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
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
Stream Health

Percent Impervious Surface

- <5%
  - 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

- 5-10%
  - 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

- 10-20%
  - 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

- >20%
  - 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

<table>
<thead>
<tr>
<th>Practice</th>
<th>Reduces Stormwater Runoff</th>
<th>Improves Water Quantity</th>
<th>Improves Water Quality</th>
<th>Reduces Grey Infrastructure Needs</th>
<th>Reduces Flooding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green Roofs</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Tree Planting</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Bioretention &amp; Infiltration</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Permeable Pavement</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Water Harvesting</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
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
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”)

Diagram showing structural wall, downspout, hooded overflow, gravel or splash block, filter fabric, perforated pipe, foundation drain, structural footing, and pipe to approved disposal point.
Pollutant Removal

Pathogens, Oil & Grease (UV rays)

TSS, TP (filtration)

TN, TP, Metals (root zone)

Temp (storage)
# Storage & Pollutant Removal

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

<table>
<thead>
<tr>
<th></th>
<th>Sediment Buildup</th>
<th>Litter &amp; Debris</th>
<th>Pipe Clogging</th>
<th>Invasive Vegetation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Sand or Soil Filter</td>
<td>50%</td>
<td>30%</td>
<td>10%</td>
<td>0%</td>
</tr>
<tr>
<td>Infiltration Basin or Trench</td>
<td>36%</td>
<td>21%</td>
<td>10%</td>
<td>5%</td>
</tr>
<tr>
<td>Wet Pond</td>
<td>26%</td>
<td>19%</td>
<td>21%</td>
<td>10%</td>
</tr>
<tr>
<td>Underground Sediment Device</td>
<td>58%</td>
<td>21%</td>
<td>11%</td>
<td>0%</td>
</tr>
<tr>
<td>Rain Garden</td>
<td>33%</td>
<td>22%</td>
<td>7%</td>
<td>26%</td>
</tr>
<tr>
<td>Filter Strips or Swales</td>
<td>21%</td>
<td>26%</td>
<td>5%</td>
<td>26%</td>
</tr>
</tbody>
</table>
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
Clarian Cancer Center
- Indianapolis

Indianapolis Museum of Art
- Indianapolis

3 Mass Ave – Indianapolis

City Hall – Chicago
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 Implementation

- **First Step:**
  - Stormwater Regulation
  - Development Codes

- **Second Step:**
  - Demonstration Projects
  - Education & Outreach
  - Incentives

- **Third Step:**
  - Capital Projects
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
Managing Wet Weather with Green Infrastructure

Green Infrastructure

Managing Wet Weather with Green Infrastructure

Green infrastructure is an approach to wet weather management that is cost-effective, sustainable, and environmentally friendly. Green Infrastructure management approaches and technologies infiltrate, evaporate, capture and reuse stormwater to maintain or restore natural hydrologies. See examples of green infrastructure and design approaches.

At the largest scale, the preservation and restoration of natural landscape features (such as forests, floodplains and wetlands) are critical components of green stormwater infrastructure. By protecting these ecologically sensitive areas, communities can improve water quality while providing wildlife habitat and opportunities for outdoor recreation.

On a smaller scale, green infrastructure practices include rain gardens, porous pavements, green roofs, infiltration planters, trees and tree boxes, and rainwater harvesting for non-potable uses such as toilet flushing and landscape irrigation.

- Green Infrastructure Case Studies: Municipal Policies for Managing Stormwater with Green Infrastructure (PDF) (76 pp, 8.23MB)
- Green Infrastructure in Arid and Semi-Arid Climates (PDF) (9 pp, 1.3MB)
- Green Jobs Training: A Catalog of Training Opportunities for Green Infrastructure Technologies (PDF) (52 pp, 538K) - September 2010 edition

Updating Local Codes to Cultivate Green Infrastructure and Foster Sustainable Stormwater Management:

This 2 hour webcast was presented by EPA Region 6 on December 13, 2011. The webcast describes the interaction of zoning and building codes with water quality; presents several examples of code audits conducted in Illinois, Ohio, and Minnesota; and highlights the top ten obstacles to green infrastructure adoption.

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.

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 BMP's 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....

http://www.uwrwa.org/bmpTool/index.asp
### Residential Rain Garden

<table>
<thead>
<tr>
<th>Cost Summary</th>
<th>Total Cost</th>
<th>Included in WLC Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CAPITAL COSTS</strong></td>
<td></td>
<td>Model</td>
</tr>
<tr>
<td>Base Cost of Garden</td>
<td>$3,210</td>
<td>$3,210</td>
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<tr>
<td>Associated Capital Costs</td>
<td>$572</td>
<td>$572</td>
</tr>
<tr>
<td><strong>Capital Costs</strong></td>
<td>$3,782</td>
<td>$3,782</td>
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</table>

<table>
<thead>
<tr>
<th>REGULAR MAINTENANCE ACTIVITIES</th>
<th>months between events</th>
<th>Cost per Event</th>
<th>Total Cost per Year</th>
<th>Included in WLC Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetation Management</td>
<td>12</td>
<td>$72</td>
<td>$72</td>
<td>$72</td>
</tr>
<tr>
<td>add additional activities if necessary</td>
<td>0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Totals, Regular Maintenance Activities</td>
<td></td>
<td>$72</td>
<td></td>
<td>$72</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>CORRECTIVE AND INFREQUENT MAINTENANCE ACTIVITIES (Unplanned and/or &gt;3yrs. betw. events)</th>
<th>Years between Events</th>
<th>Cost per Event</th>
<th>Total Cost per Year Equivalent</th>
<th>Included in WLC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replace mulch</td>
<td>3</td>
<td>$336</td>
<td>$112</td>
<td>$112</td>
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<tr>
<td>add additional activities if necessary</td>
<td>0</td>
<td>$0</td>
<td>$0</td>
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<tr>
<td>Totals, Corrective &amp; Infrequent Maintenance Activities</td>
<td></td>
<td>$157</td>
<td>$157</td>
<td>$157</td>
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</tbody>
</table>

http://www.werf.org/AM/Template.cfm?Section=Stormwater3&TEMPLATE=/CM/ContentDisplay.cfm&CONTENTID=10836
The Value of Green Infrastructure
A Guide to Recognizing Its Economic, Environmental and Social Benefits

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Questions?

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