Minimal Impact Design Standards

Welcome

Please tell us briefly:

How do you deal with stormwater in your job?

What is one stormwater related challenge you face?

wq-strm1-08
**Minimal Impact Design Standards**

Ordinance Package

Performance Goal

Calculation Methodologies for a Menu of Techniques
MIDS is not...

- Permit or Rule Update
- Mandatory Stormwater Standards
- Prescriptive Design Approach
The Challenge

We need consistent performance standards and matching calculation methods to enable practitioners and regulators to use innovative structural and non-structural BMPs in a manner similar to stormwater ponds.

Minnesota Cities Stormwater Coalition
The Challenge

We need coordination and synchronization of coverage under federal and state regulatory programs.

MCSC and others
The Challenge

We need more flexibility in design to give credit for a wide variety of structural and non-structural BMPs.

Builders Association of Minnesota
The Challenge

Water resources are continuing to degrade. We need a better system to protect and restore our urban and urbanizing systems.

Environmental and Natural Resource Groups
Other Considerations

Integrate MIDS process with State Stormwater Manual Update

State Stormwater Steering Committee
Other Considerations

Recognize the importance of Cost-Effectiveness and long term maintenance
Other Considerations

*Training and Education are critical to the success of this project*
How did MIDS come about?
Stormwater Standards and Credits to Protect Water Quality

- Minimal Impact Design Standards
- SF 1892
- HF 2133

Stormwater discharges management standards and appropriation
New State Legislation

(c) The agency shall develop performance standards, design standards, or other tools to enable and promote the implementation of low-impact development and other stormwater management techniques. For the purposes of this section, "low-impact development" means an approach to storm water management that mimics a site's natural hydrology as the landscape is developed. Using the low-impact development approach, storm water is managed on-site and the rate and volume of predevelopment storm water reaching receiving waters is unchanged. The calculation of predevelopment hydrology is based on native soil and vegetation.

Minnesota Statutes 2009, section 115.03, subdivision 5c
Typical pre-development conditions:

Natural Watershed

- 40% up
- 50% down
- 10% down
Typical post-development conditions

Urban Watershed
Stormwater Management

Infiltration

Conveyance

Filtration

Storage
National Urban Runoff Program

- Technical studies that compiled data about urban runoff
- Resulted in treatment recommendations and easy to apply standards for design and review
- Led to proliferation of ponds
National Urban Runoff Program

NURP: Our main tool for stormwater controls

1983
Past practices...have been ineffective at protecting water quality in receiving waters and only partially effective in meeting flood control requirements
How do you make this... 300-600 ppb TP

function like this? 20-50 ppb TP
“Stormwater control measures that harvest, infiltrate, and evaporate stormwater are critical to reducing the volume and pollutant loading of small storms.”
Low Impact Development
(and redevelopment/retrofits)

Conserve Natural Areas and maintain natural drainage patterns

Minimize development impacts

Keep soils healthy

Treat stormwater at the source
Multifunctional, Multiple Benefits

From Ferguson et al., Stormwater magazine July 2001
Engineered
The MI DS Project

• Phase I - Funding ($480,000) through 2012 by Legislation and EPA
  - New Residential Development & Redevelopment
  - Administered by MPCA
  - Stakeholder Input:
    • Final Workplan Development
    • Ongoing Throughout Process

• Phase II+
  - Commercial Development & Redevelopment
  - Linear Projects
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Performance Goal

Calculation Methodologies for a Menu of Techniques
**Minimal Impact Design Standards**

**Performance Goal**

- Rate and volume control to mimic natural hydrology
- Most likely: 2 - 5 year storm event
- Based on native soils and vegetation
- No loss of water quality for new development
- Regional and site-specific constraints will be considered

**Graph: Minneapolis/St. Paul Int. Airport Rainfall Data**

- 99% of events
- 97% of volume

**Legend:**
- Red line: Rainfall Depth/Volume
- Blue line: Percentile Frequency
**Minimal Impact Design Standards**

**Performance Goal**

Pre-development runoff quality and quantity

Clean Water Act requires state to adopt and implement nondegradation for:

Protection of existing uses

Protection of high quality waters (waters where water quality is better than the standard)

Protection of exceptional waters - Outstanding National resource waters (ONRWs/ORVWs)

Nondegradation = Antidegradation
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Performance Goal

Pre-development runoff quality and quantity

- Designed to meet anti-degradation and outstanding resource value waters (ORVW) requirements

- MIDS would also assist with determination of load reductions for Total Maximum Daily Load compliance

- Provides clarity to communities
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Performance Goal

Calculation Methodologies for a Menu of Techniques
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Menu of Techniques

- State of the Art Review – full range of stormwater techniques
- Standardized calculation methodologies
- Credits system

To be determined with stakeholder input
Nonstructural LID Tools

• Ordinances
  - Subdivision requirements
  - Stormwater
  - Zoning and land use

• Information/education
  - Citizen engagement
  - Marketing programs
  - Trainings and workshops

• O&M
  - Street sweeping
  - Turf management
  - Pollution prevention
Nonstructural LID Tools

• Planning/ Design
  – Cluster Development, Conservation Design
  – Minimize total disturbed area
  – Protect natural flow pathways
  – Protect riparian buffer areas
  – Protect sensitive areas
  – Reduce impervious areas
  – Impervious disconnection
LI D Structural BMPs

- Infiltration practices
  - Biorention (rain gardens, urban forestry)
  - Infiltration trenches
  - Detention basins with infiltration design
- Vegetated swales, filter strips, biofiltration
- Vegetation: native landscaping, trees (uptake and evapotranspiration)
- Green Roofs
- Capture / Reuse (cisterns, rain barrels, ponds)
- Permeable hard surfaces (pavers, roads, parking, driveways, sidewalks)
- Landscaping Soil Quality: protection or restoration (amendments, de-compaction)
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Calculation Methods

- Designers need a calculation methodology they can work with.
- A good calculation methodology for ponds has supported the use of that technique.
- We need to apply the same principle to the full range of desired techniques.

To be applied to a full range of techniques.
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**Calculation Methods**

To be applied to a full range of techniques

- Format of final calculation methods has yet to be determined
- Stakeholder input will be critical
- Possible formats include spreadsheets, CN, model inputs, and other approaches
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Performance Goal

Calculation Methodologies for a Menu of Techniques
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To implement credits and goals at the local level

Zoning

Erosion and Sediment Control

Tree, Slope, Wetland Protection

Subdivision

Stormwater Management

Community Programs
MIDS is not...

Permit or Rule Update

Mandatory Stormwater Standards

Prescriptive Design Approach
The Good Life In Minnesota
Gov. Wendell Anderson

Carrol Henderson
MIDS: Diverse Needs & How to Best Address?

- City planners
- Public works staff
- Decision makers
- Developers
- Design engineers
- Reviewers
- Landowners
- Public
MIDS: Top Requests

- Spreadsheet - calculate pre and post rates and volumes Virginia
- Credits for TMDLs, Nondegradation
- Assessment procedure to calculate removal rates for BMPs in series P8
- Inventory of proposed land surface types, potential BMPs. Typical design criteria used to generate an estimate of capital costs and ongoing maintenance costs for each BMP. “Modular Stormwater Management Tool for LID Site Planning” – Contech Stormwater Solutions and Walker Engineering out of California.
MIDS: Potential Products

• Visioning software: GIS linked
• P8, Hydrocad, GIS
• Better costs & benefits, operation and maintenance for BMPS and downstream water bodies
Concept of Credits

• Incentive to encourage stormwater management:
  – Reduction in volume (and hence loads)
  – Preserving landscape features
  – Allowing more intense development

• Volume and/or load (mass balance) credits for TMDL or nondegradation
Credits

- Relatively simple to calculate
- Easy to review
- Field verifiable

- In Stormwater Manual: associated with 6 better site designs
Credits: Existing SW Manual

- Natural area conservation
- Site reforestation, prairie restoration
- Drainage to stream or shoreline buffers
- Impervious Cover disconnection
- Rooftop disconnection
- Grass channels
MIDDS: Examples

- Virginia’s
  - Technology approach. MS4 BMPs based on impervious cover
    - 16% to 21% impervious – options are vegetated filter strip or grassed swale
    - 22% to 37% imp. – options are extended detention, constructed wetlands etc…).
  - P Performance approach used simple method to calculate pre and post loads (must match) P removal efficiencies provided.
### Drainage Area A Land Cover (acres)

<table>
<thead>
<tr>
<th></th>
<th>A soils</th>
<th>B Soils</th>
<th>C Soils</th>
<th>D Soils</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest/Open Space (acres) --</td>
<td>0.00</td>
<td>0.00</td>
<td>0.28</td>
<td>0.00</td>
<td>0.28</td>
</tr>
<tr>
<td>undisturbed, protected</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>forest/open space or reforested</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>land</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Managed Turf (acres) --</td>
<td>0.00</td>
<td>0.00</td>
<td>0.73</td>
<td>0.00</td>
<td>0.73</td>
</tr>
<tr>
<td>disturbed, graded</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>for yards or other turf to be</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>mowed/managed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impervious Cover (acres)</td>
<td>0.00</td>
<td>0.00</td>
<td>1.15</td>
<td>0.00</td>
<td>1.15</td>
</tr>
</tbody>
</table>

**Total**                        |         |         |         |         | 2.16   

### Apply Runoff Reduction Practices to Reduce Treatment Volume & Post-Development Load in Drainage Area A

<table>
<thead>
<tr>
<th>Credit</th>
<th>Unit</th>
<th>Description of Credit</th>
<th>Credit</th>
<th>Credit Area (acres) (cf for Credit 2.f)</th>
<th>Volume from Upstream RR Practice (cf)</th>
<th>Runoff Reduction (cf)</th>
<th>Remain Run Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Green Roof</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1a. Green Roof #1</td>
<td>acres of green roof</td>
<td>45% runoff volume reduction</td>
<td>0.45</td>
<td>0.00</td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1b. Green Roof #2</td>
<td>acres of green roof</td>
<td>60% runoff volume reduction</td>
<td>0.60</td>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2. Impervious Surface Disconnection</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2a. Simple Disconnection to A/B Soils</td>
<td>impervious acres disconnected</td>
<td>50% runoff volume reduction for treated area</td>
<td>0.50</td>
<td>0.00</td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
# 2. Impervious Surface Disconnection

## 8. Extended Detention Pond

<table>
<thead>
<tr>
<th>8.a. ED #1</th>
<th>8.b. ED #2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impervious acres draining to ED</td>
<td>Impervious acres draining to ED</td>
</tr>
<tr>
<td>3% runoff volume reduction</td>
<td>15% runoff volume reduction</td>
</tr>
<tr>
<td>0.60</td>
<td>0.15</td>
</tr>
</tbody>
</table>

## 9. Sheetflow to Conservation Area or Filter Strip

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Impervious acres draining to conserved open space</td>
<td>Impervious acres draining to conserved open space</td>
</tr>
<tr>
<td>75% runoff volume reduction</td>
<td>50% runoff volume reduction</td>
</tr>
<tr>
<td>0.75</td>
<td>0.50</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>9.c. Sheetflow to Vegetated Filter Strip in A/E soils or Amended C/D soils</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turf acres draining to conserved open space</td>
</tr>
<tr>
<td>50% runoff reduction volume for treated area</td>
</tr>
<tr>
<td>0.50</td>
</tr>
</tbody>
</table>

### Total Phosphorous Removal Required (lb/yr)

<table>
<thead>
<tr>
<th>TOTAL PHOSPHORUS REMOVAL REQUIRED (lb/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>225</td>
</tr>
</tbody>
</table>

### Total Runoff Reduction (cf)

<table>
<thead>
<tr>
<th>TOTAL RUNOFF REDUCTION (cf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1573</td>
</tr>
</tbody>
</table>

### Phosphorus Removal (lb/yr)

<table>
<thead>
<tr>
<th>PHOSPHORUS REMOVAL (lb/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>150</td>
</tr>
</tbody>
</table>

### Adjusted Post-Development Phosphorus Load (TP) (lb/yr)

<table>
<thead>
<tr>
<th>ADJUSTED POST-DEVELOPMENT PHOSPHORUS LOAD (TP) (lb/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.4</td>
</tr>
</tbody>
</table>

### Additional Phosphorous Load Reduction Needed (lb/year) Based on 0.28 lb/ac/year Loading Rate Target

<table>
<thead>
<tr>
<th>ADDITIONAL PHOSPHOROUS LOAD REDUCTION NEEDED (lb/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.76</td>
</tr>
</tbody>
</table>
# Post-Construction Water Balance Calculator

## Project Information

<table>
<thead>
<tr>
<th>Cell</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A2</td>
<td>User may make changes from any cell that is orange or brown in color (similar to the cells to the immediate right). Cells in green are calculated for you.</td>
</tr>
</tbody>
</table>

## Runoff Calculations

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>If you know the 85th percentile storm event for your location enter it in the box below.</td>
</tr>
<tr>
<td>1b</td>
<td>If you cannot answer 1a then select the county where the project is located (click on the cell to the right for drop-down). This will determine the average 85th percentile 24 hr. storm event for your site, which will appear under precipitation to left.</td>
</tr>
<tr>
<td>1c</td>
<td>If you would like a more precise value select the location closest to your site. If you do not recognize any of these locations, leave this drop-down menu at location. The average value for the County will be used.</td>
</tr>
</tbody>
</table>

### Project Name

Optimal

### Water Discharge Identification (WDID)

Optimal

### Date

Optimal

### Sub Drainage Area Name (from map)

Optimal

### Runoff Curve Numbers

<table>
<thead>
<tr>
<th>Unit</th>
<th>Sq Ft</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Group C Soils

Low infiltration. Sandy clay. Infiltration rate 0.05 to 0.15 when wet.

### Wood & Grass

<50% ground cover

### Lawn, Grass, or Pasture

Covering more than half of the open space

Complete Either:

<table>
<thead>
<tr>
<th>Unit</th>
<th>Acres</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proposed Development Pervious Runoff Curve Number</td>
<td>74</td>
<td>(Step 6) Sub-watershed Area:</td>
</tr>
<tr>
<td>-------------------------------------------------</td>
<td>----</td>
<td>-------------------------------</td>
</tr>
<tr>
<td><strong>Design Storm</strong></td>
<td></td>
<td><strong>Percent of total project</strong></td>
</tr>
<tr>
<td>Based on the County you indicated above, we have included the 85 percentile average 24 hr event - 0.62 in (in)* for your area.</td>
<td>0.62</td>
<td><strong>in</strong></td>
</tr>
<tr>
<td>The Amount of rainfall needed for runoff to occur (Existing runoff curve number - P from existing RCN (in)*)</td>
<td>0.44</td>
<td><strong>in</strong></td>
</tr>
<tr>
<td>P used for calculations (in) (the greater of the above two criteria)</td>
<td>0.62</td>
<td><strong>in</strong></td>
</tr>
</tbody>
</table>

*Available at www.cabohandbooks.com

<table>
<thead>
<tr>
<th><strong>Sub-watershed Conditions</strong></th>
<th><strong>Complete Either</strong></th>
<th><strong>Calculated Acres</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-watershed Area (acres)</td>
<td>Sq Ft</td>
<td>Acres</td>
</tr>
<tr>
<td>Existing Rooftop Impervious Coverage</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Existing Non-Rooftop Impervious Coverage</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Proposed Rooftop Impervious Coverage</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Proposed Non-Rooftop Impervious Coverage</td>
<td>0</td>
<td>0.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Credits</strong></th>
<th><strong>Acres</strong></th>
<th><strong>Square Feet</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Porous Pavement</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td><strong>Tree Planting</strong></td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td><strong>Downspout Disconnection</strong></td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td><strong>Impervious Area Disconnection</strong></td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td><strong>Green Roof</strong></td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td><strong>Stream Buffer</strong></td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td><strong>Vegetated Swales</strong></td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td>0.00</td>
<td>0</td>
</tr>
</tbody>
</table>

**Subtotal Runoff Volume Reduction Credit** | 0 Cu. Ft. |
<table>
<thead>
<tr>
<th>Description</th>
<th>Credits</th>
<th>Acres</th>
<th>Square Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Porous Pavement</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Tree Planting</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Downspout Disconnection</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Impervious Area Disconnection</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Green Roof</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Stream Buffer</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Vegetated Swales</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td>0.00</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Subtotal Runoff Volume Reduction Credit</strong></td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Volume (cubic feet)</strong></td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Rain Barrels/Cisterns</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Soil Quality</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Subtotal Runoff Volume Reduction Credit</strong></td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total Runoff Volume Reduction Credit</strong></td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

You have achieved your minimum requirements.
Stormwater Best Management Practice (BMP) Handbooks

The California Stormwater Best Management Practice Handbooks have provided excellent guidance to the stormwater community since their publication by the Stormwater Quality Task Force (SWQTF) in 1993. The SWQTF became the California Stormwater Quality Association (CASQA) in 2002 and in 2003 CASQA published an updated and expanded set of four BMP Handbooks. These Handbooks reflect the current practices, standards, and significant amount of knowledge gained since the early 90s about the effectiveness of BMPs. For additional information, please visit the [CASQA](http://www.casqa.org) website.

Click on the links below to view and download the individual handbooks.

This website has been updated for access to the 2004 Errata of the Handbooks.

The California Stormwater Quality Association (CASQA) is an independent advisory group. The statements, views, and contents of this site do not necessarily reflect those of the State Water Resources Control Board or the Regional Water Quality Control Boards.

New Development and Redevelopment

Construction

Industrial and Commercial

Municipal

Purchase BMP Handbooks by mailing a completed [Order Form](http://www.casqa.org/orderform.pdf) with payment by check or purchase order

OR

Click this link to purchase by [Credit Card or Electronic Check](http://www.casqa.org/orderform.pdf).

Interested in training related to the CASQA BMP Handbooks? Through an agreement with CASQA, the Office of Water Programs of the California Department of Fish and Wildlife has developed training modules that cover the BMP Handbooks. You must register at the [Casqa Website](http://www.casqa.org) to access the modules.
Storm Water Program

2009-0009-DWQ CONSTRUCTION GENERAL PERMIT (NOT EFFECTIVE UNTIL JULY 1, 2010)

- Response to Significant Comments
- Adopted Order 2009-0009-DWQ
  - Complete download with Attachments and Appendices
  - Fact Sheet
  - Order
  - Attachment A – Linear Underground/Overhead Requirements
  - Attachment A 1 – LUP Type Determination
  - Attachment A 2 – LUP Permit Registration Documents
  - Attachment B – Permit Registration Documents
  - Attachment C – Risk Level 1 Requirements
  - Attachment D – Risk Level 2 Requirements
  - Attachment E – Risk Level 3 Requirements
  - Attachment F – Active Treatment System (ATS) Requirements
  - Appendix 1 – Risk Determination Worksheet (PDF | Excel)
    - 303(d) List
  - Appendix 2 – Post-Construction Water Balance Performance Standard
California Non-structural Practices Available for Crediting

- Porous Pavement
- Tree Planting
- Downspout Disconnection
- Impervious Area Disconnection
- Green Roof
- Stream Buffer
- Vegetated Swales
- Rain Barrels and Cisterns
- Landscaping Soil Quality
## Costs

<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>$1,598,909</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(^c)</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>

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

In all cases, LID provided other benefits that were not monetized and factored into the project bottom line.
Minimal Impact Design Standards

Stakeholder Input Meeting

October 29, 2009 - Plymouth, MN