



Pathways to **LIVING** CITIES

A framework to help practitioners
advance equitable, abundant, and thriving
green infrastructure in cities across Canada.



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Green infrastructure is about land and our relationship with it. It's about learning from and working with the land and natural processes to make our cities environmentally and economically sustainable, healthy and livable for all. The diverse Indigenous Peoples of Turtle Island—which encompasses the lands now known as Canada—have long created their communities and settlements in ways that work with and respect the land and natural processes. Colonial settlements were built upon drained wetlands and cleared forests; in floodplains that required rivers to be dammed to prevent them from flooding. They hardened surfaces, removed vegetation, and hindered the ability of the land to deliver the multiple gifts and services it naturally does. The cities that colonial descendants built and continue to grow today are a continuation of this legacy of development that gives rise to a host of environmental, economic and social problems.

The authors would like to acknowledge the Indigenous Peoples across northern Turtle Island who have long worked with and respected the land, and who have shared their knowledge with settlers and non-Indigenous peoples. It is our hope that green infrastructure can be a vital piece of the reconciliation journey where we can create communities that work for people, the natural world, and all relations.

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About Living Cities Canada:

Living Cities Canada is a pan-Canadian project to advance green infrastructure (GI) and enable Living Cities across Canada. Living Cities are places where GI is equitable, abundant, and thriving. The Living Cities project is coordinated by Green Communities Canada (GCC) and supported by a team of partners from the University of Toronto, the Green Infrastructure Ontario Coalition, and local environmental partner organizations. Find out more at:

www.livingcities.ca

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Key Terms

Co-Benefits: Used to describe multiple positive outcomes that may occur simultaneously and/or inadvertently as a result of the implementation of climate change adaptation policies, strategies, or interventions. Green Infrastructure Co-benefits may reference positive social, economic, cultural, and environmental outcomes beyond expected flood-abatement or improved water quality.

Equity: The process of ensuring that processes, programs, and social conditions are fair, and provide equal possible outcomes for every individual, regardless of personal positionality in relation to societal power and privilege. Equity particularly focuses on righting historic and ongoing injustices by providing additional focus, resources, and support to equity-deserving groups.

Equity-Deserving Groups: Communities that experience barriers to equal access, opportunities, and resources due to disadvantage and discrimination and actively seek social justice and reparation. This marginalization could be created by attitudinal, historic, social, and environmental barriers based on characteristics that are not limited to sex, age, ethnicity, disability, economic status, gender, gender expression, nationality, race, sexual orientation, and creed.

Green Gentrification: The unintended displacement or segregation of socio-economically vulnerable populations from urban centers due to increased property taxes and cost of living resulting from local investment in urban greening and GI initiatives.

Green Infrastructure (GI): The natural vegetative systems and green technologies that collectively provide society with a multitude of economic, environmental, health, and social benefits. GI includes natural

assets (e.g. woodlots, street trees, wetlands, grasslands), enhanced assets (e.g. rain gardens, green roofs and walls, bioswales) and engineered assets (e.g. permeable pavements, infiltration trenches). GI is or uses nature, natural materials and processes to deliver community services.

GI Practitioners: Used throughout to describe anyone employed in a role that deals with GI, including (but not limited to) GI planning, policy, design, construction, operations, and maintenance.

Green Infrastructure Asset Management (GI AM): Quantifying the benefits and services GI (including natural, engineered, and enhanced assets) provides to account for these assets within standard municipal asset management processes. This process includes surveying and assessing GI to ensure ongoing maintenance can be accurately accounted for.

Grey Infrastructure: An approach to water management that uses conventional engineered infrastructure such as pipelines, reservoirs, and water and wastewater treatment plants, dams, seawalls, and roads.

Living City: Communities where green infrastructure is equitable, abundant, and thriving. Equitable Living Cities are places where GI is prioritized in locations with the greatest environmental and social needs and underserved groups shape GI decision-making. Abundant Living Cities are places where GI is “the new normal:” it is implemented widely and championed by diverse stakeholders. Thriving Living Cities are places where GI is installed, maintained, and functions well over the long-term.

Low Impact Development (LID): A subcategory of green infrastructure that includes enhanced assets (such as rain gardens, green roofs and walls, bioswales, urban trees, and naturalized stormwater ponds) and engineered assets (permeable pavements, rain barrels, cisterns, perforated pipes, and infiltration trenches). These technologies mimic natural processes for stormwater management to reduce overall storm flows and protect aquatic habitat and water quality.

Natural Assets: Ecological features, including wetlands, forests, parks, meadows, lawns, gardens, and soil that provide quantifiable ecosystem services to human populations. Natural assets are also referred to as “natural infrastructure”

Nature-based Solutions (NbS): An umbrella term for approaches that aim to protect, sustainably manage, and restore natural or modified ecosystems. NbS includes GI that is or that uses vegetation in its design and implementation. As such NbS encompasses natural and enhanced GI assets, but excludes engineered GI that mimic natural processes but do not use natural vegetation (e.g. permeable pavements, cisterns).

Stormwater Management (SWM):

Managing urban stormwater from rainfall and snowmelt, as well as runoff from human activities, such as pool drainage, watering lawns, and car washing into sewers, lakes, and streams. Stormwater management aims to maintain the hydraulic cycle and the health of water bodies and aquatic life, while simultaneously preventing increased flooding, water quality, and stream erosion. Stormwater management can include permeable pavements, bioswales, rain gardens, and ponds.

Stormwater Fee: A user fee charged to real estate owners resulting in a source of revenue for local governments to manage stormwater.



Overview & Purpose of this Framework

Overview & Purpose of this Framework

Cities across Canada are facing numerous challenges and pressures. Some 80% of Canadians live in cities with a population larger than 10,000, and this number has been steadily increasing. This growing urban population has resulted in notable patterns of land-use change in cities. In particular, urban cores are intensifying, and peripheral suburban areas are spreading outward.¹ As a result, nature and green spaces in urban and developed areas are on the decline: over the last 20 years, three-quarters of large and medium-sized cities in Canada have become less green.²

At the same time, the impacts of climate change are being more acutely felt in Canada and around the world. Canada is warming at twice the global average, and temperature and precipitation patterns are becoming more extreme.³ Hardened surfaces and the loss of nature and green spaces make cities and towns particularly vulnerable to the effects of climate change,⁴ especially flooding and extreme heat. The risks of these impacts are not felt equally: socioeconomically vulnerable populations (in particular, low-income people, Black people, Indigenous People, and People of Colour) are at the highest risk.⁵ Heat-related deaths in cities are on the rise in Canada.⁶ At the same time that cities face some of the largest climate threats, they also disproportionately contribute to climate change: estimates suggest cities are responsible for approximately 75% of global emissions.⁷

Protecting and restoring natural features and processes with green infrastructure can help to mitigate climate change and build resilience to its impacts in cities. Green infrastructure (GI) also offers many other benefits, like supporting biodiversity, improving water

quality, and supporting improved physical and mental health of residents. It can help address socioeconomic inequities and make communities more liveable for everyone. It can help to advance reconciliation between settler governments and Indigenous Peoples. And it can help municipalities deliver infrastructural, environmental, and social services in a more efficient and cost-effective way. Despite the promise of GI, and over a decade of ample academic and applied research showcasing its benefits, green infrastructure remains limited in implementation and poorly integrated into land-use planning and decision-making in most municipalities in Canada. Numerous policy, technical, financial, and social barriers inhibit its uptake and success and prevent most Canadians from reaping the benefits of GI where we live. For the full benefits of GI to be felt in Canadian cities, it must be equitably implemented, abundant throughout the landscape, and thriving.

The *Framework for Living Cities* is intended to support local governments bypass barriers that inhibit equitable, abundant, and thriving GI in their communities. Our team completed an extensive scan of academic research, grey literature, and case studies from cities across North America and Europe on how local governments can fully and equitably integrate GI into city-building and place-making. We reference and include links to more than 250 studies, resources and examples in this document (see [Appendix 2](#) for a full list). The framework synthesizes key strategies and provides case studies, examples and resources to help local governments learn what has worked and how they can advance GI in their own community.

How to Use This Framework

This framework has been designed to provide municipal staff and decision-makers practical knowledge to advance the green infrastructure in their communities. The aim is to provide an overview of evidence-based strategies and actions to plan for and implement GI thoughtfully and effectively and provide a curated collection of case studies and resources that will help practitioners apply these strategies and actions. Using this framework, municipalities can identify short, medium, and long-term actions—that have been used in other municipalities across North America and Europe—to help transform their community into a Living City: a place where green infrastructure is equitable, abundant, and thriving. Others working in green infrastructure-related work (e.g., planners, landscape architects, urban design consultants, non-profit organization staff) will also find this framework useful.

The framework has been organized into three core sections that support the three pillars of a Living City: An Equitable Living City (Section 1), An Abundant Living City (Section 2), and A Thriving Living City (Section 3). Each section has subsections that synthesize best practices, detail overarching principles, and provide strategies that speak to and help operationalize each pillar. Each section also

includes key questions you can ask yourself, several resources that provide more detail on specific aspects of GI governance and implementation, and related case studies from municipalities across North America and Europe. Citations are provided in endnotes and there are hyperlinks throughout the document that provide more detailed resources and case studies pertinent to the various sections of the framework. A master list of all the resources contained in hyperlinks is also provided at the end of the document, in [Appendix 2](#).

It is important to note that the study and practice of green infrastructure implementation is inherently an expansive, inter-disciplinary endeavour that encompasses many fields and requires consideration through multiple lenses—from social to technical, and in between. As such, each subsection in the framework could be accompanied by a standalone resource (and indeed, we do reference many that speak to various subsections). The goal of this framework is not to offer comprehensive guidance for municipalities to advance equitable, abundant, and thriving GI, but rather to support them in knowing *what* they can do, *how* they can do it, and *where* they can find more information to support them on their journey, based on research and the experiences of other municipalities.

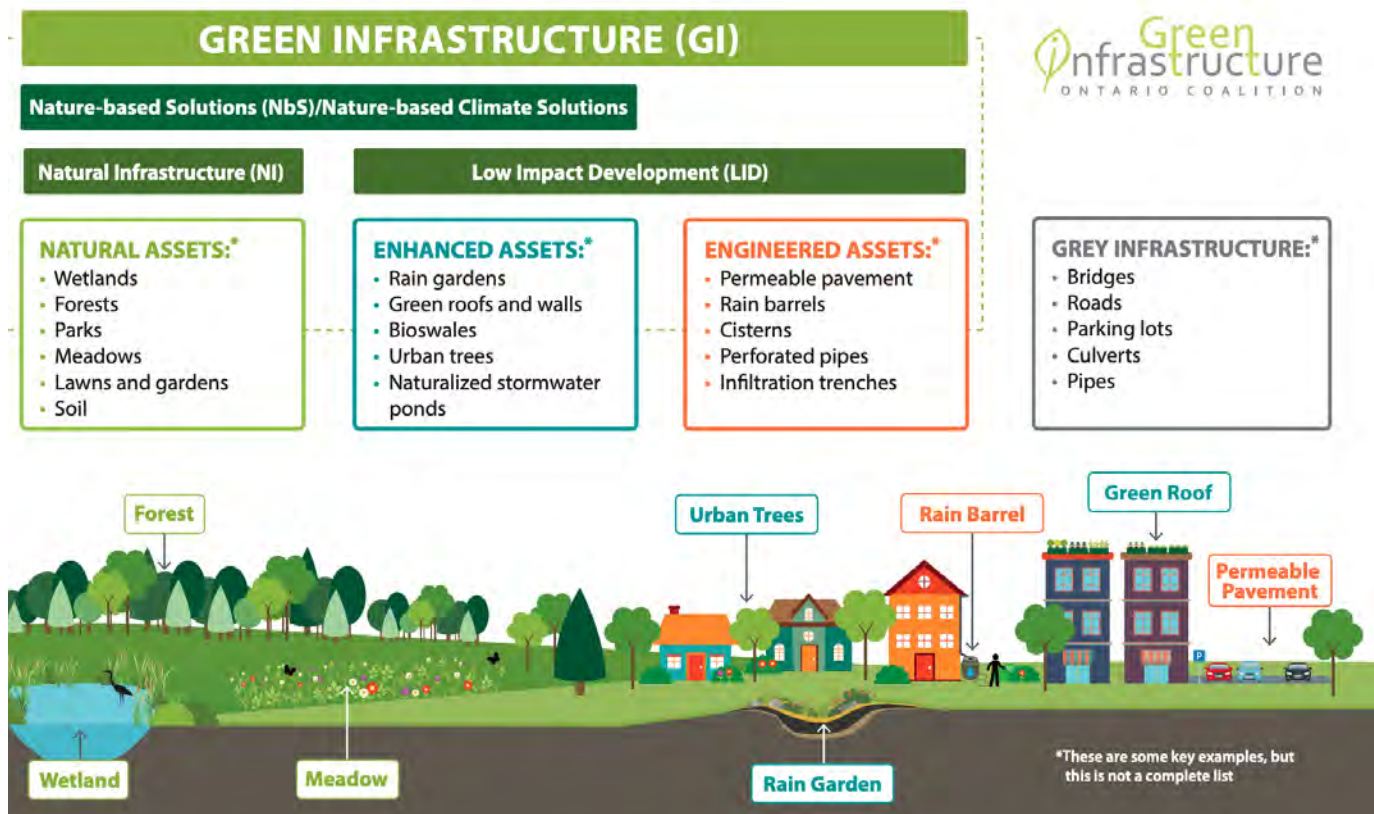


What is Green Infrastructure?

Green infrastructure refers to “the natural vegetative systems, engineered features and green technologies that collectively provide society with a multitude of economic, environmental and social outcomes.”⁸ Essentially, green infrastructure is, or uses, nature and/or natural processes to deliver infrastructural and other services. GI includes parks and green spaces, urban forests (e.g., street trees, private trees, woodlots), stormwater management assets (e.g., permeable pavement, bioswales, rain gardens, ponds), natural heritage systems, community gardens, and green roofs and walls. Green infrastructure offers a wide range of social, ecological, and economic benefits (outlined in [The Evidence is In: GI is Good for Communities](#)).

Green infrastructure encompasses a range of assets, and although they have in common the use of nature and/or natural materials and processes, GI assets can be qualitatively quite different from each other. For example, forested natural areas and permeable pavements are both GI, but the services delivered by these assets and the benefits

derived from them are quite different. Nature-based assets (i.e., natural and enhanced assets) tend to offer the highest number of co-benefits (e.g., providing multiple positive social, environmental, or economic outcomes). As a result, we encourage the integration of nature into GI assets where possible. This may not always be possible or practical. Even though GI that is, or that integrates, nature may offer more co-benefits than GI that is not nature-based, we believe *all* GI assets offer some co-benefits, especially compared to traditional grey infrastructure. For example, permeable pavement does not offer biodiversity, community recreation, or mental health benefits, but it still offers stormwater management, helps keep polluted runoff from entering surface water bodies (water quality benefits and associated health benefits), and is more cost-effective than grey infrastructure pipes and treatments (economic benefits). Throughout this framework, we tend to talk about green infrastructure in the aggregate, but try to distinguish when different strategies or outcomes might more aptly apply to different kinds of GI (e.g., natural vs. engineered assets).



What is a Living City?

Living Cities are communities where green infrastructure of all types (natural assets, enhanced assets and engineered assets) is equitable, abundant, and thriving.



Pathways to becoming a Living City will look different in various communities, but will all focus on taking advantage of opportunities to integrate GI into urban policies and decision-making processes so that it becomes “the new normal.” Some evidence-based approaches to mainstream GI and transform communities^{9,10} include:

1. Involve communities and prioritize GI for environmental equity and reconciliation:

Nature is not evenly distributed through communities. GI should be prioritized in locations with the greatest environmental and social need and underserved groups should help shape GI decision-making to address structural inequalities. Making partnerships and supporting Indigenous-led green infrastructure can also advance reconciliation efforts and help shift toward GI as the ‘new normal.’

2. Set requirements and standards for GI:

Green infrastructure can be mainstreamed as a grey infrastructure alternative through public mandates, measurable targets, and mandatory requirements.

3. Lay the groundwork for systemic integration of GI: Knowledge sharing and development, applied experience, and collaboration can help to shift mindsets and entrenched practices and build capacity to mainstream green infrastructure in land-use,

asset management and other decision-making processes. Financial incentives can help prompt landowners to conserve or restore GI, alongside targeted public investment. Green infrastructure often offers both public and private benefits that can help create business cases for investment and add value to existing activities and processes.

4. Grow support for GI: Collaboration with other levels of government can create policy frameworks, design standards, capacity, and funding streams for GI. Community-based action can build awareness and generate widespread support for GI.

5. Ensure GI can thrive over the long term: Building partnerships and finding champions can help bring the goals and operations of multiple stakeholders into alignment in support of GI implementation. Ensuring that the values and services offered by green infrastructure are incorporated into decision-making processes requires changing practices and operational workflows.



Methodology

To develop the Framework for Living Cities, we conducted a survey and literature review, held a virtual forum, and sought input of expert reviewers:

Survey: Invited individuals working in the GI space to complete a survey to identify knowledge gaps and needs. 74 individuals across Canada completed the survey, 42% of whom were municipal staff or elected leaders, with the rest from the non-profit, consulting, and academic sectors.

Literature Review: With gaps and needs identified in the survey, we conducted a literature review of primary (i.e., peer-reviewed literature) and grey (e.g., reports and case studies) literature that examined green infrastructure and nature-based solutions. The literature review helped us identify best practices for designing, implementing, and maintaining green infrastructure as well as understand the benefits and disadvantages, equity considerations, barriers for its implementation, and insights into policy and economic instruments used to enable green infrastructure.

Virtual Forum: We hosted a two-day, virtual forum¹¹ March 29-30, 2022 with the aim of enabling dialogue among green infrastructure practitioners, researchers, and advocates to exchange ideas, experiences, and best practices to systematically integrate green infrastructure into city-building and place-making. Forum participants delved into the three pillars of a Living City: equity, abundance, and thriving. Insights from the forum and findings from the literature review were used to guide the analysis and provide the recommendations within this framework.

Expert Reviewers: A draft of the framework was reviewed by eight individuals from the academic, non-profit, consulting, and local government sectors with expertise on GI planning, policy, and implementation.



Why Should Your Community Become a Living City?

Why Should Your Community Become a Living City?

The Evidence is in: GI is Good for Communities

A key characteristic of green infrastructure is the many co-benefits it can provide, enhancing quality of life in communities while building resiliency and environmental sustainability. Benefits vary depending on the type of GI. Typically, benefits are more numerous for GI that uses trees and plants (nature-based GI), but all GI offers co-benefits. Benefits of GI include¹²:

Climate Change Benefits



Flood Management

GI allows rain to drain into the natural environment, diverting stormwater from conventional systems and reducing flows during extreme weather events. This leads to reduced overland flooding and can help mitigate riverine flooding.



Urban Cooling

City centres are typically 2-3°C warmer than the surrounding countryside and sometimes up to 6-7°C warmer. GI, especially shade trees, can help keep cities much cooler and reduce the “urban heat island effect.”



Reduced GHGs

Nature-based GI solutions can sequester greenhouse gases (GHGs) through photosynthesis, storing it in their biomass and soil. Using GI can also help local governments avoid the need to build or replace carbon-intensive grey infrastructure.



Other Environmental Benefits



Water Quality

GI improves local water quality by enabling soil, plants and other media to filter polluted stormwater. GI can reduce the risk of pollution caused by combined sewer overflows, where untreated wastewater is released directly into waterways during extreme weather events.



Groundwater Recharge

Conventional stormwater systems are designed to rapidly convey storm flows to the nearest water source, reducing opportunities for groundwater recharge. GI allows rain to drain where it falls, aiding groundwater recharge and reducing seasonal water shortages.



Air Quality

Urban forests and vegetative barriers planted near roads and parking lots can lessen the impacts of vehicle emissions and related health concerns by reducing particulate pollution and ground-level ozone.



Urban Biodiversity

Nature-based GI can provide vital habitat, supporting local pollinators and wildlife and helping restore ecosystem functions and services.

Social Benefits



Physical Health

People are more likely to walk and bike in GI-rich neighbourhoods, supporting physical health. Further, air and water quality benefits from GI can reduce human exposure to contaminants, lowering mortality risk and increasing vitality.^{i,13}



Mental Health

Studies have shown, even just being exposed to the colour green can improve psychological well-being and lower anxiety and depression.¹⁴ Increasing green-spaces and GI in cities helps to reduce stress and improve mental health.



Social Cohesion

Communal spaces can facilitate increased interactions among neighbours, which helps improve local attachment, community cohesion, and reduce crime levels.



Food Provision

Nature-based GI assets such as green roofs and urban gardens can be planted and maintained to reduce food insecurity and increase equitable access to healthy foods.



Environmental Education

Community-led GI demonstration projects support residents to get involved in local greening initiatives. This environmental and civic empowerment may lead to shifts in other sustainable behaviours. Permanent signage can amplify community learning and encourage further action.

ⁱ An increase in community greenspace can reduce the risk of diabetes, respiratory illness, and cardiovascular disease. Exposure to residential greenspaces have been found to reduce the incidence of stroke by 4% and dementia by 3%. Similarly, mortality risk can be decreased between 8-12% from respiratory illness and cardiometabolic disease due to an increase in residential greenspace.

Economic Benefits



Efficient Use of Public Resources

GI is often less capital intensive than grey infrastructure, and, unlike grey, can become more valuable over time with proper care and maintenance. GI can take pressure off existing grey infrastructure, extending its life and avoiding costly replacements of public infrastructure.



GDP and Job Creation

Each dollar invested in GI yields \$3 to \$15 of environmental, social, and health benefits. A recent study estimated that GI in Ontario contributed \$8.33 B in GDP and created 122,000 jobs in 2018 alone.¹⁵



Homeowner Savings

Homeowners receive many economic benefits from installing GI, including flood abatement, lower property maintenance costs (when using native and/or drought-tolerant plants), and reduced overall utility costs (in the case of variable-rate stormwater fees).



Energy Savings

GI can reduce energy demand. For example, shade-providing or insulating GI can reduce cooling costs; rainwater harvesting systems can reduce energy to treat potable water.



GI Won't Happen on its Own

Despite the promise of GI, uptake is limited in the majority of Canadian municipalities.^{ii,16} GI is limited by **policy, technical, financial, and social barriers**. Typically, existing local governance systems are not well designed to support innovation and the uptake of GI.¹⁷ The fragmentation of decision-making power can lead to projects being scaled down for perceived efficiencies. It is often difficult for urban planning or policy design processes to recognize that GI is an appropriate solution despite its multiple benefits. GI is often not included at the strategic planning level and is implemented as an “add-on” to existing projects. New policies that commit to GI may not filter down to operational practices and create the intended change. Similarly, a lack of standardized practices and materials may lead to a reluctance to use GI because of perceived uncertainties around specifications and effectiveness. GI solutions can be implemented as an alternative or complement to grey infrastructure but often lacks the asset management practice and knowledge of traditional infrastructure.¹⁸ Decision-makers and investors may resist funding GI without a compelling business case, requiring evidence-based assessments that may be lacking due to diffuse benefits that can be difficult to qualify and quantify. Further, GI is often viewed as a primarily ecological solution, while its broader social and economic benefits may not be recognized in the same manner. This may prevent it being embraced and implemented at the organizational level. These barriers work together to create friction to change and make it more difficult for local changemakers to



break with historical infrastructural practices and the status quo.

Where green infrastructure does exist in communities, access to its benefits is not equal. Analyses of municipalities, including Canadian communities, have found that low-income neighbourhoods and neighbourhoods with higher proportions of visible minorities and newcomers (underserved communities) are more likely to have fewer green spaces,¹⁹ compounding the social and health inequities experienced by these communities. The lack of greenspace in these communities was made even more apparent during the COVID-19 crisis, when access to quality outdoor spaces was in extremely high demand. Communities that were most negatively impacted by COVID-19 were also most likely to have a dearth of greenspace.²⁰

To mainstream GI into urban development, we need to understand barriers inhibiting its uptake, functioning, and equitable distribution and begin to create pathways to overcome them. Without overcoming these barriers and mainstreaming GI into municipal planning, we will not realize the environmental, social, economic, and health benefits of GI in Canada.

ii In 2017, Green Communities Canada and the Canadian Freshwater Alliance launched a “Stormwater Scorecard” where they surveyed municipal representatives on the state of GI implementation. Representations from 30 communities responded, indicating that, while most had a few pilot projects, policies, or public engagement programs relating to GI, it remained quite marginal to land-use planning and decision-making.



The Hierarchy of GI

Mature and contiguous nature-based GI (e.g., forests, wetlands, mature street trees) typically provide more and richer benefits than newer and more fragmented green infrastructure. It is also much more expensive to restore urbanized or degraded lands than to preserve and maintain what is already there.

Living Cities should prioritize their approach to GI by:

#1 Preserving existing GI: e.g., plans, regulations and other tools that protect existing woodlands, wetlands, mature street trees, and meadowlands, whenever possible.

#2 Maintaining and restoring degraded GI: e.g., removing/remediation of invasive species, planting native species, and maintaining and repairing enhanced or engineered GI.

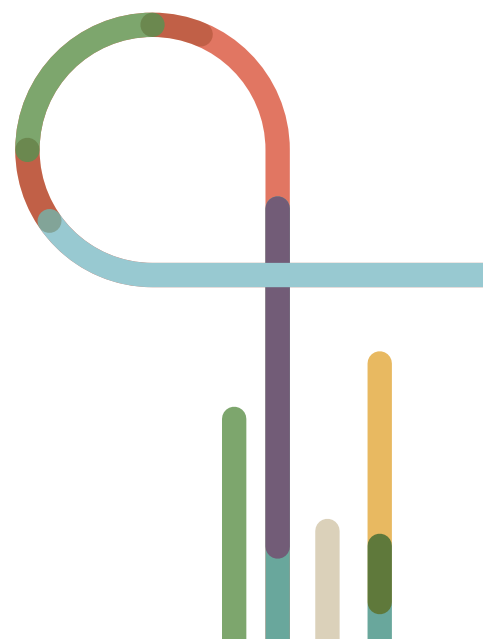
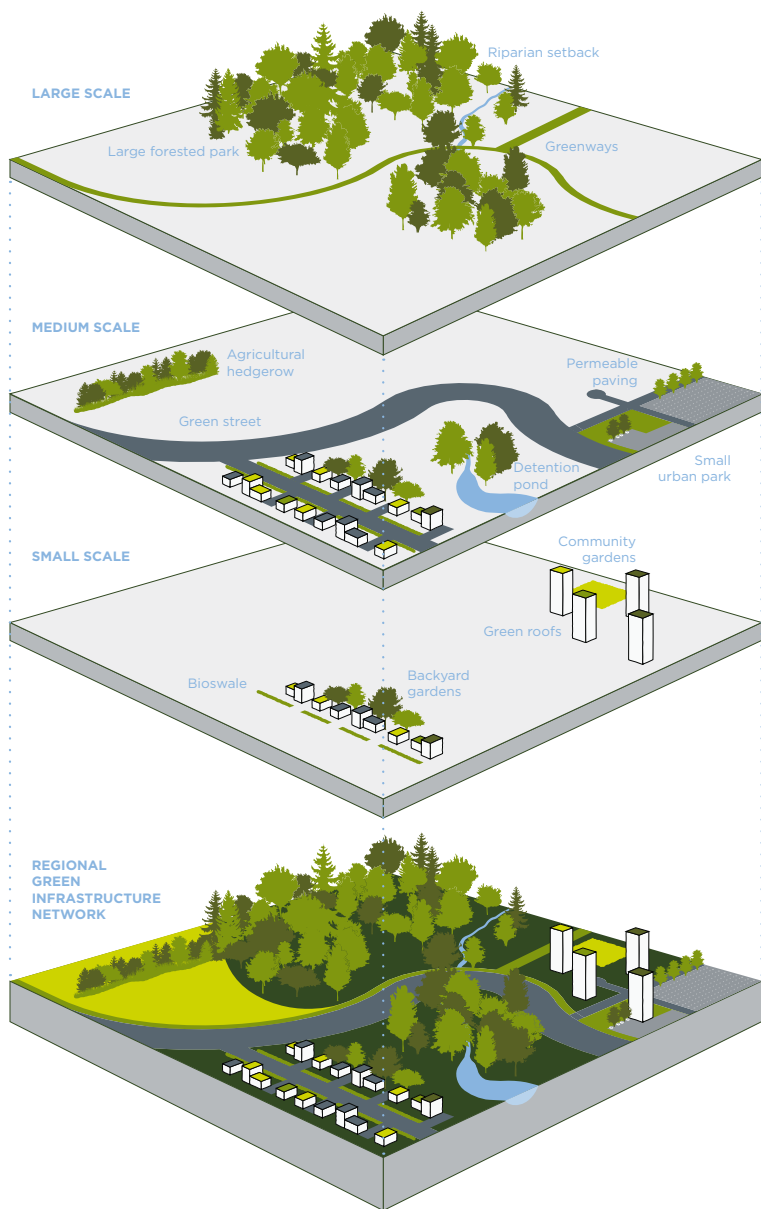
#3 Creating new GI in urbanized areas: e.g., minimizing or preventing hard surface footprint; disconnecting impervious areas in new developments; re-naturalizing brownfields; removing hardened surfaces and installing soils, rocks, native plants, trees, permeable pavements, installing greenroofs or other infiltration technologies.



Green infrastructure can be both a complement and alternative to grey infrastructure (e.g., stormwater sewers, pipes, treatment plants). A particularly important consideration is that, unlike grey infrastructure that degrades and deteriorates over time, properly maintained green infrastructure can become *more* valuable and effective at delivering services over time. This is especially true of nature-based GI (engineered assets are more susceptible to degradation over time and require maintenance to continue to provide meaningful benefits). For example, a new seedling does not have deep roots

or a wide canopy, and therefore does not as effectively absorb stormwater or reduce heat as a mature tree. Natural ecosystems work in symbiotic ways to most effectively offer environmental services, such as flood mitigation, water filtration, carbon sequestration, heat reduction, and biodiversity, and the social and public values of these ecosystems are also higher compared to smaller, fragmented greenspaces or assets. It is also much more cost effective to preserve existing ecosystems and greenspaces than to alter or destroy, and then re-naturalize them.

When crafting strategies to advance green infrastructure, local governments should observe the “GI hierarchy” by prioritizing the preservation of existing ecosystems and greenspaces, then more effectively managing existing degraded greenspaces, then restoring and transforming urbanized lands with GI.^{21,22} Of course, municipalities can develop actions to advance GI at all three of these scales at the same time. In fact, an integrated approach of protecting large-scale GI, remediating existing GI, and constructing new GI features can support an abundant and thriving network of connected green infrastructure across the landscape. “Ecosystem planning” is an example of an approach that strives to conserve existing natural features while also incorporating design features that enhance the ecological function of a site.²³



Source: <http://www.metrovancouver.org/services/regional-planning/PlanningPublications/ConnectintheDots.pdf>

An Equitable Living City

An Equitable Living City



Living Cities are communities where green infrastructure is equitable, abundant, and thriving. Living Cities make a commitment to equitable implementation of GI, which means prioritizing it in locations with the greatest environmental and social need and involving underserved groups to plan, preserve, maintain, and create GI.



Aim of this Section: Centering Equity in GI Planning and Implementation

In Living Cities, GI is prioritized in locations with the greatest environmental and social need, and underserved groups help shape GI decision making. This section aims to help experts prioritize environmental equity as they move their Canadian community forward on the pathway to become a Living City. The following section **introduces the concept of equity** and its relevance to green infrastructure. It presents **recommendations for how to prioritize GI for environmental equity**, and advance **reconciliation** and right relations between municipalities and Indigenous Peoples.

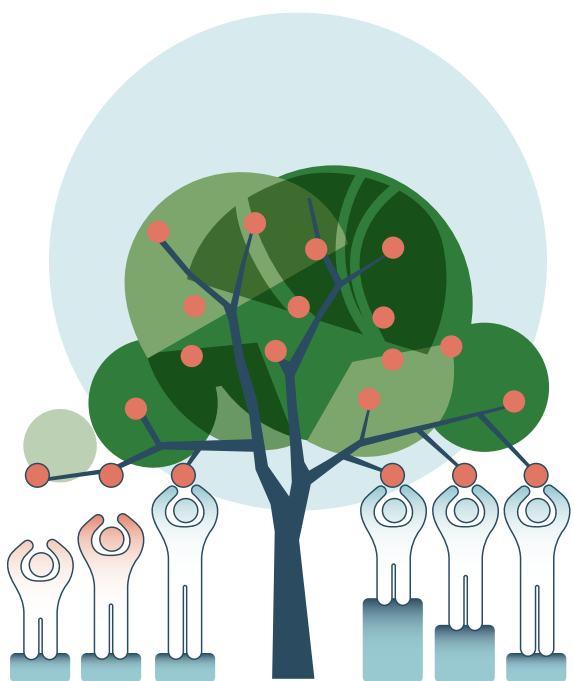
Questions that could be considered in your community

- ❓ Where are under-natured areas in your community? Which areas are most vulnerable to impacts of climate change? How do these areas relate to socio-economic and demographic data?
- ❓ Which First Nations share traditional lands with your community? Which treaties and land agreements govern the land in your community?
- ❓ What kinds of GI-related projects are local First Nations prioritizing? What work has already been done? How can we work with local First Nations to support mutually beneficial GI?
- ❓ How can members of under-natured neighbourhoods be engaged in GI decision-making, planning, and implementation?
- ❓ What kinds of capacity-building and training will help your organization prioritize GI for environmental equity?
- ❓ What kinds of resources and supports will help underserved communities prioritize and participate in GI planning and implementation?

Purpose	Recommendations
<p>Prioritize GI for Environmental Equity</p>	<ol style="list-style-type: none"> 1. Identify under-natured areas by examining the distribution of green infrastructure relative to community demographics. 2. Understand the distribution of challenges such as climate change impacts and how GI can address the priorities of underserved communities (e.g., food security or inadequate shelter). 3. Engage people in planning and decision making to catalyze participatory action that empowers people. 4. Employ policy tools to enhance accessibility and avoid displacement such as land-use tools, developer requirements, and financial schemes.
<p>Use GI to Advance Reconciliation</p>	<ol style="list-style-type: none"> 5. Support Indigenous-led green infrastructure where Indigenous communities lead decision-making. 6. Build municipal-Indigenous partnerships where municipalities and community groups work to build reflexive, equitable and reciprocal partnerships with Indigenous Peoples.

What is Equity?

Equity recognizes that there are differences in power, access to resources, and needs among actors. Therefore, instead of treating every individual the same, equity requires responses that strive to minimize power and resource differences and that meet the unique needs of different individuals. In other words, equity is about giving differential treatment in a fair manner and removing barriers, risks, and obstacles so individuals can fairly benefit. Equity differs from equality, which is a concept that sees every individual as the same and deserving of the same treatment. Equity focuses on systemic changes to address historic and contemporary injustices. Underserved groups are more vulnerable to harms (e.g., climate change impacts) and are less able to access benefits. They are also excluded (both overtly and inadvertently) from decision-making processes. Advancing equity requires recognising and working to address these barriers by **shifting social and institutional norms** and using an intersectional lensⁱⁱⁱ to identify different dimensions of inequality and vulnerability.



Equality is different from Equity

ⁱⁱⁱ Intersectionality refers to an individual's overlapping social identities including class, race, gender, and sexuality that result in a specific type of systemic discrimination and oppression.

Why is Equity Important?

In cities in Canada and around the world, municipal services and infrastructure do not work for everyone. Inequitable access to the benefits of municipal services is unfair in and of itself, and can lead to or exacerbate social and environmental issues. If not addressed, these issues can become worse over time. GI, like other services and infrastructure, is not equally distributed across communities in Canada.²⁴ When cities have tried to address this by developing new GI in underserved communities, they have sometimes inadvertently exacerbated the problem by making a neighbourhood more desirable and increasing property values. This reduces affordability for residents and increases the risk of displacement. This ‘green gentrification’ tends to occur when GI implementation focuses more on aesthetics rather than on function and utility (e.g., recreational environmental services).²⁵ By focusing on GI functions that are accessible and inclusive rather than on improved aesthetics, you can alleviate potential negative effects of new GI projects. It is important to ensure that where GI investment is planned, those communities who already use the space and who live in the vicinity can remain and are actively engaged in the planning process.

It is important to note that equity is a journey: it is not “achieved” through a single intervention, but is a process that requires ongoing commitment and continuous learning. Organizations doing this work may not “get it right” at first, but they can learn and build trust with underserved communities as they continue to engage in this work in good faith. The planning, relationship-building, and iterative nature of equity-based work can make the process seem challenging, time-consuming, and uncomfortable, especially when organizations are new to this kind of work. However, it should not be abandoned.

By centering equity, local governments can start to build relationships that will help address multiple social and environmental issues. It is also paramount to delivering services that are just and consider the diverse needs of individuals in your community.

Equity and Indigenous Peoples

It is particularly crucial to recognize that Canada’s legacy of settler-colonialism has led to ongoing structural injustices for Indigenous Peoples. Equitable approaches to GI should acknowledge that Indigenous Peoples are rights holders with robust historical, cultural, and spiritual knowledge and connection to their traditional lands and with jurisdiction over their territories. Municipalities and organizations seeking to advance GI must take seriously their responsibility to involve local Indigenous Peoples in that work. This means engaging Indigenous Peoples early in the process, and with a commitment to work in collaborative partnership when instituting GI projects that involve or affect Indigenous populations. See pages [34-37](#), where we provide more context, examples, and strategies for GI as a tool to advance equity with Indigenous Peoples.



CASE STUDY

Green Gentrification - The Atlanta Beltline

Green gentrification refers to creating new, or aggravating existing, social inequities by implementing GI or other environmental initiatives.^{26,27}

When GI or urban greening initiatives increase social desirability and hence property values of certain neighbourhoods, it can result in the displacement or segregation of socio-economically vulnerable populations due to cost increases in rent, land, food, and services making these more inaccessible.^{28,29} These green gentrification effects can occur even when urban GI developments have no intention to drive social inequalities.

The city of Atlanta, Georgia, began an initiative to redevelop a former railway corridor into greenspace in the year 2000. In the six years following, before construction had even begun, median house prices in adjacent areas increased by 130%, much higher than average increases elsewhere in the city. This resulted in not only increased house values but also increased rents and cost of living. City council eventually responded to this by enacting a “Mandatory Inclusionary Zoning Overlay” in 2017, requiring that 15% of all new multi-family developments within a half mile of the Beltline be affordable housing units. Despite some new affordable housing being created in the area, affordability continues to be a significant issue, leading advocates to call for more action on affordable housing around the Beltline.^{30,31}



Prioritizing GI for Environmental Equity

The following are some strategies municipalities can take to prioritize GI for environmental equity. One thing to note is that, because many under-natured neighbourhoods in underserved communities are more likely to have higher populations of Black and Indigenous People and people of colour (BIPOC), and higher rates of poverty, residents may mistrust people from outside their communities, such as municipal staff or non-profit workers. Well-intentioned outsiders may inadvertently do harm to these community members if they are not careful. For this reason, staff involved in GI planning have benefited from organizational investment in anti-oppression training, trauma-informed practice training, and community development practices.

#1 Identify Under-Natured Areas

An equitable Living City requires data-informed decision-making. Spatial assessments and data analyses can be used to identify the existing distribution of green infrastructure in a community, demographics (e.g., age, sex, ethnic groups), and population distribution. There are a variety of existing resources available to municipalities that can be used (e.g., cadastral maps and georeferenced spatial information).³² For example, a spatial analysis can be used to better understand the impacts of urban heat island effect.^{33,34}

Spatial multi-criteria decision analysis (MCDA) has also gained significant attention by scholars due to its usefulness for GI decision-making.^{35,36,37} MCDA is a process that integrates spatial analyses and value judgements with the aim of solving social and environmental problems. For example, a recent study used spatial MCDA to identify areas in Barcelona that could benefit the most from green roof implementation based on a variety of ecosystem services indicators (e.g., thermal regulation, recreation and relaxation, social cohesion).³⁸ Using spatial MCDA can assist in identifying which communities would benefit from different types of GI and the diverse benefits provided by each type of GI. The [HealthyPlan.City](#) is an equity tool which allows individuals the opportunity to see how different populations access tree canopy coverage and experience heat islands within Canadian cities. The user selects the city they want to explore, chooses a built environment to examine including tree canopy coverage, or heat island effect, and lastly selects a vulnerable population.

#2 Understand the Distribution of Challenges

Adverse impacts of climate change are a growing concern for cities. However, climate change impacts are not equally distributed. Areas within a city may be differentially vulnerable but individuals from vulnerable socio-economic groups tend to be most affected. GI can create more resilient cities by reducing the intensity of climate change impacts. For example, green roofs and green spaces can act as thermal buffers during heat waves.^{39,40} Building upon the spatial approaches section above, GI projects should also be informed by **municipal vulnerability assessments and risk assessments** to identify areas more prone to climate risks.

An equitable approach to GI involves not only identifying and prioritizing under-natured areas, but also listening to and involving members of underserved communities who are most affected by the lack of GI and new GI projects. This requires engagement early in the GI development process to understand the needs and issues they face.

While targeting development of GI in the most under-natured communities is best practice, these communities often have more imminent concerns (e.g., food security, inadequate shelter, employment stability). GI development in these communities can be leveraged to address these issues. For example, GI can be embedded in other municipal priorities like affordable housing and food security. Some municipalities, like Vancouver, have worked with social agencies to create training and work opportunities for precariously employed people in GI maintenance. Investment in GI can be a part of a broader strategy to bring about substantial change.



CASE STUDY

The Sustainable Neighbourhood Action Program (SNAP) from the Toronto and Region Conservation Authority (TRCA)

The Sustainable Neighbourhood Action Program (SNAP) from the Toronto and Region Conservation Authority (TRCA) is an example of what municipalities can do to address climate risks by focusing on vulnerable or underserved neighbourhoods. The SNAP program uses extensive community engagement following a three-phase approach to co-produce GI projects in communities. Neighbourhood selection needs to be inclusive and equitable, and prior work is needed to identify vulnerable and underserved neighbourhoods.

Once a neighbourhood has been selected, phase 1 requires an initial analysis of climate risks and neighbourhood needs. This scoping exercise is done through multi-stakeholder engagement involving the public and private sectors, as well as community members. In phase 2, program coordinators identify climate risks and perform a vulnerability assessment to understand how to enhance the adaptive capacity of the neighbourhood in an equitable manner. For this step, local knowledge is extremely important to co-produce actions that address the most pressing needs for the community. Once risk areas have been identified, phase 3 requires co-creating an action plan with a set of adaptation measures that can be monitored and evaluated to ensure they are reducing the identified climate risks and do not result in maladaptive responses. Once the action plan is complete, it is ready to be **implemented** together with the community.

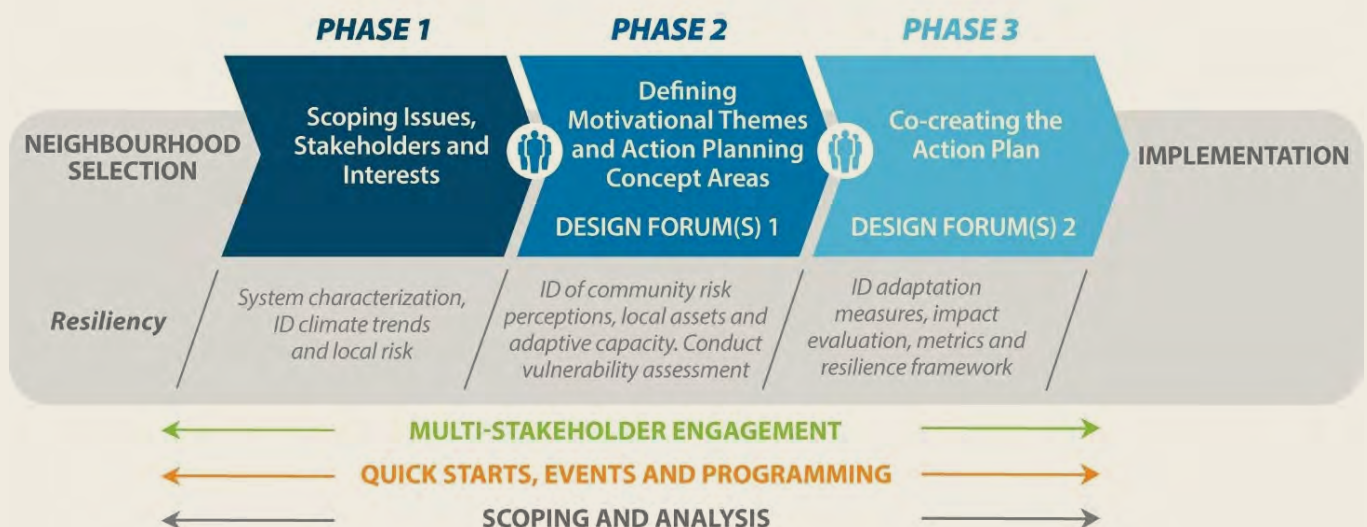


Figure reproduced from TRCA SNAP Program

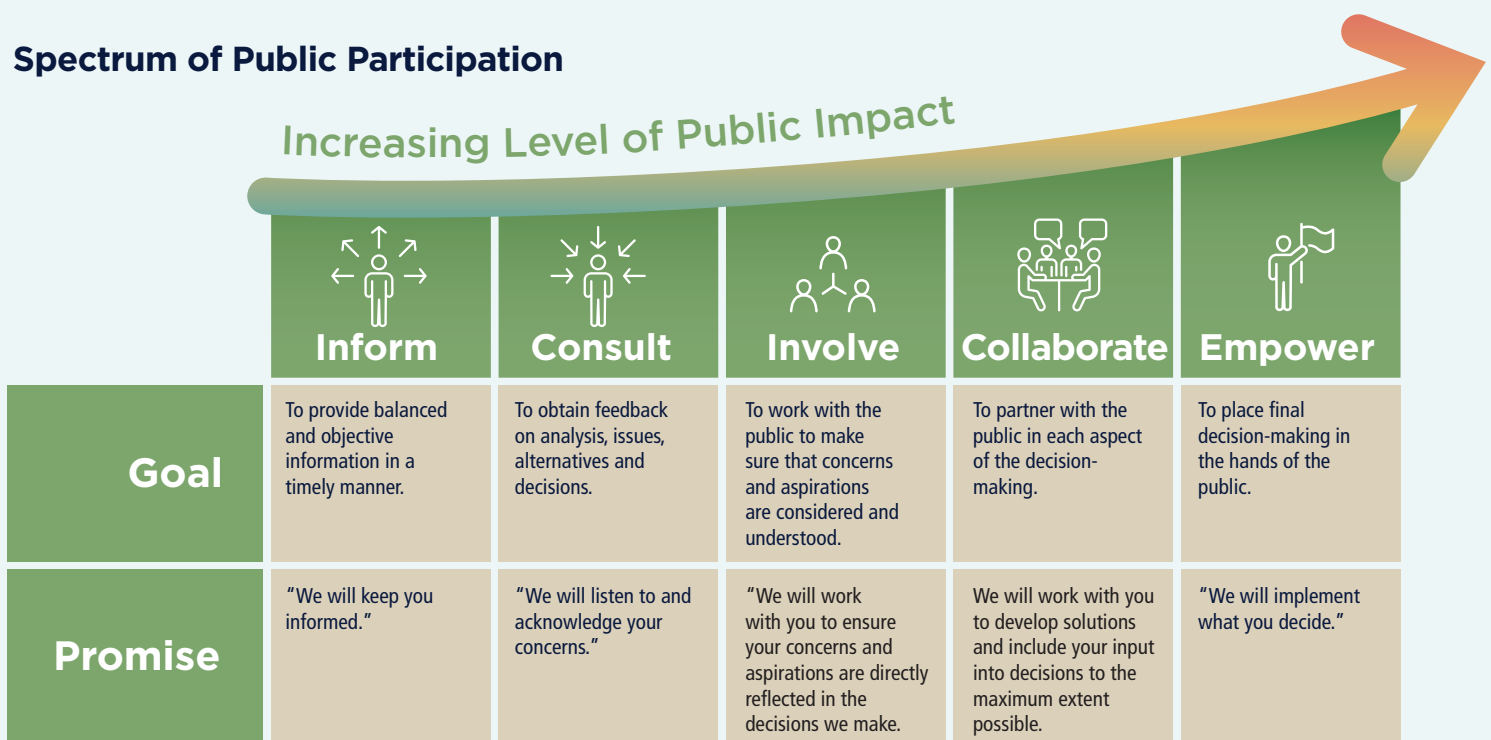
#3 Engage People in Planning and Decision-Making

Lessons learned from equitable community-focused GI projects demonstrate that community engagement is essential to avoid exacerbating existing inequities. GI projects can be catalysts for participatory action that empowers people to take agency in the design and enhancement of their community. To do this, GI work must go beyond infrastructural functionality and include additional benefits that support the wellbeing of local people in their lives (e.g., provide spaces with shade, access to food gardens, communal gathering spaces). Trust can be built by approaching existing community champions to lead engagement as intermediaries between community and GI developers. There are many different tactics to involve communities in GI planning and creation, like citizen panels, participatory planning workshops, and district forums, and a variety of **activities** that can be used depending on the needs of the

project and community members. The more participatory the engagement process, the greater the public impact and commitment to the project.

Consultation and engagement with any community should be adaptive to social inequities and barriers faced by people in that community. Communities who face barriers to accessing and using green space often also face barriers to participating in planning and policy decision-making. Strategies to reduce these barriers include paying people well for their time and travel, providing refreshments, providing accommodations for childcare, making events accessible, making promotional materials in languages spoken by the target community, offering translation services, and holding meetings about GI in the neighbourhood being addressed.

Spectrum of Public Participation



Adapted from the International Association for Public Participation. www.iap2.org



RESOURCE HIGHLIGHT:

NATURVATION's **Citizen Engagement Handbook** provides hands-on advice and specific approaches that municipalities and civil society organizations can use to engage citizens throughout a green infrastructure project.

Active Neighbourhoods Canada, a partnership between the Montreal Urban Écologie Centre, Sustainable Calgary, and the Centre for Active Transportation, developed an online toolkit called **Co-Designing the Active City**, which includes a number of resources for community engagement, such as a list of structured engagement **activities** and more.

#4 Employ Policy Tools to Enhance Accessibility and Avoid Displacement

Policymakers and planners can draw on a range of policy mechanisms, planning tools, and financial instruments to avoid displacement and promote just and inclusive green infrastructure development.⁴¹ Living Cities can combine the series of tools that are right for the context of their community.

Table: Anti-displacement policy responses and equitable green development tools used in North America and Western Europe⁴²

Anti-displacement Policy Responses	Land-use tools , including inclusionary zoning; up-zoning; rezoning of green space to residential space; preservation of historic districts; regulations on touristic/short-term rental apartments; moratorium on new businesses, hotels, and other hospitality industry permits; defense of single-family homes or minimum lot size; community land trusts; land banks
	Developer requirements , including obligation for developers to include affordable units in development; density bonuses to encourage affordable housing; support for developers to develop empty lots or buildings into affordable housing; property tax payment support for homeowners; homestead tax credit/tax exemption
	Financial schemes , aimed at homeowners, aimed at renters, and community-focused (e.g., property tax payment support, tax exemptions, freezes to property tax, housing credit programmes, rent subsidies)
Equitable Green Development Tools	Land-use tools , including eco-district zoning and climate change mitigation; rezoning of urban land to green space; opening of private green space to the public; ambitious green space development plan; green amenity planning in large-scale urban developments; conservation areas to preserve green spaces; interim green spaces on vacant land; re-purposing of streets to green transit areas; measuring/mapping access to green space; and waterfront redevelopment
	Developer requirements , including fee paid by developer directed to green funding; minimum amount of green space in new development projects
	Financial schemes , including specific national financial schemes to fund green infrastructure or parks; green bonds; regulations to support the development of urban agriculture; new/improved urban green amenities; and green resilient infrastructure funding in socially and environmentally vulnerable neighborhoods



CASE STUDY

The 11th Street Bridge Park in Washington, DC

In Washington, D.C., a new project will connect historically underserved communities to the city. The 11th Street Bridge Park is both a park and way for residents to cross the river and more easily gain access to the wider city. Designers of the project have made explicit the goal to avoid displacement of local residents, and have embedded the social mission of making the park work for local residents.

An **equitable development plan** for the bridge park lays out a number of actions the city will take to support local residents, such as engaging in workforce development, supporting local small and black-owned businesses, supporting housing affordability measures, and celebrating local arts and culture. The park itself will include pollinator gardens and urban farming opportunities for local residents.



Using GI to Advance Reconciliation

In an equitable Living City, municipal governments should be working to advance reconciliation, and green infrastructure can be a tool to help do this. The 43rd call to action from the Truth and Reconciliation Commission of Canada (TRC) calls for “municipal governments to fully adopt and implement the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) as the framework for reconciliation”.⁴³ Thus, this framework aims to center reconciliation efforts as part of an equitable city, in line with the UNDRIP.

Centring equity in GI implementation requires not only the participation of underserved communities in planning and designing GI, but also having local and Indigenous knowledge inform this work in “non-extractive” ways.⁴⁴ In other words, respecting the rights of Indigenous Peoples means Indigenous knowledge is not treated as “just data” that informs a municipal process, but instead results in outcomes that are beneficial for the communities involved.⁴⁵ Building trust and relationships between Indigenous and settler communities in Canada can help during the design, implementation, and maintenance phases of GI and can be a way forward for reconciliation in an equitable Living City. The following strategies can help municipalities advance reconciliation with GI.



“The history and future of cities in Canada are interwoven with Indigenous peoples, lands, rights, systems, identities and futures so it’s appropriate that municipalities and civic leaders commit to investing in and supporting opportunities directed at the restoration of land rights, strengthening of cultural identities and capacity-building, and building robust communities that are self-determined by Indigenous peoples.”

**Civic-Engagement Placekeeping
and Partnership Building Toolkit**

#5 Support Indigenous-led Green Infrastructure

Indigenous Peoples have been caretakers of the lands and waters of the place now called Canada for many generations. Indigenous worldviews and ways of knowing, although diverse, share common values of living in relation with the Earth and other beings. In this sense, Indigenous Peoples have unique and valuable expertise in “green infrastructure” (which may not be referred to as such by those communities). A variety of Indigenous-led urban green infrastructure projects already exist throughout Canada, such as the **Tu’wusht Garden** in Vancouver, BC, and the **Wisahkotewinowak Garden** in Guelph, ON. These projects share many things in common, including involving Indigenous Peoples and local communities in decision-making processes, engaging with youth and other individuals to connect with the land, and fostering stewardship and guardianship of land. Indigenous-led GI can also provide spaces for shared learning. For example, lessons learned from the Tu’wusht Garden in Vancouver showed that beyond the provision of food, growing medicinal plants allowed sharing medicinal knowledge with students from the University of British Columbia, underlining the connectedness of the land with health, and cultural customs.⁴⁶

UNDRIP and Local Government

The **United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP)** was adopted by the United Nations General Assembly on September 13, 2007. The UNDRIP recognizes that “*Indigenous peoples have the right to the full enjoyment, as a collective or as individuals, of all human rights and fundamental freedoms...*” (Article 1) and that “*Indigenous peoples have the right to participate in decision-making in matters which would affect their rights, through representatives chosen by themselves in accordance with their own procedures, as well as to maintain and develop their own indigenous decision-making institutions.*” (Article 18). In other words, the implementation of the UNDRIP requires respecting and recognising the rights of Indigenous Peoples. Indigenous Peoples are sovereign rights-holders and municipalities exist on Indigenous land governed by treaties and land agreements.

A steppingstone in the implementation of the UNDRIP in Canada was set with the adoption of the United Nations Declaration on the Rights of Indigenous Peoples Act (S.C. 2021, c. 14) on June 21, 2021. The Act indicates that: “[M]unicipal governments each have the ability to establish their own approaches to contributing to the implementation of the Declaration by taking various measures that fall within their authority.”⁴⁷



Grand Chief Wilton Littlechild, a Cree Chief from Canada, makes a ceremonial call to order prior to an event held on the International Day of the World's Indigenous Peoples and the 10th anniversary of the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP), under the theme “A Decade in Review: Achieving the Rights of Indigenous Peoples.”



A conceptual rendering of the Kapyong Barracks redevelopment. Taken from the *Former Kapyong Barracks Master Plan (2021)*.



CASE STUDY

Kapyong-Barracks Master Plan (March 2021)

Treaty One Development Corporation in partnership with Canada Lands Company CLC Limited have developed a **Master Plan for the former Kapyong Barracks** in Winnipeg. The 160-acre site will be transformed into a mixed-use community emphasizing Indigenous design excellence and integrating green and blue infrastructure. The strategic direction for green and blue infrastructure emphasizes:

- ✔ Using native species to share knowledge about cultural value, carbon sequestration, and habitat creation
- ✔ Maximizing permeable surfaces and striving for a minimum 20% reduction in asphalt and concrete compared to typical developments
- ✔ Considering reusing rain runoff
- ✔ Promoting green roofs
- ✔ Eliminating the use of fertilizers on public and private lands
- ✔ Integrating naturalized bio-retention in the public realm design (e.g., constructed wetlands, bioswales)
- ✔ Reducing water consumption in buildings
- ✔ Encouraging residential rainwater collection
- ✔ Engaging community members about green and blue infrastructure

#6 Build Municipal-Indigenous Partnerships

In Living Cities, municipalities and community groups can work to build reflexive, equitable, and reciprocal partnerships with Indigenous Peoples. These efforts span building internal institutional values and competencies in support of Indigenous engagement, creating space for dialogue, and co-developing working arrangements and governance frameworks.

The [Civic-Engagement Placekeeping and Partnership Building Toolkit](#) suggests these 14 common principles to guide collaborative partnerships:⁴⁸

- 1 Community engagement and relationship-building are foundational to every process and project.
 - 2 Build internal values and competencies within the organization in support of Indigenous leadership, engagement, and cultural awareness.
 - 3 Engage and consult early and often throughout a project.
 - 4 Community-driven, inclusive and representative of the diversity of community voices.
 - 5 Provide time to understand the experiences and emotions embodied in people's stories.
 - 6 Create spaces and opportunities for Indigenous Peoples to share their reflections, concerns, and ideas.
 - 7 Identify appropriate solutions and roles to leverage individual and collective capacities.
 - 8 Consult Indigenous knowledges and methodologies to shape processes and inform decisions. Get educated about and honour Indigenous sovereignty, governance, and inherent rights (related to lands in cities) in urban planning, design, and decision-making.
 - 9 Prioritize land stewardship and land-based approaches; strive for responsible development.
 - 10 Reflect on and understand how your municipality can improve its own policies, practices, procedures, and institutional values to achieve fully respectful relationships.
 - 11 Advance mutually respectful and cooperative dialogue, consensus decision-making, and collaboration skills.
 - 12 Once a baseline understanding has been achieved, reach out to Indigenous practitioners and community leaders, and start to build a respectful relationship based on a sincere appreciation for each other that will evolve over time.
 - 13 Collaboratively create shared content and value within the design development process to ensure the results reflect Indigenous People's cultural values, identities, and expressions; are usable and relevant; and meet their needs and desired outcomes.
 - 14 Bring an open mind and an open heart, and be ready to challenge yourself and your preconception.
- Other considerations include being responsible for your own learning (i.e., come to the table having done your own learning and not expecting Indigenous partners to teach you everything) and to adequately compensate Indigenous participants and knowledge-holders for their time.



KEY RESOURCES

Created for elected officials, senior and middle management, municipal staff, and community organizations, **Advancing Equity and Inclusion A Guide for Municipalities** offers a flexible guide for municipalities to advance equity and inclusion within their communities.

The **Active Neighborhoods Canada** network offers resources including tools and approaches to creating green, healthy, and active neighborhoods including a **guidebook** (2015) on participatory urban planning.

The Green Infrastructure Leadership Exchange recently created the **Equity Guide for Green Stormwater Infrastructure Practitioners** (2022) and several complementary resources to help practitioners implement the guide.

The **Civic-Indigenous Placekeeping and Partnership Building Toolkit** (2019) created by Evergreen and Future Cities Canada, offers tools for community leaders, practitioners, and civil and cultural organizations to build partnerships with Indigenous partners for placekeeping, reconciliation, and city building.

CityStudio Vancouver and Simon Fraser University are conducting ongoing research to provide recommendations to overcome barriers related to the equitable implementation of GI in Vancouver. **Bridging the Gap** (2021) aims to embed equity into GI implementation, and bridge knowledge gaps between departments in this process.

Taking Action for Urban Nature: Citizen Engagement Handbook (2019) created through the Naturvation project, showcases participation methods for GI implementation and outlines how municipalities and civil society can boost citizen engagement.

Policy and Planning Tools for Urban Green Justice: Fighting displacement and gentrification and improving accessibility and inclusiveness to green amenities (2021) created by the Barcelona Laboratory for Urban Justice and Sustainability, is part of a series of reports from the GreenLULUs ERC-funded project. The report provides 50 tools to promote best practices for housing affordability and stability, and access to greenspace.





An Abundant Living City

An Abundant Living City

Abundant

GI is the new normal; it is implemented widely and championed by diverse stakeholders.

Living Cities are communities where green infrastructure is equitable, abundant, and thriving. To become a Living City, GI needs to be abundant in your community. That means that GI is the new normal; it is widely implemented and championed by diverse stakeholders.



Aim of this Section: Making GI the New Normal

Currently, green infrastructure is not well integrated into land-use planning and decision-making and is limited in implementation in most Canadian municipalities. Consequently, many are losing valuable ecosystems and greenspace: three-quarters of large and medium-sized cities in Canada became less green between 1999 and 2019.⁴⁹

This section gives guidance and resources to help municipalities overcome barriers that hold back GI. Mainstreaming GI as the *new normal* is complex, but a variety of policies, plans, programs, and funding mechanisms have helped communities around the world make GI more abundant throughout the landscape. The following section outlines evidence-based approaches to make GI more abundant, and includes real examples from Canada, the US, and Europe.

Questions you can ask in your community:

- ❓ Which policies and regulations in your jurisdiction already support GI and what are the opportunities to align existing policies with GI?
- ❓ What kinds of support and resources to enable GI are available in your community and what needs further development?
- ❓ What weaknesses and gaps in policy frameworks and operational practices are holding back the preservation and implementation of GI?
- ❓ What skills and knowledge gaps do we have within our staff and those we work with to implement GI? How can we promote learning within our municipality and with those we work with?
- ❓ How can your municipality and green infrastructure champions collaborate with other levels of government other levels of government and facilitate community-based action?

Policies, Plans, Programs, and Funding for Abundant GI

While the challenges and opportunities vary in different places, municipalities can identify and enact a combination of relevant initiatives for their community by:

- ✔ Setting requirements for GI,
- ✔ Laying the groundwork for systemic integration of GI, and
- ✔ Growing support for GI.

There is no one-size-fits-all solution. Communities can build their pathway to become a Living City by combining any of the following initiatives that make sense within their context.

Purpose	Recommendations
Set requirements and standards for GI	<ol style="list-style-type: none"> 1. Provide a public mandate through policy frameworks or plans, mandatory regulations, or broader policy instruments. 2. Align with other strategic priorities to position nature as a solution for health, place-making, climate change, liveability, etc., and leverage related policies and requirements.
Lay the Groundwork for Systemic Integration	<ol style="list-style-type: none"> 3. Build knowledge and technical capacity related to GI broadly among practitioners involved in urban development. 4. Use valuation approaches and asset management to better integrate GI into city-wide decision-making. 5. Introduce and expand funding mechanisms including stormwater fees and similar tools, economic incentives, public/private co-financing, and green or conservation bonds. 6. Improve data and monitoring to develop evidence about the need for and performance of GI using tools like data portals, maps, and indicators.
Grow Support for GI	<ol style="list-style-type: none"> 7. Seek support to create policy frameworks, design standards, capacity, and funding streams for GI. 8. Facilitate community-based action to build awareness and generate widespread support for GI.

Set requirements and standards for GI

#1 Provide a Public Mandate:

A public mandate can be provided by **developing new or aligning existing regulatory and policy tools with GI values and goals.**

Policy tools act as leverage points to bring key stakeholders, like developers or builders, into more collaborative arrangements. Capacity and relationship-building across departments and disciplines might be required to change

influential policy and legislation. Similarly, GI policies can give rise to governance arrangements that help facilitate collaboration across departments and disciplines. Communities on the pathway to become a Living City can take an inventory of applicable policies and regulations in their jurisdiction to identify which initiatives already support GI and where improvements can be made.

Examples of Relevant Regulations & Policies:

- Official Plans
- Green Infrastructure Strategies
- Stormwater Management Plans
- Green Procurement Policy
- Asset Management Plans
- Climate Change Action Plans
- Sustainability Plans
- Heritage Policies (Civic and/or Natural Heritage)
- Low Impact Development Guidelines
- Land-use Plans
- Utility Plans
- Green Roof Bylaws
- Urban Forest Management Plans
- Brownfield Policies
- Complete or Green Streets Guidelines (Transportation)⁵⁰

Municipalities can use both binding (e.g., bylaws) and non-binding measures (e.g., use guidelines, incentives, disincentives) to support GI. Some of the most effective ways to provide a public mandate for GI include adopting a community-wide goal to manage stormwater using GI, developing a community-wide plan to achieve GI goals, and adopting GI targets.

GI targets are typically based on performance measures (e.g., volume of rainfall captured, pollutant reduction) or desired outcome

(e.g., amount of tree canopy, accessibility of greenspace, social goals). Target-setting is context-specific and can depend on the capacity of the location. However, for targets to be reached, they must be transparent, clearly defined, measurable, include timelines, and outline roles and responsibilities as well as the necessary budget.

Kind of Target	Description and Example
Tree Canopy Coverⁱ	<p><u>London, Ontario's</u> tree canopy goal is 34% by 2065.</p> <p>The <u>City of Toronto</u> plans to increase its tree canopy from 27% to 40% by 2050.</p>
Stormwater Infiltration	<p>Vancouver, BC's Rain City Strategy reiterates the municipal goal of capturing and cleaning 90% of average annual rainfall in close proximity to where it lands. The strategy amended the rainwater management design standard for green infrastructure site plans and assets to capture and treat 48mm of rainfall a day.</p> <p>Seattle, WA's Green Stormwater Infrastructure (GSI) Implementation Strategy sets the target of increasing the volume of water controlled with GSI by 700% by 2025 (700,000 ga), compared to a 2012 baseline (100,000 gal). As of 2020, Seattle has already increased the volume of stormwater controlled with GI by 450%.</p>
Impervious Surfaces	<p>The land area within Calgary, AB, currently comprises approximately 44% impervious surface – a 12% increase over a 1998 baseline. The city's Municipal Development Plan has set a target of drastically reducing the total impervious area in the city to 10-20% by 2076.</p>
Parks & Greenspace	<p>In Ontario, the City of Kitchener's Parks Strategic Plan outlines a target for each neighborhood to have a minimum of 1.5 ha of parkland for every 1,000 residents. This target also includes the goal of the creation of one playground or park within 400-500 m (5-minute walking distance) from all residences, and one accessible playground in each planning community.</p> <p>London, UK, currently has the goal of being the world's first "National Park City." To achieve this goal, the city has set the target of making half its urban areas green by 2050.</p> <p>The "3-30-300 rule" is increasingly gaining traction among environmental planners, researchers, and advocates. The rule states that every resident should: be able to see a minimum of three trees from their house, live in a neighbourhood with at least a 30% tree canopy cover, and be 300 m from the nearest park or greenspace.</p>
Absorbent Landscape Design	<p>Soil compaction during development can significantly alter the natural water balance of the land, impeding stormwater infiltration. "Absorbent landscape design" uses soil depth and grading specifications to encourage stormwater infiltration in new developments.</p> <p>To maximize absorption, topsoil depths under turf should be at least 300 mm, with at least 5% organic matter, and be compacted no more than 85%. For plants and shrubbery, depths should be 450-600mm, and for trees, upwards of 1000mm is appropriate. The City of Richmond Hill, ON is developing Sustainability Metrics to help guide site plan approvals for new developments. The proposed metrics give points for various development measures. 200 mm is proposed as a minimum topsoil depth, and 300 mm is proposed as an ideal depth. The District of Saanich, BC also proposes 300 mm topsoil as a minimum recommended depth for lawn conditions, and 450 mm as minimum depths for planter areas in their Stormwater Best Management Practices guidelines.</p>
Biodiversity & Conservation Corridors	<p>To encourage the movement of a wide variety of species, the City of Surrey, BC's Biodiversity and Conservation Strategy includes targets for corridor and greenway width. For local corridors, The target is between 10 and 50 m for local corridors and between 50 and 100 m for regional corridors.</p>

ⁱ Tree canopy targets of at least 30-40% are typically considered good minimum targets in urban areas to sustain watershed health and support other ecological functions. However, different cities have different climates, environmental conditions, and development contexts that can influence this target. American Forests notes that cities in forested areas can attain tree canopy cover of between 40-60%, development conditions permitting; for cities in prairie or grasslands, 20% is a more realistic target; and in desert cities, 15% is more suited to the ecosystem. In addition to quantity targets, quality targets are important (e.g., condition of urban forests, tree diversity, using native species). See: <https://www.americanforests.org/cities/why-we-no-longer-recommend-a-40-percent-urban-tree-canopy-goal/>.

Existing nature can be protected by enacting a variety of **environmental protection programs and requirements**. For example, [a growing number of municipalities](#) have enacted tree protection and preservation bylaws to prevent mature trees growing on private lands from being removed. Municipalities may also protect environmentally significant areas from future development by designating them as Environmental Reserves or Environmentally Sensitive/Significant Areas (as done in the [Region of Waterloo](#), ON, and elsewhere) or by requiring that new developments adjacent to Environmentally Significant Areas mitigate as much damages as possible, using tools such as Environmental Development Permit Areas (as [employed in Vernon, BC](#) and elsewhere). Municipalities may also enact growth boundaries, outside of which new development cannot proceed, or [develop programs](#) that promote brownfield sites to be prioritized for re-development over greenfield sites. A growing number of municipalities are turning to programs that incentivize developers to preserve natural soils or vegetation in new developments (e.g., Richmond, WA's [Green Building and Green Infrastructure Incentive Program](#)).

Policy tools can also make green infrastructure mandatory in new developments, such as the City of Toronto Green Roof Bylaw or the [Green Space Factor](#) in Malmö, Sweden and Seattle, USA, which assigns points to various types of GI based on the social and environmental features offered. To better incentivize GI that can provide functions such as mitigating the heat island effect, increased biodiversity, and recreational space, local governments require developers to meet a points-based threshold to ensure urban greenery is a part of the development process. The benefit of the tool is that it allows for flexibility in achieving the threshold.⁵¹

Local governments can also develop explicit **green infrastructure strategies** that focus specifically on promoting the integration/adoption of green infrastructure, instead of locating green infrastructure within other strategies where it may

get lost to competing priorities.

Stormwater management policies and design standards are also key tools for entrenching GI. In Ontario, stormwater plans are one of the most common places GI is integrated into municipal planning. Stormwater management (SWM) has conventionally been undertaken as a flood control measure; however, cities around the world are increasingly realizing other benefits of using GI as a SWM practice, such as water quality improvement, since GI helps to reduce runoff and therefore contaminated water from entering lakes, rivers, and streams. SWM policies can set a standard for prioritizing the use of green infrastructure to manage stormwater at the source with native plants and soils, and using other “conventional stormwater” measures as second and third resorts. The [draft Ontario LID Guidance Manual](#) suggests a runoff volume control target of 90% of total annual rainfall volume when designing stormwater management projects.⁵²

Design standards can set out objective and best practices for using GI in SWM. For



example, the City of London, ON's Stormwater Management Requirements include a [Stormwater Management Control Hierarchy](#) to guide the design of SWM infrastructure systems by following three priorities: 1) infiltration or retention by native soils, 2) filtration focused on volume capture and release, and 3) other volume detention and release techniques.



CASE STUDY:

Saskatoon Green Infrastructure Strategy (SGIS) (2020)

Saskatoon is growing and anticipates surpassing a population of a half-million. The city has identified key needs, such as “providing high quality green space to all city residents while supporting stormwater management and other ecosystem services” in the face of a growing population and risks brought on by climate change and concerns over habitat fragmentation and biodiversity loss. The SGIS, passed in 2020, attends to these needs and risks by presenting a clear roadmap to integrate green infrastructure into land-use planning and asset management.

Developing the SGIS involved mapping and analyzing the connectivity, distribution, significance/values (e.g., ecosystem services provided, category of recreational or cultural use), and ownership of green/blue spaces and assets, as well as relevant cultural and community spaces. The analysis considered

physical and social geography, ecology, and current and anticipated effects of population growth and climate change to identify needs, risks, and opportunities for strengthening Saskatoon’s network of natural assets and green infrastructure. Drawing on this work, the SGIS identifies key actions, geographies, and partnerships, as well as performance indicators to monitor the implementation of the strategy.

The SGIS also includes an inventory of 48 municipal bylaws, policies, plans, and guidelines, regional (Meewasin) conservation authority policies and plans, and federal and provincial policies and plans relating to green infrastructure. It codes each into high, medium, or low relevance according to four key themes of the green network strategy (community, open space, ecology, stormwater).

RESOURCE HIGHLIGHT:

Decision support tools like the **Low Carbon Resilience (LCR) Decision Tool** or NATURVATION’s **Urban Nature Navigator** can help project leaders understand which tools and strategies are relevant to their particular interests and context. Using decision support tools that are already available, or adapting one to fit your municipality’s context and needs, will help your organization avoid the need to create a new one (saving time and resources).

#2 Align with Other Strategic Priorities

Since GI offers multiple co-benefits, it can be readily deployed to help address multiple issues and priorities. Aligning GI with other strategic priorities can also help leverage related requirements and resources. For example, if improving local health indicators is a priority, GI can be positioned as a **solution** to help achieve this. This may involve specific kinds of assessments and measurements to collect evidence demonstrating the benefits and impacts of GI on physical, mental, and community health. **EcoHealth Ontario** has created a **policy toolkit** focused on municipal, public health, and watershed management tools to help build a shared vision of ecohealth in the province.

Green infrastructure offers both climate change mitigation and adaptation benefits. Highlighting how GI can act as a locally

relevant climate solution can create opportunities to access resources and garner interest from a wider set of stakeholders.⁵³ For example, many communities have declared climate emergencies, and GI can be factored into resulting climate action plans.

Aligning GI with other priorities and program areas is key to its integration into city-building at a wider scale. For example, integrating GI into utility planning can help ensure that GI complements other utility needs and that developed or re-developed utility corridors are designed to accommodate GI needs (e.g., tree root systems, rainwater trenches). Several municipalities are working toward integrating GI into transportation planning. The City of Toronto included green infrastructure in their **Complete Streets Guidelines** and created the **Green Streets Technical Guidelines** to provide direction for the planning, design, integration, and maintenance of a range of GI options appropriate for Toronto street types and conditions.

CASE STUDIES:

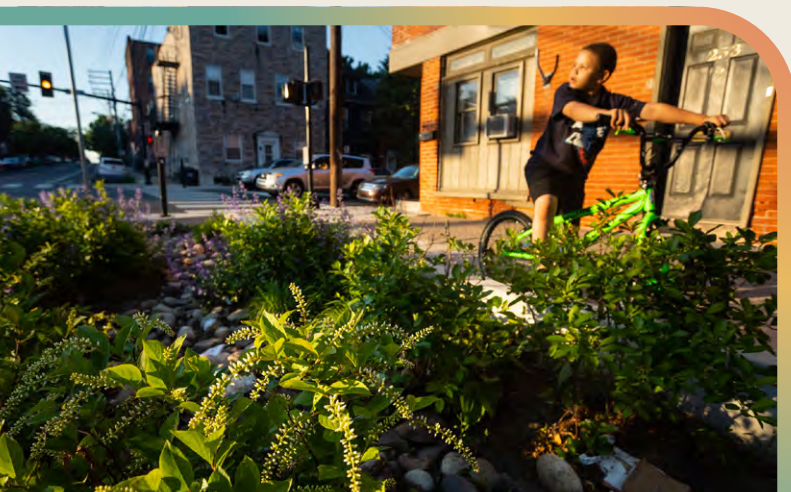


Aligning GI with Health

Vancouver's Healthy City Strategy promotes healthy lifestyles and active living through green space access. Decision-makers were able to quantify the physical, social, and mental health benefits associated with greenspaces. Success was measured based on tree canopy cover, the distance residents lived from green spaces used for recreational purposes, and the number of

residents who were able to meet the Canadian Physical Activity Guidelines. This plan uses direct evaluation metrics to evaluate the health impacts of using GI, which helps create opportunities for GI uptake.

Researchers in Toronto conducted an **exploratory Health Equity Impact Assessment (HEIA)** focusing on the health and equity impacts of nature-based green infrastructure in Ontario municipalities. **HEIA's** are specialized Standard Health Impact Assessments (HIA), which are comprehensive assessments to evaluate the human health impact of a project. The study surveyed 36 volunteers and workers in GI programs, and eight municipal public health professionals to determine the impact of GI on mental, physical, and social health. Researchers found that in places where GI was accessible to the public and productive, there were significant benefits for underserved groups such as increased food security, social connectivity, and a rise in skills development.



Lay the groundwork for systemic integration

#3 Build Knowledge and Technical Capacity

Green infrastructure policy, planning, design, construction, monitoring, and maintenance requires the participation of a variety of practitioners with a breadth of knowledge and skill sets.⁵⁴ It also requires that adequate financial and human resources be dedicated to GI. Many municipal practitioners have identified knowledge and skills gaps as a barrier to integrating GI into city-building and ensuring it operates well over its life cycle.⁵⁵ Gaps in GI specialist knowledge at policy and planning levels can result in limited human and financial resources being directed toward GI at the outset. Gaps in technical skills and knowledge can result in poorly designed or maintained GI that fails to deliver its full range of benefits. Knowledge and capacity can also be limited by operational silos within municipalities and a lack of communication among planning, design, capital, and operations groups. Cognitive barriers such as a “business as usual” mindset, perceptions around higher costs and decreased effectiveness, and risk aversion can make municipalities reluctant to take the steps necessary to grow GI-related knowledge and skills among key personnel.⁵⁶ Some solutions to grow knowledge and skills to advance GI include:

- 1. Fostering internal champions.** Staff within municipalities who can support internal learning and educate other staff, especially those staff with more internal influence (e.g., director-level staff) is key to advancing GI. An internal champion was integral to building the staff capacity necessary to formulate and resource Vancouver’s Rain City Strategy. It is particularly helpful to secure the necessary financial resources to advance GI when a city’s Chief Financial Officer or City Manager is a GI champion.⁵⁷
- 2. Creating teams with the right skills and competencies.** At the Living Cities forum, many participants expressed the value of bringing the right staff on board to achieve the necessary breadth of competencies within the team. It is also crucial to link members of GI teams to other teams and departments to avoid operational silos. The city of Vancouver is a leader in this regard. To support the implementation of the Rain City Strategy, the city of Vancouver has an interdisciplinary, 20-person “GI team” that supports the implementation and monitoring of green infrastructure. The team includes staff with backgrounds in engineering, planning, landscape architecture, urban ecology, financial analysis, communications, environmental technology, and construction. This team works closely with higher-level planners in the Integrated Watershed Management branch of the Planning Division to link across departments and ensure green infrastructure opportunities are contemplated early in utility planning work.
- 3. Supporting staff learning, training, and education.** GI can be complex, and practices and technology are constantly evolving. A growing number of trainings, tools, and resources have been developed to support municipal practitioners advance GI (including this framework). Municipal decision-makers should support staff to participate in professional development opportunities. Informal opportunities include conferences (e.g., the [Grey to Green conference](#)), webinars (e.g., the Sustainable Technology Evaluation Program’s [webinar series](#)), and

opportunities for self-directed learning (e.g., the Green Infrastructure Ontario Coalition has pulled together many available resources on their online [Municipal Hub](#)). There are also fora that support peer-learning, such as the [Green Infrastructure Leadership Exchange](#) Community of Practice, which is open to North American municipalities committed to advancing GI. Formal learning opportunities include courses and accreditations offered by postsecondary institutions and professional associations. For example, the Climate Risk Institute worked with Engineers Canada to develop their [Infrastructure Resilience Professional \(IRP\) Credentialing Program](#), which includes GI. Simon Fraser University offers an online course on [Green Infrastructure in Urban Centres](#), and McMaster University offers a professional certificate course in [Sustainable Infrastructure: Low Impact Development & Climate Resilience](#).

4. Leveraging demonstration projects.

Demonstration projects can build capacity because they showcase GI working in practice and help practitioners develop processes for addressing challenges.⁵⁸ [STEP's Green Infrastructure Map](#) and [Resource Library](#) showcase LID demonstration sites in and around the Greater Toronto Area. Outside Canada, demonstration projects within the UK have provided support in the expansion of GI knowledge, bridged gaps in evidence, and fostered the scaling-up and implementation of projects. The [Green Infrastructure Fund](#) in Scotland has also been pivotal in showcasing how GI can provide co-benefits and addressing social and environmental issues.

5. **Growing awareness, education, and support for GI in key private sectors.** GI planning and implementation requires support from multiple sectors. Growing awareness and capacity in these sectors can be key to advancing abundant GI in communities. Municipalities can develop programs to support construction and maintenance contractors and developers to understand the benefits of GI, how to design and take care of various GI assets. Seattle, WA, offers a program called [RainWise](#), which offers rebates to residents who install green stormwater infrastructure on their properties. They require that contractors who are engaged to do this work complete [training](#). Municipalities can also use [design competitions](#), awards, and more to incentivize uptake of GI in the private sector. Another way to incentivize learning in the private sector is to prioritize contractors and consultants that have undergone professional certification that incorporate GI solutions. For example, the Institute of Sustainable Infrastructure developed its [Envision](#) program and certification to support public agencies in delivering sustainable infrastructure. As a part of their [Fusion Landscaping Program](#), Landscape Ontario offers training and certifications to their members and [contractors](#) in LID design, construction, operations, and maintenance. The US-based [National Green Infrastructure Certification Program](#) (NGICP) recently expanded to offer their program internationally, with practitioners certified in New Zealand and Canada. The certification provides the base-level skill set needed for entry-level workers to properly construct, inspect, and maintain GI.ⁱⁱ

ii Other certification schemes include: Building with Nature, a UK-based accreditation scheme that specifically focuses on urban GI; BREEAM, an international certification scheme that assesses "the sustainability performance of individual buildings, communities and infrastructure projects"; and DGNB, a scheme from the German Sustainable Building Council (Deutsche Gesellschaft für Nachhaltiges Bauen).

6. Supporting job and workforce development for GI. Many local governments are looking to bridge skills gaps in GI installation, construction, and maintenance by supporting workforce development programs. For example, 14 municipal governments and public utilities in the USA founded the NGICP to help build local capacity for GI implementation and upkeep. The City of Toronto supports the **RainScapeTO** program (run by the non-profit organization, Toronto Green Community), which provides training and job opportunities to unemployed and underemployed people, with a focus on Indigenous individuals. The city of Vancouver partnered with Coast Mental Health to develop a social enterprise that trains and employs workers in GI maintenance.⁵⁹

7. Growing public awareness, support, and action for GI. In order to spend public resources on GI, municipalities need a supportive public to ensure there is a mandate for this work. Municipalities can directly, or with support of local civil society groups and/or educational institutions, deliver programming and communications that raise public awareness and support for GI. Establishing resident incentive programs for GI (e.g., rain garden rebates), grant programs (e.g., San Francisco's Public Utility Commission's **Green Infrastructure Grant Program**), and holding award or recognition programs to encourage uptake of GI among residents are other strategies to deepen awareness, support, and resident-led action.⁶⁰ Directly engaging members of the public in GI planning and implementation is also a vital way to grow public awareness, support and action (**see section, Facilitate Community-Based Action**, for more information on engaging the public in GI planning and implementation).



#4 Use Valuation Approaches and Asset Management

Valuation Approaches

Natural systems and green infrastructure are frequently undervalued by local governments and viewed as a “nice amenity,” rather than as providing critical services that are core to the functioning of a municipality and resident well-being. Communities can use various **valuation approaches** to integrate GI into decision-making and more appropriately state the importance of GI. Two of the more common methods are the *replacement cost method* (cost to replace the asset if it was lost) and the *value transfer method* (applying quantitative estimates of service values).

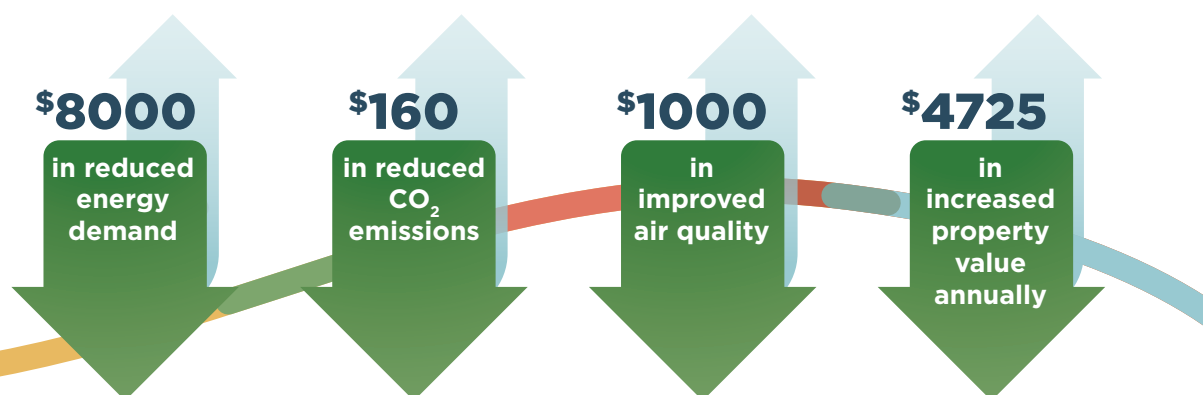
The **replacement cost method**. The replacement method shows how much it would cost an organization to replace a given asset with a new asset that performs the same function. Using the replacement method to value urban forests within your municipality, you might: 1) do an inventory of all the trees on public lands, 2) determine the average trunk width for all of these trees, then 3) calculate replacement value for all of the trees based on: cost to purchase and plant an equivalent trunk diameter (e.g., if average trunk diameter is 50 cm, it would take 5 younger trees with trunk diameters of 10 cm to replace one tree), plus the cost of watering and maintenance for three years to ensure the survival of new seedlings. Using this method, the City of London determined their urban forests would **cost approximately \$402.1M to replace**. While

the replacement method can provide useful information about the economic value of an asset, it does not shed light on the multiple services and benefits offered. The benefit of the replacement cost method is that it allows for a direct comparison of GI assets to grey assets in municipal planning and decision making, placing these assets on a level playing field.

The **value transfer method** elucidates the many benefits provided by GI assets. This method uses information from existing studies that provide ecosystem service valuation estimates for a given ecosystem or asset (“a study site”) and applies that to a site of interest with similar characteristics (“a policy site”). This method considers the kinds of services provided by the asset as well as the benefits derived by beneficiaries of those services.⁶¹ There are a growing number of studies and tools offering financial estimates of the services derived from GI that municipalities can consult (see bulleted list below). The city of Vancouver estimates that green stormwater infrastructure (GSI) is 3-6 times more cost-effective than grey infrastructure when its provision of multiple services is considered.⁶² In their Rain City Strategy, they note that one fully vegetated acre of GSI translates to “\$8,000 in reduced energy demand, \$160 in reduced CO₂ emissions, \$1000 in improved air quality and \$4,725 in increased property value annually.”⁶³

Although a growing number of studies illustrate how GI can be more cost-effective than grey infrastructure for a number of functions, grey may be more appropriate in certain circumstances. **Trade-offs** must be evaluated when comparing green and grey infrastructure.

Vancouver’s Rain City Strategy estimates that 1 acre of GI results in:





CASE STUDY:

Philadelphia and the Value of Green vs. Grey Infrastructure



By assigning a value to GI, the city of Philadelphia, PA, has demonstrated how GI can offer much more cost-effective solutions than conventional grey infrastructure. Through its **Green City, Clean Waters** program, the city has invested heavily in green infrastructure to help address combined sewer overflows leading to degraded water quality in the Delaware River and its tributaries.

The program is projected to cost the city \$1.6 B over 25 years. An independent economic analysis revealed that the city would have needed between \$8-10 B to replace the combined sewers without the investments of *Green City, Clean Waters* taking pressure off the aging stormwater infrastructure. Using GI solutions, then, is expected to save the city \$6-8 B in infrastructure costs.⁶⁴

Gathering quality and reliable data is important to appropriately value GI. There are many methods and tools to inform valuation, including:

- Simon Fraser University's Action on Climate Change Team's **Accounting for Natural Assets in Local Government** report (2020)
- The Earth Economics Green Infrastructure **Valuation Tool** and **User Guide**
- The Centre for Neighbourhood Technology's **Green Values Stormwater Management Calculator tool**
- The **Financial and Economic Values Database** created by Naturvation (showcases economic value of GI and includes an aggregate of 205 economic valuations from 105 studies between 1978 and 2017)
- The **Business Case for Natural Assets in Peel**, a web-based tool to create a business case for natural assets in the region
- A **global database** maintained by The Economics of Ecosystems & Biodiversity office of the United Nations
- The US Environmental Protection Agency's **list of resources**, which assesses cost-benefit information related to GI

Not all values derived from GI can or should be expressed in financial terms. **Extensive research has shown the numerous social and cultural values** that people hold for green infrastructure: well-being, education, intrinsic value, social inclusion, place-based values, aesthetic, recreation, and more. While it may not always be appropriate to quantify these values financially, they can still be documented and integrated into policymaking in ways that substantively inform how decisions are made. The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) recently released a **comprehensive report** (July 2022) that documents various methods for integrating diverse values into decision-making. They suggest the following steps to achieve this:

- 1 constructing a legitimate process,
- 2 defining the purpose of valuation,
- 3 scoping the valuation,
- 4 selecting and applying valuation methods, and
- 5 articulating the values into decision-making.

The report's authors state that diverse values are much more likely to influence policy outcomes when a combination of values are articulated and leveraged at different points throughout the decision-making process.

Green Infrastructure Asset Management

Valuing and accounting for green infrastructure assets is a key step. However, for GI to become abundant throughout the landscape, this work must inform municipal decision-making processes at the organizational level. **Green infrastructure asset management (GI AM)** is an important strategy to do this.

The four core components of asset management can be applied to both green and grey infrastructure. They are:

Asset inventory: gaining an understanding of all the assets owned and managed by your organization, how much they are worth, the condition they are in, how long they are expected to last.

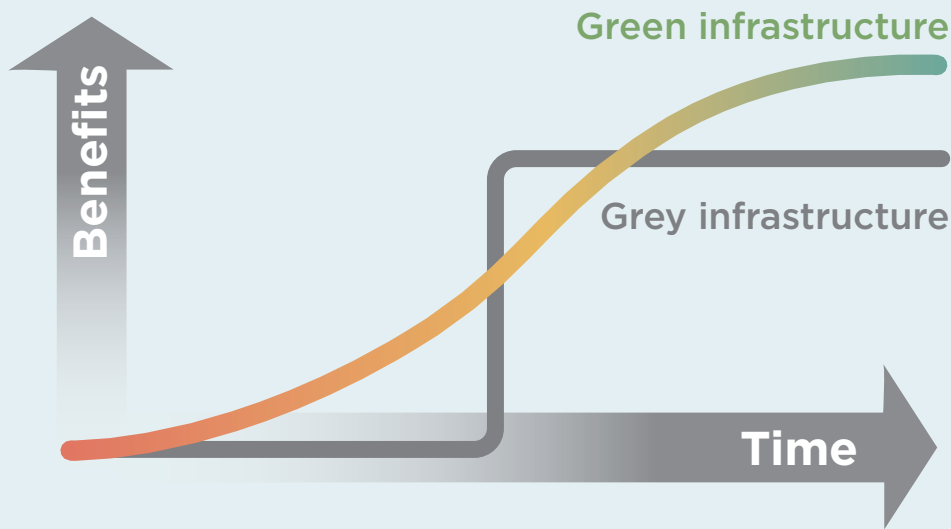
Levels of Service: determining the quantity, quality, and reliability of services the assets should provide to its users. Doing this allows asset managers to determine how the system must be operated and maintained to provide these desired levels of service.

Life-Cycle Management Strategy: developing a strategic plan to operate and maintain your assets, based on the level of service they should offer; the risk (likelihood and consequence) of failure; projected costs associated with assets at each stage of their lives to ensure proper functioning and service-delivery and that they are repaired, rehabilitated, or replaced as necessary.

Long-term Funding: based on the management strategy, ensuring there is adequate funding in place to support long-term and day-to-day operations of your assets (both capital and operating costs). Notably, GI typically requires much less upfront capital investment than grey infrastructure, but may have higher long-term maintenance costs.ⁱⁱⁱ Funding strategies need to ensure they are responding to the specific resource needs of GI.

ⁱⁱⁱ Overall maintenance costs are reduced when GI is designed and maintained appropriately (e.g., regular light maintenance can help avoid the need for significant maintenance in the longer term due to asset failure). GI has often been found to be much more cost-effective than grey alternatives, and/or to support grey infrastructure to perform more effectively and extend its life cycle. See [operations and maintenance] for more information on designing and maintaining GI for optimal performance.

Phasing of Green Infrastructure and Grey Infrastructure Benefits Over Time



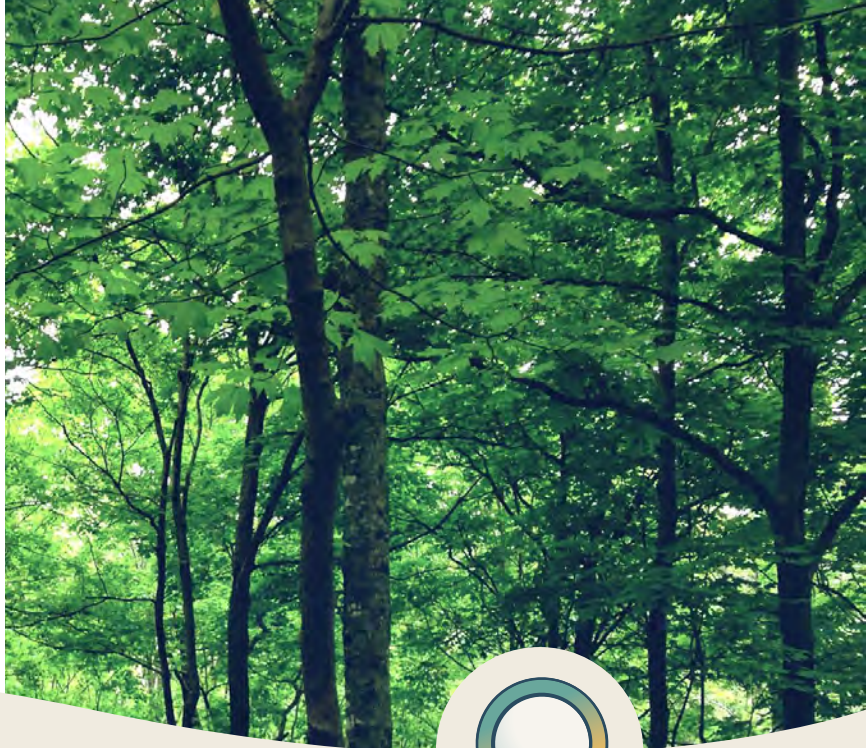
It is important that green infrastructure assets are valued using the same methods as traditional infrastructure to allow for comparison between service areas and asset categories. GI AM may reveal that green infrastructure is a better choice than grey infrastructure to deliver certain services. For example, depending on the type of green asset (i.e., natural, enhanced, or engineered), asset managers may find that a GI asset:

- meets a number of service-delivery objectives at the same time (e.g., stormwater management, urban heat reduction, recreation),
- is carbon-neutral or carbon-positive,
- is more cost-effective to operate and maintain than grey alternatives,
- depreciates more slowly over time, or may even appreciate, and
- offers more long-term benefits than grey alternatives.

There are some challenges related to incorporating green infrastructure into asset management planning. For instance, some GI assets have a non-typical life cycle (i.e., some may last in near perpetuity with proper care and maintenance but be vulnerable to external risks like extreme weather events). In addition, some assets like trees have delayed service provision (i.e., a shade tree must grow for years before it meets the desired level of service). Another challenge may include the multi-disciplinary or cross-departmental approach necessary, as the realm of GI assets may be managed by various departments within a city. As more municipalities include GI in their asset management plans, there is a growing base of knowledge and experience among municipal practitioners to address these challenges. Ontario municipalities, in particular, are actively growing their GI AM knowledge and experience, as a provincial regulation (O.Reg. 588/17) passed in 2017 requires all municipalities in the province to incorporate green assets into their asset management plans by July 2024.

Learn more about integrating GI asset management:

- ▶ [Green Stormwater Infrastructure Asset Management Resources Toolkit](#)
- ▶ [Municipal Natural Assets Initiative \(MNAI\) resources](#)
- ▶ [City of Saskatoon Case Study](#)



CASE STUDY:

Town of Gibsons Natural Asset Management

In Gibsons, BC, **natural assets** are an integral part of the community's infrastructure. The town, which is located on the Sunshine Coast, relies on the Gibsons Aquifer for water storage and filtration, the woodlands and creeks for rainwater management, and the foreshore as a seawall to protect from storm surges and rising sea levels. To effectively manage the town's natural assets and make decisions concerning the operation of the entire life cycle of those assets, the town pioneered a **natural asset management strategy**. The objectives include managing risk, reducing costs, maintaining the health of ecosystems, and ensuring natural assets do not degrade with time.

In 2016, Gibsons became a founding member of the Municipal Natural Asset Initiative (MNAI), which provides support for municipalities as they value and account for natural assets within their asset management and financial planning. As part of this effort, MNAI conducted a valuation of Gibsons' **Whitetower Park ponds stormwater management services** and found the ponds to be valued between \$3.5 and \$4 M. The goal of this valuation was to assess and incorporate the value of the Whitetower Park ponds into

an asset management plan and showcase the application of the **Overview Guidance Document for Stormwater Management**, created by MNAI.

Steps laid out by the MNAI guidance document to reach this valuation included:

- ✓ characterizing the natural capital asset of interest,
- ✓ developing and running a SWMM model to capture current watershed conditions,
- ✓ developing alternative scenarios to current conditions, such as the replacement of the pond system with detention ponds, or the use of a bypass pipe,
- ✓ using the replacement cost method for economic valuation to determine the economic value of the ponds, and adding information on beneficiaries, including taxpayers and residents.

#5 Introduce and Expand Funding Mechanisms

As noted above, incorporating green infrastructure into the municipal asset management process is instrumental to understanding the kinds of services that GI can deliver and quantifying the financial resources needed to ensure GI assets continue to deliver those services (i.e. ensuring proper accounting for the long-term operations and maintenance requirements of GI). However, accessing financial resources, particularly over the long-term, is consistently highlighted as a challenge for GI implementation. Although green infrastructure can be more cost-effective than grey infrastructure and provide a wide range of benefits to society, governments often undervalue and underinvest in green infrastructure.⁶⁵

Despite this challenge, GI's unique ability to deliver multiple co-benefits can motivate action and support for GI projects from unlikely and diverse champions. Communities on the pathway to become Living Cities can fund GI by **incentivizing private action** and **targeting public investments**. Funding strategies can be compared using various decision-making criteria, such as funding availability, flexibility, municipal budget impact, administrative burden, and legal constraints.

Conventionally, many municipalities have funded stormwater management (SWM) activities through general property tax coffers, development charges, and grants for infrastructure or environmental projects. These funding streams have contributed to

alarming deficits in infrastructure funding. Due to these historic infrastructure deficits, many municipalities across Canada are struggling to maintain and repair existing grey infrastructure and are unable to sufficiently service and protect communities from climate impacts.^{66,67} Rapid expansion of impervious surface area created through urban development and increasing severity of weather events due to climate change further burden these already underfunded systems.

Federal Grants and Programs

Municipalities may look to higher levels of government to close this infrastructure gap and fund new green infrastructure projects. The Canadian government has developed programs that support municipalities with these investments, including the Investing in Canada Infrastructure Program, Disaster Mitigation and Adaptation Fund and the newly introduced Natural Infrastructure Fund.



Municipal Stormwater Fee

Although federal programs may help close the funding gap, they are not a consistent source of revenue, and they tend to prioritize capital costs rather than costs associated with longer-term operations, maintenance and monitoring. Municipalities are looking to funding methods that allow them to achieve full-cost recovery associated with operating, maintaining, and replacing stormwater infrastructure—including green infrastructure. Many Canadian municipalities are increasingly turning to a **stormwater fee** as a sustainable, full-cost recovery, municipal funding source. As of 2016, **21 municipalities in Canada** used these fees to fund stormwater management activities.⁶⁸ Stormwater charges provide a steady stream of funds to build GI. However, GI should be tied into a municipal stormwater master plan and implementation plan so the fee is strategically implemented and the strategies receive adequate funding. SWM funding mechanisms can also be designed to incentivize private action by developers and property owners to take responsibility for proper SWM (e.g., reducing runoff leads to reduced fees). Methods for calculating SWM fees include a flat fee or tiered flat fee, Equivalent Residential Unit (ERU) and Single-Family Unit (SFU) billing, and an Impervious Area Charge.

Municipal Green Bonds

Green or conservation bonds are also becoming increasingly popular with municipalities and other public and private organizations to fundraise for the necessary capital to acquire land and make large capital investments.⁶⁹ Municipalities issue bonds that allow them to invest in projects that advance sustainability goals, and investors receive their initial investment back in addition to a low-interest return. In Toronto, the City launched the **Green Debenture Program** and raised \$630 M (CAD) over three rounds of investing from 2018-2020. The green bond offers capital for various projects focused on increasing environmental sustainability in the City including cycling infrastructure, green retrofits for social housing, the **Port Lands Flood Protection project**, and others. Similarly, in Portland, a 2019 **parks and nature bond measure**, approved by 71% of voters, proposed the introduction of a \$475 M (USD) green bond to be used on sustainable projects that focus on racial equity and supporting underserved communities.



CASE STUDY:

Stormwater Fees in Ontario Municipalities



Kitchener, ON, uses a tiered flat fee based on monthly utility bills. A flat or tiered flat fee does not vary based on size or use of land, but may be tiered based on land use categories (e.g., residential vs. commercial build). There are 13 tiers based on property type, number of residential units, and impervious area. For an average single-dwelling homeowner, the charge for stormwater management is \$11.44/mo. The stormwater fee helped finance improvements to Victoria Park Lake. Find out more in this [case study](#).

In Mississauga, ON, an ERU is used with different calculations depending on land use. ERU and the SFU billing uses statistical sampling to determine the impervious area within a given area, and then uses this value as the base billing unit. For residential properties, there are five tiers with charges ranging from \$50-170/ y, based on rooftop area. Through the “[stormwater charge estimator](#),” property owners can determine their charge by entering their address through an online platform. The city created a credit program for non-residential properties and multi-residential properties to receive 50% off their stormwater fee. Many unfunded projects in the city were able to come to fruition due to the implementation of the stormwater charge.

Guelph, ON, implemented a stormwater fee in 2017 through ERU billing to manage its \$4.1 M funding gap for stormwater services. The new fee, which is billed directly to residents through utility bills instead of property taxes, provides stable funding for services. The city needed to switch their funding method due to an inability to adequately address stormwater management risks like flooding and erosion, as well as to degraded waterways and drinking water quality. An ERU charge where every residential property pays the same amount was chosen because it was deemed the best method to balance administrative costs with fairness. In early 2022, the fee was \$7/mo for one unit (\$84/y). Residential properties are billed based on the number of dwelling units, and non-residential properties are billed based on impervious area divided by the average cost of hard surfaces across the city times the ERU fee. The city has also initiated financial incentive programs to encourage reduced stormwater quantity or improved quality and increased use of LID and green infrastructure for both residential and non-residential customers. Programs include:

- ▶ [The Rain Garden Rebate](#)
- ▶ [Subsidized Backyard Tree Planting Program](#)
- ▶ [Seasonal Outdoor Rainwater Harvesting Rebate](#)
- ▶ [Subsidized Rain Barrel Sale](#)
- ▶ [ICI Stormwater Service Credit Program](#)



Co-Financing Arrangements

Green infrastructure offers both public and private benefits. Creating opportunities to support **public/private co-financing arrangements** showcases these benefits and can unlock innovative financing for GI. In Winnipeg, MB, for example, the convergence of the Red and Assiniboine Rivers is known as the Forks. What once was a meeting place for First Nations, and then an industrial hub for the city, became a degraded brownfield. However, in the 1990s, the area was revitalized by the **Forks North Portage Partnership (FNPP)** to become a vibrant area with a river walkway, museums and historical sites, green spaces, and sports and cultural centres. The influx of public and private investment created a dramatic change in the riverfront area. The FNPP is owned by the federal, provincial, and municipal governments, but operates as a private development corporation governed by a Board of Directors from each level of government. Monetary support from the government was scaled back after the redevelopment's initial success. The business model for the redevelopment was partly financed by small companies, which were offered low-cost retail space nearby. The project currently provides the local economy with \$112.5 M annually and reinvests all profits back into development and programming.

Green roofs and energy efficiency projects have also been successful targets for co-financing efforts. In a joint effort, the city of Amsterdam financed a scan conducted by Booking.com of all the hotel rooftops in the city. This effort kick-started green roof adoption by accommodations in the municipality. Another project in the Netherlands spearheaded by the Green Deal Green Roofs and the ASN Bank led to green roofs being financed through mortgage credit for new

homeowners as energy efficiency measures. A financial instrument was developed by Bank Nederlandse Gemeenten (BNG), the Dutch Municipality Bank, to provide homeowners who had low credit scores the opportunity to invest in energy efficiency tools.⁷⁰

Economic Incentives

Municipalities can use a range of **economic incentives** to advance in the integration of GI. Some municipalities incorporate green infrastructure incentives as a complement to stormwater charges. Tax schemes can incentivize GI and disincentivize measures that create more impervious surfaces or prevent urban greenspace. For example, there has been a proposed tax cut for Dutch households with a green roof to reduce stormwater overflow from the sewage system.⁷¹ Launched in 2009, **Toronto's Eco-Roof Incentive Program** provides financial incentives through grants to industrial, commercial, and institutional property owners. The program offers a step-by-step guide to apply for a roof that supports vegetation or a cool roof that reflects the sun. A green roof can offer compensation of \$100/m² and a cool roof \$2-\$5/m.

When creating a pathway to become a Living City, remember that funding mechanisms can either enable specific kinds of GI or benefits from GI.⁷² For example, urban gardening or urban tourism can showcase direct financial payoffs, which may be easier to quantify financially, whereas ecosystem services such as improved air quality can require more complex valuation strategies. It is important to consider how diverse funding mechanisms can link GI to a wide range of benefits and beneficiaries in particular communities.

#6 Improve Data and Monitoring

It is crucial to develop an evidence base to support decisions about where to prioritize GI (i.e., areas that are underserved and/or experiencing greater climate impacts; see section, [Identify Under-Natured Areas](#)) and about the performance of GI. **Performance data** can shed light on how assets are delivering services, inform the details of maintenance activities, and help optimize the protection of existing assets (i.e., natural assets) and design of future assets (i.e., enhanced and engineered assets). Effective monitoring and performance tracking—using tools like data portals and maps—can create an evidence base for how assets are delivering services. This evidence helps to build a local business case for investing in GI solutions, and supports GI asset management planning and tracking. **Indicators** can be developed that measure the multitude of values and services provided by GI, such as economic values, job creation potential, runoff reduction, water quality improvements, urban cooling, pollinator abundance, or wetland area. Indicators can also be used to evaluate the impact of GI on social processes and outcomes, such as equity, community engagement, ecological knowledge.

Governments across North America and Europe are increasingly investing in data collection and storage tools for GI. For example, the Dutch National government funded the [Natural Capital Atlas](#) and [TEEB City](#) (the Economics of Ecosystems & Biodiversity) to improve data collection for GI solutions. The Natural Capital Atlas is a digital repository containing the spatial distribution of ecosystem services used by municipalities and provinces for spatial planning purposes. TEEB City calculates the monetary value of GI, such as the social benefits or air filtration services they provide. TEEB City is used by a wide variety of stakeholders, including health

insurers, housing corporations, entrepreneurs, water boards, and the public.⁷³

Municipalities can work with other sectors to gain access to quality data and research to inform their GI strategies, such as governmental agencies, non-profit organizations, and postsecondary institutions. **Insurance companies are another potential partner**, since they hold data that can inform decisions related to damage costs and have an interest in reducing damages and claims by insured claimants. For example, in both the Netherlands and Sweden, industry associations representing the insurance market launched surveys to better understand the uptake of climate resilience measures and developed insurance products to offer risk assessments for homeowners and companies alike.⁷⁴ In Canada, the federal government has been convening a partnership that includes the insurance industry, all three levels of government, and Indigenous communities to develop a new National Flood Insurance Program for Canadians in high-risk areas. The program will include updated flood maps and an online portal for Canadians to assess the risk of flooding in their area and view resources on how to protect their homes.⁷⁵

In Ontario, the Sustainable Technologies Evaluation Program (STEP) carries out extensive research and monitoring to evaluate green stormwater infrastructure. This monitoring has informed the creation of their [Low Impact Development Stormwater Management Planning and Design Guide](#), which is continuously updated as new information becomes available. The initiative delivers educational programs, collaborates with industry and academic partners, and advocates for the use of GI. More information and strategies for data and monitoring can be found in [Section three \(“Thriving GI”\)](#) of this Framework.



CASE STUDY:

Improve Data and Monitor for Equity

To maximize the benefits of GI, it is crucial to prioritize equity in the decision-making process. In Canada, municipalities are not mandated to implement GI, which leads to Canadian municipalities implementing GI in opportunistic ways—that is, municipalities may implement GI following redevelopment or utilities works, but might not be systematically prioritizing it in neighborhoods that would benefit the most from GI. GI implementation goes beyond ecological and technical considerations: neglecting political, institutional, financial, and cultural aspects may worsen existing inequalities and/or create new ones. Inequalities can be mitigated by incorporating social considerations into urban planning.⁷⁶

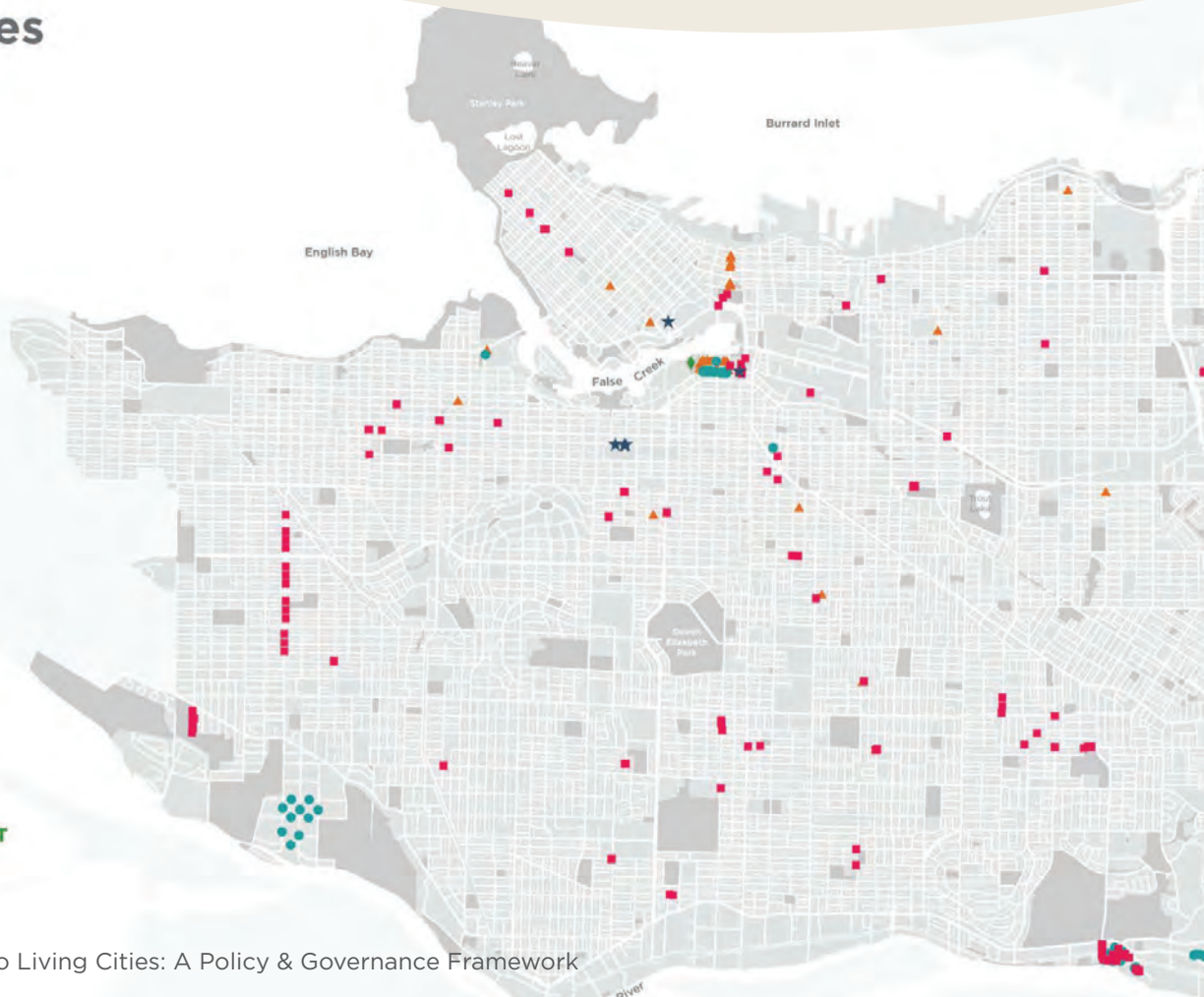
Local governments can incorporate equity into the decision-making process by using tools such as GIS mapping paired with spreadsheets,

or scorecards that consider and weigh various equity criteria. The city of Vancouver uses a tool specifically for GI projects to assign scores to different factors to better understand if a project should be pursued at a specific site. The city also uses a GIS sustainability analysis map to map spatial factors that can influence and be influenced by GI placement (e.g., land use and urban heat island effect).

Researchers from EcoPlan International, the University of British Columbia, and Simon Fraser University are teaming up with the goal of better understanding how to improve equity and inclusion in the planning and decision-making process across Canada. The team is creating a **framework** for research on equitable decision-making and identifying methods to increase equity in decision-making. Research is also being done to provide recommendations on how to better integrate GI implementation and equity in the city of Vancouver.⁷⁷ See **“An Equitable Living City”** for more tools on how to center equity in GI decision-making.

GRI Asset Types

- Bioretention
- ▲ Permeable Pavement Areas
- Subsurface Infiltration Assets
- ★ Rainwater Tree Trenches
- ◆ Engineered Wetland



Grow Support for GI

#7 Seek Support From Higher Levels of Government

Higher levels of government can develop policy tools that substantially increase uptake of green infrastructure. For example, the US Environmental Protection Agencies' (EPA) requirements for water quality per the Clean Waters Act (CWA) has been a major driver of American municipalities investing in GI. GI has been deployed as a tool to improve water quality of runoff and prevent combined sewer overflow events, both of which are regulated under the CWA. In addition to mandating regulatory requirements, the EPA has developed extensive **guidance and resources** to support municipal governments to implement GI and provides funding for local governments for GI projects.⁷⁸

Policies and programs from higher levels of government have been instrumental to advancing GI at the local level in Europe, as well. **Germany** and the **UK** have biodiversity offsetting regulations, which require developments to maintain or enhance

RESOURCE HIGHLIGHT:

How can higher levels of government support GI uptake at the local level? The German government wanted to explore how it could support cities and towns to have more green spaces, so it authored the **Green Spaces in the City** white paper in 2018, which outlines roles the federal government can take.

biodiversity on-site or offset any losses by enhancing nearby biodiversity. The Department for Environment, Food and Rural Affairs (DEFRA) in the UK developed tools for local stakeholders to implement GI projects. The Biodiversity Metric is a technical standard that calculates biodiversity loss from urban development. Because developers must compensate for the loss, the tool can assist with the integration of GI within housing developments. The Office for National Statistics in the UK conducts annual assessments of natural capital across the country, including urban areas.⁷⁹



The federal and provincial governments have given significant support to Toronto's Portland Renaturalization Project. Image reproduced from Waterfront Toronto.



In Canada, both the provincial and federal government have roles to play in advancing green infrastructure at the local level. The provincial government is responsible for overseeing and regulating municipal affairs, most areas pertaining to the environment, and educational requirements. The federal government can act in a more supporting role by, for example, providing funding to municipalities; providing research, guidance, and resources; developing standards; and coordinating and convening those working in the GI space. Municipalities can **seek out higher levels of government to collaborate and support GI projects**, as the City of Toronto has done with the [Toronto Portlands renaturalization project](#).

Municipalities can work with community partners, municipal associations, and networks to **advocate for policy and**

funding changes that lay the groundwork for the systemic integration of GI. In Canada, provincial-municipal associations can offer opportunities for local governments to advocate for green infrastructure-related policies. For example, in 2021, a resolution was passed at the Union of British Columbia Municipalities calling on the provincial and federal governments to remove constraints and implement requirements for the use of natural assets and green infrastructure in flood management.⁸⁰ Climate Caucus is a Canadian-based network of local affected leaders that has made **a number of advocacy asks** to higher levels of government related to climate action. Evidence-informed advocacy can result in concrete policy changes. For example, in Canada, the newly introduced federal Natural Infrastructure Fund was in part due to **advocacy efforts** led by national environmental organizations.

#8 Facilitate Community-based Action

Green infrastructure is a strategy that is necessarily diffuse—it is most effective when it is employed widely across the landscape. Since most lands in municipalities are privately owned, residents and businesses must be part of the solution of creating and stewarding GI projects. Municipalities can **partner with private property owners** to create **public-private communal GI** that improves the larger municipal stormwater system. Community and stakeholder engagement is also crucial to implementing place-based and equitable GI in urban areas, from the construction of new GI assets or the conservation, enhancement, and maintenance of existing ecosystems. Bringing together diverse voices and giving space for those who stand to be most impacted through the advancement of GI is an important enabler for successful and abundant interventions. This can be accomplished by:

- 1) **Partnering** with community organizations to engage residents and deliver GI projects.
- 2) **Delivering information** in plain language through diverse and accessible channels such as websites, videos, brochures, training programs, and social media. Communication should avoid technical jargon and focus on how the benefits of GI can be experienced in the day-to-day lives of individuals.
- 3) **Implementing demonstration projects** and involving volunteers in the process.
- 4) **Depaving communities** by partnering with property owners and public institutions to replace pavement with greenspaces.
- 5) **Conducting community education and outreach** to teach community members how to install GI.
- 6) **Giving advice specific to the site**, including one-on-one visits with property owners.
- 7) **Designing competitions** and offering prizes for community members, such as student groups, to design and retrofit pre-chosen sites.
- 8) **Providing public recognition** through awards or profiling community members who implement GI.
- 9) **Offering incentives** to attract early movers. This can include rebates or discounts on GI equipment.
- 10) **Providing online methods** for property owners to see how GI could be implemented and used to address issues like stormwater runoff.
- 11) **Giving maps and tours** to highlight existing GI projects.
- 12) **Engaging community members** to incorporate community needs and desires in the GI decision-making process (see “**Engage People in Planning and Decision-Making**” for more information on engaging community members in GI).⁸¹

RESOURCE HIGHLIGHT:

How can you increase public awareness and support for GI in your community? The Georgetown Climate Center offers a collection of resources to inform **Communication Strategies for Green Infrastructure**.

Depave, a non-profit based in Portland, OR, has been working to center equity and community-based action to plan and deliver GI. In Portland, there is a significant correlation between surface temperature and income, where the poorest neighbourhoods have an average surface temperature that is more than 12°C (6.7°C) warmer than the wealthiest neighbourhoods. Depave **works** to empower communities in addressing environmental injustice by removing areas of unused asphalt and replacing it with native-planted greenspaces.

In 2012, **Green Communities Canada** adopted the Depave program and brought it to Canada. The program, called **Depave Paradise**, has supported community partners to depave 80 sites in cities across the country, removing over 16,000 m² of hardened surfaces and restoring natural drainage of approximately 25,000,000 L (10 Olympic-sized swimming pools) of stormwater. Each depave site involves robust community engagement and participatory

site design activities so local communities can provide input and vote on the final design before implementation. The process leads to new community spaces that better reflect local needs and desires and a feeling of investment from the community to maintain these vital greenspaces into the future.

Municipally delivered funding programs can be instrumental to facilitating community-based action. London, UK's **Green Community Fund** has a stream that supports tree planting and community greening initiatives. Since 2016, the fund has spent £5 M to support over **250 community-lead greening initiatives**. Facilitating community-based action using funds can also increase awareness and uptake of GI. For example, Madrid, Spain introduced a program in which residents apply to develop green zone areas into public urban gardens. Previously, there was little major public interest in urban nature, but urban farming has since grown significantly in the city.⁸²

CASE STUDY



Supporting Citizen-Lead GI: Kitchener, ON's Boulevard Beautiful Program

In most cities, the vast majority of boulevards—municipally-owned lands that exist between sidewalks and roadways—are landscaped with turf. Although individual boulevards are typically not very large, at the city scale, these spaces can collectively make up dozens or hundreds of hectares of land. Maintaining these boulevards can inadvertently contribute to carbon emissions (e.g. through gas-powered lawn mowing), and they offer few stormwater, biodiversity, aesthetic, or other benefits. There are growing citizen-lead movements across North America and beyond to renaturalize these spaces and make them more functional using native plants and Low Impact Development techniques. However, a number of municipalities have bylaws

or other specifications that many such boulevard projects would contravene. Many citizen groups have decried city bylaw enforcement officers removing native plants and other features from boulevards near their homes.

In order to support community-lead GI on public lands, the City of Kitchener has implemented a "**Boulevard Beautiful Program**", which provides information and support to residents to install gardens and other green infrastructure features on city-owned boulevards. The City has prepared a guide to walk citizens through the process of planting their boulevard, have liaisons able to support groups of neighbours to plan and implement boulevard beautification projects, and have small pots of funding available to help this process. The City also enacted a **new bylaw** to allow non-turf plantings that still ensure visibility and safety for street traffic, and offer support to the program.

Before



After



A Depave Paradise event in Hamilton, ON. Credit: Depave Paradise.

KEY RESOURCES

GIO Municipal Hub was developed by Green Infrastructure Ontario Coalition (GIO) as a place for municipal staff, councillors, Conservation Authority staff, and practitioners to find resources to overcome barriers and effectively implement GI in communities.

The Green Bylaw Toolkit for Protecting and Enhancing the Natural Environment and Green Infrastructure (2021) by the Stewardship Centre for British Columbia was created to assist BC planners and municipal governments in implementing sustainable land-use practices. The document is broken up into three parts: 1) Protecting Green Infrastructure, 2) How to Use Green Bylaws, 3) Sample Bylaw Provisions.

The **Municipal EcoToolkit** offers five tools for maintaining natural systems: protection, planning, practices, perceptions, and persuasion. Created by Miistakis Institute, the toolkit was developed for municipalities in Alberta to build awareness and assist those looking to advance GI.

The **Sustainable Technologies Evaluations Program (STEP)** created in a partnership between Toronto and Region Conservation Authority (TRCA), Credit Valley Conservation, and Lake Simcoe Region Conservation Authority, offers programs and resources to build capacity for sustainable technology implementation, including a **Green Infrastructure Map** of the GTA and surrounding regions and a **Resource Library** housing reports, tools, guides, and videos.

Mobilizing Capital for Natural Infrastructure in Canada, a report created by the International Institute for Sustainable Development, offers insight into paths for large-scale investment for Canadian funders and recommendations for how best to align GI projects with financing tools.

Scaling Up: Integrating Green Infrastructure into Existing Processes, a toolkit by Georgetown Climate Center, offers strategies to integrate GI into existing processes including **planning tools**, **regulatory tools**, **incentive-based tools**, and **government operations**.

RESOURCE HIGHLIGHT

The Nature-based Urban Innovation Naturvation Project: **Pathways for Systemic Integration of Nature-Based Solutions** outlines 20 key stepping stones to mainstream GI projects. Based on research in the Netherlands, Sweden, Spain, the United Kingdom, Hungary, Germany, and the European Union, the report focuses on financial, regulatory, and urban development domains. The project offers five reports, including **Climate Change** and **Biodiversity**, to highlight how GI can be mainstreamed to address these issue areas.

The NATURVATION **Urban Nature Navigator** is a tool to assess which GI solution best meets sustainability challenge needs and is based on **indicators** created by Naturvation to showcase the benefits of GI.

Urban Stormwater Fees: How to Pay for What We Need, written by the Environmental Commissioner of Ontario in 2016, outlines inadequate funding methods for stormwater management, which are common in Ontario municipalities. The report goes on to recommend stormwater fees, which are already in use in eight municipalities, and can provide the necessary funding source for stormwater management.

Resilient Infrastructure for Sustainable Communities (RISC) Solutions is a cluster of Great Lakes area professionals focused on GI for stormwater that has produced toolkits and reports on GI finance and delivery.

The Stormwater Scorecard shows what Canadian communities are doing to reduce stormwater runoff and runoff pollution and was developed by Canadian freshwater leaders, including Green Communities Canada, to spur the adoption of strategies to transform rainwater management and create a baseline of strategies used across the country.

The Smart Prosperity Institute's report **The Nature of Health: Integrating Health Considerations in Urban Nature-Based Solutions**, offers evidence for the connection between access to greenspace and improved mental, physical, and social health for Canadians. The report also outlines challenges and gaps in environmental health issues, as well as opportunities to address these barriers in Canada.

Improving Access to Large Parks in Ontario's Golden Horseshoe: Policy, Planning, and Funding Strategies was prepared by Green Infrastructure Ontario Coalition in 2022. The document offers information on the importance of large parks, how to map existing parks, policy models and funding strategies to increase the size and quality of parks, and recommendations for governments to collaborate, fund, and make legislative changes to support large parks.

A Thriving Living City



A THRIVING LIVING CITY

Thriving

GI is installed, maintained and functions well over the long-term.

To become a Living City, GI needs to be thriving in your community. That means multi-functional GI is successfully implemented and maintained, offers its full range of benefits, and continues to function well over the long term.



Aim of this Section: Creating GI that Flourishes

In a Living City, GI should not only be implemented abundantly throughout the landscape; it should also *work*—that is, it should effectively deliver the multiple environmental and social services and values it has the capacity to provide. If GI is not properly protected, planned for, designed, constructed, maintained, and monitored, it will not be able to deliver its full range of benefits (or the benefits it provides will not be given due consideration in city decision-making processes, and opportunities to implement GI may be missed).

This section contains guidance to help your community ensure that GI can thrive over the long term, providing positive benefits to community members. It outlines the need to **build strong partnerships** between stakeholders, **identify appropriate indicators** that inform diligent long-term monitoring, and enable and finance operational practices to **maintain GI over time**.

Questions you can ask in your community:

- What kinds of services and values does GI offer in our community? How are we tracking and monitoring how our GI assets deliver these services?
- Is there a systematic approach to GI as part of a larger plan or strategy?
- Are we adequately budgeting for short, medium, and long-term maintenance needs of GI to deliver its full range of services (and benefits)?
- What are the current operations and maintenance practices for GI in our community? Are operations training and recordkeeping practices adequate? How can they be improved?
- Who are the GI champions in your community across the civil society, private, and public sectors?
- Where are the opportunities to create partnerships that span across sectors and professional disciplines?
- What forms of evaluation are important to groups in your community?
- Which indicators will help ensure your community reaches its goals?



Purpose

Recommendations

Ensure that GI can Thrive over the Long Term

- 1. Build partnerships and find champions** to bring the goals and operations of multiple stakeholders into alignment in support of GI implementation.
- 2. Pick indicators and monitor over time** to track progress relative to targets, identify how well GI is performing, and flag issues.
- 3. Support GI operations and maintenance** by ensuring adequate resourcing, technical expertise, and clear responsibilities.

#1 Build Partnerships and Finding Champions

GI is most effective when it is distributed widely and abundantly across the landscape. For example, one bioswale may not noticeably reduce stormwater runoff at an aggregate level, but dozens in a targeted neighbourhood certainly will. A few lone trees in a neighbourhood may have a minimal impact on urban heat reduction: a multitude of trees forming an abundant canopy would be much more effective at reducing temperatures. Because of this, GI requires a much more decentralised approach than conventional infrastructure. GI knowledge also crosses multiple disciplines and skill sets. For this reason, GI is most successful when multiple stakeholders with diverse backgrounds are

involved in its implementation and stewardship. One key task is to bring the goals of these multiple stakeholders into alignment. Based on research, four key strategies are:⁸³

1. identifying champions who can speak for the value of nature,
2. identifying those who benefit from GI and finding ways to communicate and make visible the value of these benefits,
3. creating windows of opportunity for GI, and
4. working with change agents and organizations that can bridge these multiple benefits.



While there is no one-size-fits-all approach for institutional and governance arrangements that support GI uptake, research shows GI implementation is most successful when those arrangements foster interdisciplinary collaborations both within government, and among key players from the public, private, and civil society sectors.⁸⁴ In terms of **internal governance**, many GI practitioners report that the disciplinary silo-ing common in governmental institutions can make cross-organizational collaboration difficult. In order to address this, a number of municipalities are creating new roles or units that can function as cross-cutting intermediaries that work across departments (see The city of Vancouver’s GI team, as described in the “[Building Knowledge and Capacity](#)” section of part two). This can help improve internal communication and workflow processes between departments (e.g., between engineering/design and maintenance). Technical expertise across the life cycle of GI is a crucial component of these cross-cutting teams.

In terms of **external governance**, municipalities can take several steps to bring together stakeholders to support GI. Municipalities can align GI efforts with provincial and federal plans, build and enable organizations to form broad-based partnerships, and find champions for projects. For example, in 2015, the Buffalo Sewer Authority in Buffalo, NY, teamed up with a local non-profit organization, **People United for Sustainable Housing** (PUSH), to pilot a new technique for green stormwater infrastructure on post-demolition sites. The organization’s

“PUSH Blue Team”—an eco-landscaping team staffed by previously unemployed or underemployed people—worked with the city and other private contractors to install GI at 221 sites across the city (7.7 ha of land area).⁸⁵ Municipalities will be most successful when they build coalitions of support around new and existing GI projects and programs.

It may also be possible to think about **alternative institutional models** within local government. For example, the city of Barcelona enhanced coordination between departments with the goal of strengthening their climate change plans.⁸⁶ This included collaboration among the planning, environment, infrastructure, and transport departments, and the establishment of an urban ecological municipal directorate. The main goal of the new directorate was to develop policies and projects focused on urban sustainability at the city level and improve the process of communicating critical information among agencies. The enhanced collaboration and creation of the urban ecological municipal directorate led to a better flow of information among departments and increased experimentation in the city. The creation of the ‘Barcelona Superblocks’ stemmed from this multidisciplinary approach, where roads were replaced by greenspaces, bike and bus lanes, benches, and playgrounds. The project has resulted in improved mobility within the city and showcases how investments in GI can be increased by an intermediary body such as the urban ecological municipal directorate.⁸⁷

CASE STUDY:

Montréal Blue-Green Alleys⁸⁸



The Blue-Green Alleys (*Ruelles Bleues-Vertes*) in Montréal showcase an innovative approach to GI partnership between civil society and the private sector. The Blue-Green Alleys project is co-led by consulting firms Vinci Consultants and *Ateliers Ublo* and non-profit group Montréal Urban Ecology Centre, along with community organizations *Collectif 7 À Nous*, and *Société d’Habitation Populaire de L’est de Montréal*, and the city of Montréal. It involves disconnecting gutters in densely populated urban centres, including *Bâtiment 7 Alley* in the Southwest borough and *Turquoise Alley* in *Mercier-Hochelaga-Maisonneuve* borough and redirecting the stormwater from multiple units into green infrastructure assets located on both private and public property. The Blue-Green Alleys project showcases an integrative approach to site-design, using collective stormwater solutions for mixed-use buildings with multiple property owners to address neighbourhood-scale stormwater concerns.

To achieve a community-supported design, the project developed an alternative governance model, the “Blue Green Alley Alliance,” which involves all project partners and provides financial resources to community organizations to become involved in planning and design. Montréal Urban Ecology Centre’s innovative **participatory urban planning process** was used to integrate citizens into the project, designing the Blue-Green Alleys through a series of interactive community co-design workshops: environmental awareness, co-design, tactical greening, validation, plant-selection, and the unveiling of the final site design. These additional opportunities for community engagement helped build consensus among project stakeholders and develop GI that was both technically sound and reflective of community needs and desires. This process of civic engagement disrupts the usual ways of doing things in cities, but by leveraging participation of citizens and collectives final project outcomes are strengthened and larger neighbourhood-scale projects are made possible.

Funding for the project was provided by the City of Montreal, as well as with grants and support from the provincial government (Ministry of Municipal Affairs and Housing), a non-profit funder (*Fonds d’action québécois pour le développement durable*), the Federation of Canadian Municipalities, and social economy hub *7 À Nous*.



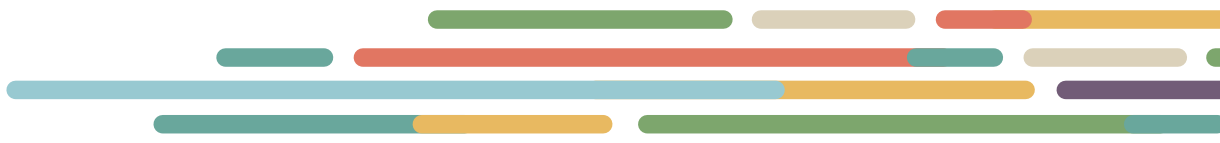


#2 Pick Indicators and Monitoring Over Time

As we note above, data derived from monitoring and assessment is an important part of the GI decision-making process, as it allows practitioners to track progress relative to targets, identify how well it is performing, and flag issues. This is particularly important for municipalities that are early in their GI journey. Data derived from monitoring and assessment can show how GI assets provide a range of services and let practitioners iterate and, where necessary, revise targets and/or reallocate resources to ensure GI is protected, designed, and maintained in a way that will allow it to thrive. Selecting indicators is important to consistently measure how GI is delivering services and the positive and negative outcomes of GI assets.

GI projects can provide a wide array of co-benefits, such as stormwater attenuation, climate change mitigation and adaptation, water quality improvement, public health enhancement, biodiversity increases, and more. **What you measure** (i.e., the indicators

you chose and operationalize for monitoring and assessment purposes) should be based on factors like existing policy and technical targets, as well as other priorities and needs of your community. **How you measure**, and how you evaluate what those measurements mean, are also context-dependent. The intent and values communicated by measurements should be considered. Some indicators and targets will lend themselves more readily to technical and quantitative measurements (e.g., stormwater infiltration or urban heat reduction). For other targets, this kind of measurement might be inappropriate. For example, indicators that measure social or cultural values or phenomena, especially subjective values (e.g., enjoyment of nature, environmental awareness) might require different methodologies and approaches. Indigenous communities may want to use storytelling approaches over statistical analysis during the monitoring process. It can be helpful to strengthen evaluation by involving local communities in developing indicators and paying communities to collect monitoring data.



The **NATURVATION project** has developed an **in-depth list of indicators** for nature-based GI, including:

- air cooling (degrees Celsius)
- artistic value
- attachment to community
- carbon storage (kg carbon/m²)
- change in noise annoyance
- change in number of crimes
- citizen involvement in the management of greenspaces
- ecological knowledge
- economic value of urban nature
- engagement in community
- environmental awareness of students concerning blue areas
- equal access to urban nature
- fruit set (the percent of flowers which mature into fruits)
- green-blue areas as a proxy for biodiversity
- health outcomes of increase in available green space
- historical and cultural meaning
- job creation potential
- legal framework (e.g., do legal conditions foster, demand, or hinder NBS, or are they neutral)
- life satisfaction
- particulate matter (PM) reduction (the efficiency in percent of urban vegetation removing pollutants)^{iv}
- peak flow reductions during storm or flooding events
- perceived general health
- perception of safety
- physiologically equivalent temperature
- pollinator abundance
- run-off reduction
- wetland area

It is important to develop metrics and a plan for tracking performance during the planning, implementation, and maintenance stages of GI projects. At a minimum, monitoring should take place five and 10 years after initial construction, as these are important milestones to monitor plant development, succession planning, and other factors.⁸⁹ Public reporting on GI performance is an important way to share knowledge and learnings and to demonstrate a commitment to accountability.

iv Total Suspended Solids (TSS) is a common way for PM to be expressed. For example, LEED Sustainable Sites standard 6.2 requires that developments. See: <https://www.usgbc.org/credits/core-shell/v20/ssc62>.



RESOURCE HIGHLIGHT:

The Cities of **Vancouver** and **Seattle** both recently published public-facing reports that use different indicators to measure progress toward various GI-related targets set out in policies and technical guidelines.

#3 Support GI Operations and Maintenance

Operations and maintenance have been a major obstacle for GI, both in Canada and internationally. Because GI is a relatively new strategy in urban planning and service delivery, many municipalities have not yet adequately accounted for the costs of designing, implementing, maintaining, and monitoring GI throughout its life cycle. As we note in the **Green Infrastructure Asset Management** section, the initial capital costs of GI are often less expensive than grey infrastructure, but operation and maintenance needs can be higher; however, these needs are often **not adequately resourced**, both financially and in terms of human resources. This applies to enhanced and engineered GI assets (e.g., bioswales, permeable pavement), as well as natural assets. Inadequate resources to maintain parks, greenspaces, and urban biodiversity is a common complaint among practitioners.⁹⁰

Technical expertise to maintain GI assets is another common challenge, as discussed in the **Knowledge and Capacity-Building** section. This pertains to both in-house staff and external contractors. It can be difficult to find contractors with the appropriate knowledge and skill sets to maintain GI assets—especially in smaller and mid-sized communities with a smaller pool of contractors. This challenge can be compounded by a lack of standardization in the design and construction of enhanced and engineered GI assets within and across municipalities, as well as a lack of common terminology and targets.⁹¹



Some strategies to address these barriers include:⁹²

- Investing in **staff and contractor training and education**, as outlined in the [Build Knowledge and Technical Capacity, above](#),
- Developing **technical guidelines for GI** that include objectives, targets, standard definitions, and design considerations for GI assets to help municipal staff, contractors, developers, and consultants integrate GI into planning and design and use common practices for construction, operations, and maintenance of GI. The Canadian Standards Association recently developed standards for the **design** and **construction** of Low Impact Development systems, which can help municipalities to develop technical guidance (see CSA W200-18 and CSA W201-18).
- Developing **green infrastructure maintenance guidance** that depicts the design and function of GI assets and describes routine maintenance procedures [see City of Philadelphia's [Green Stormwater Infrastructure Maintenance Manual](#) and Sustainable Technologies Evaluation Program's (STEP) [LID Stormwater Inspection and Maintenance Guide](#),
- **Improving understanding of the life-cycle costs** and needs of GI assets in your municipality. This process will necessarily be iterative (you will gain insight on these costs after implementation and performance monitoring^{v,93}), but there are existing resources to support this process such as the STEP [LID Life Cycle Costing Tool](#),
- Developing a **GI operations and maintenance plan** that outlines financial and staffing resource needs for GI maintenance, roles and responsibilities, standard and site-specific protocols, and frequency of maintenance operations. This plan should be developed/updated during the design phase of new GI assets to ensure that design considerations are reflected in maintenance procedures (see City of Lancaster, PA's [Green Infrastructure Operations and Maintenance Plan](#)), and

Using a **digital database or project management software** that allows staff in different departments and/or external contractors to identify and track maintenance needs and activities for GI assets (*Lucity* and *Fulcrum* are examples of software used by municipalities for GI purposes).

v For example, after extensive implementation and monitoring, Vancouver estimates their green stormwater assets cost approximately \$7.40/m² to maintain.

It is also strongly recommended that GI be integrated into your community's asset management planning (as detailed in the *GI Asset Management planning section above*), as this process is key to identifying costs and resource needs for GI assets.

Because GI maintenance is often under-resourced, some municipalities have **initiated volunteer-led programs to engage residents in GI upkeep and maintenance**. These programs can result in substantial cost savings for municipalities and generate other benefits (e.g., increasing public awareness and support of GI, increased uptake on private properties). However, communication with volunteers and keeping them engaged in GI maintenance can be a challenge (e.g., volunteers may not feel motivated to continue if they do not feel

adequately recognized or appreciated; when residents move, maintenance responsibilities may not be sustained).⁹⁴ Some strategies to sustain volunteer communication and engagement include:

- Delivering volunteer training and resources for volunteers to consult (see the city of Vancouver's *Green Streets Volunteer Program resources*),
- Developing programs with a range of commitment levels, so that volunteers can fulfill duties as their capacity allows,
- Helping to foster communication networks among volunteers



Holding volunteer appreciation events, Creating staff roles for volunteer engagement or supporting community organizations to lead GI-based volunteer engagement (they can often deliver this service in a more nimble and cost-effective manner).⁹⁵

Maintenance can be pre-planned or can occur after the monitoring and evaluation processes. The threshold for triggering maintenance should be identified during the planning stages of the project. Maintenance frequency can vary greatly based on the action and the reason for maintenance. The maintenance needed for GI will differ based on the scale of the asset, the services it delivers, and its design and

function (e.g., Is vegetation used? What are the maintenance needs of the vegetation?). For example, maintenance could occur bi-weekly for grass cutting, seasonally for litter and sediment removal, and on an event-triggered basis (e.g., after a severe rainstorm). Keeping a record of maintenance including location, date, and other useful information is important, because it can help identify patterns and pinpoint upcoming issues, as well as help with coordination efforts across municipal departments. Regular reporting can also support learning that will inform adequate resourcing and streamline maintenance and operations needs.



Maintenance needs for GI may be **different in the short term than in the long term**. This is particularly true for nature-based assets. For example, new plants take time to grow their roots and establish themselves. This establishment period is typically between two to five years. In this case, maintenance needs (e.g., watering, weeding) will be greater in the short-term than in the longer-term. **With proper design, municipalities can take steps to cut down on long-term maintenance needs.** Strategies include:

- **Use standard products and design**, when appropriate, to reduce cost and the need for specialized equipment.
- **Ensure a warranty period** (for contractor-installed GI) to ensure proper installation and functioning and plant survival in nature-based GI.
- **Include pre-treatment devices** to create a buffer zone around where sediment occurs.
- **Remove sediment** through hand tools, vacuum trucks, and high-pressure washers.
- **Use four-season design** to reduce costs, especially winter maintenance, such as salting, sanding, and plowing, and anticipating vegetation deposition during the fall.
- **Select vegetation** appropriate for the local and site conditions. For example, drought-tolerant native plants require less watering than non-native plants and may be hardier.⁹⁶
- **Conduct monitoring**, including acceptance inspections and performance monitoring.

- **Design with maintenance in mind** by minimizing pipe bends and being able to maintain LID feature with available equipment.
- **Keep records**, such as construction inspections, records of inspections, records of field changes, and as built surveys so municipalities have full record of the asset.

Long-term maintenance of GI strategies should include **agreements between stakeholders outlining who is responsible for maintenance.** For instance, agreements can be made between the municipality and the developer so the municipality takes over maintenance responsibilities and can properly allocate funding for such maintenance in their annual budgets. An operations and maintenance agreement can be signed by a property owner and a municipality to ensure investments made by the city are maintained.⁹⁷ Landowners can lease their land to an organization or other stakeholder with a bigger capacity to ensure necessary maintenance. Municipalities can also form partnerships with non-profit organizations or neighbourhood associations to perform long-term maintenance on GI assets, which can help GI thrive in the long-term by helping to foster community-supported oversight. These partnerships are most successful when they are backed with funding support.





CASE STUDY:

Maintaining GI Stormwater Assets in the Region of Peel, ON

Although municipalities typically have a solid understanding of grey infrastructure, incorporating GI into stormwater asset management systems is still relatively new and unfamiliar. The Region of Peel is collaborating with Credit Valley Conservation and Toronto Region Conservation Authority through the **STEP Water partnership** to bridge that gap and comply with recently-passed Provincial regulations (**O. Reg 208/19** and **O. Reg 588/17**). STEP Water has expertise in enhanced and engineered GI through its full life cycle. This collaboration focuses on GI stormwater assets within road rights-of-way and on Region-owned properties. Of

the Region's 26 arterial roadways, 15 have been retrofitted with GI assets. This will grow through future roadway construction designs.

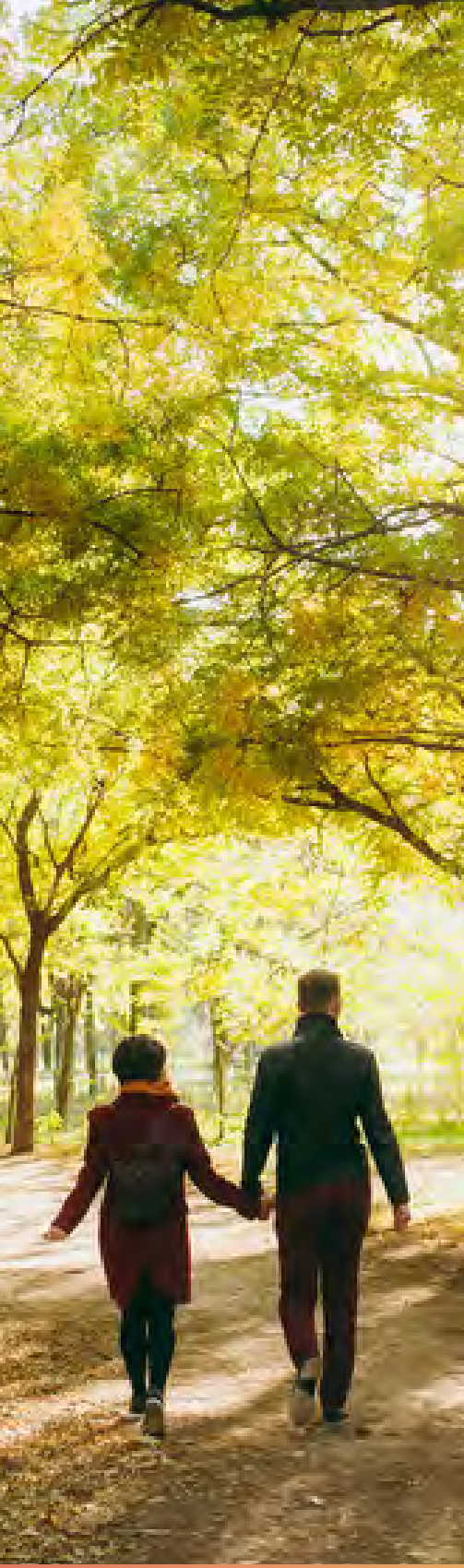
STEP Water and the Region of Peel are working together to inventory, inspect, assess, identify maintenance needs, coordinate maintenance activities, estimate life-cycle costs, and monitor performance of GI assets. Initial work began in 2019 with the development of GI road-site standard operating procedures (SOPs) and now continues with design review; construction acceptance and routine inspections, condition assessments, and maintenance prioritization.



Figure: (Photo Left) Region of Peel and CVC staff conducting acceptance inspections of infiltration galleries along Queen St West in Brampton, ON; (Photo Right) Catch basin with snout protecting infiltration feeder pipe filled with sediment.

Lessons learned to-date:

- Design briefs are critical in assessing the condition and performance of GI assets.
- GI assets must be maintainable and ideally not require specialized equipment or expert training.
- Inspect and document (photos/video) GI assets during construction.
- Include responsibility for GI facility inspection and maintenance (e.g., catch basin cleanout, CCTV) in contracts.
- Ensure field changes are properly documented, tracked, and noted with as-built surveys.
- Municipal champion(s) who can coordinate work across multiple departments are critical to establish workflow processes.



KEY RESOURCES

The **Low Impact Development Stormwater Management Guidance Manual** (Draft for Consultation) created by the Ministry of the Environment, Conservation and Parks offers ways to managing stormwater through ecosystem-based water balance approaches to replace the traditional stormwater management model of grey infrastructure use and end-of-pipe controls. The manual offers an overview of the environmental planning process in Ontario, stormwater design criteria, groundwater considerations, LID modeling approaches, the use of LID in addressing climate change, erosion and sediment control, operation and maintenance considerations, and monitoring, performance, and assumption protocols.

A Green Infrastructure Guide for Small Towns, Communities and Rural Settlements is a guide to support rural and smaller regions, developed by GIO and the Greenbelt Foundation. The guide offers recommendations for the application of GI in peri-urban landscapes.

The **Sustainable Technologies Evaluation Program (STEP)** is an initiative created by Toronto and Region Conservation Authority (TRCA), Credit Valley Conservation, and Lake Simcoe Region Conservation Authority, to build capacity for the implementation of sustainable technologies to protect water resources and for carbon footprint reduction. They offer an updated-as-needed online guide on LID and Stormwater Planning and Design, which includes a comprehensive manual on inspections and maintenance of LID assets.



Crafting Your Community's Living Policy Pathway

Crafting Your Community's Living City Policy Pathway

Pathways to become a Living City will look different in various communities, but will all focus on taking advantage of opportunities to integrate GI into urban policies and decision-making processes so it becomes the new normal. Here are some evidence-based approaches to mainstream GI and transform communities:

- 1 Involve communities and prioritize GI for environmental equity and reconciliation.
- 2 Set requirements and standards for GI.
- 3 Lay the groundwork for systemic integration of GI.
- 4 Grow support for GI.
- 5 Ensure GI can thrive over the long term.



You can use this framework to start to identify the collection of the steppingstones that make up your pathway to mainstream green infrastructure and transform your community into a Living City. Follow these steps to craft your Living City policy pathway:

STEP 1

Map the key players in the green infrastructure space in your community.

STEP 2

Detail existing municipal commitments, targets, policies, and programs that support the preservation of existing and creation of new green infrastructure in the municipality. Detail programs and initiatives lead by non-municipal actors to support and advance GI.

STEP 3

Summarize enabling factors and challenges that have hindered or helped mainstream green infrastructure in land-use decisions and transform landscapes.

STEP 4

Use the Living Cities Framework to identify policy and program gaps where your municipality currently has no or weak commitments, targets, policies, or programs that advance equitable, abundant, and thriving GI.

STEP 5

Provide short- (1-3 years), medium- (3-7 years), and long-term (7-10 years) actions municipality and other key players can take to advance equitable, abundant, and thriving GI.

Our team has developed a number of standard tools and resources to support you in developing a Living Cities Policy Pathway for your community. Please get in touch if you would like to learn more about how [we can help you](#).

Appendix 1 & 2

Reference & Resources



Appendix 1: Endnotes

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APPENDIX 2: List of Embedded Hyperlinks

List of Embedded Hyperlinks

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Pathways to
LIVING
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A framework to help practitioners
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