Overcoming Barriers to Implementation of LID Practices

2011 LID Symposium

Maintenance | Costs | Benefits in Developed Areas
Outline

- Working under difficult conditions
- Cost
- Maintenance
- Delayed approvals
Understanding LID Practices – It Is Not Just Infiltration

- Mimic predevelopment hydrology
- Pollutant removal mechanisms:
  - Detention
  - Evapotranspiration
  - Filtration
  - Reuse
  - Infiltration

- TSS
- TP
- Temp
- TN
- Pathogens
- Metals
- Oil & Grease
Improving Understanding Through “Multifunctional Landscapes” = Green Infrastructure in Public Spaces
Difficult Condition: Cold Climates

- Design and maintenance considerations can overcome most cold conditions
- When it is warm enough to rain, it is warm enough to drain
Bioretention: Cold Weather Climate Considerations

- Good drainage!
- Sandy course media
- Combination filtration / infiltration
- Provide extra surface storage
- Larger surface area
- Selection of plants
- Proper location and use
- Reduced salt or use alternative deicers
- Ground water levels
- Maintenance
Permeable Pavement: Cold Weather Considerations

- Make sure pavement system drains
- “Protect” drainage lines if need be
- Maintain Pavement
- Several permeable pavement applications in cold regions
  - University of Guelph, City of Toronto, Penn State University, Villanova U., Walden Pond (Mass)
- Adjust snow plow
  - Pavement-scraping plow blade “tears up” permeable pavement
- Avoid applying sand on pavement
Difficult Conditions: Arid Climates

- Water rights
- Sustainable vegetation
- All the rain falls during one small period of time
- Overcome by available resources and the retention, detention, and water quality benefits of LID practices
Difficult Conditions: Tight/Clay soils

- Infiltration is reduced, but to what level?
- Occlusions in soils will prevent infiltration
- Overcome with site inspections and creative designs
- More permeable layers may be deeper
Design for Tight Soils

Traditional Design

- Include underdrains where Ksat < 0.5 in/hr
- Underdrains provide a reliable discharge
  - Ensure that system drains between storms
  - Minimize vector concerns
- Can include an elevated underdrain

New Directions

- Increasing regulatory emphasis on maximizing volume reduction in bioretention
- Using an underdrain can “short-circuit” infiltration
- However, marginal soils may be more susceptible to clogging and compaction
Option 1: Elevated Underdrains
Design for Tight Soils

Option 2: Large Surface Area

- Large ratio of infiltration footprint to tributary area
- Shallow ponding depth
- Soil amendments and vegetation
Overcoming Cost as a Barrier

- Perception: LID practices cost more to install and maintain than conventional practices

- Overcoming ideas:
  - Communicating the benefits of LID through studies based on lessons learned
  - Identify and implement reliable and dedicated funding sources
    - Stormwater utilities
    - Watershed improvement districts
Overcoming the Cost Barrier

- **EPA Study**
  - Fact sheet and study available on nonpoint source website
  - Seventeen case studies demonstrate LID practices can reduce project costs and improve environmental performance
### Table 2. Summary of Cost Comparisons Between Conventional and LID Approaches

<table>
<thead>
<tr>
<th>Project</th>
<th>Conventional Development Cost</th>
<th>LID Cost</th>
<th>Cost Difference</th>
<th>Percent Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd Avenue SEA Street</td>
<td>$868,803</td>
<td>$651,548</td>
<td>$217,255</td>
<td>25%</td>
</tr>
<tr>
<td>Auburn Hills</td>
<td>$2,360,385</td>
<td>$1,598,989</td>
<td>$761,396</td>
<td>32%</td>
</tr>
<tr>
<td>Bellingham City Hall</td>
<td>$27,600</td>
<td>$5,600</td>
<td>$22,000</td>
<td>80%</td>
</tr>
<tr>
<td>Bellingham Bloedel Donovan Park</td>
<td>$52,800</td>
<td>$12,800</td>
<td>$40,000</td>
<td>76%</td>
</tr>
<tr>
<td>Gap Creek</td>
<td>$4,620,600</td>
<td>$3,942,100</td>
<td>$678,500</td>
<td>15%</td>
</tr>
<tr>
<td>Garden Valley</td>
<td>$324,400</td>
<td>$260,700</td>
<td>$63,700</td>
<td>20%</td>
</tr>
<tr>
<td>Kensington Estates</td>
<td>$765,700</td>
<td>$1,502,900</td>
<td>–$737,200</td>
<td>-96%</td>
</tr>
<tr>
<td>Laurel Springs</td>
<td>$1,654,021</td>
<td>$1,149,552</td>
<td>$504,469</td>
<td>30%</td>
</tr>
<tr>
<td>Mill Creek&lt;</td>
<td>$12,510</td>
<td>$9,099</td>
<td>$3,411</td>
<td>27%</td>
</tr>
<tr>
<td>Prairie Glen</td>
<td>$1,004,848</td>
<td>$599,536</td>
<td>$405,312</td>
<td>40%</td>
</tr>
<tr>
<td>Somerset</td>
<td>$2,456,843</td>
<td>$1,671,461</td>
<td>$785,382</td>
<td>32%</td>
</tr>
<tr>
<td>Tellabs Corporate Campus</td>
<td>$3,162,160</td>
<td>$2,700,650</td>
<td>$461,510</td>
<td>15%</td>
</tr>
</tbody>
</table>

- **a** The Central Park Commercial Redesigns, Crown Street, Poplar Street Apartments, Prairie Crossing, Portland Downspout Disconnection, and Toronto Green Roofs study results do not lend themselves to display in the format of this table.
- **b** Negative values denote increased cost for the LID design over conventional development costs.
- **c** Mill Creek costs are reported on a per-lot basis.

Just Some of the Cities Incorporating Green Approaches

- Washington, DC
- Chicago, IL
- Philadelphia, PA
- Kansas City, MO
- Pittsburgh, PA
- Milwaukee, WI
- Portland, OR
- Omaha, NE
- Seattle, WA
Historically this is a real problem due to the dispersion of many small practices instead of few larger conventional practices.

Overcome by establishing agreements, regulations, and funding sources to ensure inspection and maintenance.
Conventional Development

Centralized Pipe and Pond Control
Multiple Systems

Disconnected
Decentralized
Distributed
Multi-functional
Water Use

LID Development

Conservation
Minimization
Soil Amendments
Open Drainage
Rain Gardens
Rain Barrels
Pollution Prevention

Disconnected Decentralized Distributed Multi-functional Water Use
- Descriptions and Maintenance of Treatment BMPs
- County Maintenance
- Flood Control District, Conservation District, State or Federal Agency (County Requires Funding)
- Subsequent Owners (Backup Agreement w/Developer)
- **County Service Area or Assessment District**
  (SW Utility)

- **Lease Agreement**
  (County Holds Title Leased to Other Party)

- **Conditional Use Permits Include Maintenance**

- **“Type” Depends on Categories and Maintenance Generally Required**

[www.sdcfcd.org/annrain.html](http://www.sdcfcd.org/annrain.html)
Delays in Approvals as a Barrier

- Delays in project/construction = $$$$$ and are of great concern to owners and contractors
- Delays due to LID Practices proposed are often identified as barriers to their use
- Overcome by demonstrating benefits of LID including costs and increasing awareness at all levels
Houston’s LID Competition

- Consciousness-raising process
- Goal to accelerate adoption, adaption, and implementation of LID
- Three projects-teams submit LID plans for one or more
- Must include licensed CE, Architect, and Landscape Architect
- 22 teams, 48 firms, >225 professionals
Houston Results

- Three awards only part of the picture
- Participants impressed by their own analysis
  - LID practices can in fact manage most SW events on site and replace conventional
  - LID is cheaper and provides attractive features = No-Brainer
The AWC is responsible for revitalization of lands along the river and coordinating environmental and programming initiatives that promote river clean up.

Proposed 1-inch on-site retention standard for new development and re-development.

Stated preference for vegetated controls.
**Landscaping with Rain Gardens**

**Soaking It All In**

In front of you is a Rain Garden, also called a bioretention cell, designed to act as a sponge and to filter stormwater runoff. It has specially selected soils and plants that are both water and drought tolerant. Rain gardens are designed to mimic natural processes in forests or meadows where rainfall is evaporated, taken up by plants or drained into the soil. Rain gardens are simple to build and can be installed in residential yards, schools, parks, parking lots, along roads – almost anywhere.

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**Rain Gardens are Constructed in Layers with Different Materials**

- To construct a rain garden, an area is excavated and partially filled with gravel.
- Growing media composed of sand and planting soil is installed over the gravel and then protected with a layer of mulch.
- Plants are added to maintain soil porosity, take up water, and treat pollutants.
- Plants should be selected that are hardy and can tolerate wet and dry soils; as well

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Summary: Overcoming LID Barriers

- Improved communication of LID Benefits
- Good design and construction practices
  - Design applicable to local conditions
  - Follow through
- Share lessons learned