Green Infrastructure Best Management Practices

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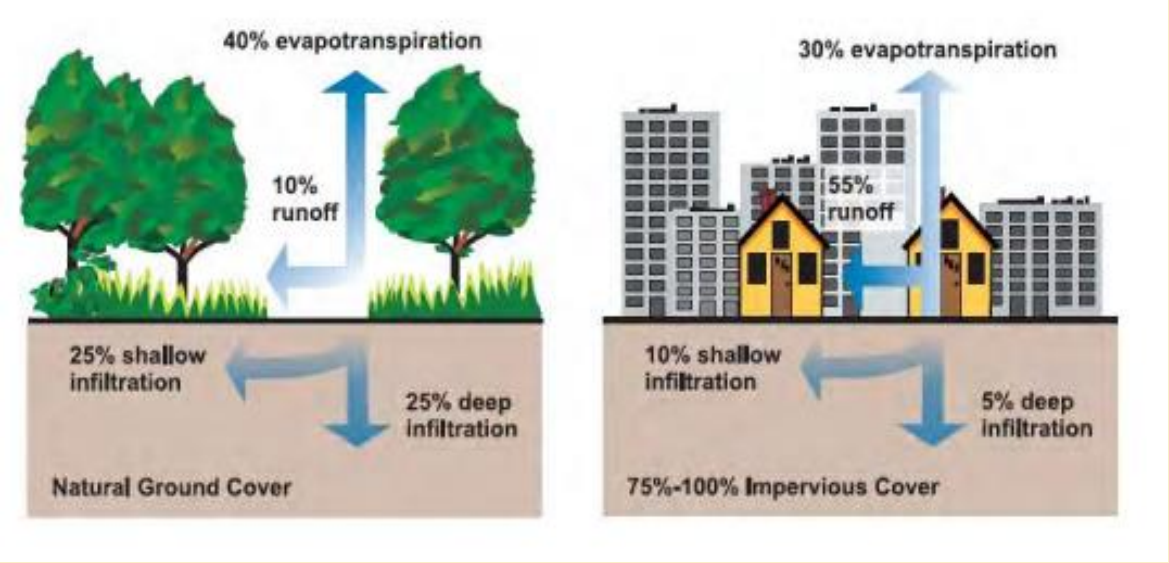
April 28, 2020

Urban Stormwater Runoff

- Much of the land surface in urban and suburban areas is covered by buildings, pavement, and compacted terrain that do not allow rain and snowmelt to soak into the ground.

- These impervious surfaces greatly increase the volume and velocity of stormwater runoff.

- As it flows over urban land surfaces, stormwater runoff also picks up pollutants that can adversely affect water quality if discharged untreated into lakes or streams.



- Urban stormwater runoff is a major nonpoint source of water pollution in Illinois.

- Runoff in urban areas often contains nitrogen, phosphorus, total suspended solids, sediment, pesticides, motor oil, road salt, household chemicals, and bacteria.

Gray stormwater infrastructure (i.e., conventional piped drainage) is designed to move urban stormwater away from the built environment.

Green infrastructure reduces stormwater flows to storm sewer systems or to surface waters while also delivering other environmental benefits, such as nonpoint source pollution control.

Green Infrastructure

Green Infrastructure is any stormwater management technique or practice employed to capture, filter, or reduce runoff while also preserving, restoring, mimicking, or enhancing natural hydrology.

Green Infrastructure includes:

- methods of using soil and vegetation to promote percolation, evapotranspiration, and filtration;

- the preservation and restoration of natural landscape features, such as forests, floodplains, headwaters, and wetlands; and

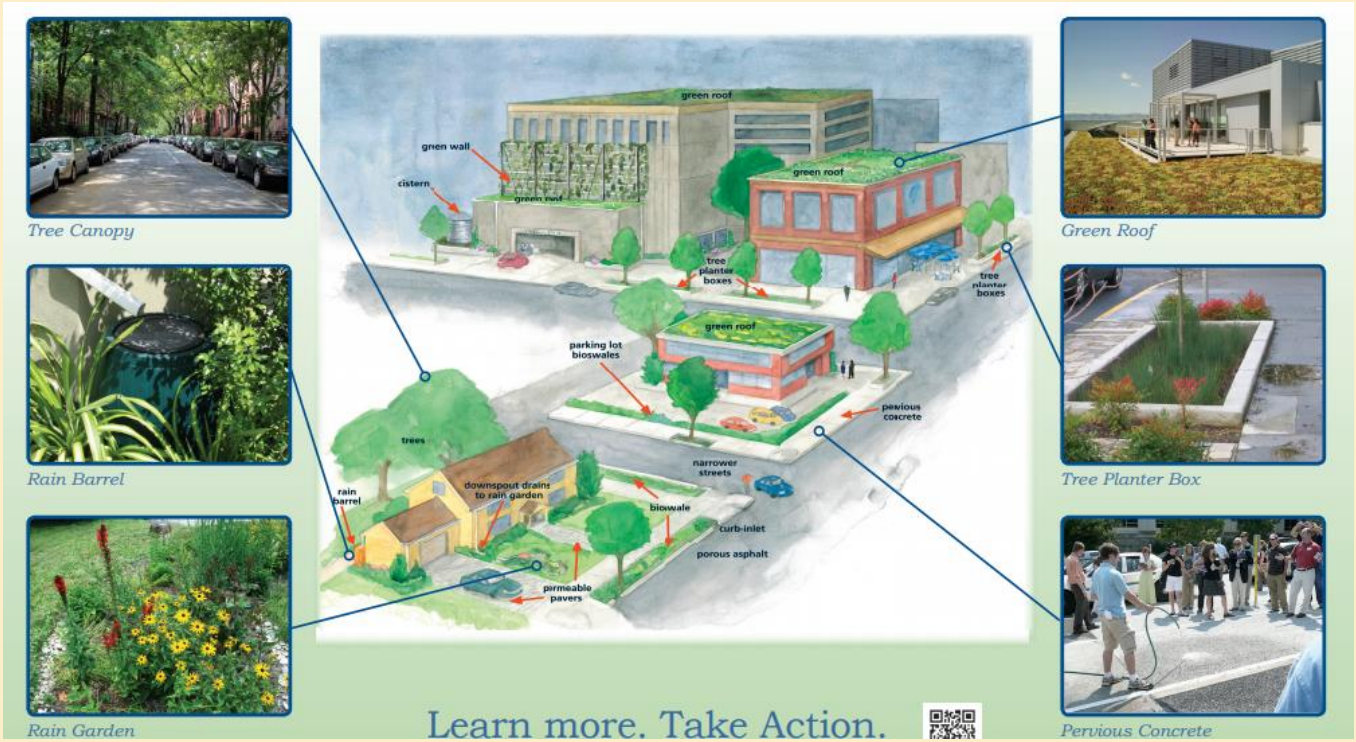
- rainwater harvesting for non-potable uses, such as toilet flushing and landscape irrigation.

Green Infrastructure Practices

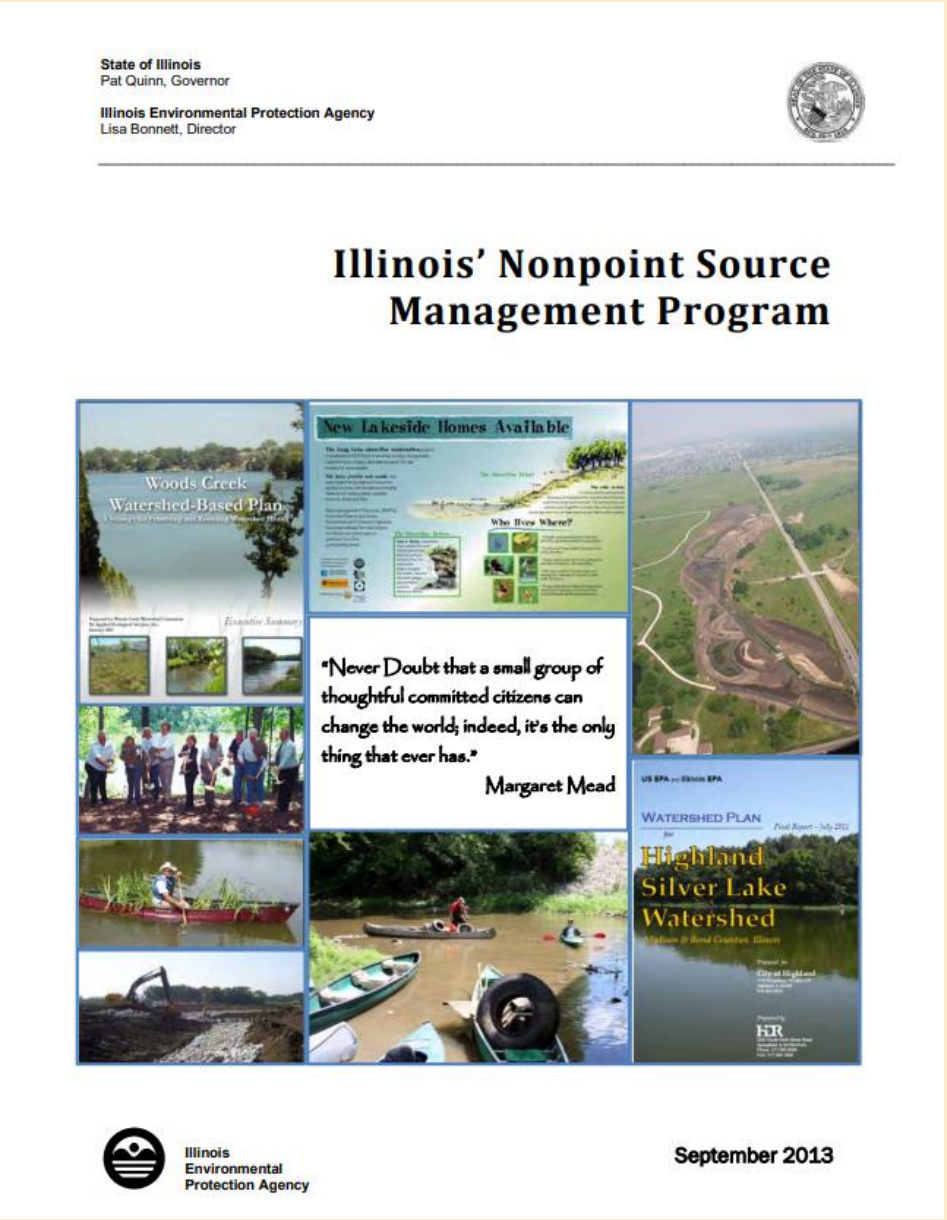
- Are designed to meet multiple stormwater management objectives, including runoff volume reduction and water quality protection.

- Can be constructed individually, or as part of a larger scale approach.

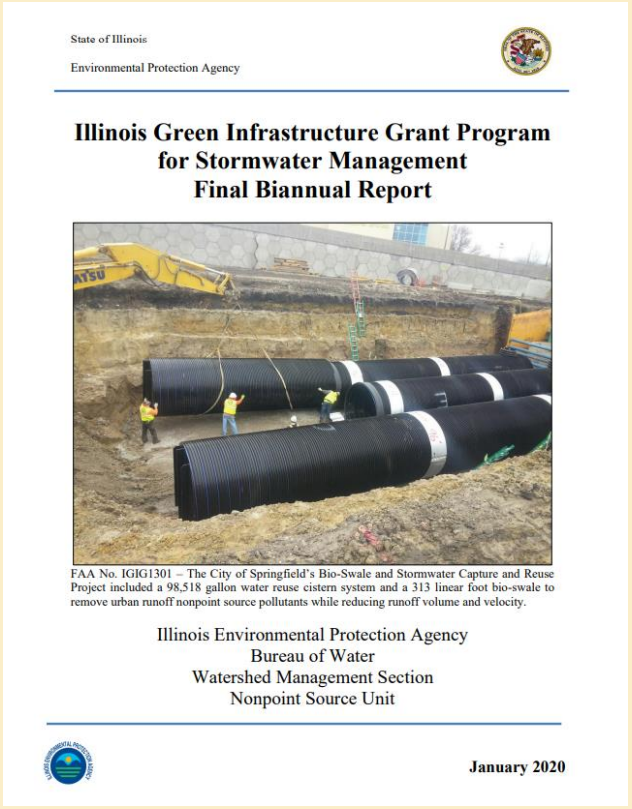
- Should be part of a decentralized management strategy that uses multiple localized controls, which combine into a “treatment train” to provide comprehensive stormwater treatment.



Illinois' Nonpoint Source Management Program encourages the use of green infrastructure to control pollution from urban stormwater runoff.



Illinois EPA has helped to fund the implementation of green infrastructure for stormwater management through various funding programs, such as the Illinois Green Infrastructure Grant Program for Stormwater Management (IGIG) and Section 319(h) – Nonpoint Source Pollution Control Financial Assistance Program.



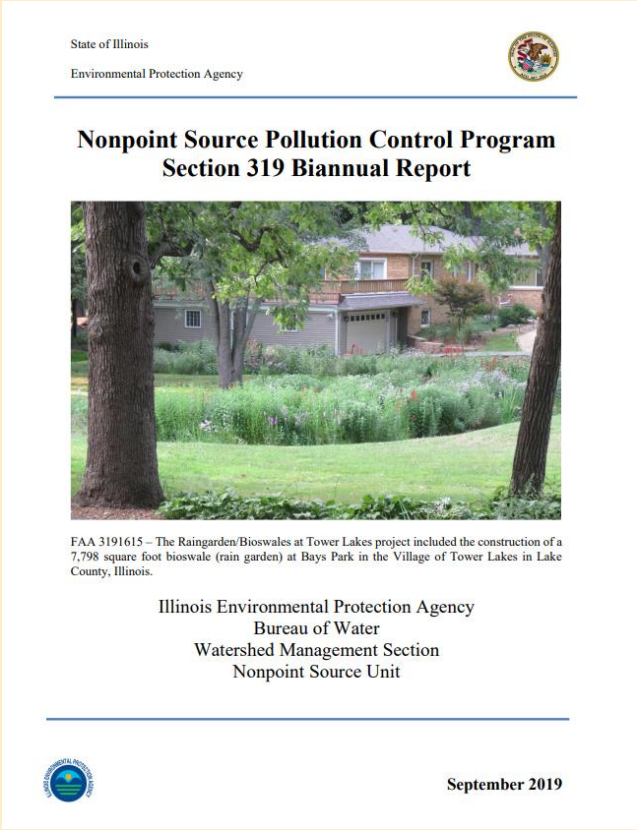
State of Illinois
Environmental Protection Agency

Illinois Green Infrastructure Grant Program for Stormwater Management Final Biannual Report

FAA No. IGIG1301 – The City of Springfield's Bio-Swale and Stormwater Capture and Reuse Project included a 98,518 gallon water reuse cistern system and a 313 linear foot bio-swale to remove urban runoff nonpoint source pollutants while reducing runoff volume and velocity.

Illinois Environmental Protection Agency
Bureau of Water
Watershed Management Section
Nonpoint Source Unit

January 2020



State of Illinois
Environmental Protection Agency

Nonpoint Source Pollution Control Program Section 319 Biannual Report

FAA 3191615 – The Raingarden/Bioswales at Tower Lakes project included the construction of a 7,798 square foot bioswale (rain garden) at Bays Park in the Village of Tower Lakes in Lake County, Illinois.

Illinois Environmental Protection Agency
Bureau of Water
Watershed Management Section
Nonpoint Source Unit

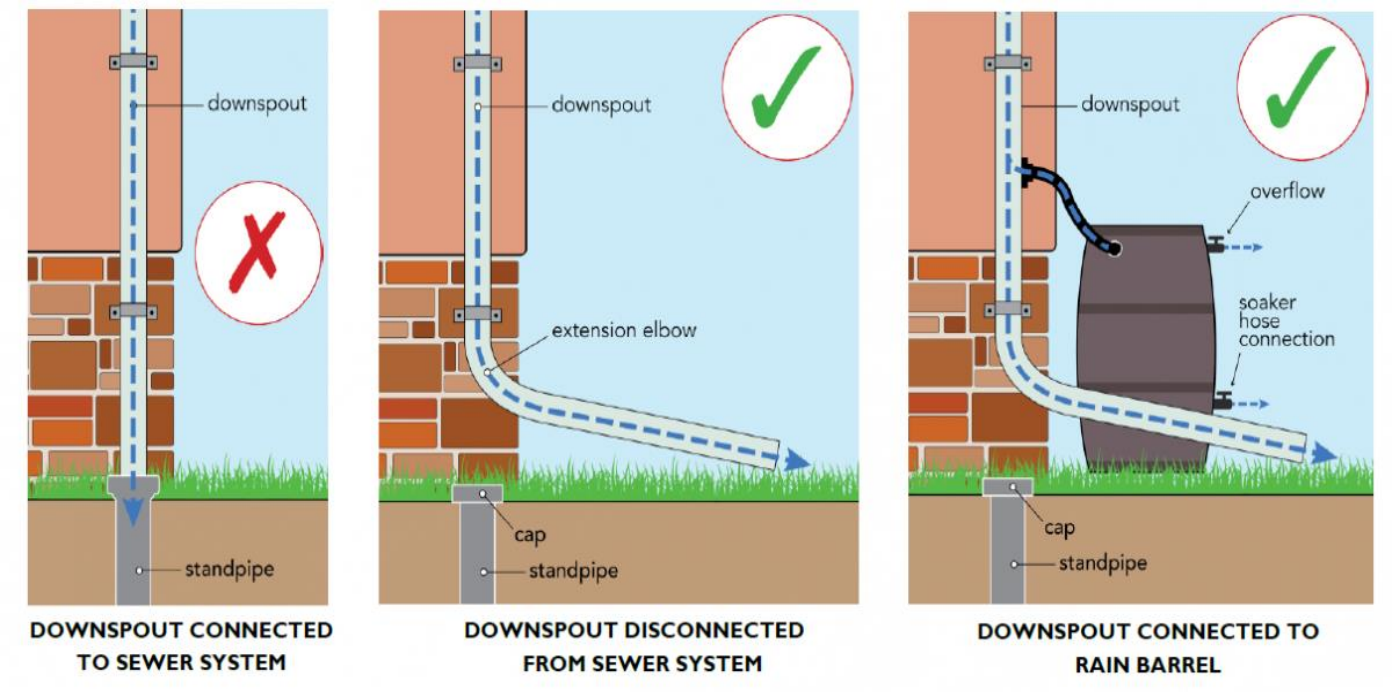
September 2019

Types of Green Infrastructure for Stormwater Management

- Downspout Disconnection
- Rain Barrels
- Cisterns
- Rain Gardens
- Bioswale
- Bio-retention Facility
- Infiltration Trench
- Green Roofs
- Permeable pavement
- Riparian Buffers / Natural Shorelines
- Urban Stormwater Wetland / Extended Detention
- Stream Channel Restoration

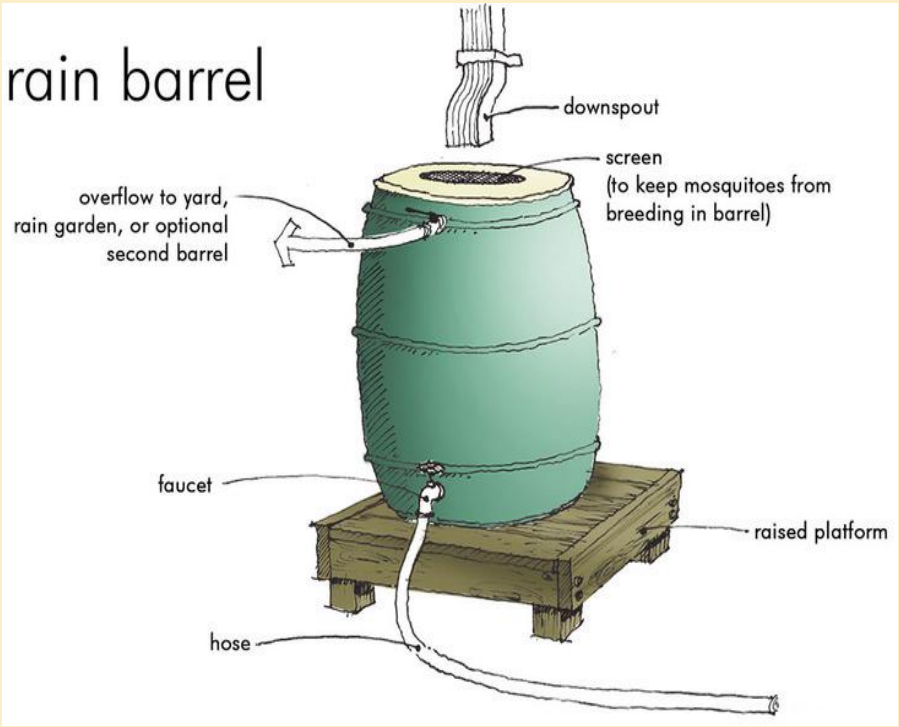
Downspout Disconnection

- Roof downspouts are disconnected from directly flowing into storm sewers or onto impervious surfaces that lead directly to storm sewers.
- Runoff is redirected into rain barrels, cisterns, or permeable areas.
- Reduces the risk of sewer system overflows.
- Especially beneficial in cities with combined sewer systems.



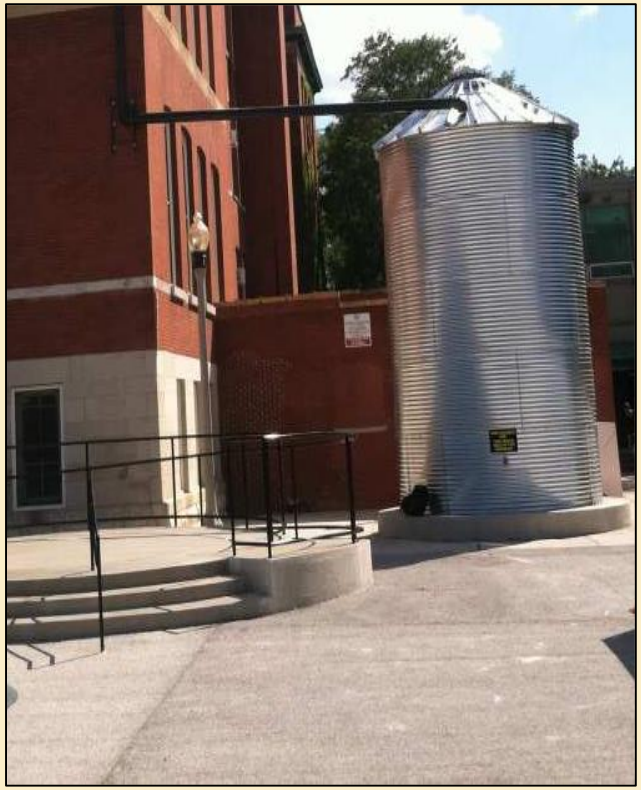
Rain Barrels

- Capture rain from rooftops and are commonly used in residential settings.
- Collected runoff can be stored and used later for watering a lawn or garden.
- Help reduce runoff volume, reduce erosion, promote infiltration.
- Take up very little space, are inexpensive ($50-$200), and easy to install.
- Low maintenance: drain after rainstorms, remove leaves and debris collected on screens.



Cisterns

- Used to intercept, divert, store, and release stormwater runoff.
- Reduces the volume and velocity of runoff leaving the site.
- Can be above ground or below ground.



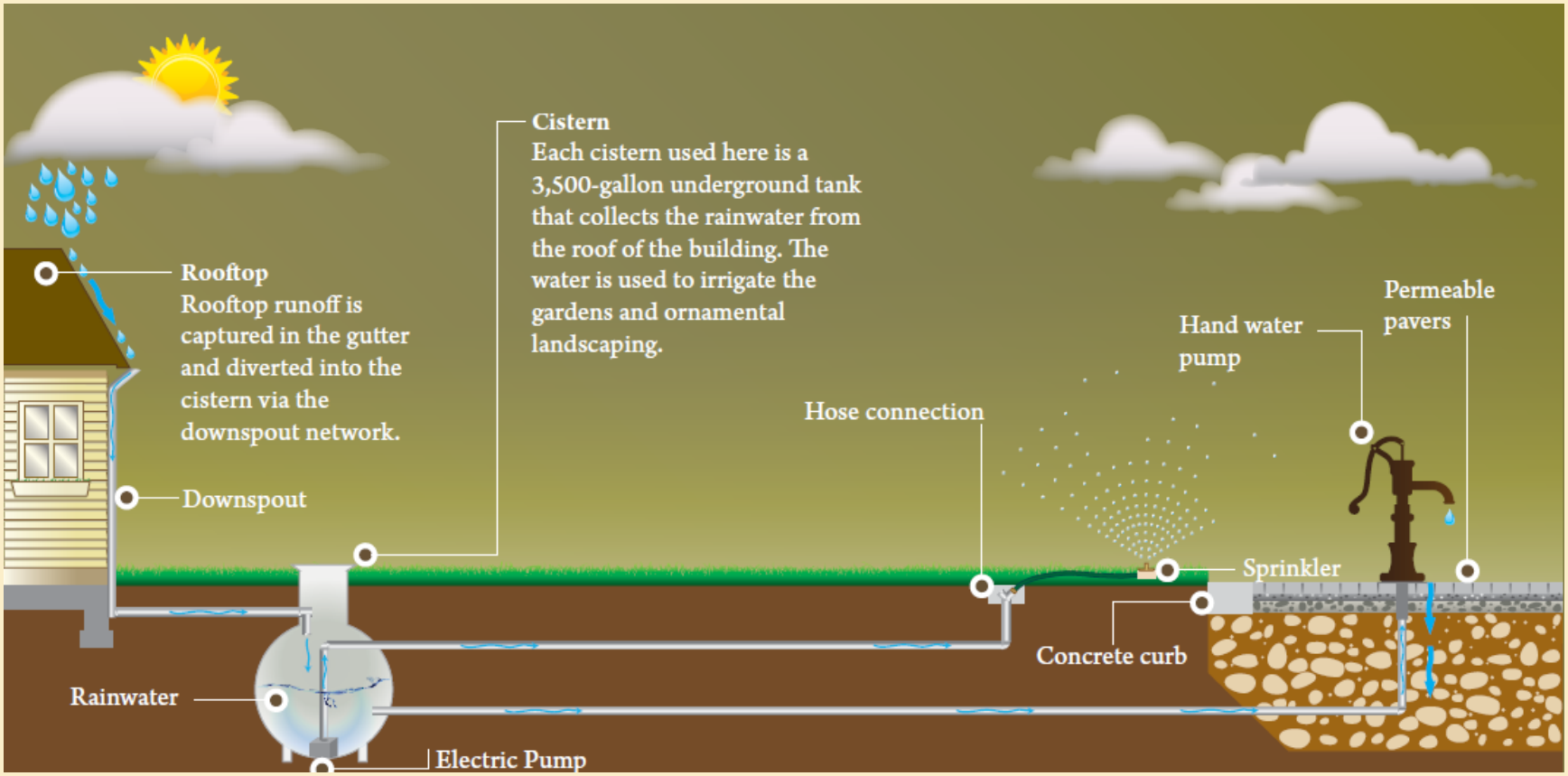
Goethe Elementary School, Chicago IL (IGIG1204)

Springfield IL (IGIG1301)

Cisterns

- Captured water can be used for irrigation or other non-potable uses.

- Moderate / low maintenance depending on the size and complexity of the system. Biannual inspections, cleaning out filters and sediment accumulation in storage tanks, etc.



Naper Settlement, Naperville, IL (3191014)

Rain Gardens

- Small, shallow, vegetated basins that collect and absorb runoff from rooftops, driveways, or other impervious surfaces.
- Can be placed strategically in areas where stormwater currently exceeds drainage capacity.
- Use plants to improve infiltration, reduce runoff, and remove pollutants.

Greenbriar School,
Northbrook, IL (IGIG1108)

Rain Gardens

- Also reduce temperatures, provide wildlife habitat, support groundwater recharge, and improve aesthetics.

- Moderate / low maintenance: give plants plenty of water until well established; mulching, weeding, and replacing plants that fail to thrive.

- Moderate cost: $10 per square foot depending on area, site preparation, plants, and accent features.

Metra parking lot, Deerfield, IL (3191110)

Bioswales

- Shallow, vegetated channels designed to slowly convey runoff to storm sewer inlets or surface waters.

- Provide treatment and retention as they move stormwater from one place to another.

- Use vegetation to slow, infiltrate, and filter pollutants from stormwater flows.

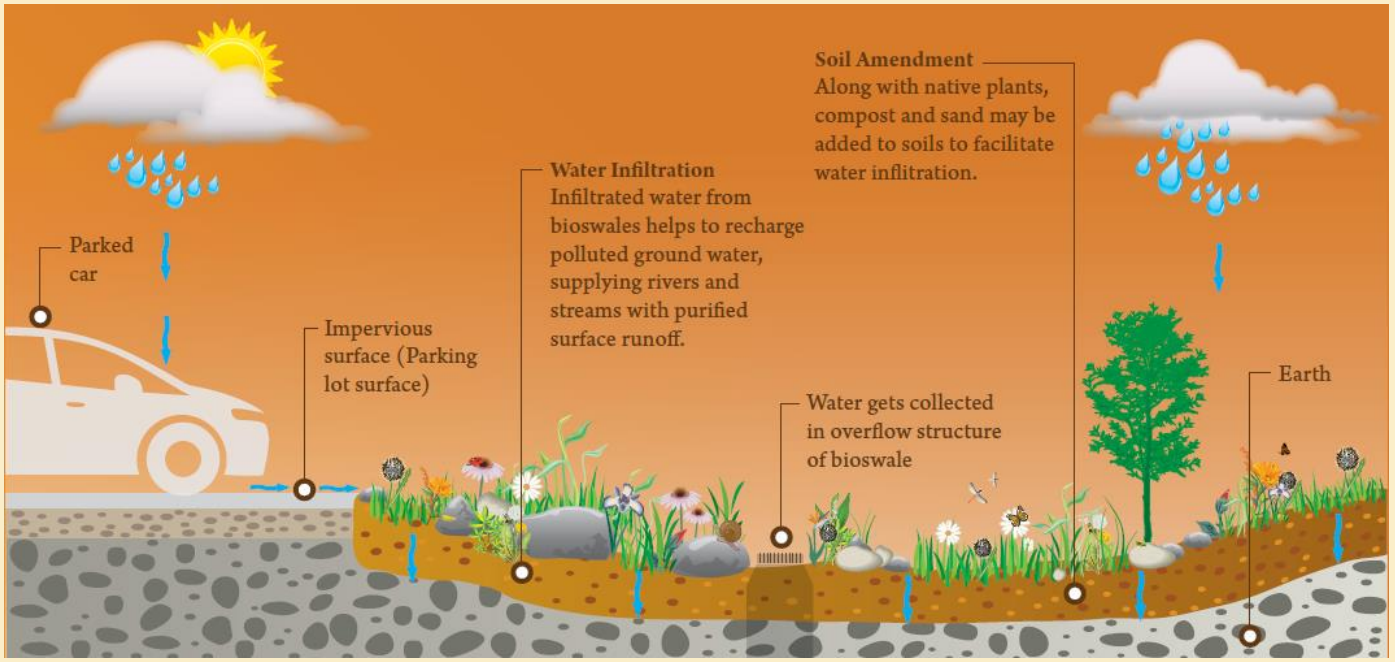
Tower Lakes, IL (3191615)

Bioswales

- Cheaper than using pipes to convey stormwater runoff.

- Moderate / High maintenance: must use straw matting or other erosion control materials while vegetation is being established; weed control, reseeding of bare areas, and clearing of debris and accumulated sediment.

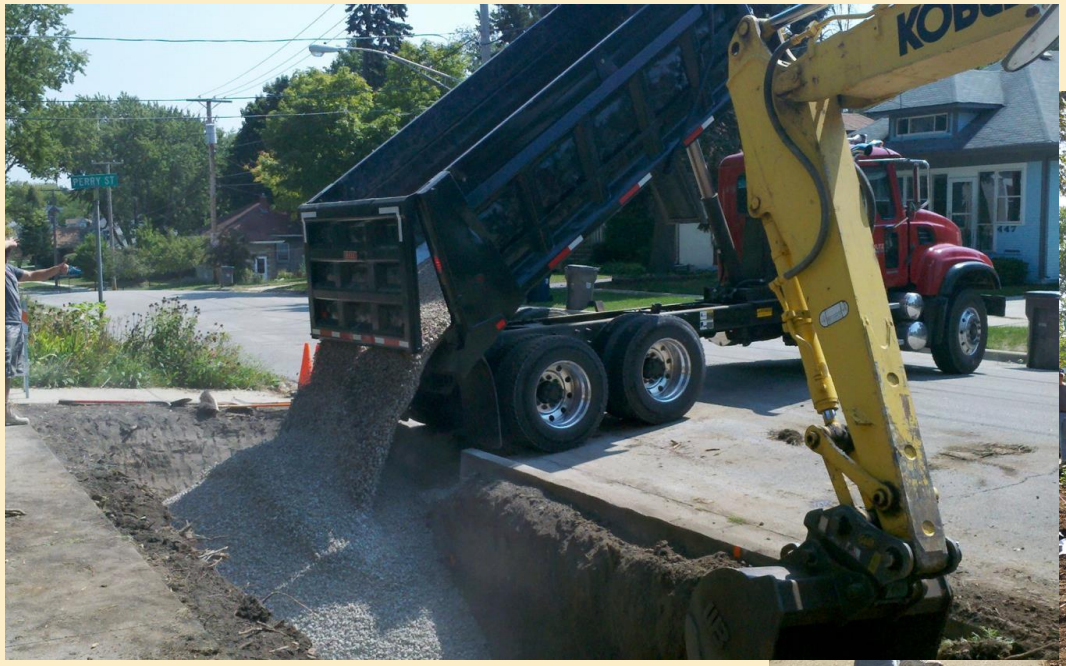
- Can also reduce temperatures, increase biodiversity, and improve air quality.



Bio-retention Facilities

- Are depressions that contain vegetation grown in an engineered soil mixture placed above a gravel drainage bed.

- Runoff is filtered by vegetation and by passing through an engineered soil medium, and is then either infiltrated into the subsoil or exfiltrated through an underdrain.



Elgin, IL (IGIG1102)

Bio-retention Facilities

- Engineered soil has a mixture of sand, soil and organic material (filtering media) with a surface mulch layer.

- Provides runoff reduction, filtration, and pollutant removal.

Aurora, IL (IGIG1203)

Bio-retention Facilities

- Well suited to being placed along streets and parking lots.
- May need to work around existing utilities.

Aurora, IL (IGIG1203)

Infiltration Trenches

- Are narrow ditches filled with gravel to create an underground reservoir for stormwater runoff.

- Provide storage volume and additional time for captured runoff to gradually infiltrate into the surrounding soil.

Lewis and Clark Community College, Godfrey, IL (IGIG1412)

Infiltration Trenches

- Help preserve the natural water balance on the site.

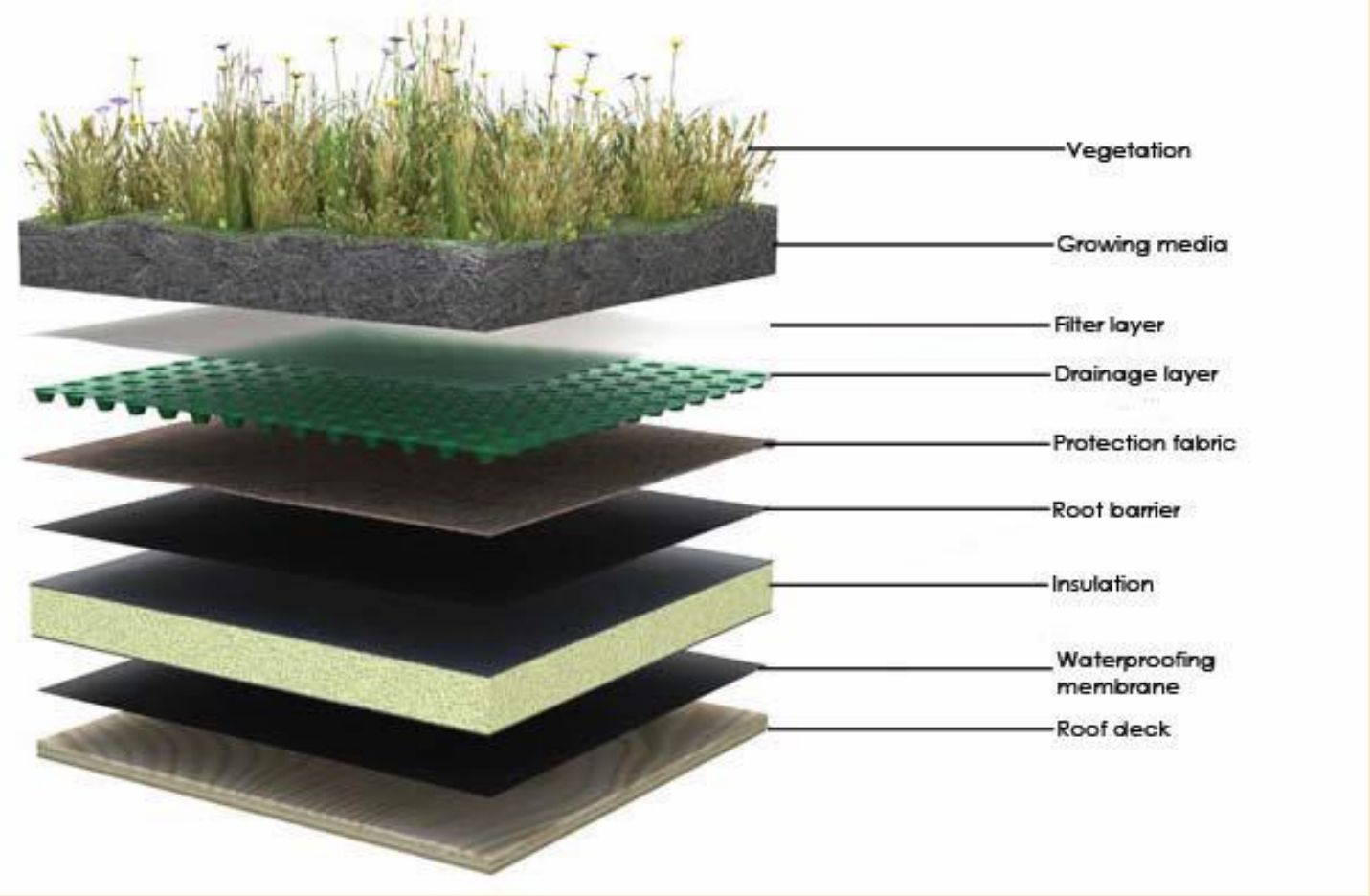
- Limited to areas with porous soils where the water table is well below the bottom of the trench.

Niles, IL (IGIG1101)

Green Roofs

- Include a waterproof layer, a drainage layer, a growing medium, and vegetation.

- Reduce runoff by absorbing and retaining rainwater in the soil medium for plant growth.



Green Roofs

- Vegetation shades the roof and cools the air through evapotranspiration, which reduces energy costs for cooling and reduces urban heat island effects.

- The vegetation also improves air quality by capturing CO2 and provides urban wildlife habitat.

- Particularly cost-effective in dense urban areas where land values and stormwater management costs are likely to be high.

Greenbriar Elementary School, Northbrook, IL (IGIG1108)

Green Roofs

- Require greater structural support than conventional roofs and are expensive to install ($15 to $20 per square foot).

- Last longer than conventional roofs, since the roofing material itself is shielded from ultraviolet light and thermal stress.

- Moderate / low maintenance: watering during establishment, weeding once or twice a year.

Greenbriar Elementary School, Northbrook, IL (IGIG1108)

Permeable pavement

- Has spaces to allow rainwater to pass through the surface into the underlying layers of rock and soil for storage and infiltration.
- Includes pervious concrete, porous asphalt, permeable interlocking concrete pavers, and vegetated grid systems.
- An underdrain may be required if subsoil infiltration rate is too low.

Westchester Public Library,
Westchester, IL (IGIG1308)

Permeable pavement

- Reduces peak runoff rates and volumes.
- Reduces pollutant loads and promotes groundwater recharge.
- Initial costs are typically higher than conventional pavements, but that's offset by reducing the need for other stormwater infrastructure.
- Moderate / low maintenance: Annual sweeping or vacuuming of sediments to maintain permeability, occasional sand or gravel replenishment.

Geo-block grass pavement prior to Soil/Sand In-fill, Highland Park High School, Highland Park, IL (IGIG1307)

Riparian Buffers / Natural Shorelines

- Use deep-rooted, native vegetation to create a filter strip or buffer directly adjacent to a body of water.
- Reduces streambank or shoreline erosion.
- Filters pollutants entering the waterbody by overland flow.
- Improves wildlife and fish habitat by providing food, shelter, and cooling water temperatures.

Culver Memorial Park in
Homer Glen, IL (3191707)

Riparian Buffers / Natural Shorelines

- Reduces runoff by increasing stormwater infiltration into soil.

- Can provide an attractive privacy screen for property owners while maintaining water views, and can increase property value and recreational opportunities.

- Native plants often thrive with less human intervention like watering, fertilizing, pesticides, and mulching.

Culver Memorial Park in
Homer Glen, IL (3191707)

Urban Stormwater Wetlands / Extended Detention

- Temporarily store runoff in relatively shallow pools that support conditions suitable for the growth of wetland plants.
- Remove pollutants from runoff through settling, and through uptake and filtering by wetland vegetation.
- Reduce peak runoff rates when designed as a multi-stage, multi-function facility.
- Provide wildlife habitat and aesthetic features.

Tower Lakes, IL (3191615)

Stream Channel Restoration

- Returns a stream ecosystem's structure and function to a state more reflective of its pre-disturbance form.

- Restores the physical, chemical, and biological composition of a stream's ecosystem to a condition that more closely resembles its pre-development state.

Dam removal at Rasmussen Lake, Antioch, IL (3191712)

Stream Channel Restoration

- Includes things like re-meandering, dam removal, reconnecting the stream to its floodplain, channel reconstruction or daylighting, etc.

Two-stage ditch, Algonquin, IL (3191608)

Skokie River daylighting, IL (3191304)

Summary

Gray stormwater infrastructure (i.e., conventional piped drainage) is designed to move urban stormwater away from the built environment.

Summary

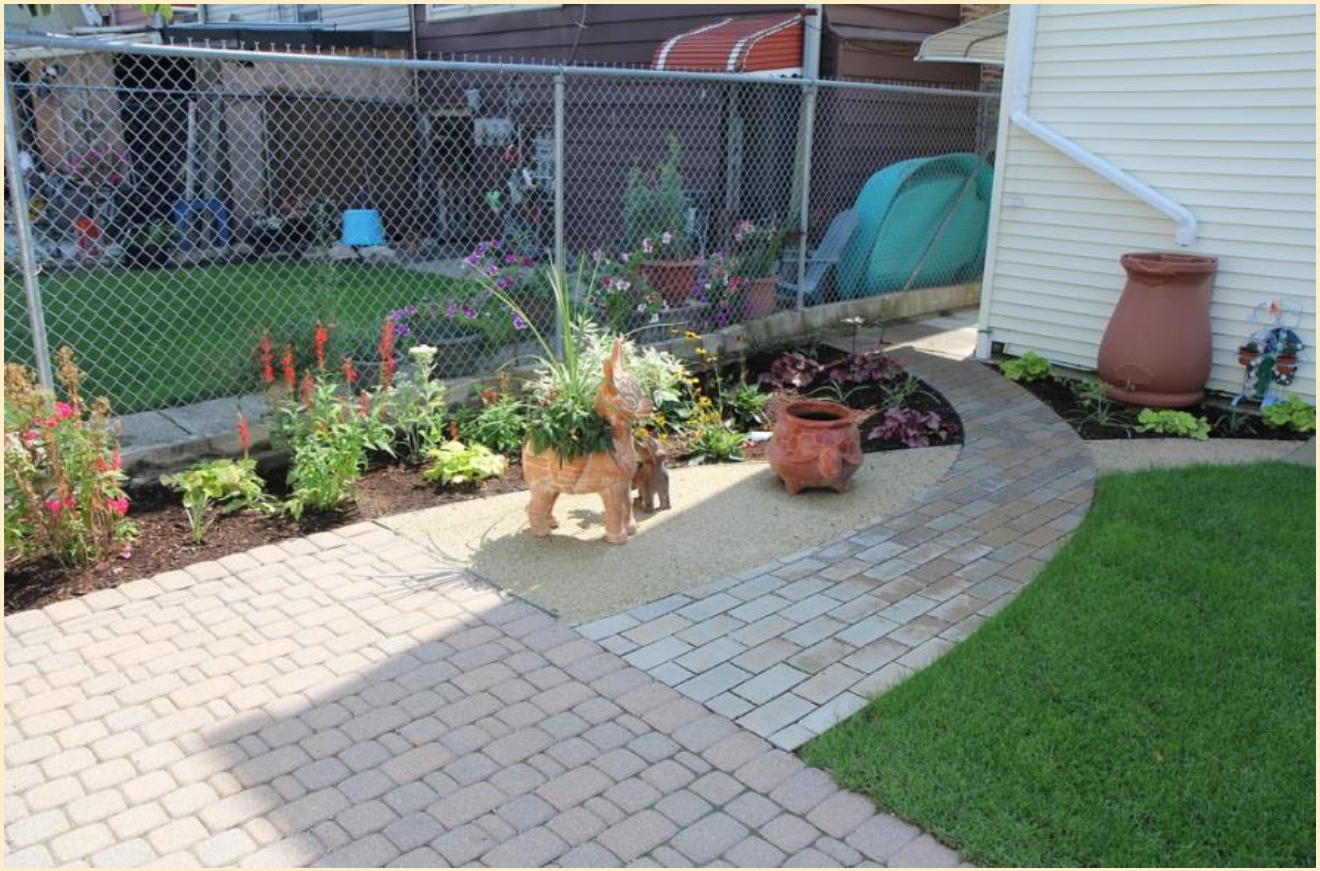
Green infrastructure reduces stormwater flows to sewer systems or to surface waters while also delivering other environmental benefits, such as:

- Reduce nonpoint source pollution;
- Improve air and water quality;
- Provide habitat for plants and animals;
- Create recreational and educational opportunities;

Carpentersville, IL (3191616)

Summary

- Reduce combined sewer system overflows;
- Improve groundwater supply and quality;
- Increase property values;



Chicago, IL (IGIG1109)

Summary

- Reduce flooding;
- Reduce heat island effect / cool air and water temperatures;
- Attract businesses, services, and new residents;

Glenview, IL (3191412)

Summary

- Revitalize downtown and streetscapes;
- Reduce the impact of heavy rainfalls on fixed-capacity storm sewer systems; and
- Postpone or eliminate the need for gray infrastructure upgrades.

Aurora, IL (IGIG1114)

Summary

Lots of different types and variations of green infrastructure BMPs. Selection should be based on the multiple objectives you have for the project and take advantage of existing natural landscape.

TABLE 1: Green infrastructure Primary and Secondary Functions

		Reduce stormwater runoff	Filter /reduce water pollutants	Store stormwater	Water saving / recycling	Ground water recharge	Energy saving	Mitigate urban heat island effect	Absorb greenhouse gases	Create visual amenity	Provide recreation space	Reduce soil erosion	Biodiversity habitat	Transportation
	Primary function													
	Secondary function													
Building	Green Roof	●	○	○	○		●	○	○	○	○		○	
	Green Wall						●	○	○	○				
	Rainwater Harvesting			●	●									
Public realm and landscape	Bioswale	●	●	○	○	○		○	○	●		○	○	
	Constructed Wetland	●	●	●		○			○	●	○	○	○	
	Dry Pond	●												
	Filter Strip		●							○		○		
	Hedgerow									○		●	○	
	Perforated Pipe	●				○								
	Permeable Pavement	●	●			○				○				●
	Rain Garden & Bioretention	●	●	●		○		○	○	●	●	○	○	
	Riparian Buffer		●										●	
	Soakaways, Infiltration Trenches & Chambers			●										
	Tree Canopy Expansion	○	○				○	○	○	●	○	○	○	
	Wet Pond	●	●	●				○	○	●	○	○	○	
	Xeriscaping	●	○							●			○	

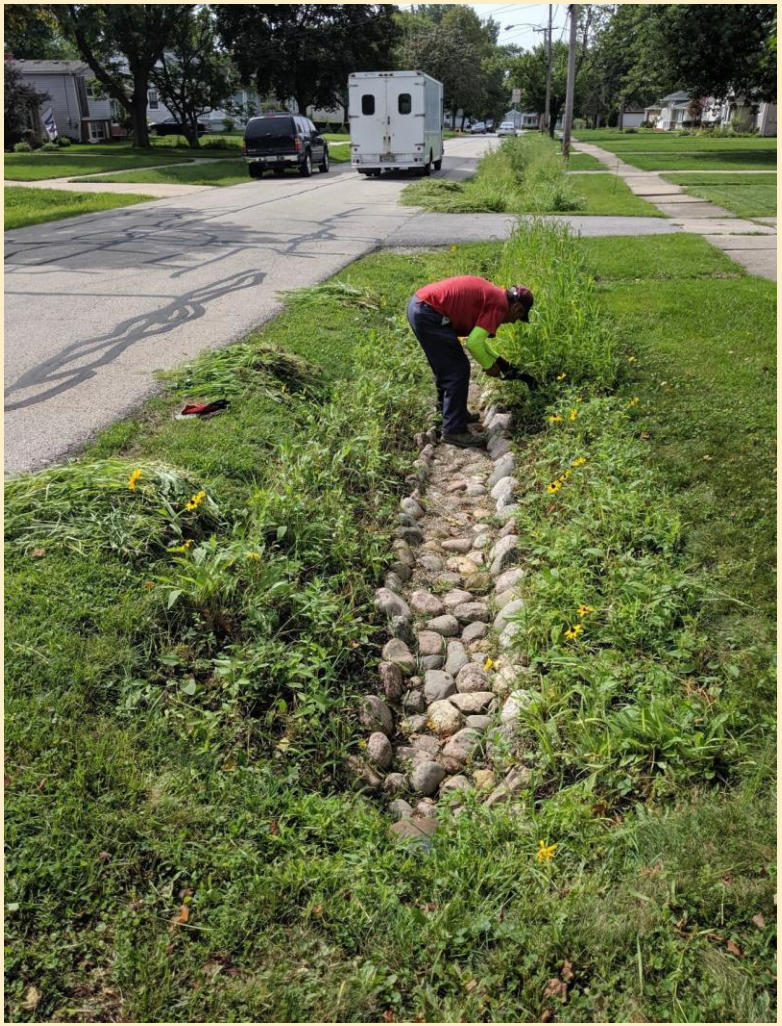
Summary

There are tools that can compare the performance, costs, and benefits of green infrastructure to conventional gray infrastructure stormwater practices, such as the **Green Values Stormwater Toolbox**, which is available on the Center for Neighborhood Technology's website.

Summary

- In addition to selecting the right practice for the site, the success of green infrastructure BMPs in achieving the multiple objectives you have for the project will depend upon proper design, materials, construction, and maintenance.

- Mistakes made in regard to any of these elements of BMP implementation can cause the practice to fail or cause other unwanted problems.



Villa Park, IL (IGIG1311)

Summary

- Public works departments have a long history in how to do gray infrastructure. But training will be needed for them to be successful with green infrastructure.

- And training for property owners may also be needed to get community acceptance and cooperation.

Summary

- Fortunately, there are technical guidance materials and resources available that can help, such as the Illinois Urban Manual. https://illinoisurbanmanual.org/

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https://www2.illinois.gov/epa/topics/water-quality/watershed-management/Pages/default.aspx