Urban Green Practices

Indiana Watershed Webinar Series
January 25, 2012

Agenda

1. Low Impact Development (LID) & Green Infrastructure (GI) defined
2. Benefits of LID/GI
3. Common Drivers
4. How does it Work?
5. Examples
6. Tools & Resources Available

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1. **LID/GI Defined**
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Low Impact Development is…

- The management of stormwater runoff at the site through the use of conservation, planning or engineered methods that mimic natural systems to reduce drainage problems and treat polluted runoff.

Conventional Approach

LID Approach

Major Components of LID

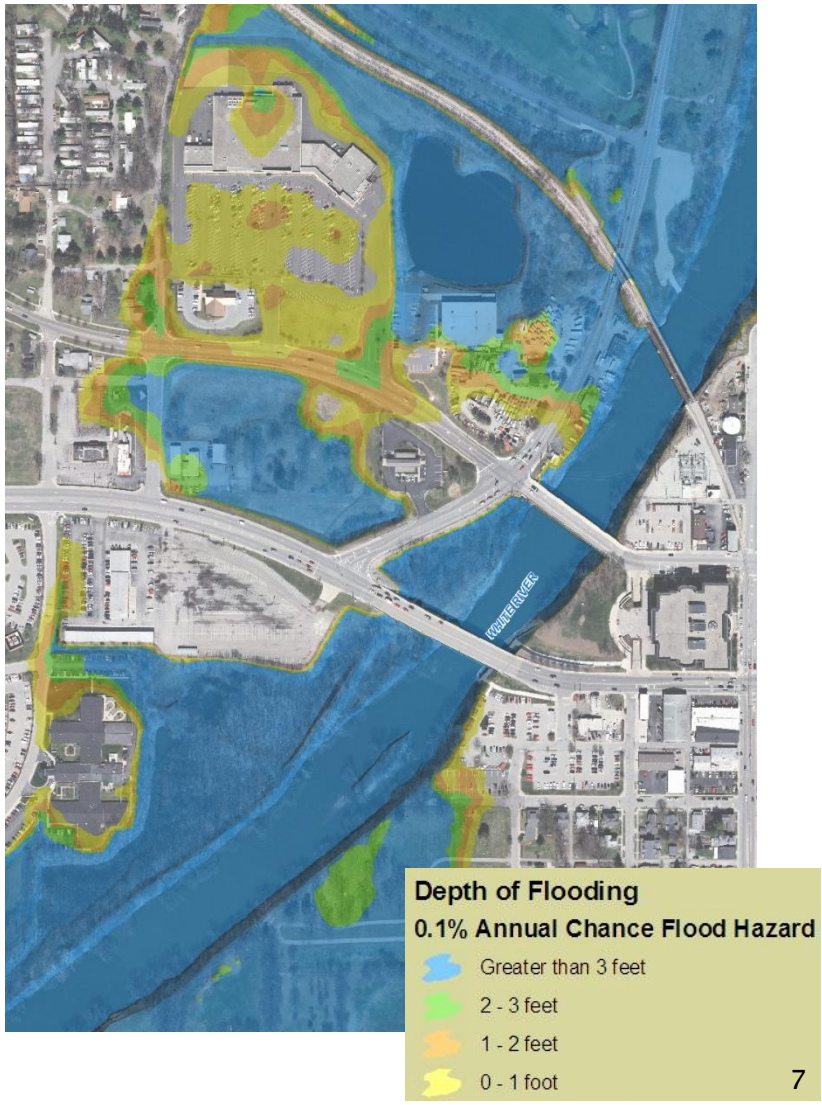
1. Conservation Design
   - Preserve open space
   - Preserving vegetated buffers along stream
2. Better Site Design
   - Minimize impact of development
   - Changes codes/rules
3. Green Infrastructure
   - Mitigate the impact of development using onsite practices

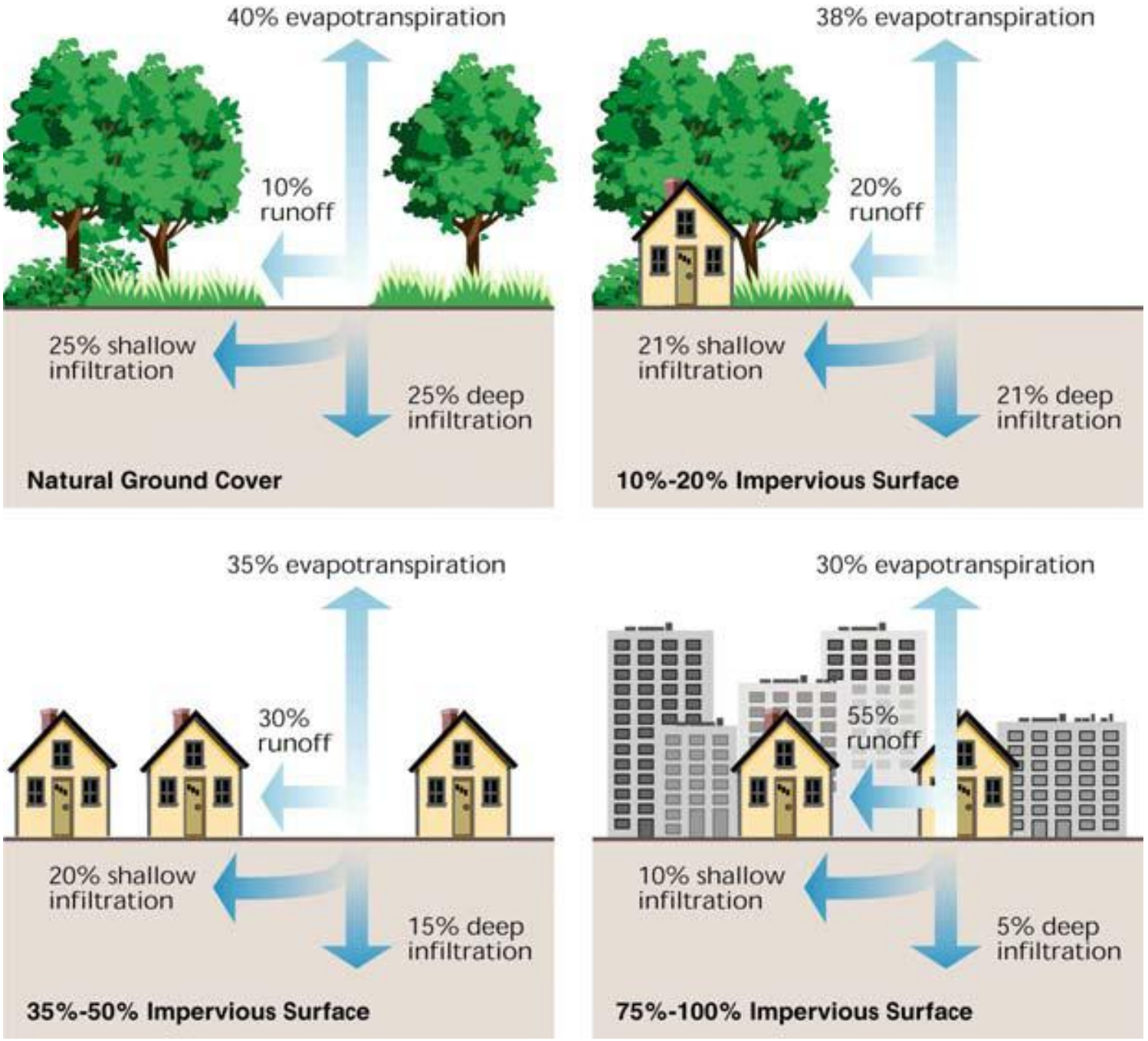
Green Infrastructure is…

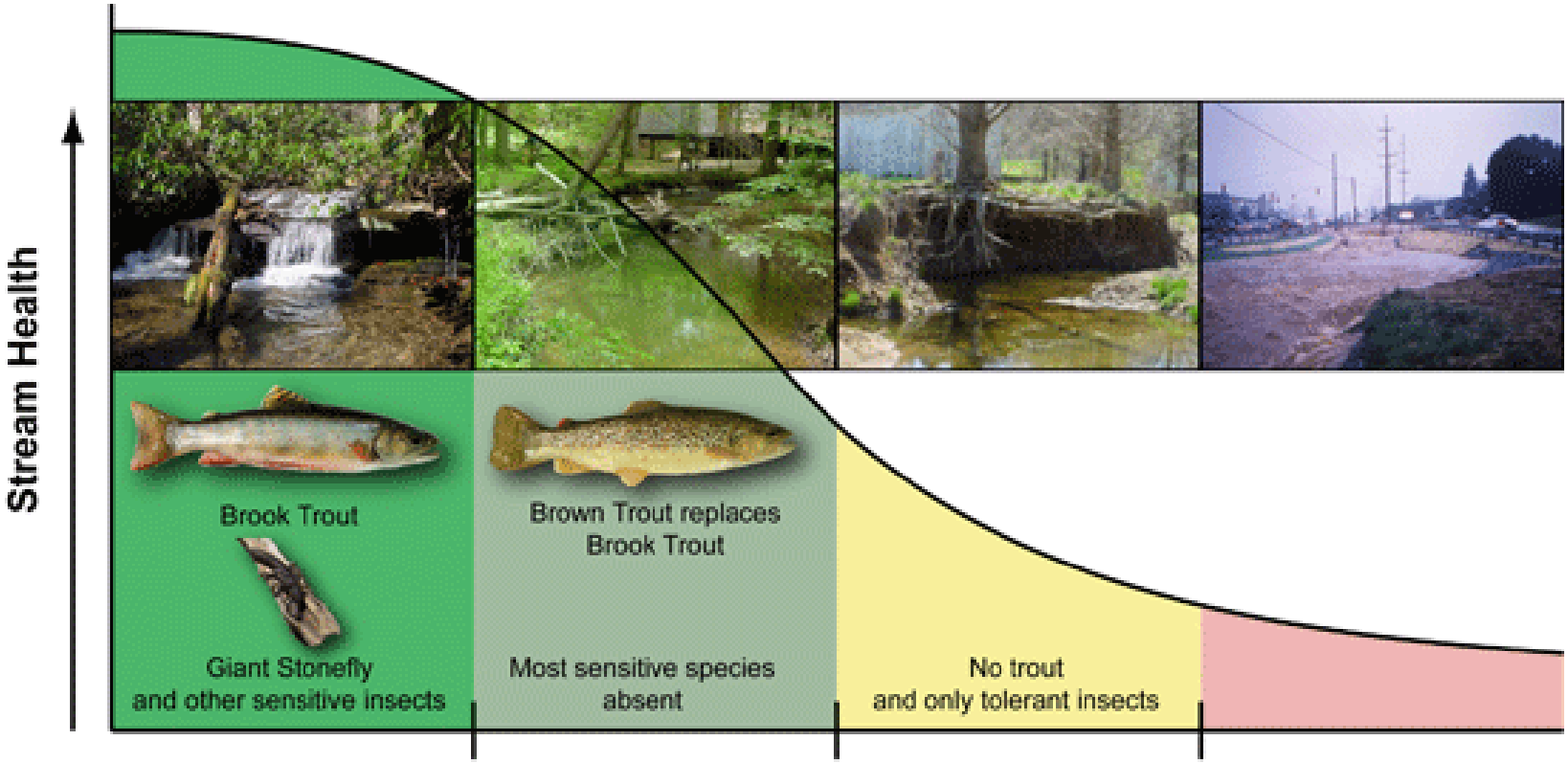
- Engineered systems that mimic natural processes and characteristics of soil and vegetation to enhance water quality and reduce runoff.

Green Infrastructure is…

- **NOT** meant to replace flood control structures
- **NOT** meant to provide storage for more than 1 to 2 inches of runoff




40% evapotranspiration
10% runoff
25% shallow infiltration
25% deep infiltration
Natural Ground Cover
38% evapotranspiration
20% runoff
21% shallow infiltration
21% deep infiltration
10%-20% Impervious Surface
35% evapotranspiration
30% runoff
20% shallow infiltration
15% deep infiltration
35%-50% Impervious Surface
30% evapotranspiration
55% runoff
10% shallow infiltration
5% deep infiltration
75%-100% Impervious Surface



<5%	5-10%	10-20%	>20%
• Water cool and clean • Stream banks and bottom typically stable • Trout can be found • Endangered species can be found • Many fish species • Many salamander species • Many freshwater mussels • Many insect taxa	• Water may be warmer and slightly polluted • Erosion may be evident • No brook trout • Most rare and endangered species absent • Many pollution tolerant fish • Fewer salamander species • Only tolerant mussels • Fewer insect taxa	• Water warmer • Erosion usually obvious • Trout absent • Rare stream species absent • Fewer fish species • Only three tolerant salamander species • No native mussels • Mostly tolerant insects	• Water warm and pollution usually evident • Unstable habitat • Trout absent • Non-native species dominate some streams • Only tolerant fish species • One salamander species • No native mussels • Only tolerant insects

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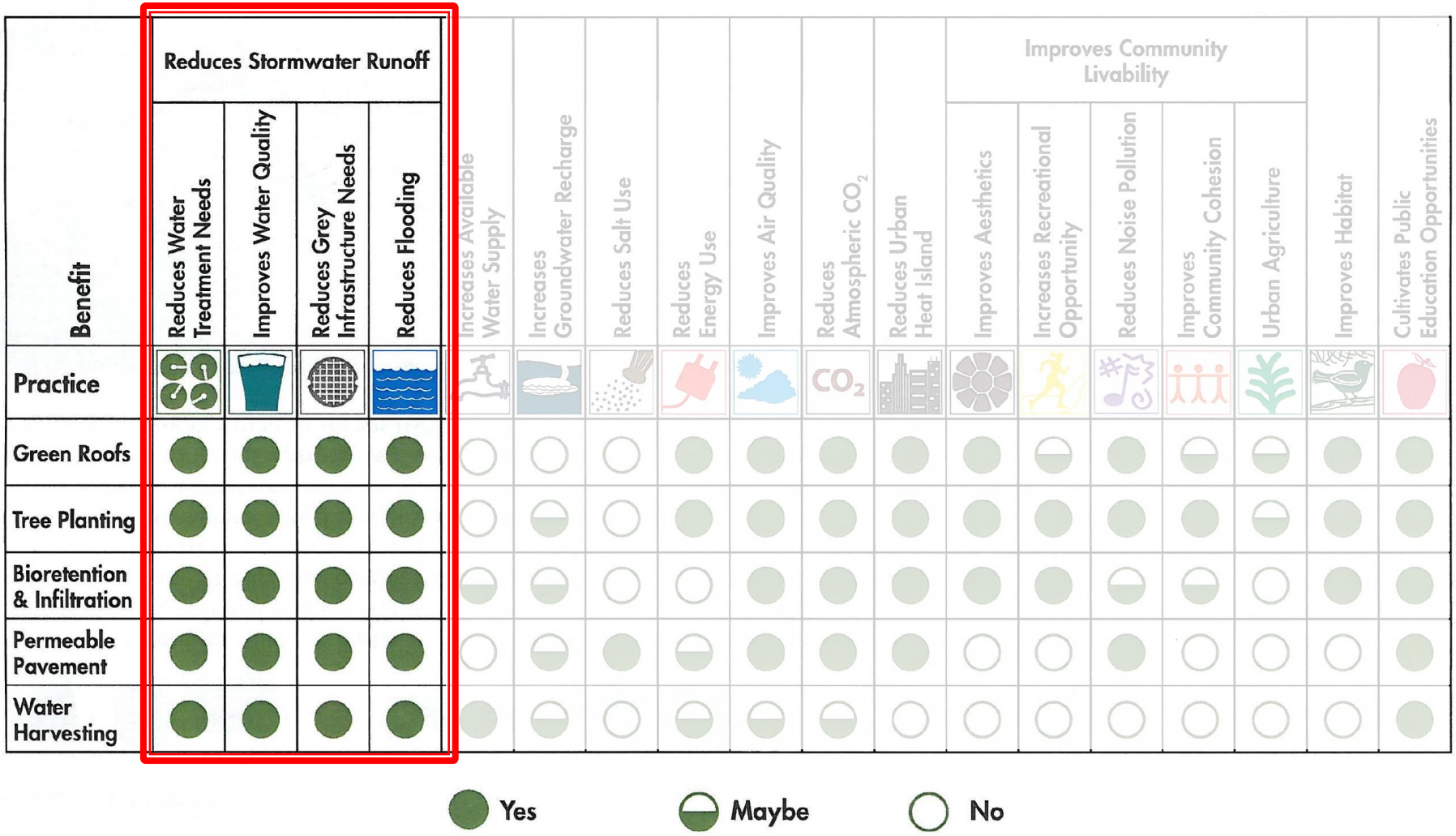
Benefits of LID/GI

- People (Social)
  - Human Health
  - Sense of Place
- Planet (Environment)
  - Water Quality & Quantity
  - Air Quality
  - Habitat
- Profit (Economic)
  - Capital & Life Cycle Costs
  - Property Value

Benefits of GI Practices



CNT, 2010

Triple Bottom Line

- An expanded baseline for measuring performance, adding social and environmental dimensions to the traditional monetary benchmark

1. Cost Metric
   - Capital Cost (CSO, TSS reduction)
   - Lifecycle Cost
   - Funding Opportunities/Shared Resources

Triple Bottom Line

2. Social Metric
   - Revitalization/Streetscape Improvements
   - Reduction in Flooding (basement, street)
   - Job Creation on Capital Projects
   - Open Space/Recreational Areas
   - Public Health
3. Environmental Metric
   - Streambank Erosion
   - Flood Protection
   - Water Quality
   - Biological Diversity/Connectivity/Habitat

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Common Drivers

- **Regulatory Requirements** – able to meet MS4 water quality treatment requirements
- **Infrastructure** – able to reduce size, operation and maintenance of grey infrastructure
- **Drainage Problems** – able to reduce peak flow volume and velocity, frequency and severity of nuisance flooding
- **Quality of Life** – able to provide social, economic, and environmental benefits

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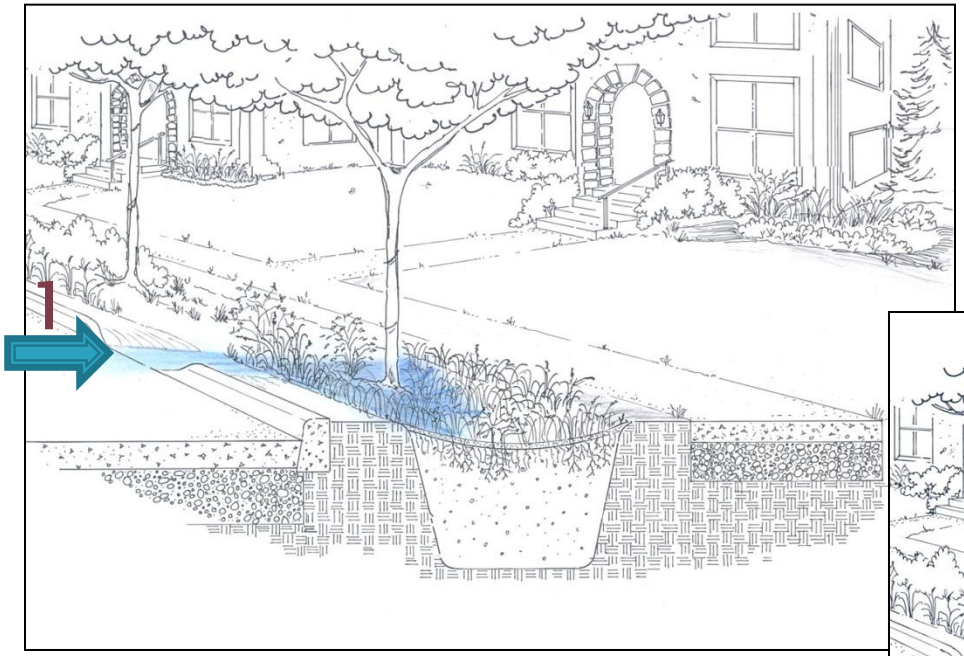
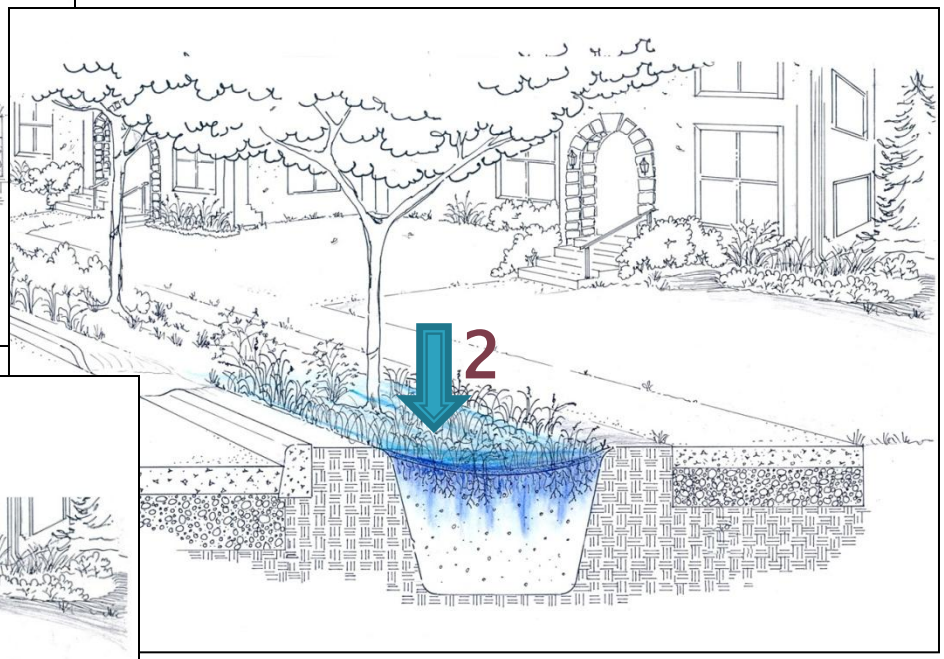
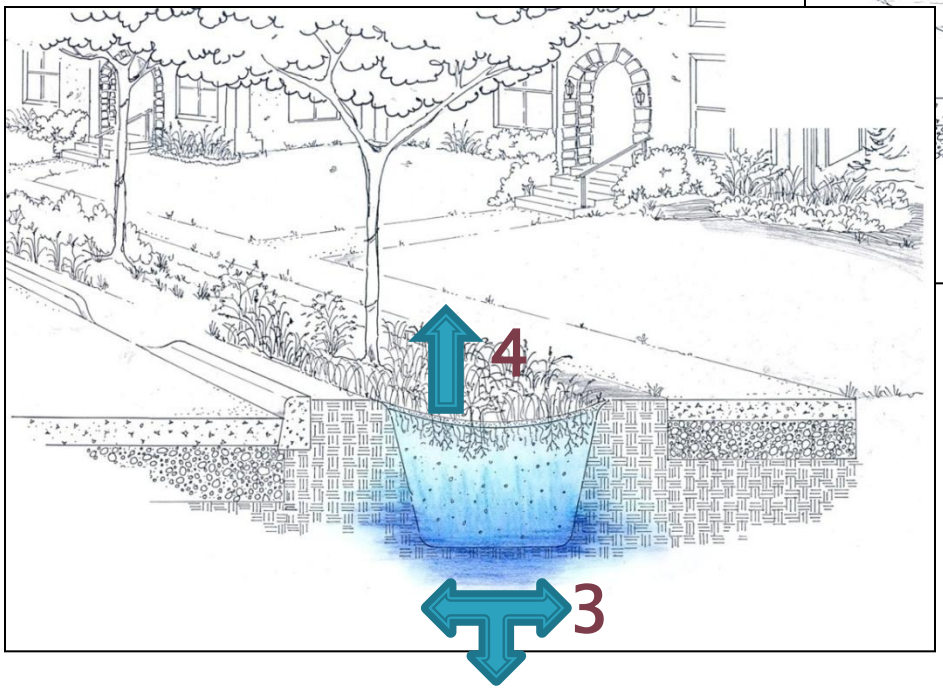
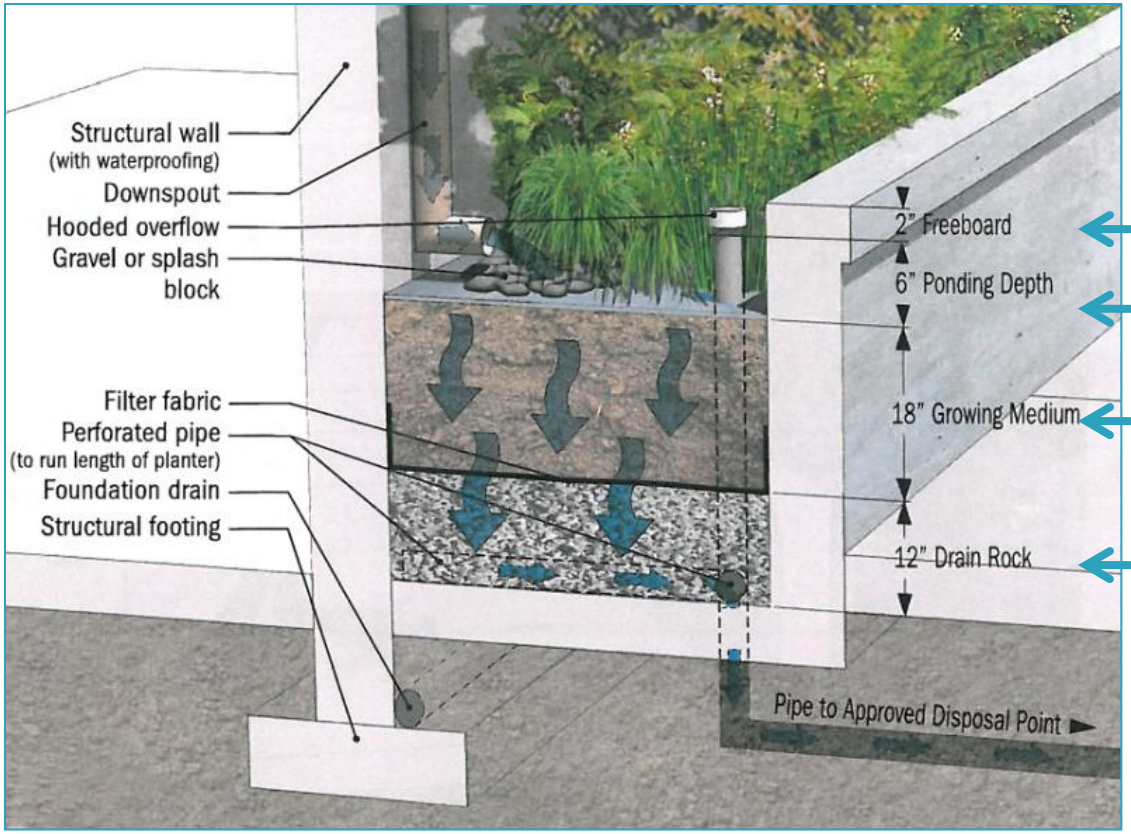
How does it work?







Storage Potential



2" Freeboard

6" Ponding Depth

18" Growing Medium
(30% voids=5.4")

12" Drain Rock
(40% voids=4.8")

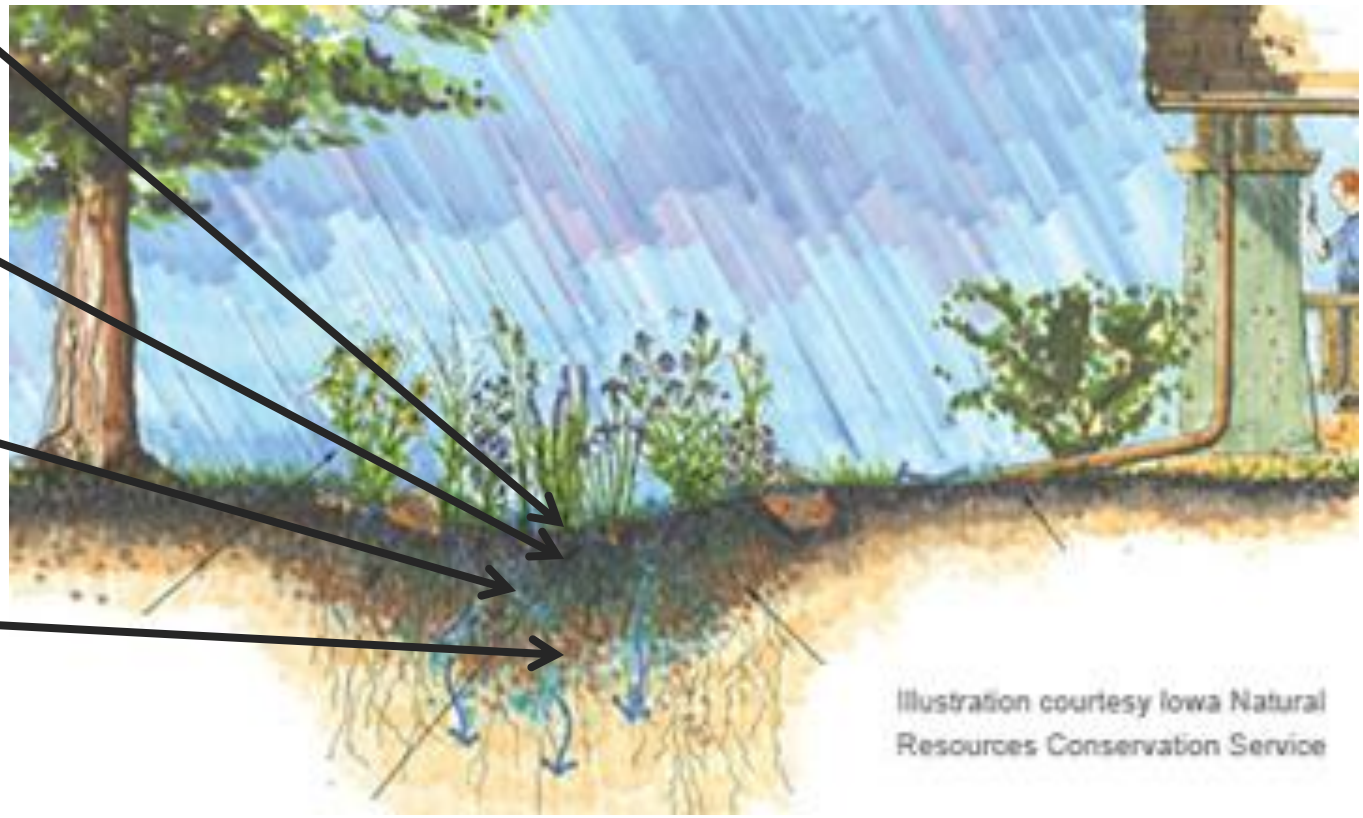
Pollutant Removal

Pathogens,
Oil & Grease
(UV rays)

TSS, TP
(filtration)

TN, TP, Metals
(root zone)

Temp
(storage)



Storage & Pollutant Removal

Practice	Storage	Pollutant Removal
Bioinfiltration/ Bioretention/ Rain Garden	6” on surface and 12” washed stone (40% voids)	TP = 55% TN = 64% TSS = 70%
Rainwater Harvesting	1” rainfall	TP = 75% TN = 75% TSS = 75%
Green Roof/ Blue Roof	1.5”	TP = 45% TN = 40% TSS = 70%
Permeable Pavement	24” washed stone (40% voids)	TP = 59% TN = 59% TSS = 80%
Tree Boxes	6” on surface and 12” washed stone (40% voids)	TP = 55% TN = 64% TSS = 70%

Need for Maintenance

- Critical to performance of GI practices
- No longer does “mow, blow and go” or “spray and pray” approach work
- Basic elements O&M:
  - Requirements to inspect and maintain practices
  - Easements or covenants for maintenance
  - Identify party responsible for maintenance
  - Authority to inspect
- Requires trained staff and good resource materials

Factors Affecting Performance

	Sediment Buildup	Litter & Debris	Pipe Clogging	Invasive Vegetation
Surface Sand or Soil Filter	50%	30%	10%	0%
Infiltration Basin or Trench	36%	21%	10%	5%
Wet Pond	26%	19%	21%	10%
Underground Sediment Device	58%	21%	11%	0%
Rain Garden	33%	22%	7%	26%
Filter Strips or Swales	21%	26%	5%	26%

Maintenance Considerations

- Design with maintenance in mind
- Be aware of material substitutions, compaction, and siltation during construction
- Inspect and track progress
- Focus on prevention maintenance efforts

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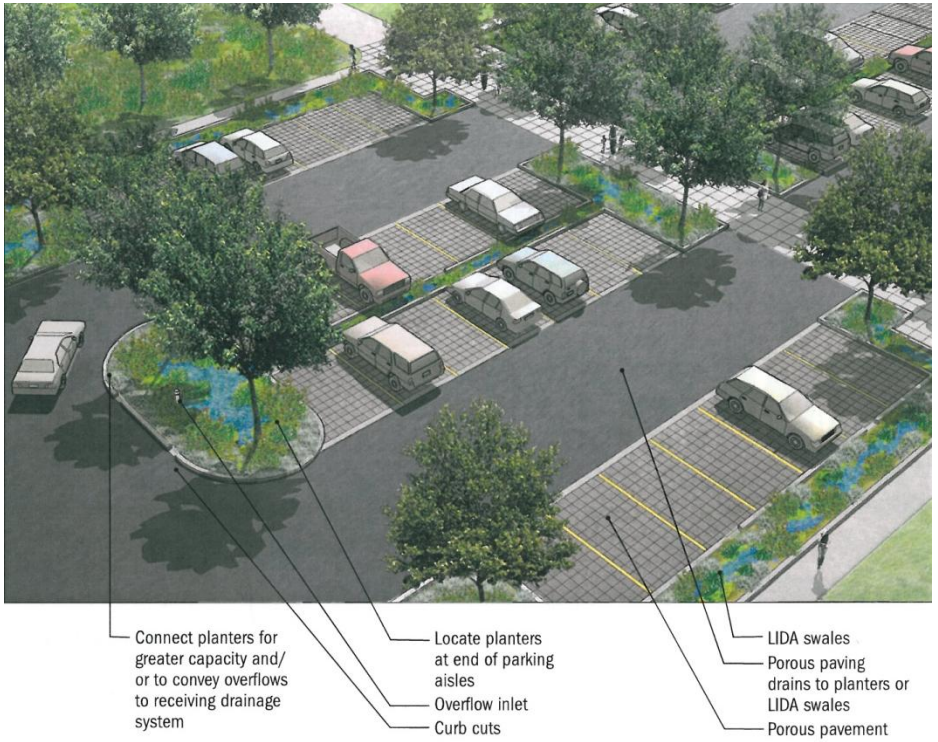
Green Alleys Program – Chicago

The Nature Conservancy – Indianapolis

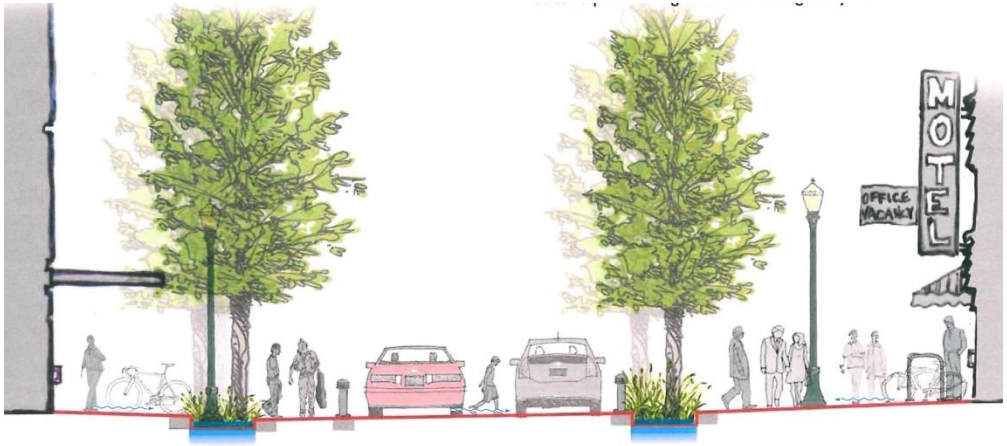


LIDA Handbook – Tualatin Basin, OR

Cultural Trail – Indianapolis

Green Streets – Vancouver, BC

McCormick Street – Portland, OR



Deaderick Street – Nashville, TN


produce

Clarian Cancer Center – Indianapolis

Indianapolis Museum of Art – Indianapolis

City Hall – Chicago

3 Mass Ave – Indianapolis

Contech Urban Green – Examples of LID Application

Nickel & Nickel's Winery – Napa Valley, CA

Fire Station – Denton, TX

Keep Indianapolis Beautiful – Indianapolis

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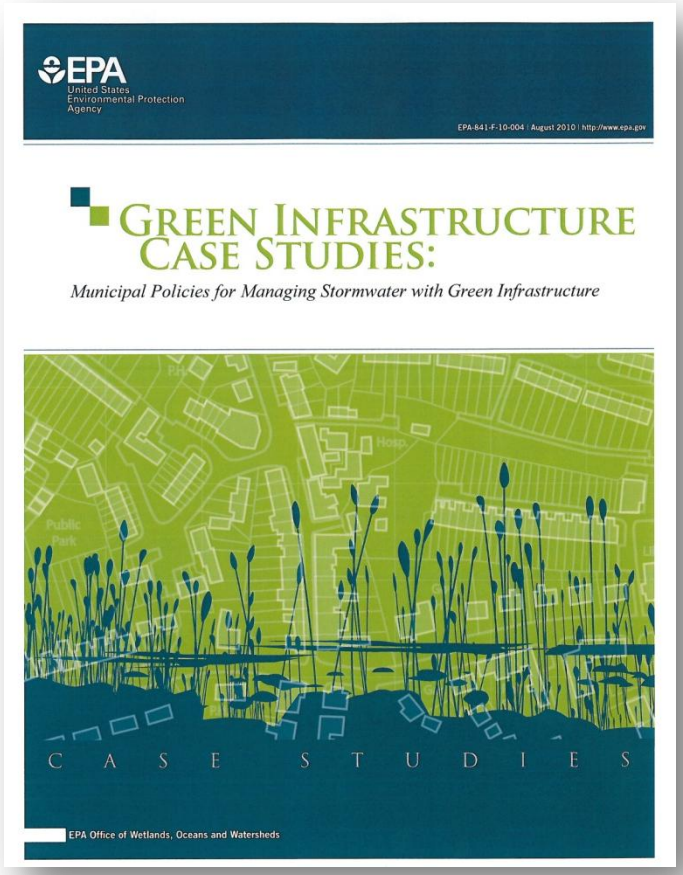
Policies for Implemenation

- First Step:
  - Stormwater Regulation
  - Development Codes
- Second Step:
  - Demonstration Projects
  - Education & Outreach
  - Incentives
- Third Step:
  - Capital Projects

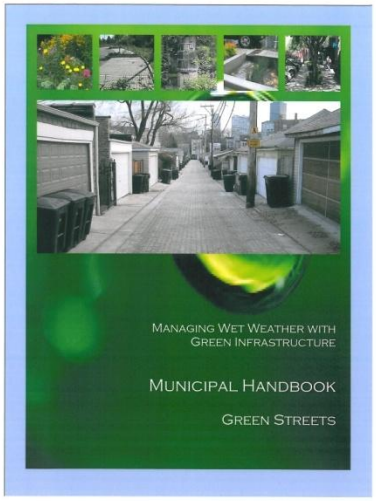


www.epa.gov/owow/NPS/lid/gi_case_studies_2010

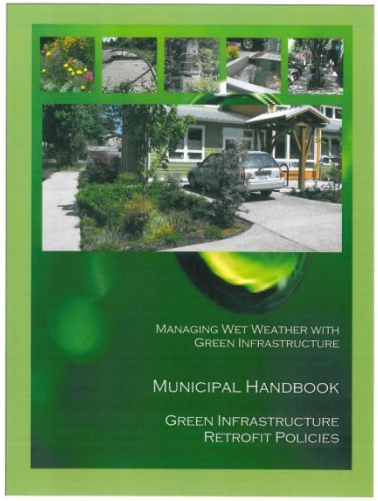
Policies for Implementation

- EPA Municipal Handbook Series: Managing Wet Weather with Green Infrastructure

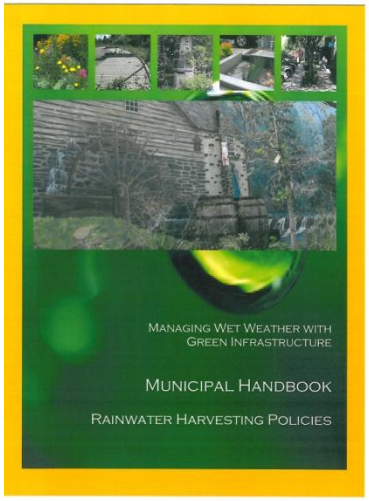
  www.cfpub.epa.gov/npdes/greeninfrastructure munichandbook.cfm



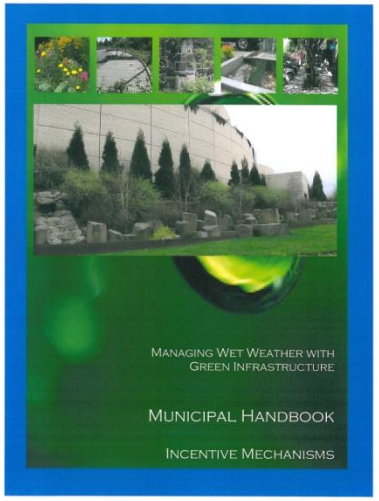
Green Streets



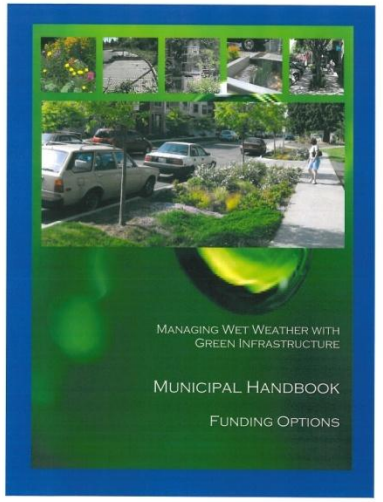
Retrofit Policies



Rainwater Harvesting Policies



Incentive Mechanisms



Funding Options

Tools & Resources

http://cfpub.epa.gov/npdes/home.cfm?program_id=298

Best Management Practice Selection Tool

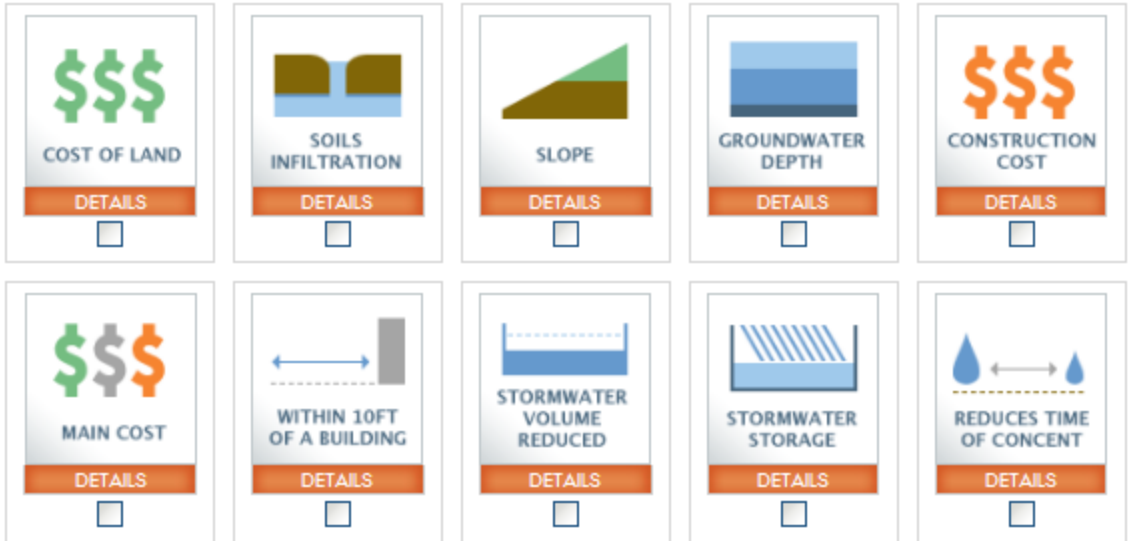
The BMP Selection Tool is intended to help educate site designers and developers about some of the important factors associated with the selection of post-construction stormwater BMPs for a given site. Volume control, groundwater protection, and pollution reduction are growing concerns in Central Indiana. Each of these, as well as other factors make some BMPs more applicable to certain sites and more successful tools for water quality protection.

Assumptions & Details Behind this Tool

To better understand the role of the various factors shown below as icons, click the 'Details' box. Information will appear to help you understand whether it is something you need/want to consider. If that factor is important to your goals, simply click the small box below to select it. A given BMPs ability to address that particular factor will be reflected by its presence/absence in the BMP remaining in the list on the right. Continue checking the boxes of other factors that represent your site conditions or objectives and watch the list narrow further. When you want to know more about a BMP that appears in the list, click on it. Fact sheet style information will appear for that BMP including some O&M guidance for that BMP. If you select a combination of factors that leads you to a very narrow list of BMPs or none at all, simply reconsider your selected factors and prioritize those that are most pressing. Try some different combinations – Enjoy and please be thoughtful about what you are designing!

PLEASE USE INTERNET EXPLORER WHEN USING THIS PROGRAM....

MAKE SELECTIONS | BMPS



BMP Choices

- Bioretention
- Bioretention with Underdrain
- Rain Gardens
- Rain Gardens with Underdrain
- Infiltration Basin
- Infiltration Basin with Underdrain
- Trench
- Trench with Underdrain
- Permeable Pavement
- Permeable Pavement with Underdrain
- Filter Strips

http://www.uwrwa.org/bmpTool/index.asp

Residential Rain Garden

M	User entered 'MEDIUM' maintenance level in Sheet 1.
P	User entered 'Professional' installation type in Sheet 1.
S	User entered 'Single Home' installation type in Sheet 1.
A	User entered 'Option A' Capital Cost Option in Sheet 2.

Site Name:

Site Location:

Date:

Cost Summary

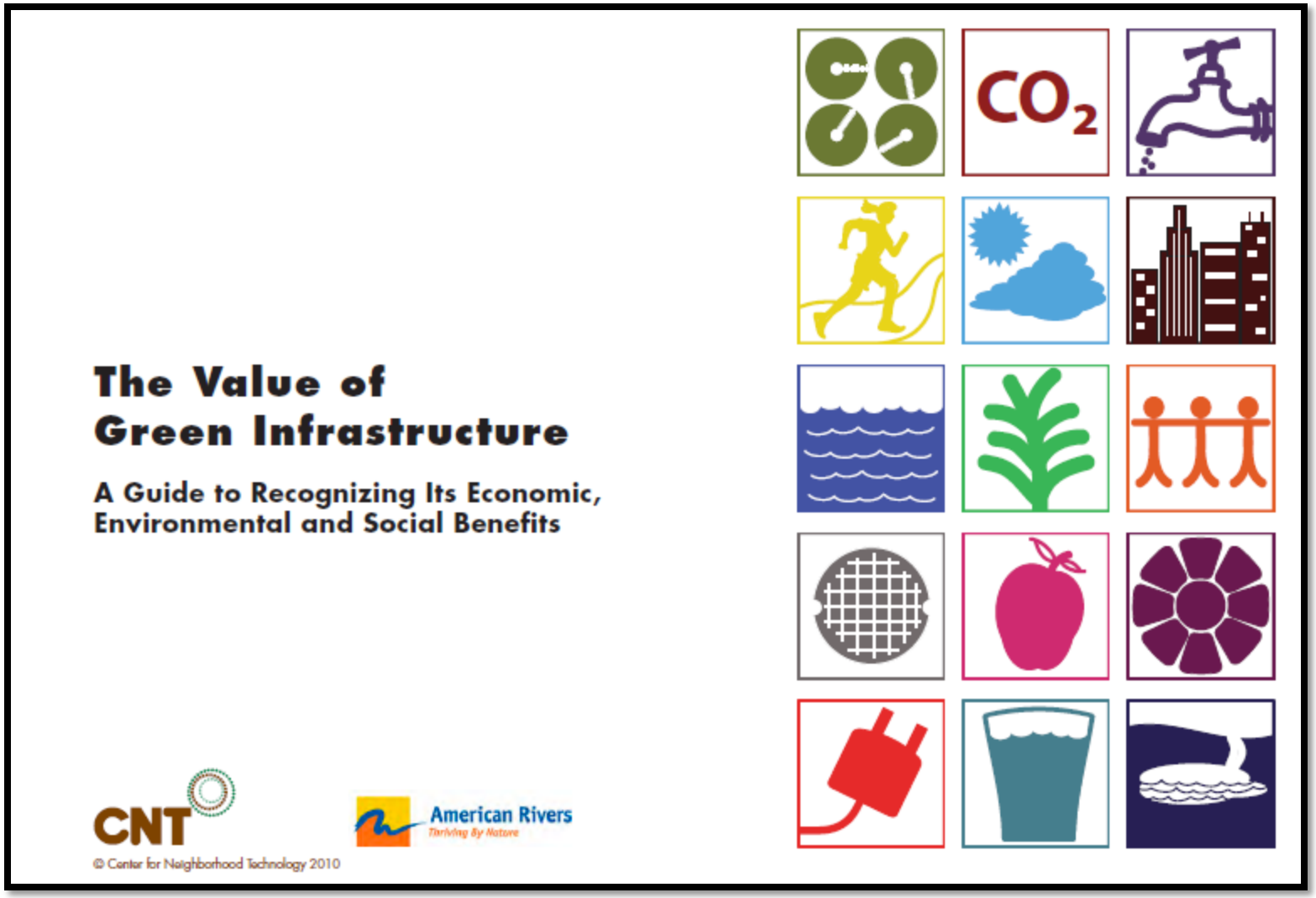
CAPITAL COSTS	Total Cost	Included in WLC Calculation: Model	User	Chosen option
Base Cost of Garden (rounded up to nearest $100)	$ 3,210	$ 3,210		$ 3,210
Associated Capital Costs	$ 572	$ 572		$ 572
Capital Costs		$ 3,782		$ 3,782

REGULAR MAINTENANCE ACTIVITIES	months between events	Cost per Event	Total Cost per Year	Included in WLC Calculation: Model	User	Chosen option
Vegetation Management	12	$72	$72	$72		$ 72.00
add additional activities if necessary	0	$0	0	$0		$ -
add additional activities if necessary	0	$0	0	$0		$ -
Totals, Regular Maintenance Activities				$72		$ 72.00

CORRECTIVE AND INFREQUENT MAINTENANCE ACTIVITIES (Unplanned and/or >3yrs. betw. events)	Years between Events	Cost per Event	Total Cost per Year Equivalent	Included in WLC: Model	User	Chosen option
Replace mulch	3	$336	$112	$112		$ 112.00
Till Soil	5	$224	$45	$45		$ 44.80
add additional activities if necessary	0	$0	$0	$0		$ -
Totals, Corrective & Infrequent Maintenance Activities				$157		$ 156.80

1.Design & Maintenance Options | 2.Capital Costs | 3.Maintenance Costs | **4.Cost Summary** | 5.Whole Life Costs | 6.Present Value

http://www.werf.org/AM/Template.cfm?Section=Stormwater3&TEMPLATE=/CM/ContentDisplay.cfm&CONTENTID=10836



http://www.americanrivers.org/assets/pdfs/reports-and-publications/the-value-of-green-infrastructure.pdf

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Questions?

Sheila McKinley, ASLA, AICP, CFM, LEED Green Associate

Christopher B. Burke Engineering, LLC.

smckinley@cbbel-in.com

317-266-8000