Beyond Clean Water: The Triple Bottom Line Benefits of Green Stormwater Infrastructure

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Agenda

- Historical Development
- Green City Clean Water Vision
- Green Stormwater Infrastructure Techniques
- TBL Benefits Of Green Stormwater Infrastructure
- Summary and Further Analysis
Trunk Sewers Complete
Early 1900s
“Green City – Clean Waters” Vision

- Regulatory Compliance: Clean Water Act, National CSO Control Policy, Consent Order
- Comprehensive, watershed-based program to invest money wisely for maximum public benefit
Green Stormwater Infrastructure Goals

- Decentralized Stormwater Management
- Maximizes infiltration, evaporation, transpiration
- Uses slow release back to sewers when necessary
- Utilizes vegetation, if possible
- Complete the vision with stream restoration
Degradation Exposes Infrastructure
Restoration Protects Infrastructure
What is the Triple Bottom Line?

1. Economic
   - Traditional cost analyses

2. Environmental
   - Air and Water Quality, Recreation

3. Social
   - Health Benefits, Heat Stress Reduction, Quality of Life, Reduced Social Costs
Environmental, Social, and Economic Benefits

- **Green infrastructure is compatible with living resources restoration goals**
  - Restores more natural balance between dry and wet weather flow
  - Protects investment in stream restoration

- **Tunnel is not compatible with living resources restoration goals**
  - No increase in groundwater recharge, lack of dry weather streamflow needed for healthy aquatic ecosystem
  - Wet weather flow stored, treated and discharged outside system, lack of hydrologic variability
Environmental, Social, and Economic Benefits

- CO$_2$ avoided/absorbed

![Graph showing carbon footprint with CO$_2$ emissions avoided for different greening areas: 25%, 50%, 75%, and 100%. The percentage of CO$_2$ emissions avoided increases with the greening area.](image_url)
Environmental, Social, and Economic Benefits

- Health Benefits

**Health Effects from Improving Air Quality**
Annual Health Benefits from Trees Improving Air Quality

- 25%: $0
- 50%: $1,000,000
- 75%: $2,000,000
- 100%: $3,000,000

Average Annual Health Benefits from Trees

Greened Area
Environmental, Social, and Economic Benefits

- Recreational New User-Days

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<tr>
<th>Greened Area</th>
<th>Average Annual New User-Days</th>
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<tr>
<td>25%</td>
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Environmental, Social, and Economic Benefits

- **Restored Ecosystems**

![Bar chart showing the annual value to the public for water quality and habitat restoration, with willingness to pay in millions of dollars for greened area percentages of 25%, 50%, 75%, and 100%: $2,000,000 for 25%, $4,000,000 for 50%, $6,000,000 for 75%, and $8,000,000 for 100%.}
Environmental, Social, and Economic Benefits

- Excessive Heat Deaths Avoided

![Bar chart showing the average annual deaths avoided due to excessive heat events in relation to greened area percentage. The chart shows a gradual increase from 25% to 100% greened area, with the most significant increase occurring between 75% and 100% greened area.]
Maximization of Benefits

- Plant trees near buildings
- Maximize green space
- Give public access to enhanced features
- Reduce new material/material hauling
Summary and Further Analysis

- “Green City – Clean Waters” seeks to meet regulations while maximizing benefits
- Green infrastructure has many benefits
- Green infrastructure can be implemented through long-term redevelopment trends
- Further study: porous pavement temperature effects, including reductions in summer and enhanced snowmelt in winter
Beyond Clean Water: The Triple Bottom Line
Benefits of Green Stormwater Infrastructure

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