. In the City of Airdrie, Alberta, for example, the trigger was a revenue shortfall combined with a fear of increased taxes. An integrated strategy was pursued to increase the amount of non-residential property as a way to pay for service delivery. In the Town of Vernon, British Columbia the trigger was the urgent need for funds to upgrade an ageing sewer and water system, especially in light of many new development proposals that needed servicing. An integrated strategy was adopted that streamlined development approvals and accelerated the cash flow from developers.

Environmental concerns, and quality of life are also key factors. In the Town of Okotoks, Alberta, the fear of becoming too large and losing community identity was a trigger. A visioning exercise led to an integrated strategy for capping growth and creating a sustainable small community at build out. In Chilliwack, British Columbia, the trigger was storm run-off from new development and the attendant damage to fish habitat and agricultural land. An integrated strategy was developed and tested, in partnership with the province and other towns.

3.2.2 A Motivated Leader and an Administration Committed to Change

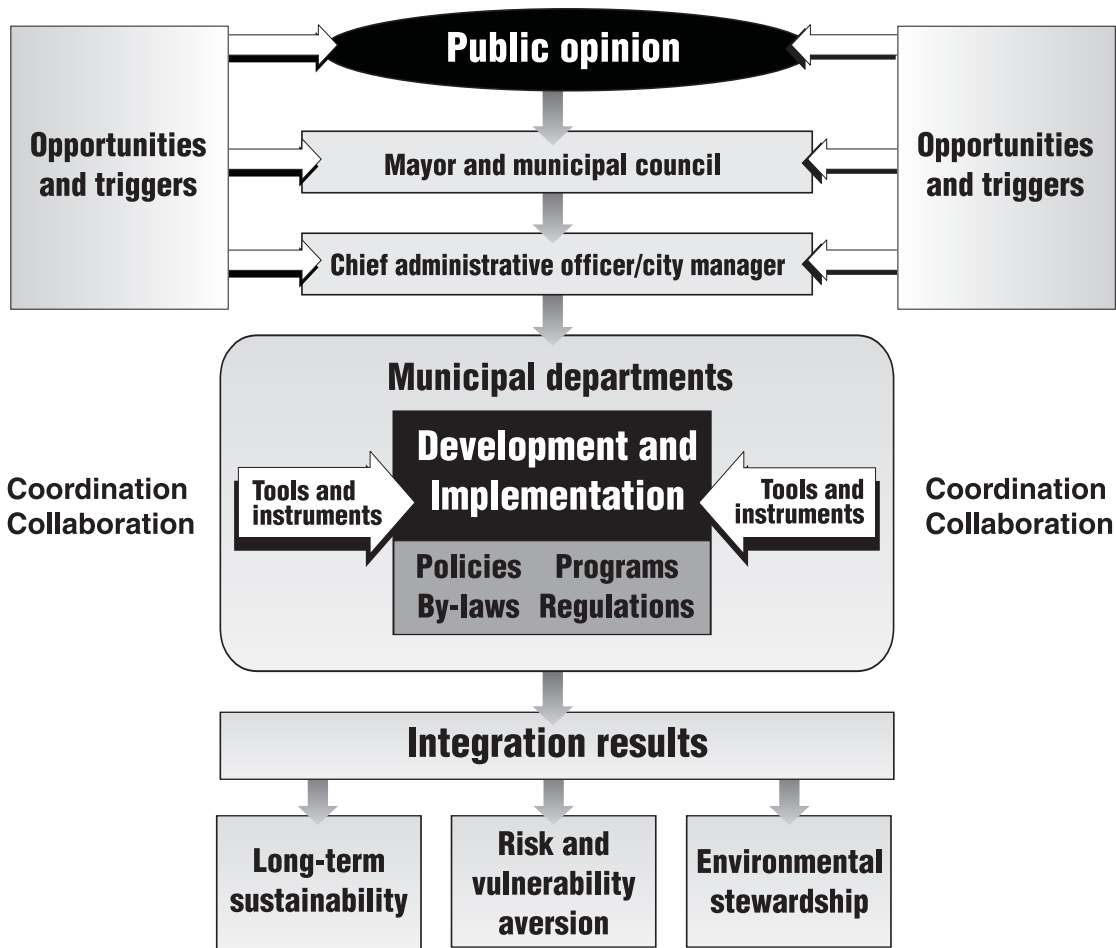
Municipal councils represent the general public and business community. Some municipal councils conduct regular surveys to gauge public opinion on important issues. The results of the surveys are used to guide broad direction of municipal councils. In addition, councils attend briefing sessions with the administration to express their desires and understand municipal processes.

Demographic changes by region and industry innovation lead to new patterns of population growth. In many regions, a substantial increase in infill developments seems prevalent, and municipalities feel pressure to limit suburban expansion. In these regions, there is increasing consumer demand for inner-city redevelopment, leading to associated changes in demand for municipal infrastructure and municipal services. In other regions, many families prefer single-family homes in suburban communities. In both cases, cost and lifestyle remain important considerations for homebuyers.

Although the pressures experienced by municipal governments to move forward with land use and development continue to grow, the reasons to embrace land use and infrastructure integration also grow. The key is to establish strong leadership from an individual working within the institution who can move the process of integration forward. Champions can emerge from any level in a municipality—a member of council, the mayor, a city manager or a concerned staff person. The champions depend on an administration committed to incorporating changes into their business processes.

In Airdrie, the city manager led the initiative to diversify the tax base, which was backed by a cross-department multi-disciplinary team. In Okotoks, the leadership came from residents working with the council, supported by a city manager and local businesses.

Figure 3–1: Essential elements of a framework to create greater integration of infrastructure into land use planning



In Vernon, the mayor was the champion of the fast track system, which was also endorsed by an enthusiastic city manager and local developers. In Chilliwack, the city engineer convinced the administration and council to try new methods for stormwater management, with support from senior levels of government.

3.2.3 Essential Elements and Considerations

Based on the case studies, some key issues considered essential elements of a framework to create greater integration of infrastructure into land use planning include the following.

What issue will be the catalyst for change?

The catalyst is usually an issue motivated by fear, concern about growth or financial crisis and often described as the “pain” issue. This creates an opportunity to initiate change.

Who is the champion that will take charge of the issue?

The champion can emerge from any level in a municipality and is the key figure providing leadership and initiating action. The champion may be a member of council, the mayor, city manager, or a concerned staff person. There can be more than one champion; one on the administration and one on council.

Is council supportive and committed to change?

Before financial and human resources are allocated to address the pain issue, council must pass a motion or other directive as an indication of support.

3. Methodology

3.2 A Framework for Integration

Figure 3–1
Essential elements of a framework to create greater integration of infrastructure into land use planning

The key is to establish strong leadership from an individual working within the institution who can move the process of integration forward. Champions can emerge from any level in a municipality—a member of council, the mayor, a city manager or a concerned staff person.

3. Methodology

3.2 A Framework for Integration

Monitoring the implementation of integration and its success are key to promoting greater integration within a municipality and as is sharing success stories with other municipalities.

Is the administration unified, mobilized, and equipped to develop solutions to resolve the pain issue?

The CAO or city manager causes integration to occur within the organization. Solutions are incorporated across departmental lines in strategies and departmental business plans.

Is the solution institutionalized and have the most effective tools been used?

Solutions to integration become institutionalized when they are adopted by by-laws and imbedded in policies, zoning by-laws, service standards, agreements and regulations.

Is the integration effective on the ground?

The integration only has an impact when it is implemented and affects change. For example, is infrastructure given a higher priority in budgets, have land use by-laws been adopted and implemented and has there been a physical change to infrastructure?

Is the integration successful and information shared?

Monitoring the implementation of integration and its success are key to promoting greater integration within a municipality and as is sharing success stories with other municipalities.

4. Implementation

4.1 Implementation Needs

An integrated approach to land use planning is achieved through the use of various instruments available to municipalities at the policy and implementation stages of the planning process. In some provinces, more than 200 pieces of legislation and regulations control land use. Municipalities can integrate infrastructure planning and land use planning using many of these existing legislative authorities.

The case studies at the end of this best practice indicate that success may depend on adopting **innovative tools** and using **existing tools** more effectively. They emphasize the value of combining different categories of policy tools, including research, education, demonstration projects, fiscal reforms, market reforms, and regulatory instruments. They also suggest that a key innovation is to adopt process tools, such as the establishment of multidisciplinary teams, and the implementation of collaborative planning exercises involving businesses, the public, experts, and senior levels of government.

One of the most important strategies available to municipalities is the power of legislative authority to enforce changes efficiently and thoroughly.

The **land developer** is the primary initiator of, and investor in, specific projects that turn a municipality's land use policies into realities. The developer has the financial means and experience to implement land use plans. In addition, the developer uses a team of professionals who know the regulations and standards. As a member of the development team, the urban planner uses a palette that contains tools and instruments, such as provisional laws, municipal laws, urban design guidelines, zoning by-laws, and engineering standards.

Most developers do not work in a vacuum, and appreciate the importance of consulting with staff and elected officials to better understand the community vision, policies, and servicing requirements. The primary instruments, which incorporate servicing standards into development, are subdivision and site plan agreements.

An ideal relationship between a developer and a municipality is characterized by three key principles.

1. An administration that has a clear **vision**, well defined land use **policies**, and an "open for business" **attitude** is more likely to garner support from a developer to implement policies and regulations, and negotiate off-site improvements.
2. Timely processing of development applications is very important, as a developer's primary objective is to generate revenues in a positive market environment.
3. After a development application is filed, don't change the rules.

4.2 Land Use Plans

There is a growing trend among municipalities to incorporate fiscal goals and policies, and requirements for fiscal impact analysis as part of the land use planning and plan approvals process.

Land use is the primary catalyst for all municipal expenditure and revenue generation. Different categories of land use produce different costs and revenues. The considerable complexities of the relationship between land use and municipal expenditures and revenue generation emphasize the value of regular and detailed impact assessment.

For example, while it is generally assumed that residential development results in a net loss in revenues, this is not true for all residential uses. The cost of infrastructure and revenues generated from land use can be calculated by

4. Implementation

4.1 Implementation Needs

4.2 Land Use Plans

One of the most important strategies available to municipalities is the power of legislative authority to enforce changes efficiently and thoroughly.

Land use is the primary catalyst for all municipal expenditure and revenue generation.

4. Implementation

4.2 Land Use Plans

4.3 Life Cycle Cost of Infrastructure

undertaking a fiscal impact analysis, which considers the long-term life cycle cost of municipal infrastructure, and the reserve funds needed to pay for infrastructure over the long term.

It is frequently assumed that higher densities result in lower infrastructure costs. This may be true if the length of infrastructure is substantially reduced. However, the capacity of services must still accommodate approximately the same population due to the slight reduction in population per residential unit. For much higher densities, the savings in linear deep infrastructure will be greater.

As for revenues, those from lower density units are generally higher. Net or surplus revenues are calculated by subtracting the life cycle costs from revenues for various land use categories.

In **greenfield** situations, the municipality will most likely achieve net surplus revenues from high-end market low density residential development than from higher densities.

The reason is that lower density developments produce much higher revenues per unit of assessment than higher density developments. The probability of much higher densities producing net surplus revenues is lower.

In **infill** development where capacity exists in on-site and off-site infrastructure, higher density uses will most likely generate net surplus revenues.

In **transportation planning**, a municipality can incorporate land use planning to achieve its land use, infrastructure and fiscal goals.

If an appropriate level of population density exists, planning appropriate public transit will reduce the requirement for land. Conversely, the layout and densities of land use will encourage the use of public transit.

Transportation policy and the transportation plans that follow play a significant role in determining future land use, capacity and municipal revenue.

All of the above situations must be analyzed as part of land use planning. This can be implemented as policy by incorporating fiscal goals into land use policy documents, such as general municipal plans, plans d'urbanisme, official plans, master plans, and secondary plans. Such changes to policies allow land use planners to use the need for services, and existing capacity of infrastructure systems as an instrument to influence and control growth.

Ideally the new policies incorporated in such plans should include:

- a business process that makes infrastructure planning and associated revenue allocation an integral part of the land use decision-making; and
- an effective process for ensuring that long-term infrastructure funds are protected against competing short-term interests.

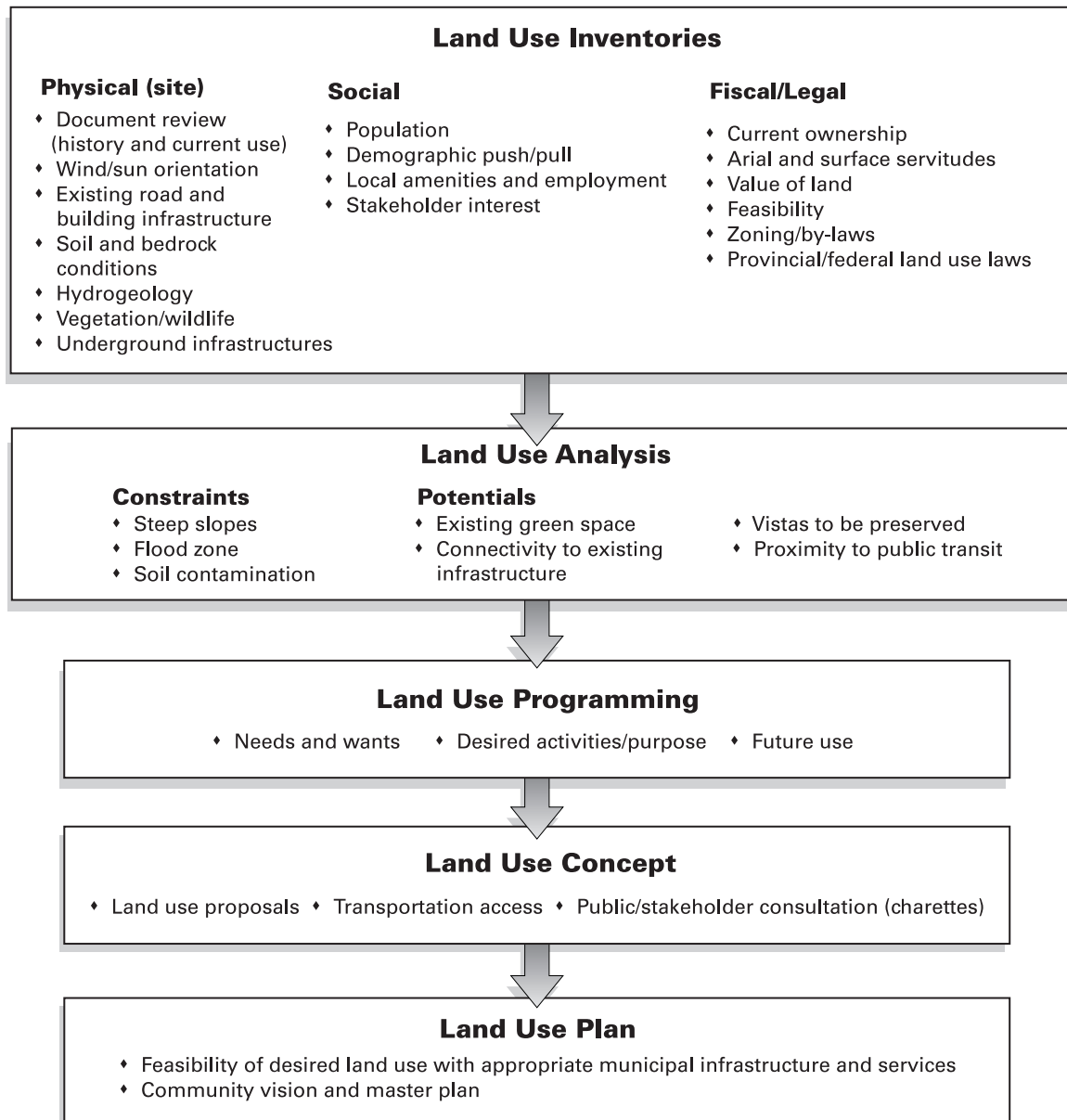
There is a recognized land use planning process among practising professionals and in academia that bring us closer to a comprehensive plan.

Figure 4-1 illustrates a summary of this process.

4.3 Life Cycle Cost of Infrastructure

Life cycle costing (LCC) is a tool that municipalities use to define acceptable standards and prevent further deterioration of infrastructure systems. Life cycle costs include construction, operations, maintenance, rehabilitation, and replacement; it requires that a life expectancy and rate of deterioration be estimated for each type of asset. It then becomes possible to quantify the maintenance and rehabilitation requirements. The maintenance of municipal infrastructure and related components, such as pump stations and treatment facilities, is costly; such infrastructure must be recognized as a drain on municipal revenues. If the costs are well quantified for a variety of development scenarios, they can be minimized at both the policy and implementation levels of land use planning.

Figure 4–1: Land Use Planning Process



4. Implementation

4.3 Life Cycle Cost of Infrastructure

Figure 4–1
Land Use Planning Process

Calculating the life cycle costs and revenue from infrastructure at build-out is one method of avoiding fiscal risks, and achieving better integration of infrastructure and land use planning. For municipalities that are not constrained by physical or environmental limitations to expanding land use, a more comprehensive, regional approach to planning is needed. Integration of regional planning with neighbouring municipalities, particularly in commuter sheds is key to ensuring land uses are compatible with surrounding municipalities.

4.3.1 Reserve Funds

A significant challenge faced by many municipalities is the establishment of adequate budgets to replace infrastructure. As a result, the need for substantial capital expenditures to replace deteriorating infrastructure has become more compelling. The need to account for the full cost (including replacement) is mandated by legislation and can be recovered from user fees. However, this does not apply to all infrastructure. A greater understanding of cost recovery mechanisms for replacing ageing infrastructure is needed.

Integration of regional planning with neighbouring municipalities, particularly in commuter sheds is key to ensuring land uses are compatible with surrounding

4. Implementation

4.3 Life Cycle Cost of Infrastructure

4.4 Land Use Planning Authorities and Tools

The following are some suggestions that may help a municipality establish and better manage reserve funds:

- Land uses generate recurring revenues that support infrastructure; a portion of these revenues could be allocated to reserves to pay for the replacement of infrastructure. This would be similar to the process of utilities where a portion of user fees is allocated to pay for replacement of infrastructure.
- Reserve funds are a means to allocate a portion of revenues to an account allocated for a variety of municipal expenditures. Reserve funds may be used to set aside money gradually and incrementally for replacement of infrastructure. Municipalities that have been diligent at building and maintaining reserve funds are not in a financial crisis.
- Reserve funds are prone to “raids” created by competition to allocate funds from reserves for non-infrastructure related matters and projects. Municipalities should consider establishing a reserve specifically earmarked for infrastructure replacement. If reserves are not created for the purpose of capital investment requirements over the life of the asset, the current estimated cost of \$57 billion to replace ageing infrastructure in Canadian municipalities will increase.

4.4 Land Use Planning Authorities and Tools

Instruments for land use planning are grouped in two main categories: authorities created through by-laws, acts and statutes; and supporting tools, which do not have legal status and are used to support the planning process. Authorities and tools are used at two levels of planning: when land use policies are created and when land use plans are implemented.

4.4.1 Authorities

Authorities that can support improved infrastructure—land use planning integration include the following.

- Adoption through a by-law of statutory policy plans, such as general municipal plans or *plans d’urbanisme*, can contain generalized enabling policies or explicit standards and requirements.
- Some policy documents such as general municipal plans (in Quebec *plan d’urbanisme et son documents complémentaires*), may require mandatory requirements for special studies, such as fiscal analysis, capacity analysis, or criteria for infrastructure services.
- Zoning by-laws establish development permissions and the explicit means to implement them.
- Municipal budgets are adopted by law and establish a municipality’s commitment to expenditures for the next fiscal year.
- Development and servicing agreements, such as those required for installation of services and site-specific site plan control implement standards for infrastructure and quantify financial obligations for on-site and off-site servicing.
- Inter-municipal agreements control the shared services, which usually include water supply, water quality provided by one municipality for another and corresponding wastewater collection and standard of treatment.
- Licences for water rights are granted by provincial departments of environment or natural resources, and control the amount of water that can be drawn from natural sources, such as rivers and wells.
- Development charges or development cost charges are enacted by law in some provinces and are, in theory, intended to cover costs of off-site services related to a given development.

4.4.2 Land Use Tools

Tools that can support improved infrastructure — land use planning integration include:

- growth management studies which are optimized to provide infrastructure to support growth;
 - physical inventories of site (geo-technical, topography, hydrology studies);
 - sustainable community models and strategies, which embody the concepts and principles of achieving a financially sustainable economy, including fiscal sustainability;
 - engineering studies of drainage basins and feasibility analysis, that identify and quantify the means to reduce the cost of infrastructure;
 - stormwater management studies that focus on using processes of the natural environment to facilitate stormwater reduction and costs, and identify how the built-form can be used to minimize demand on stormwater management systems;
- fiscal impact analyses that consider land use potential, life cycle costs, levels of service, and revenues to produce a bottom line determination if land use will generate sufficient revenues to support the cost of infrastructure, including contributions to reserve funds to balance life cycle costs; and
 - demonstration projects that explore alternative approaches to meeting infrastructure services as part of land use policy. This may include new technologies such as distributed and on-site infrastructure, and building standards that reduce demand for centralized infrastructure services.

4. Implementation

4.4 Land Use Planning
Authorities and
Tools

5. Municipal Applications of Integration

5. Municipal Applications of Integration

Lessons learned from municipalities that have attempted land use and infrastructure integration are important for those considering the practice. The following summarizes of the lessons learned from certain municipalities that have achieved positive results in the integration of infrastructure and land use planning. The examples highlight innovations in each of the four cornerstones of land use

and infrastructure integration: land use, policy, implementation and infrastructure. These examples, and those outlined in greater detail in the **Appendices A and D**, show the results of an integration framework involving a champion, a trigger, and inter-departmental collaboration that produced new or improved capacity to integrate land use and infrastructure planning.

Table 5-1
Summary of Case Studies highlighting innovations in Land Use, Policy, Implementation, and Infrastructure in Selected Cities.

Table 5-1: Summary of Case Studies Highlighting Innovations in Land Use, Policy, Implementation, and Infrastructure in Selected Cities.

Municipality	Land Use	Policy	Implementation	Infrastructure
Airdrie A policy level case study	Location of annexation was greatly influenced by the cost of infrastructure. The addition of more commercial will generate more revenues to support the cost of infrastructure.	The City adopted a policy incorporating fiscal analysis, infrastructure life cycle costing, and revenues in the plans approval decision-making process.	The integrated approach is institutionalized in by-laws and policies across departmental lines.	The least expensive engineering solutions have been chosen.
Okotoks A policy level case study	Land uses are confined to self-imposed limit of development.	The Town has adopted policies limiting growth.	The integrated approach has been institutionalized and embedded in cross departmental business plans.	Infrastructure played a major role in defining the limits of growth and controlling growth by limiting capacity of infrastructure.
Vernon An implementation level case study	Land use conforms to community policies.	The City changed its policy regarding the sequence of approvals to generate revenues sooner and enable repayment of investment on infrastructure system improvements.	The policy and approvals process required changes across departmental lines.	Private systems were abandoned, and existing and new developments were connected to the City's common system.
Chilliwack An implementation level case study	Official community plan (OCP) is in place, the local government planning statement (by-law) will form the basis for a liquid waste management plan.	Adoption of the guidelines across departmental lines insures an integrated approach and institutionalizes the solution and policy.	Development standards applied at the site level were key. The objective in making changes at the site level is to achieve cumulative benefits over time, one lot at a time.	The water balance methodology enables local governments to establish achievable performance targets for reduction of rainwater runoff volume at the site level.
Corner Brook An implementation level case study	Changes to land use are being made as part of the review of the general community plan. with an emphasis on intensification in the core area.	Policies will direct growth to the core area based on limitations and opportunities afforded by the existing system capacity.	Implementation will occur within the scope of policies in the general municipal plan.	Capacity of the existing infrastructure will define the amount and location of growth.

6. Gauging the Path to Integration

Once a municipality has officially committed to integrating land use and infrastructure planning, it is helpful to determine if the approach will lead to success. The following section outlines some key questions a municipality might ask itself to determine if it is taking a supportive approach for the integration of land use and infrastructure planning. This is not intended to be a comprehensive checklist of considerations since municipalities approach integration differently. Some further considerations and tools for integration are identified in **Appendix B**.

- Has your municipality undertaken institutional change, such as creating an **internal committee** or working group that coordinates land use and infrastructure planning? A function of this committee would be to cross-interdepartmental lines to identify and resolve common issues.
- Does your municipality have a working group or committee that has a mix of elected officials, senior executives, and interdepartmental working level staff?
- Has your municipality adopted an **integrated planning model** or policies?
- Does your municipality undertake a financial analysis to determine if revenues generated from land use are sufficient to cover the **life cycle** cost of infrastructure over the long-term?
- Is land use planned and managed to **optimize the overall cost** of infrastructure systems?
- Does your municipality consider how to allocate land uses to make the best use of infrastructure capacity?
- Has your municipality adopted new methods of land use planning that result in **cost savings for planning** and managing components of infrastructure, such as a reduction of stormwater runoff, which, in turn, reduces the need for costly deep infrastructure solutions?
- Is your municipality **consulting and engaging as partners the private sector** development industry, and using their expertise on integrated land use and infrastructure planning?

6. Gauging the Path to Integration

Once a municipality has officially committed to integrating land use and infrastructure planning, it is helpful to determine if the approach will lead to success.

7. Questions and Issues for Future Research

7. Questions and Issues for Future Research

- How will future infrastructure **design standards** and land use planning consider and protect against the impacts of climate change?
- What **legislative authorities** empower municipalities to create special capital reserves for replacement of infrastructure? Where will the funds come from, how can they be collected, and how much is needed and when?
- Find examples of integrative, **collaborative process tools** to illustrate how different professionals can work together and overcome conflicting goals to align outcomes more effectively.
- Applied research clarifies how to enhance the **flexibility and adaptability** of infrastructure systems, and the opportunities for incorporating design features that allow for extending and intensifying systems.
- Examples of multiple use infrastructure systems so engineers, planners, and designers can better appreciate how features of infrastructure systems, including facilities and rights of way, can **contribute to improved land use** within the community.
- Municipalities and utilities need more guidance on **life cycle costing** tools, to better evaluate the full lifetime capital and operating costs of alternative infrastructure systems. This could include a national database on the expected life of alternative components and materials, and a catalogue of software tools that can be used for projecting useful lifetimes, management strategies, and replacements costs for existing systems;
- A concerted research effort is needed to assist in evaluating the **interaction** between infrastructure systems, (including choice of materials and products) and land uses, from the perspective of life cycle analysis. For example LCA can be used to measure the impact of infrastructure systems on the users of land, including their mobility, comfort, economic costs, and so on.
- More work is required to **identify indicators** based on real life examples and experiences to monitor progress towards integration.
- How have municipalities that have engaged in **integrated planning** efforts with the private sector developers and builders benefited from the resulting decisions?

Appendix A: Case Studies

A. Case Studies

A.1 City of Airdrie— A Policy Level Case Study

The following case studies are based on interviews held with selected municipalities for the purposes of developing this best practice document.

A.1 City of Airdrie—A Policy Level Case Study

Municipality and interviewee	City of Airdrie, Alberta: population 27,000.
Subject of best process	An integrated approach to City of Airdrie annexation of 2,400 acres.
Central issue	The City of Airdrie is on the edge of the City of Calgary and is experiencing rapid growth in the range of six percent per year. The City of Airdrie has a growth strategy to meet demand and balanced use and revenues and has opted to not adopt a policy of containment. In 1997, the City examined its growth rate for residential uses and determined that there was an imbalance in the mix of residential and non-residential uses and revenues. The City needed more land to accommodate more residential units and a higher percentage of land and revenues from non-residential uses. Higher revenue generation from non-residential uses was needed to pay for the anticipated cost of service delivery.
Champion(s)	The City Manager lead an initiative to correct the imbalance in revenue split between revenues from residential uses as compared to relatively low revenues from non-residential uses.
Triggers	The primary triggers that initiated the annexation are: <ul style="list-style-type: none"> ■ the need for more non-residential land to generate revenues to pay for service delivery; ■ the need to have a higher percentage of assessment from non-residential uses; and ■ the inability to reach a negotiated solution with the adjacent municipality, the Municipal District of Rockyview.
Approach	<p>Initial Approach—First Attempt at a Solution</p> <p>The City of Airdrie and the Municipal District of Rockyview have an inter-municipal development plan for the joint planning of adjacent lands. Under this agreement, an inter-municipal committee was established to attempt to negotiate a solution for the City of Airdrie’s requirements. Members of the committee from the City of Airdrie included the mayor, deputy mayor, CAO, and the director of planning. This process failed to produce a mutually agreeable solution and the City filed an application to the provincial Annexation Review Board.</p> <p>The City of Airdrie began an alternate planning process which included the following:</p> <ul style="list-style-type: none"> ■ a cross department multidiscipline team; ■ a growth management strategy; ■ studies of demand for residential and revenue generating non-residential land uses; ■ studies of the deep infrastructure required to support several growth options; ■ a fiscal impact analysis of the long-term life cycle cost of infrastructure for each land use option; and ■ the calculated future revenues to support infrastructure and the revised revenue mix to achieve a higher percentage of revenues from non-residential sources. <p>The growth management strategy and the analysis described above were used to support the City’s case at the Annexation Review Board.</p>

A. Case Studies

A.1 City of Airdrie— A Policy Level Case Study

<p>Approach (continued)</p>	<p>Second Attempt at Solution</p> <p>The Province of Alberta, the City of Airdrie, and the Municipal District of Rockyview reached a compromise with the assistance of a mediator.</p> <p>A landowner/developer made representation to the Review Board on the basis that compromise solution reached through the mediation process was not good planning. The Review Board agreed and overturned the mediated solution in favour of the City of Airdrie’s growth management strategy based on integrated and comprehensive planning process.</p>
<p>What instruments or tools were used at the policy level or implementation level?</p>	<p>Several instruments were used in the City’s integrated and comprehensive policy level planning process, which were:</p> <ul style="list-style-type: none"> ■ the Growth Management Strategy as the primary integration tool; ■ land use concepts for several growth areas; ■ engineering studies to determine the cost of each scenario; ■ fiscal impact analysis to determine the life cycle cost of infrastructure and revenue generation from land uses; and ■ a multidiscipline cross department management team.
<p>What were the outcome/results of the process?</p>	<p>The Review Board supported the City’s annexation proposal and sufficient land was added to the City’s land base to produce revenues sufficient to support infrastructure and services for the long-term.</p>
<p>What was critical to the successful implementation and integration of infrastructure and land use planning?</p>	<p>The Review Board cited several success factors which included the City’s comprehensive planning process and a demonstrated ability to manage its financial future as a result of the fiscal analysis.</p> <p>The engineering study on deep infrastructure influenced the policy decision and rationale on where the annexation should occur based on the least expensive area for future development.</p>
<p>What were the lessons learned or things that could have been done better?</p>	<ul style="list-style-type: none"> ■ Leadership and foresight of the City Manager was a key factor in the City’s success. ■ Creation of a multidisciplinary cross-departmental team and the integrated and comprehensive approach were the key factor in the success of the annexation. ■ The City’s fiscal future is more secure as is its ability to pay for life cycle costs of infrastructure.

A.2 Town of Okotoks—A Policy Level Case Study

A. Case Studies

A.2 Town of Okotoks— A Policy Level Case Study

Municipality and interviewee	Town of Okotoks, Alberta: population 12,000.
Subject of best process	How to achieve containment and an ideal size for the Town of Okotoks.
Central issue	The Town of Okotoks is within the market influence of the City of Calgary. The growth rate is in the five percent range, which is among the highest in Alberta and Canada. The Town of Okotoks has adopted a policy of containment to cap growth and retain its small town character. There is also a strong desire and need to have a sustainable community when the town is built out. Now, it is the policy of the Town to cap the population at 30,000.
Champion(s)	The direction to cap growth is a result of the Town's residents and actions by council. Council also hired a city manager who implemented council direction and moved the process forward within the administration.
Triggers	The primary triggers are a strong desire by residents to cap growth, a clear vision of the small town, and desire to have a sustainable community at build-out.
Approach	<p>Overall Direction</p> <p>At the direction of council, a survey of residents is conducted every three years in advance of municipal elections. The results of the last three surveys show a desire to cap growth and retain the small town character of Okotoks. The sentiment has grown stronger as measured by each of the last three surveys in the last nine years.</p> <p>Strategic Direction</p> <p>Based on the results of the survey and council's direction, two parallel processes emerged. An update of the municipal development plan and the sustainable Okotoks model. The sustainable community model was the tool used to identify how a sustainable community could be achieved. This influenced the preparation of the municipal development plan, which is the legislative tool that establishes formal municipal policies.</p> <p>Unified Administration</p> <p>Municipal departments function with the guidance of business plans with overlapping goals and direction, which implements the policy of containment and elements of the sustainable community model.</p> <p>Policy Instrument—Municipal Development Plan (MDP)</p> <p>About nine years ago, the municipal development plan for the Town was adopted, which capped growth at 30,000. The desire to develop a small town and contain growth was the basis for the plan.</p> <p>As part of the review of the development plan, the Town commissioned engineering studies that examined the option of connecting to a regional sanitary and water system. Connecting to the regional systems would have allowed the Town to expand beyond 30,000. Based on the desire to retain the small town character and cost issues, the Town opted not to connect to the regional systems and to rely on local water supplies in the river and local wells.</p> <p>The water supply in the river and wells has limited capacity. This is both a constraint and an opportunity and reason to cap growth at 30,000. The water supply is governed through a licence obtained by the Town from the Province of Alberta, Department of Environment. The limited capacity of the river also limits the discharge from wastewater.</p> <p>A limited water supply is a key to implementing the long-term vision of containment. Limited water capacity influenced infrastructure planning and design.</p> <p>Town policies prohibit the extension of sanitary and water beyond the limits of the town boundary. Consequently, pipes have not been oversized to accommodate additional capacity or growth. The size of pipe diminishes toward the limits of the service area. Servicing standards for developing areas control the size of the pipe.</p>

A. Case Studies

A.2 Town of Okotoks— A Policy Level Case Study

<p>Approach (continued)</p>	<p>The limits on water capacity also affect the amount and type of land use. The Town must allocate and manage its land uses wisely to be able to generate sufficient revenues to support the life cycle cost of infrastructure.</p> <p>Land developers have also adapted to the development environment by participating in promoting water conservation to maximize unit production.</p>
<p>What instruments or tools were used at the policy level or implementation level?</p>	<p>Several instruments were used to define and implement the Town's vision of a "small town."</p> <p>Policy Level Instruments</p> <ul style="list-style-type: none"> ■ The resident survey is the primary instrument for gauging the community's desire for growth and establishing a broad vision for the Town; ■ The municipal development plan is the legislative instrument that sets the policy direction; and ■ The sustainable community model provides guidance on matters related to sustainability and helps guide direction for policies in the municipal development plan and operations identified in the administrations business units. <p>Implementation Level Instruments-</p> <ul style="list-style-type: none"> ■ The Water License issued by the Department of the Environment controls and limits water consumption. ■ Engineering and servicing standards control the location and size of pipes which limit growth. ■ The zoning by-law controls land use and density based on the overriding water consumption by land use type.
<p>What were the outcome/results of the process?</p>	<ul style="list-style-type: none"> ■ The Town of Okotoks has sustainable plan of the community at build-out. ■ The administration has been organized into business units with cross-department commitment to the vision, the municipal development plan and the Sustainable Community Model. ■ Legislative instruments, such as the water licence, municipal development plan, zoning by-law and engineering standards are in place to control growth, the water supply, and land use.
<p>What was critical to the successful implementation and integration of infrastructure and land use planning?</p>	<ul style="list-style-type: none"> ■ Completion of the resident survey identified the strong desire for a growth based on containment. ■ The direction and leadership by council to set the political direction to establish the vision for a small town at build-out.. ■ The engineering studies which examined options and costs associated with connecting Okotoks to the regional sanitary and water networks as compared reliability on local water supply provided by the river and well system. ■ Producing a water management plan defined the limits of the town based on water supply. ■ Engineering standards control the location and pipe sizes that will not be oversized and tapered, and dead-ended at the municipal boundary. ■ The size and location of infrastructure can contribute to controlling land use both at the policy and implementation levels. ■ A land use plan and allocation of land uses that relates to the consumption rates of various land uses. ■ Developers support water conservation measures so the maximum number of units can be built within the engineered envelope of the Town.
<p>What were the lessons learned or things that could have been done better?</p>	<p>Having a strong and clear community-based vision creates a launch point for future direction and political support.</p> <p>Engineering studies of infrastructure alternatives helped establish a cost-effective means for implementation of the vision.</p>

A.3 The City of Chilliwack Test Site for the Province of British Columbia Guide Book—An Implementation Level Case Study

A. Case Studies

A.3 The City of Chilliwack Test Site for the Province of British Columbia Guide Book—An Implementation Level Case Study

Municipality and interviewee	City of Chilliwack, Population approx. 70,000.
Subject of best process	The use of design guidelines for developers to improve stormwater management, and reduce the financial costs and environmental impact of municipal infrastructure.
Central issue	There was a need to develop a guidebook that would help municipalities integrate land use planning with rainwater management.
Champion(s)	A habitat biologist with the Province of British Columbia, was the chair of the Guidebook Steering Committee, and provided the inter-agency group with a vision and with leadership. The City of Chilliwack Development Engineer was also instrumental as was a member from Environment Canada who acted as co-chair of the Steering Committee.
Triggers	In many respects, it was the <i>1997 Fish Protection Act</i> that triggered a process of change, since run-off from developed sites was threatening habitat for salmon and other aquatic life. A number of forums, held in different cities around British Columbia, created the local government support and the momentum that resulted in development of <i>Stormwater Planning: A Guidebook for British Columbia (2002)</i> . Local governments were crucial to the creating of a guidebook that was both practical and credible. As part of the guidebook development and validation, two municipalities—the City of Chilliwack and the other the Regional District of Nanaimo—agreed to use the Guidebook. Their challenge was to adapt the material to their local situation and create an alternative demonstration of rainwater management.
Approach	Chilliwack adopted a process that was interdisciplinary, with a stakeholder roundtable and public forums. To achieve integration of the engineering, planning and ecological perspectives, Chilliwack followed the Guidebook's step-by-step process for integrated stormwater management plans (ISMP). In British Columbia, the term ISMP has gained widespread acceptance by local governments and the environmental agencies to describe a comprehensive approach to stormwater planning. The purpose of an ISMP is to provide a clear picture of how to be proactive in applying land use planning tools to protect property and aquatic habitat, while at the same time accommodating land development and population growth.
What instruments or tools were used at the policy level or implementation level?	<p>In most cases where an official community plan (OCP) is in place, the local government planning statement (by-law) will form the basis for a liquid waste management plan (LWMP). An LWMP minimizes the adverse environmental impact of the OCP and ensures that development is consistent with provincial objectives.</p> <p>At the core of the guidebook is the water balance methodology that enables local governments to establish achievable performance targets for reduction of rainwater runoff volume at the site level.</p> <p>Development standards were applied at the site level. The objective in making changes at the site level is to achieve cumulative benefits over time, one lot at a time.</p> <p>The provincial guidebook was an important supporting tool. It presents a methodology for both greenfield and urban retrofit that local governments can use to:</p> <ul style="list-style-type: none"> ■ develop watershed performance targets based on site-specific rainfall data, supplemented by stream flow data (if available) and on-site soils investigations; and ■ translate these performance targets into design guidelines that can be applied at the site level to mitigate the impacts of land development.

A. Case Studies

A.3 The City of
Chilliwack Test Site
for the Province
of British Columbia
Guide Book—An
Implementation
Level Case Study

<p>What were the outcome/results of the process?</p>	<p>The demonstration project in Chilliwack provided a detailed, well-illustrated example of how to operationalize the guidelines. This resulted in broad-based support for the Guidebook. The link between land use development and rainwater management was clear to all, as was the need to integrate the two.</p> <p>Land development practices in British Columbia are slowly but surely being transformed by the approaches presented in the Guidebook and the implementation of performance targets for rainwater runoff reduction.</p> <p>Research continues on the Water Balance Model, with a view towards making this tool standard practice in British Columbia for land development decisions.</p>
<p>What was critical to the successful implementation and integration of infrastructure and land use planning?</p>	<ul style="list-style-type: none"> ■ Collaboration between local and senior governments. ■ Participation by a network of municipalities. ■ Use of guidelines as a policy tool. ■ Demonstration projects for learning and validating. ■ A multi-year structured process. ■ Well-defined and shared. ■ An effective and inspirational chair for the provincial committee. ■ Strong technical expertise from consultants, including technical innovations like the water balance methodology.

A.4 The City of Vernon—An Implementation Level Case Study

A. Case Studies

A.4 The City of Vernon—An Implementation Level Case Study

Municipality and interviewee	City of Vernon, British Columbia: population 33,500.
Subject of best process	Fast Track Development Process.
Central issue	<p>The City of Vernon is located in rolling hills of the Okanogan Valley and is a destination for retirees and resort developers. Historically, the rolling terrain has presented challenges for contiguous planning of land uses and municipal services.</p> <p>The linear process of land use planning and municipal approvals is often a time and labor-intensive process. The City of Vernon desires to have a fast track process that allows development to proceed at a faster pace while still maintaining the integrity of their planning policies. Faster processes mean the municipality will recover revenues more quickly to pay for infrastructure improvements and makes Vernon improve the business environment.</p> <p>Several resort projects were developed on private standalone systems, and new resort developments were proposing private systems, because the City's system needed to be upgraded so it could be extended to existing resorts and the proposed new resorts. It is to the City's and the developers' advantage to have developments connected to the City's central system.</p> <p>Developers need to know three fundamental things before they will commit funds to the municipality: What can I build, how much can I build, and how fast can I build it?</p> <p>The developer could only commit funds at the zoning stage, which traditionally happens near the end of the approval process. By changing the order of approval process the developer would know his development rights, how many units could be built and revenue generation. In the traditional linear method, the developer would tend to hold back concessions until development rights were created at the zoning stage. If the zoning was approved earlier in the process, the municipality would benefit from financial contributions from the developer at an earlier date.</p> <p>The City of Vernon wanted a fast track process that would permit development to proceed in conformity with their policies. Developers needed an early approval of zoning on their land so they could secure financing.</p>
Champion(s)	The champion of the fast track system was the mayor who was supported by an enthusiastic city manager and land developers.
Triggers	<p>Municipal Triggers</p> <ul style="list-style-type: none"> ■ A need to upgrade the City's water and wastewater systems; ■ a need for the City to recover costs of infrastructure upgrades; ■ the need to shorten the approval process to facilitate early revenue generation from new land use proposals and connect existing developments on private systems to the upgraded systems; and ■ to increase revenue contributions. <p>Developer Triggers</p> <ul style="list-style-type: none"> ■ Needed a commitment at the zoning stage to be able to secure financing and make contributions to the city for cost sharing of upgrades.

A. Case Studies

A.4 The City of Vernon—An Implementation Level Case Study

Approach	The City changed the order of the linear development approval process. The table below illustrates the way the order was changed.	
	Traditional	Fast Track
	Application submitted	Application submitted
	Conformity with Official Community Plan	Conformity with Official Community Plan
	Submit development concept plan	ZONING APPROVED by Council, development RIGHTS SECURED BY DEVELOPER
	Public Consultation	NO BUILD COVENANT ON TITLE— concurrent with zoning
	Development concept approved	FINANCIAL CONTRIBUTION TO MUNICIPALITY
	ZONING APPROVED by Council, development RIGHTS SECURED BY DEVELOPER	Submit development Concept Plan
	Development agreements executed	Public Consultation
	FINANCIAL CONTRIBUTION TO MUNICIPALITY	Development concept approved
	Development agreements executed	
	NO BUILD COVENANT REMOVED	
What instruments or tools were used at the policy level or implementation level?	<p>The primary instrument used to achieve reordering of the fast track process is:</p> <ul style="list-style-type: none"> ■ section 219 of the Province of British Columbia <i>Local Government Act</i>, which enables the City to implement the NO BUILD covenant and restrict development. <p>This is legislated authority already in existence, which applied in a new context. This instrument is available to any municipality in British Columbia.</p> <p>Other instruments such as the OCP and zoning by-law were used in the traditional manner.</p>	
What were the outcome/results of the process?	<ul style="list-style-type: none"> ■ The key outcome was reordering the approval process that permitted zoning of the developers land earlier in the process. 	

A.5 The City of Corner Brook, Newfoundland—A Policy Level Case Study

Municipality and interviewee	The City of Corner Brook, Newfoundland, 42,000 people reside within Corner Brook, with 20,105 living within the central city area.
Subject of best process	Integrating land use and infrastructure in older inner city areas.
Central issue	<p>Approximately half of the existing population of Corner Brook lives in the older and central area of the City. This area experiences redevelopment pressures and intensification. While it is desirable to redevelop and intensify, implementation of this policy direction requires coordination with the upgrades to sanitary and water system.</p> <p>This issue will be examined during the review of the City's general municipal plan.</p>
Champion(s)	The City and most municipalities update the general municipal plan on a regular basis. However, a determination of the need for infrastructure to support land use has evolved as part of the review process in recent years. No clear champion was identified, rather the need to examine infrastructure for intensification has evolved.
Triggers	<ul style="list-style-type: none"> ■ The need to update the municipal plan. ■ Desire to make more efficient use of existing infrastructure capacity in built-up areas.

A. Case Studies

A.5 The City of
Corner Brook,
Newfoundland—
A Policy Level Case
Study

Appendix B: Checklist of Decision-Making Tools for Land-Use and Infrastructure Integration

B. Checklist of Decision-Making Tools for Land-Use and Infrastructure Integration

The following is a detailed checklist that serves as a gauge to determine the path towards land use and infrastructure integration. Not all elements of this checklist apply to every province or territory of Canada because of the varying requirements and approaches to land use and infrastructure planning that currently exist.

Table B-1
Checklist for Land Use and Infrastructure Integration

Table B-1: Checklist for Land Use and Infrastructure Integration

Policy/Strategic Tools	Implementation/Operational Tools
<ul style="list-style-type: none"> ■ Provincial land use statutes and regulations (and other relevant provincial statutes) ■ Environmental assessment statutes and regulations ■ Municipal and provincial policies ■ Municipal land use plans ■ <i>Plans urbanisme</i> ■ General municipal plans ■ Official community plans ■ Growth management studies/strategies ■ Sustainable community models ■ Engineering studies ■ Fiscal impact analyses (life-cycle costing) ■ Integration guidelines/integration framework ■ Land use and infrastructure performance ■ Targets and indicators ■ Resident surveys/needs assessment ■ Reserve funds 	<ul style="list-style-type: none"> ■ Development standards ■ Multidisciplinary, cross-departmental management team ■ Provincial standards and guidelines relating to land use and municipal services (i.e., <i>Stormwater Planning: A Guidebook for British Columbia</i>) ■ Municipal by-laws and licensing (zoning) ■ Development and service agreements ■ Inter-municipal agreements ■ Development charges/levies ■ Demonstration projects

Appendix C: Matrix of Related InfraGuide Best Practices

C. Matrix of Related InfraGuide Best Practices

Table C–1 is a list of other InfraGuide best practices, which point to the significance of the integration between or within municipal departments.

Table C–1
Other References of Integration Between or Within Municipal Departments found in InfraGuide Best Practices.

Table C–1: Other References of Integration Between or Within Municipal Departments Found in InfraGuide Best Practices.

InfraGuide Best Practice	Integration Component Tools
Planning and Defining Municipal Infrastructure Needs Decision Making and Investment Planning Best Practice #1	This best practice notes that one of the most important means to successful strategic planning is the integration of a municipal corporation's capital infrastructure plan with land use, financial plans, and corporate business plans.
Developing Indicators and Benchmarks Decision Making and Investment Planning Best Practice #2	This best practice notes that one of the most important considerations for developing appropriate indicators and benchmarks for infrastructure which can lead to better infrastructure planning is the integration of the operational knowledge of municipal corporations with those municipal officials making the actual funding decisions regarding infrastructure.
Coordinating Infrastructure Works Decision Making and Investment Planning Best Practice #5	This best practice notes the importance of coordinating infrastructure works with development related works in an effort to maximize value and minimize disruption to the public.
Investment Parameters for Municipal Infrastructure Decision Making and Investment Planning Best Practice #6	This best practice notes that when a multi-year infrastructure investment plan is established, the priorities inherent in that plan must be considered with the integration of works from other infrastructure programs.
Managing Infrastructure Assets Decision Making and Investment Planning Best Practice #7	This best practice notes that one of the key principles of an effective asset management plan for a municipal corporation is the integration of technical and financial plans. The asset management plan and the financial plan should be integrated so the relationship between the level of service and the cost can be measured.
Public Consultation for Infrastructure Renewal Decision Making and Investment Planning Best Practice #9	This best practice provides practical tools and approaches to develop and implement public consultation processes as a component of any infrastructure project. It stressed the importance of community awareness in helping municipalities make informed decisions on infrastructure renewal.
Strategic Commitment to the Environment by Municipal Corporations Environmental Protocols Best Practice #1	This best practice recognizes that each community is unique, and provides examples of municipalities of various sizes that have developed and implemented environmental practices. It recommends a strategic commitment to the environment as a first step, or to augment initiatives already underway within the corporation and the community.
Accounting for Environmental and Social Outcomes in Decision Making Environmental Protocols Best Practice #2	This best practice details the ways in which decisions regarding infrastructure can consider and integrate social and environmental outcomes. In so doing, this best practice addresses ways to ensure integrated approaches to decision making whereby economic, environmental and social costs and benefits are identified, quantified and monetized.

**C. Matrix of Related
InfraGuide Best
Practices**

Table C-1
Other References
of Integration Between
or Within Municipal
Departments found
in InfraGuide Best
Practices.

InfraGuide Best Practice	Integration Component Tools
Environmental Assessment Environmental Protocols Best Practice #3	This best practice is about the systematic integration of considerations, as it details the processes that can be used to identify, analyze and evaluate the potential natural, social, cultural, physical, economic and environmental effects of proposed activities and projects on the environment.
Demand Management Environmental Protocols Best Practice #4	The purpose of this best practice is to create an understanding of demand management as an essential strategy for municipal infrastructure management. This document provides senior municipal officials with guidance on the concepts behind demand management, current best practices, and information needs and tools for initiating and implementing demand management programs.
Stormwater Management Planning Storm and Wastewater Best Practice #12	The objectives of an integrated approach to the planning of stormwater management are to accommodate land development and population growth and protect property and natural resources. This best practice outlines some guiding principles and a framework that should be used in implementing stormwater management planning.
Source and On-Site Control for Municipal Drainage Systems Storm and Wastewater Best Practice #3	Urban development produces significant environmental and hydrologic changes, as undisturbed permeable surfaces become impermeable. This best practice is aimed to help municipalities minimize negative impacts through an integrated approach that treats stormwater as a resource to be protected. In addition, the best practice has as complementary objectives, the protection of property, aquatic resources and water quality.
Best Practices for Utility-Based Data Multi-Discipline Best Practice #1	This best practice presents a foundation and a guide for municipalities that wish to begin the process of identifying, storing, and managing utility-based information and data. When implemented, the steps outlined in this best practice will form a strong and flexible foundation from which one can add increasing levels of detailed data, thus promoting good utility management decisions.
An Integrated Approach to Assessment and Evaluation of Municipal Road, Sewer and Water Networks Multi-Discipline Best Practice #2	This best practice outlines a systematic five-step approach for the assessment and evaluation of municipal road, sewer and water networks.
Strategies for Implementing Transit Priorities Transit Best Practice #1	The objective of this best practice is to gather the best examples of how to implement transit priority on urban roads. Implementing transit priority implies that passengers on bus, light rail transit and streetcar systems are given greater status.

Appendix D: Implementation of Integrated Approaches in British Columbia

D. Implementation of Integrated Approaches in British Columbia

The Greater Vancouver Regional District (GVRD) has reached its limit for outward growth. This means that 75 percent of the next two million people will be housed in existing built-out watersheds. The resulting redevelopment is creating opportunities to restore watersheds over time. The rethinking of traditional approaches is built around integration of land use planning with volume-based rainwater management strategies.

Broad-based support for needed changes in municipal policies, regulatory tools, and standard practices is being achieved through consensus-building processes that are keyed to an interdisciplinary, inter-departmental and inter-agency roundtable sharing of knowledge and experience. The roundtable process results in integration of perspective, which in turn leads to integrated solutions. The British Columbia experience has shown that when the right people with the right knowledge are involved at the start in an interdisciplinary roundtable process, a knowledge-based approach is both time efficient and cost effective in developing integrated solutions.

For the past decade, the 22 cities comprising the GVRD have pioneered development and implementation of integrated approaches to rainwater management and landscape development. Because the regional vision is to improve the built environment and protect the natural environment, policy objectives are being translated into on-the-ground tools that are transforming the way the urban landscape is developed and serviced.

UniverCity, the sustainable community that will ultimately house a population of 10,000 adjacent to Simon Fraser University atop Burnaby Mountain, is a symbol of what the future looks like for Greater Vancouver. This project has demonstrated how to move from

policy to implementation. *UniverCity* is a complete urban community that demonstrates principles of sustainable development through a *balanced approach*, one that builds a compact community while protecting natural systems. An underpinning principle is to manage watercourses and rainwater runoff to protect aquatic habitat in affected watersheds. The *UniverCity* project enabled pilot testing of innovative approaches and methodologies to achieve regional policy objectives for watersheds.

The *UniverCity* transportation plan considers reducing single occupancy vehicles as the preferred mode of transportation by providing user-friendly transportation infrastructure and services that will encourage residents to live, work, and play within the mixed-use community. The various transportation strategies considered in the plan aim to improve the existing transit service and promote the Universal Transit Pass for community residents. The pedestrian and cycling infrastructure enhancement studied renewing walkways, paths, trails and cycling routes as well reducing parking spaces.³

The successful *UniverCity* experience then provided the foundation for a series of regional and provincial initiatives in British Columbia that are linked and cascading from high level to ground level, notably:

■ **A Watershed/Landscape-Based Approach to Community Planning:** This approach involves planning with reference to watershed-based features. Produced by an inter-municipal and inter-agency working group of the GVRD's Technical Advisory Committee, this document articulates a philosophy and defines a planning methodology for integration at three levels of effort and three scales of attention (i.e., watershed, neighbourhood, and site).

The rethinking of traditional approaches is built around integration of land use planning with volume-based rainwater management strategies.

3. The Vision Statement is available from: <<http://www.univercity.ca/bmcp/visionstatement.html>>. Accessed March 16, 2006.

D. Implementation of Integrated Approaches in British Columbia

The watershed/landscape-based approach has been incorporated as an element of the Water Sustainability Action Plan for British Columbia.

■ **Stormwater Planning: A Guidebook for British Columbia:** This guidance document is a prime application of the watershed/landscape-based approach, and has received recognition throughout North America, in part because at its heart is a pragmatic water balance methodology that enables local government to set performance targets for land development and rainwater management at the site, neighbourhood and watershed scales. In the context of the Guidebook, watershed/landscape-based planning means that resource, land use, and community design decisions are made with an eye towards their potential impact on the watershed. Therefore, what happens at the scale of the individual parcel and street affects what happens at the watershed scale.

■ **The Water Balance Model for British Columbia:** This decision support tool has been developed as an extension of the Stormwater Planning Guidebook to compare scenarios for reducing rainwater runoff volume under various combinations of land use, soil and climate conditions. As a tool

for subdivision design and local site development, the Water Balance Model promotes the integration of perspectives through a collegial and interdisciplinary approach that enables design professionals to collaborate to achieve community liveability objectives:

- **Planners:** better use of space.
- **Engineers:** rainwater infiltration design.
- **Landscape architects:** green solutions.
- **Educators:** social marketing.

The Water Balance Model is also an element of the Water Sustainability Action Plan for British Columbia.

The success of the Water Balance Model in British Columbia has generated interest in expanding the focus of the tool to reach a national audience. This has led to a decision by Environment Canada and the Canada Mortgage and Housing Corporation to create a truly national water balance model for Canada.

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Web Resources

The following Web sites (accessed March 16, 2006) provide additional information and may be of interest to readers:

City of Airdrie, Alberta.

<http://www.airdrie.com>.

Town of Okotoks, Alberta.

<http://www.okotoks.ca>.

City of Chilliwack, British Columbia.

<http://www.gov.chilliwack.bc.ca>.

City of Vernon, British Columbia.

<http://www.vernon.ca>.

City of Corner Brook, Newfoundland and

Labrador. <http://www.cornerbrook.com>.