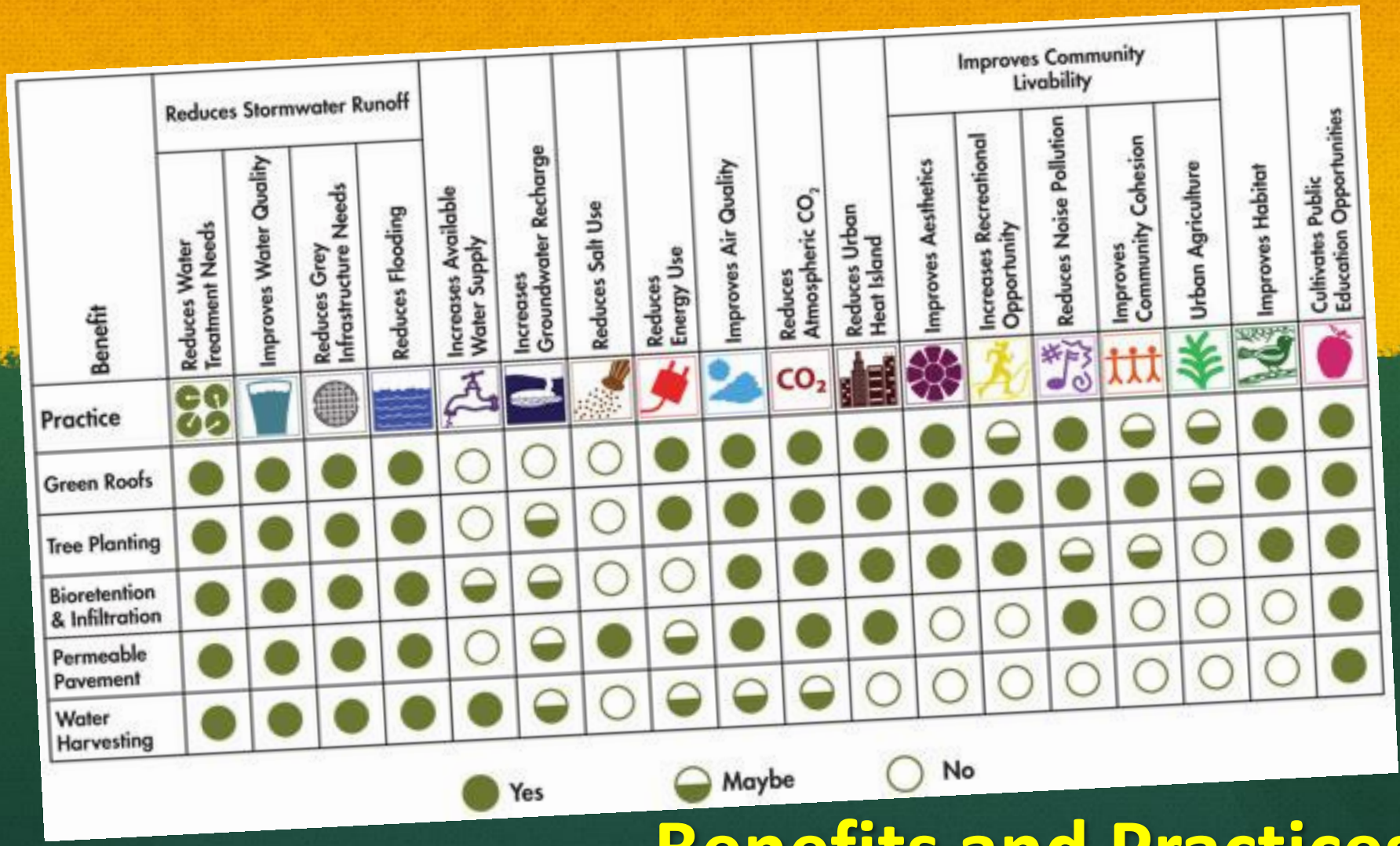
Green Infrastructure and Low-Impact Development Technologies

The guiding principles of these technologies is to manage stormwater at their sources using natural means, and establish conditions so that hydrology and water quality of developed sites approaches that of undeveloped sites.

- Green roofs & vegetative walls
- Bioretention or rain gardens
- Bioswales
- Planter boxes
- Permeable pavement
- Urban tree canopy
- Rainwater harvesting
- Downspout disconnection
- Green streets and alleys
- Green parking

Green Infrastructure (GI) and Low-Impact Development (LID) Technologies



Benefits and Practices

Green Roofs and Vegetative Walls

A rooftop or building wall planted with a media membrane and native vegetation over a waterproofing membrane/root zone barrier, which may include a drainage and irrigation system.

Benefits:

- **Reduces stormwater runoff**
- **Reduces energy use**
- **Improves air quality**

Two categories of green roofs:

- ***Extensive green roofs*: media depth 2-6 inches**
- ***Intensive green roofs*: media depth greater than 6 inches**

Bioretention or Rain Gardens

Typically constructed with high-permeability media consisting of soil, sand and organic matter, designed to maximize infiltration, improve water quality, promote vegetative growth and biological transformation processes.

Designed with a ponding zone, storage volume capacity, stormwater overflow, and exfiltration/underdrain relief.

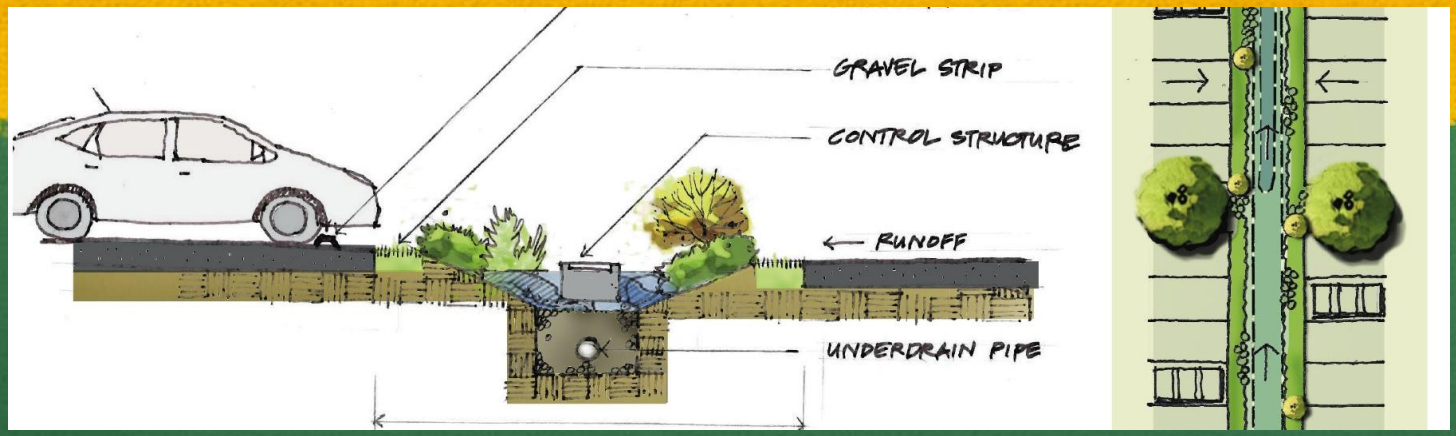
Ideally constructed:

- Areas where stormwater naturally collects
- Adjacent to roof runoff and impervious areas such as streets, parking lots, driveways

Benefits:

- Improves local aesthetics
- Traps and treats silts, fine particles, nutrients, heavy metals and bacteria from impacting downstream ecosystems
- Increases property value
- Increases biodiversity and habitat

Bioswales



Bioswales may be vegetated, mulched or xeriscaped linear channels that provide stormwater retention and infiltration.

Bioswales are a linear form of a bioretention system with a length-to-width ratio greater than 2:1, typical of standard bioretention construction.

Designed as an alternative to traditional stormwater piping, integrated into parking lots and road medians.

Planter Boxes

Planter boxes are urban bioretention systems with vertical concrete walls designed to collect and retain a specified volume of stormwater runoff and promote vegetative growth.

The design may have an open or closed bottom.

Collect stormwater runoff from sidewalks, parking lots and/or streets within the city right-of-way.

Permeable Pavement

porous concrete, porous asphalt, interlocking permeable pavers

Surfaces that are similar to sidewalks and roadways in that they allow for vehicular traffic, but dissimilar due to their abilities to absorb and infiltrate stormwater runoff through their surfaces to underlying media layers.

Typically designed for low-volume traffic areas such as parking lots, driveways and sidewalks.

Urban Tree Canopy

Planting and protection of an urban tree canopy provides many social, ecological and economical benefits.

Benefits:

- Intercepts rainfall
- Increases infiltration and soil storage capacity
- Increases evapotranspiration rates
- Supports biological communities within root zone (rhizosphere)
- Acts as a windbreak and provides shade, reducing residential heating and cooling
- Reduces air pollution (such as NO_2, SO_2, O_3)
- Appreciates and requires less maintenance with age
- Increases habitats

Rainwater Harvesting

Capturing and storing of rainwater with cisterns or rain barrels to be used for onsite irrigation, toilet flushing, car washing and other purposes.

Downspout Disconnection

The process of redirecting roof runoff away from traditional storm sewer collection systems to rain gardens, bioswales, planter boxes and other GI technologies on site.

These systems allow for infiltration, improved water quality and treatment efficiency on site and at the runoff source.

Shown to reduce DCIA by 40-44%.

Green Streets and Alleys

The integration of permeable pavement, bioswales, planter boxes, bioretention and native vegetation into an urban streetscape.

These systems are designed to store storm event volume, promote evapotranspiration and biogeochemical processes.

Benefits:

- Improves water and air quality
- Enhances livability
- Increases property values
- Enhances pedestrian and bicycle access and safety
- Protects surface and groundwater resources
- Increases urban green space and wildlife habitat
- Reduces pollution
- Reduces stormwater into combined sewer systems
- Reduces pumping and wastewater treatment costs

Green Parking

Parking lots have low traffic volume, high impervious area and vegetative islands, making them great locations to implement green infrastructure design.

The most commonly used GI technologies are pervious pavement, porous concrete, interlocking pavers, rain gardens, bioswales and tree canopies.

Sources of Images

Source of most images: U.S. Environmental Protection Agency at **www.epa.gov**

What Is Green Infrastructure?
http://water.epa.gov/infrastructure/greeninfrastructure/gi_what.cfm

Slide 3 table from *The Value of Green Infrastructure: A Guide to Recognizing Its Economic, Environmental and Social Benefits* (page 3)
http://www.cnt.org/repository/gi-values-guide.pdf