

MEMO

To: Ministry of Infrastructure and Communities

From: Green Infrastructure Ontario Coalition

Date: March 29, 2016

Re: Living green infrastructure practices to include in green infrastructure investment criteria

We are writing to urge Canada's Ministry of Infrastructure and Communities to include **living green infrastructure** in its assessment criteria for infrastructure funding applications. We would also like to formally request a meeting to discuss related issues in more details, including technical and other details related to the full range of living green infrastructure measures.

Including living green infrastructure practices in your funding criteria will spur municipalities to consider how they can incorporate these practices into projects, and help ensure that communities leverage federal infrastructure funding to maximize the multiple benefits of living green infrastructure. Communities that incorporate living green infrastructure practices into the planning and design phase of their infrastructure projects are better able to capitalize on the cost-saving, climate change resilience and other benefits living green infrastructure practices provide.

Green infrastructure is a key component of your ministry's mandate. Our concern is that the Ministry's current working definition of "green infrastructure" does not include investments that maintain, restore, and imitate ecosystem services. For clarity, we use the term "living green infrastructure", defined as follows: natural and human-made elements that provide ecological and hydrological functions and processes ([Ontario Provincial Policy Statement, 2014](#)).

This memo urges a formal change of funding policy to include and actively support the full range of living green infrastructure measures in your infrastructure funding criteria. The following fact sheets outline four examples of living green infrastructure practices that should be included:

- Urban Forests
- Bioswales
- Green Roofs
- Natural & Engineered Wetlands

We would strongly encourage the additional criteria of "any living green infrastructure practice" be considered, as there are many additional practices that can achieve similar results as the examples detailed below.

Green Infrastructure Ontario Coalition Information

The Green Infrastructure Ontario Coalition is a collaborative alliance working to promote green infrastructure in Ontario.

www.greeninfrastructureontario.org

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Overview

Living green infrastructure provides a valuable option for governments looking for infrastructure investments that provide multiple and long-lasting benefits in a fiscally responsible manner. Integrating living green infrastructure practices into project design and implementation complements standard stormwater technologies and increases the climate change resilience of infrastructure projects and communities. Living green infrastructure practices help mitigate the urban heat island, manage stormwater for quality and quantity, and provide other valuable services.

Living green infrastructure can save projects money. These practices can be cost-competitive with conventional approaches, and can **save millions of dollars** if fully incorporated into infrastructure design from the beginning.ⁱ It has been estimated that living green infrastructure is 5%-30% less costly to construct and about 25% less costly over its life cycle than conventional infrastructure of comparable performance.ⁱⁱ Incorporating living green infrastructure in to project can also help to leverage both private and provincial investment. The province of Ontario, for example, has adopted living green infrastructure in its public policy through its Provincial Policy Statement, Climate Change Strategy, and Great Lakes Strategy.

Why it is important

The Obama White House recognized the value of living green infrastructure when it issued a historic memorandum in October 2015, [Incorporating Natural Infrastructure and Ecosystem Services in Federal Decision-Making](#). The memo directs all federal agencies to factor the value of ecosystem services into federal planning and decision-making.

Many cities in the United States have challenges related to outdated **combined sewer outflow systems** and compliance with stringent federal water quality regulations. Faced with expensive upgrades, they have undertaken cost comparison studies to find the most cost effective approach to tackling these challenges. Following these assessments, communities have repeatedly chosen to reap the economic benefits of living green infrastructure practices, in combination with conventional infrastructure projects. Living green infrastructure approaches are being implemented in small and medium-sized towns and cities, and large urban centres such as New York City, Philadelphia, and Chicago.

Many Canadian cities and towns now face a similar set of challenges. They should be encouraged to consider whether living green infrastructure practices may be the appropriate approach for their community. If a community makes the business case for living green infrastructure investment, they should be confident that their innovative approach will be a positive criteria for federal green infrastructure funding.

Including living green infrastructure practices to help manage water where it falls reduces the strain on sewer infrastructure. Communities would benefit from considering these practices even if water management measures aren't directly applicable to a given infrastructure project outcome (e.g., in transit projects).

Going Forward

Living green infrastructure practices are complementary, economical approaches to help address Canada's critical infrastructure needs. The Ministry of Infrastructure and Communities can and should provide a significant boost to communities considering living green infrastructure in their infrastructure planning by **including these approaches in its assessment criteria for funding applications**. The information on four living green infrastructure practices outlined below includes examples of how living green infrastructure has been successfully integrated into relevant projects, and an overview of the key benefits it provides.

Living Green Infrastructure Practice: Urban Forests

Urban forests are made up of trees and shrubs growing in urban and suburban areas, including those on streets, parking lots, private property, and in parks and natural areas. Collectively these trees and shrubs provide numerous health and environmental benefits. Unfortunately, urban forests in cities across Canada are in decline, due to increasingly intense weather events such as ice storms, infestation from invasive insects such as the Emerald Ash Borer and insufficient protection from new development and infill development pressures.

Key Benefits

Urban forests reduce stormwater flows

- Rainfall interception by trees can reduce the magnitude of stormwater runoff during large storms. Street trees in New York City intercept 890 million gallons of stormwater annually, with a total value of over \$35 million each year.ⁱⁱⁱ This is particularly useful because NYC has combined sewer outflow system; the reduced runoff prevents water from mixing with raw sewage and ending up in their waterways.

Urban forests reduce energy use and contribute to climate change mitigation

- Trees shade buildings in summer. This reduces the need for air conditioning and therefore cuts energy use and costs. Every year the City of Toronto saves \$6.42-million from energy saved through shading and climate moderation.^{iv}
- Research has shown that a 20% increase in a city's urban forest canopy can reduce ambient temperatures by 3-4 degrees Celsius.^v
- The Greater Toronto Area's urban forest store 2.7 million tons of carbon valued at \$70 million, and these trees remove over 113,000 tons of carbon each year.

Urban forests lengthen lifespan of traditional infrastructure

- Urban forests that provide significant canopy coverage improve the lifespan of certain assets, such as asphalt, by up to 30%. They do this by shading the assets from harmful sun rays.^{vi}

Urban forests improve water and soil quality

- New York City implemented a forest protection strategy instead of building a new water treatment plant. This saved the city \$6 billion in new facility construction and operation costs.^{vii}
- Trees divert captured rainwater into the soil, where bacteria and other microorganisms filter out impurities. This reduces urban runoff and the amount of sediment, pollutants, and organic matter that reach streams, improving water quality.

Examples

Trees can be incorporated in to transit projects, new water facility construction, as well as planned sewer/pipe retrofits and upgrades. Trees can be factored in to sewer retrofits by planning for larger soil volumes and subsurface infrastructure (eg. soil cells) to support growth. It is important to consider the appropriate placement of trees to prevent removal later for maintenance or repairs.



New trees integrated in to transit and active transportation route, Toronto, ON



Trees with adequate soil to grow to maturity integrated into a streetscape, Vancouver, BC.

Living Green Infrastructure Practice: Bioswales

Bioswales are linear, vegetated channels which allow for the collection, transport, filtration and absorption of stormwater. Bioswales typically take stormwater runoff from nearby paved surfaces and hold the water long enough to allow it to slowly soak into the deep soil and possible rock drainage layer. Unlike ditches, bioswales purposely slow and filter stormwater before it enters the stormwater pipe system.

Key Benefits

Bioswales reduce strain on sewer systems

- By slowing the flow of runoff, bioswales reduce the strain on water-processing equipment, allowing a system to run within capacity during most storms.

Bioswales lessen the need for combined sewer retrofits

- In New York City, building bioswales instead of expensive combined sewer retrofits will reduce water flowing through sewage and treatment systems by 5.6 billion liters annually. The projected cost savings of slowing storm-water runoff is in excess of \$35 million annually, with an additional \$400 million obtained from new tax revenue that will result from improved property values.^{viii}

Bioswales can reduce infrastructure project costs

- A parking lot retrofit in Portland, Oregon that implemented bioswales eliminated the need for stormwater pipes, sedimentation manholes and catch basins, saving \$78,000 in construction costs despite additional fees for redesign.^{ix}

Examples

Bioswales can be integrated in to facility parking lots during construction or re-development and urban streetscapes during sewer retrofits.



Imax Parking lot bioswale, Mississauga, Ontario



Curbside bioswale on city street, New York City, NY

Living Green Infrastructure Practice: Green roofs

Green roofs employ vegetated roof covers, with growing media and plants covering or taking the place of bare membrane, gravel ballast, shingles or tiles. A green roof system is an extension of the existing roof which involves a high quality water proofing and root repellent system, a drainage system, a lightweight growing medium and plants.

Key Benefits

Green roofs provide insulation and shade for buildings, reducing both heating and cooling costs

- A National Research Council of Canada (NRCC) research study conducted in Ottawa found that a green roof delayed precipitation run-off by 45 minutes and absorbed at least 2 mm before run-off occurred. It reduced stormwater run-off by 45 to 75 per cent, depending on the relative moisture of the growing medium prior to the rainfall.^x

Green roofs help with stormwater management and improve water quality

- The same NRCC study found that in the spring and summer a green roof modified the heat flow and reduced the average daily energy demand of a building by more than 75 per cent.

Green roofs extend a roof's lifespan

- Green roofs can double or even triple the usable lifetime of roofs. Green roofs may extend the life of a roof by 40-60 years by reducing temperature variations on a roof (which can cause thermal expansion and contraction stresses) and preventing harmful ultra-violet rays from reaching roofing materials.^{xi}

Examples

Green roofs can be built on waste water treatment facilities where they help reduce the energy used to treat water while also managing stormwater for these large facilities on site. They can also be built on transit stations to help address urban stormwater and heat issues.



Pine Creek Wastewater Treatment Plant, City of Calgary



Waste Water Treatment Plant Effluent Filtration Building, Richmond, Virginia

Living Green Infrastructure Practice: Natural Wetlands & Engineered Wetlands

Natural wetlands are lands where water covers the soil or is present either at or near the surface of the soil, for all or part of the year. The recurrent or prolonged presence of water determines the types of plant and animal communities living in the soil and on the water surface. Engineered wetlands are manmade pools that mimic these natural systems and create growing conditions suitable for marsh plants.

Benefits

Wetland can provide less expensive alternatives to conventional water facilities

- In small communities wetlands can take the place of constructed plants. Building a wastewater treatment system using constructed wetlands costs about \$5.00 per gallon of capacity compared to roughly \$10.00 per gallon of capacity for a conventional advanced treatment facility.^{xii}

Wetlands store water and filter pollutants

- These systems are designed to maximize pollutant removal through retention, settling, and uptake by wetland plants.
- Whether natural or engineered, wetlands perform many functions. A single acre of wetland holding a foot of water stores up to 330,000 gallons of water and filters pollutants such as oil, sediments, and chemicals.^{xiii}

Wetlands help prevent flooding and reduce associated costs.

- By regulating water flows, wetlands help to prevent flood damage in built areas.^{xiv}
- Wetlands can reduce inflow to sewers that may be over capacity and reduce need for costly repairs.

Examples

Engineered wetlands can be built in to flood management approaches in urban areas. Natural wetlands can be conserved in new developments where they help manage stormwater.



Wetland in Corktown Commons urban park, brownfield redevelopment, Downtown Toronto, ON



Wetland in New Brighton residential development, Calgary, Alberta

All Living Green Infrastructure Practices

There are a wide range of green infrastructure practices, including rain gardens, permeable pavement, parks and gardens, urban agriculture, natural landscaping, and amenity greenspace, that can be integrated in to traditional infrastructure projects to achieve the same benefits as the examples above.

All living green infrastructure practices contribute to resilient communities and result in multiple benefits for a given project. These ancillary benefits include improved human health and wellbeing, enhanced environmental services and economic growth. The green infrastructure sector already employs over 150,000 people across the country and is poised for growth. This includes people who work as designers, growers, manufacturers, contractors and maintenance professionals.

Multiple Benefits of Green Infrastructure^{xv}

Environmental

- Carbon storage and sequestration
- Mitigation of urban heat island effects
- Reduced stormwater volume and flood risk
- Improved air quality
- Increased land use efficiency
- Added recreational space
- Protected drinking water
- Replenished groundwater
- Improved watershed health
- Pollination enhancement

Social

- Improved human health and well-being
- Establishment of urban greenways
- Pedestrian and bicycle access
- Improved health with skin cancer protection from natural tree shade providing protection from ultra-violet radiation
- Improved mental health
- Healthy childhood development with increased access to nature
- Improved aesthetics - creates attractive streetscapes and rooftops that enhance livability
- Educates the public about their role in stormwater management

Economic

- Creates jobs, business opportunities
- Save hundreds of millions of dollars in flood losses^{xvi}
- Diversification of local economy
- Reduces hard infrastructure construction costs
- Increases property values
- Encourages economic development
- Reduces energy consumption and costs
- Increases hard infrastructure life cycle cost savings

References

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About Green Infrastructure Ontario Coalition

The Green Infrastructure Ontario Coalition is a collaborative alliance working to promote green infrastructure in Ontario. Its steering committee members include:

Conservation Ontario | David Suzuki Foundation | Evergreen | Green Communities Canada | Green Roofs for Healthy Cities | Landscape Ontario Horticultural Trades Association | LEAF (Local Enhancement and Appreciation of Forests) | Ontario Association of Landscape Architects | Ontario Parks Association | Toronto and Region Conservation | Forests Ontario

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