Introduction to Green Infrastructure

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Green infrastructure includes both natural vegetative systems and green vegetative technologies located in urban, suburban and rural areas. It also includes soil in volumes and qualities adequate to sustain green infrastructure and absorb water, as well as technologies like porous pavements, rain barrels and cisterns, which replicate the functions of natural ecosystems services.

Green building initiatives often focus on the structural building itself and tend to include programs related to energy efficiency, building materials, structural water use reduction and interior systems (e.g., heating, cooling and lighting). Green infrastructure practices are complimentary approaches which can be incorporated into building envelopes, via green roofs and green walls, but also extended beyond the building itself through integration into the site design and traditional infrastructure construction (e.g. parking lots). Including green infrastructure practices in lot-level construction and design can be less expensive than traditional approaches- depending on the scale and approach, green infrastructure has been found to reduce project delivery costs, long-term maintenance costs, and/or total life-cycle costs. Furthermore, projects that incorporate green infrastructure practices into the planning and design phase are better able to capitalize on the cost-saving, climate change resilience and other benefits green infrastructure practices provide.

Examples of Green Infrastructure

Urban Forest

- 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. Large trees in particular maximize the benefits provided by this type of green infrastructure. For example, a 75-cm diameter tree in Toronto intercepts ten times more air pollution and can store up to 90 times more carbon than a 15-cm tree.

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.

Creek Restoration & Naturescaping

- Restored streams provide valuable urban green space, stormwater management benefits, and habitat for fish and wildlife. They can also provide important habitat corridors and links between larger natural areas.

Naturalized Stormwater Pond

- Landscaping of stormwater ponds can make them a community asset and can also enhance the pollutant removal.

Green Roof and Walls

- Green roofs employ vegetated roof covers with growing media and plants. Green walls are vertical gardens, some include specialized modular elements secured to building walls.

Permeable Pavement

- A type of hard surfacing that allows rainfall to percolate through to underlying soil substrate or be removed by a subsurface drain. Permeable paving can replace conventional asphalt and concrete for sidewalks, driveways, parking areas and road surfaces.

Additional Green Infrastructure Practices:

• Constructed wetlands	• Infiltration trenches/subsurface storage
• Rainwater harvesting	• Urban agriculture
• Rain gardens	• Amenity greenspace
• Bioretention curb extensions and sidewalk	

Energy Considerations

Green infrastructure practices contribute to energy conservation initiatives by insulating buildings, shading building envelopes and/or ameliorating the urban heat island effect. In addition to the direct energy saving benefits, they can also be built as a complement to sustainable energy generation practices. For example, the buildings below include solar arrays installed on a green roof.

The Multiple Benefits of Green Infrastructure [1]

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, summarized below.

Economic Benefits	Environmental Benefits	Social Benefits
Green Infrastructure: • Can reduce hard infrastructure construction costs • Maintain aging infrastructure • Create jobs, business opportunities • Increase property values • Encourage economic development • Reduce energy consumption and costs • Decrease hard infrastructure life cycle costs	Green Infrastructure: • Increase Carbon storage and sequestration • Reduce urban heat island • Reduce stormwater runoff and flood risk • Improve air quality • Increase land use efficiency • Add recreational space • Protect drinking water • Replenish groundwater • Improve watershed health • Improve human health • Provide pollinator habitat	Green Infrastructure: • Improve quality of life • Establish urban greenways • Increase concentration • Improve mental health • Create of attractive streetscapes and rooftops that enhance livability

[1] http://www.sustainablecitiesinstitute.org/Documents/SCI/Report_Guide/Guide_EPA_GICaseStudiesReduced4.pdf