Towar Rain Garden Drains
A Low-Impact Urban Retrofit

Patrick E. Lindemann
INGHAM COUNTY DRAIN COMMISSIONER
Towar Gardens neighborhood:
• Approximately 200-acre area
• Over 400 single-family homes & several multi-family and commercial developments
• Affordable housing
• Platted originally in 1920s-1940s
• 40% Impervious
Towar Gardens developed over the years with no organized drainage system for collection or conveyance of stormwater which resulted in widespread and longstanding flooding.

Flooding along Roadways – Roads in Poor Repair & Impassable at Times
Standing water would remain for days after 30-minute rainfall or less than one-year storms resulting in loss of use of private property and unhealthy conditions.
Why LID for Towar Gardens?

- Allowed for feasibly overcoming site constraints
  - Flat, low-lying topography with poorly-drained soils
  - Narrow rights-of-way with multiple utility conflicts
  - Rear yards lower than front yards
  - Downstream outlet elevation limitations for gravity flow
  - Lack of available land for detention w/o removing affordable housing
- Cost of conventional system was prohibitive for 400 modest homes ($20 million vs. $9.8 million)
- Met NPDES Phase II requirements
Savings $11,000,000.00
Full time Maintenance Person
$35,000.00
Number of Years 314
What are the Towar Rain Garden Drains?

- 200-acre watershed
- 10-year pipe design; 100-year detention design
- 8.25 miles of drain constructed
  - Collection and treatment system: underdrained rain gardens and roadside ditches (150 rain gardens/5.6 acres)
  - Conveyance system: roadway concrete drain pipes (none larger than 24”)

Patrick E. Lindemann
INGHAM COUNTY DRAIN COMMISSIONER
Overall System Treatment Train
Roadside Rain Gardens

- Underdrained infiltration bed with amended soil profile overlay
- Small, most 400 to 4,000 square feet
  - 6” topsoil/compost
  - 6” sand (geotextile fabric separating aggregate)
  - 12” aggregate
  - 12” underdrain (perforated dual wall HDPE, non-wrapped)
- Overflow weir
Rear Yard Rain Gardens

- Underdrained infiltration bed with amended soil profile overlay
- Large, most 0.10 to 0.50 acres
  - 6” topsoil/compost
  - 6” sand (geotextile fabric separating aggregate)
  - 12” aggregate
  - 12” underdrain on most (perforated dual wall HDPE, non-wrapped)
Rain Garden Planting Facts
- 111 pounds of wildflower seeds (95 species)
- 52,000 perennial forbs (125 species)
- 36,000 cubic yards of compost
- 51,000 cubic yards of topsoil

Note: 1,100 trees & shrubs (52 species)
Project Constructed March 2006 – December 2007

So what is the difference in Towar Gardens Post-Construction?

• Before
  – Many complaints of flooding of structures, streets and property reported after minor rainfall.
  – Landowner surveys revealed that 64% had drainage problems and 13.5% had basement flooding

• After
  – Put to the Test: No flooding observed, no drainage or flooding reported.
Towar Rain Garden Drains
A Low-Impact Urban Retrofit

Before

After
Patrick E. Lindemann
INGHAM COUNTY DRAIN COMMISSIONER

Towar Rain Garden Drains
A Low-Impact Urban Retrofit

Before

After
Towar Rain Garden Drains
A Low-Impact Urban Retrofit

Patrick E. Lindemann
INGHAM COUNTY DRAIN COMMISSIONER

Before

After
Towar Rain Garden Drains
A Low-Impact Urban Retrofit

Patrick E. Lindemann
INGHAM COUNTY DRAIN COMMISSIONER

Before

After
Towar Rain Garden Drains
A Low-Impact Urban Retrofit

Before

After
Towar Rain Garden Drains
A Low-Impact Urban Retrofit

Patrick E. Lindemann
INGHAM COUNTY DRAIN COMMISSIONER

Before

After
Analysis Of Sump Pump And Dehumidifier Operating Costs (Pre & Post Construction)  
*Based On Records From Two Flood Prone Homes*

- Pre-construction: homeowners frequently reported sump pump use “all the time”
- Post-construction: homeowners frequently report reduction in sump pump use
- Estimated total annual savings of $350 per home
- Average annual assessment is $255 per home

<table>
<thead>
<tr>
<th></th>
<th>Total Sump Pump Annual Savings</th>
<th>Total Dehumidifier Annual Savings</th>
<th>Total Annual Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before Project</td>
<td>$218 Savings</td>
<td>$132 Savings</td>
<td>$350 Savings</td>
</tr>
<tr>
<td>After Project</td>
<td>$32 Savings</td>
<td>$150 Savings</td>
<td>$470 Savings</td>
</tr>
</tbody>
</table>
General Results of Infiltration and Water Quality Testing
(Rain Gardens were designed to dewater in less than 24 hours. All tests recorded dewatering within 1 hour)

Vegetated Rain Garden
- High infiltration rate
- Treated runoff (Tested TSS, TP, TN)

Turf Rain Garden
- Low infiltration rate
- Bypassed most runoff w/o treatment (Tested TP, TN)

Turf Ditch
- No Infiltration
- No treatment (Tested TP, TN)
Given the success of Towar Rain Garden Drains, why not more retrofits like it?

Challenges of large-scale LISMS

- **Neophobia**
  - Public
  - Public officials / Regulatory agencies
  - Engineers

- **“In your face” infrastructure**
  - Interaction between public and infrastructure
  - Aesthetics

- **Complexity of design and execution**
  - Relative newness and lack design guidance
  - Knowledgeable professionals