SUSTAINABLE RETURN ON INVESTMENT (SROI)

AN INTERACTIVE DEMONSTRATION - CASE STUDY ON GREEN INFRASTRUCTURE AND LAND USE PLANNING
Agenda

- Introduction to Rightsizing and U.S. Programs
- Introduction to Saginaw, MI and USEPA Project
- Green vs. Grey Infrastructure Options
- SROI Decision Support Framework
- Demonstration of Methods
- Wrap-up
Definition

- Re-adjusting the built environment (buildings and infrastructure) to match the needs and desires of a shrinking cities’ current and projected population.
### Top 15 Older Industrial Cities’ in Population Loss and their 2000 Residential Vacancy Characteristics

<table>
<thead>
<tr>
<th>City</th>
<th>Pop decline (1960-2000)</th>
<th>Vacant Units (Percent of Total Units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>St. Louis, MO</td>
<td>53.6 %</td>
<td>16.6 %</td>
</tr>
<tr>
<td>Youngstown, OH</td>
<td>51.6 %</td>
<td>13.4 %</td>
</tr>
<tr>
<td>Cleveland, OH</td>
<td>45.4 %</td>
<td>11.7 %</td>
</tr>
<tr>
<td>Buffalo, NY</td>
<td>45.1 %</td>
<td>15.7 %</td>
</tr>
<tr>
<td>Pittsburgh, PA</td>
<td>44.6 %</td>
<td>12.0 %</td>
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<tr>
<td>Detroit, MI</td>
<td>43.0 %</td>
<td>10.3 %</td>
</tr>
<tr>
<td>Utica, NY</td>
<td>39.6 %</td>
<td>14.0 %</td>
</tr>
<tr>
<td>Harrisburg, PA</td>
<td>38.6 %</td>
<td>15.4 %</td>
</tr>
<tr>
<td>Huntington, WV</td>
<td>38.4 %</td>
<td>11.4 %</td>
</tr>
<tr>
<td>Binghamton, PA</td>
<td>37.6 %</td>
<td>12.0 %</td>
</tr>
<tr>
<td>Saginaw, MI</td>
<td>37.1 %</td>
<td>9.6 %</td>
</tr>
<tr>
<td>Dayton, OH</td>
<td>36.7 %</td>
<td>12.8 %</td>
</tr>
<tr>
<td>Flint, MI</td>
<td>36.6 %</td>
<td>12.1 %</td>
</tr>
<tr>
<td>Cincinnati, OH</td>
<td>34.1 %</td>
<td>10.8 %</td>
</tr>
<tr>
<td>Newark, NJ</td>
<td>32.5 %</td>
<td>8.7 %</td>
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</tbody>
</table>
New Bern, NC
Drivers

- Economic changes - manufacturing shift
- Legacy cities and costs
- Foreclosure and housing crisis
- Regional development patterns
Programs- Strong Cities, Strong Communities

- Interagency collaboration
- Place based pilots- Fresno, Memphis, New Orleans, Chester Co, PA, Detroit, Cleveland,
- Develop Ground Up Solutions
- Improve Federal Coordination/Remove Barriers
- Develop Lasting Partnerships
Programs- Partnership for Sustainable Communities

Federal Partnership for Sustainable Communities
FY 2011 Grantees

Legend:
- Cross-navigators
- DOT TIGER
- EDA-Building America Cities
- EPA-Housing Resource Assessment
- EPA-Transportation Planning
- FHWA-Alternative Analysis
- FHWA-Loebgraham
- DOT Transportation, Comm., and System Protection Program
- HUB Community Challenge Grants
- HUD Sustainable Communities Planning Grants
- EPA-Cleaner Cities
- USDA-Grants Field
EPA pilot program to provide planning assistance (not for site assessment or cleanup)

- advancing an ongoing local planning process,
- developing a brownfields area-wide plan, and
- identifying next steps and resources needed to implement the plan

...within an area affected by brownfields, such as a neighborhood, district, corridor, etc
Programs – Not for Profit/Philanthropy

- Center for Community Progress
- Brookings Institution
- German Marshall Fund
- Funders Network for Smart Growth
- Regional Funders (Kellogg, Kreesge, Gund, Boston, etc)
US EPA’s Interest and Role

- Land Use and development patterns affect environmental outcomes and quality;
- Vacancy and property abandonment often impacts public and community health;
- Environmental justice, social equity, and sustainability are connected;
- Provide resources, tools, information and research
Programs and Priorities – US EPA

- Green Infrastructure Priority
- Community Action for a Renewed Environment (CARE) Grants
- Brownfields Program
  - Funding to inventory, assess, clean-up and job training on brownfield properties.
- Office of Sustainable Communities
  - Technical Assistance
  - Change the Conversation
  - Provide tools and Resources
Saginaw, Michigan Implementation Assistance

- Support city/county partnership – greening of NE Saginaw
- Understand issues associated with rightsizing infrastructure
- Develop framework to assess infrastructure management land use change in a declining neighborhood
- Contribution to SC2 Initiative
Overview of Green Infrastructure

- Objectives
- GSI BMPs
  - Types
  - Selection criteria
  - Scalability
- Saginaw, MI
- Lakewood RainCatchers case study, Seattle, WA
Overview of Saginaw, MI
Objectives

- Reduce flooding
- Improve water quality
- Invest in communities
- Reduce energy consumption
- Meet current and future regulatory requirements
  - CSO control
  - NPDES stormwater permit
- Pave the way for future revitalization
Objective - Cost-Effective Solutions

Everett to pay up to $1.5 million for flooding to homes

By Darby Jepson, Herald Writer

EVERETT — The city expects to pay as much as $1.5 million to make eight dozen of north Everett homes damaged by flooding safe for habitation.

Many of the residents filed claims with the city after the storm overwhelmed the city's sewer system, sending raw sewage into their basements.

Eight of those claims have been settled. The city also has looked over the money for cleanup work on all the homes. So far, six paid out a total of $927,000, said Dave Bonney, Everett public works director.

In the next several months, officials plan to work more closely to repair homes and replace damaged property, he said.

"It's a large number of customers, but the city is still providing a lot of money for work," he said. "We're working on it.

Many of the homes involved had flooded during a storm in 2005, and the city then offered to help residents build up their sewer lines.

"We're trying to help prevent wastewater from leaking into sewer lines."
## Types of GSI BMPs

<table>
<thead>
<tr>
<th>Infiltration-Based Green Infrastructure</th>
<th>Non-Infiltration Green Infrastructure</th>
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</thead>
<tbody>
<tr>
<td>Green streets</td>
<td>Removal of impervious surface</td>
</tr>
<tr>
<td>Green parking</td>
<td>Green roof</td>
</tr>
<tr>
<td>Permeable pavement</td>
<td>Rainwater harvest and reuse</td>
</tr>
<tr>
<td>Bioretention swales</td>
<td>Tree planting/tree retention</td>
</tr>
<tr>
<td>Rain gardens</td>
<td>Constructed stormwater wetland</td>
</tr>
</tbody>
</table>
BMP Selection
Parcel-scale
BMP Selection
Block-scale
BMP Selection
Basin/Regional-Scale

- Integrated riparian/regional stormwater facilities/parks
BMP Selection
Basin/Regional-Scale

- Underground detention with co-located parks
BMP Selection
Basin/Regional-Scale

- Off-line water quality channel
Saginaw, MI
The Green Zone

- Approx. 350 acres
- >40% Vacant/abandoned parcels
- Remaining parcels scattered
- RTBs constructed in all 7 basins
Existing Conditions & Opportunities

Excessive impervious areas

Community anchors

Wide planter strips

Relatively new housing development
Existing Conditions & Opportunities

- Crumbling sidewalks w/ vegetation
- Clogged inlets
- Nuisance ponding
Planning Framework

Short Term Plan: Inventory, Data Analysis and Planning Stage
- Develop Green Zone Vision & Master Plan
- Inventory and planning for historic / cultural sites
- Explore partnership opportunities
- Amendments to land use, zoning and utilities code

Medium Term Plan: Strategic Planning, Option Assessment Stage
- Alternative land use options assessment
- Implement historic preservation plans
- Community building around centers of consolidation
- Refine Green Zone Master Plan

Long Term Plan: Development, Investment, Renewal Stage
- Decisions, investment, and stewardship of alternative land uses (e.g. urban agriculture, forestry, parkland, commercial/industrial)
- Community rebuilding and revitalization

Management and Planning

Infrastructure
- Assess Critical Infrastructure
- Assess Green Stormwater Infrastructure (GSI) Options
- Perform decommissioning projects

Land Use
- Acquire vacant properties
- Demolition of buildings on vacant land

Strategic Planning
- Strategic consolidation & Targeted decommissioning
- Pilot alternative land use
- GSI Monitoring and refinement

Option Assessment
- Desired Outcomes

Completion of Green Zone Land Use Plan and Implementation
- Short Term (Next 5 years)
- Medium Term (5-20 years)
- Long Term (20+ years)
Critical Infrastructure - Backbone

New residential housing

Church
GSI Opportunities

- **Short-term**
  - Continue demolition of impervious area on vacant parcels
  - Demolish blocks ??

- **Medium-term**
  - Construct block-scale bioretention/constructed wetlands
  - Pilot residential LID in new housing area
  - Pilot LID roadway projects in critical roadway areas
  - Monitor/refine

- **Long-term**
  - Grey/green infrastructure plans to sync w/ long-term plans
Lakewood RainCatchers

- SPU pilot project to reduce CSOs
- 75-acre residential neighborhood
- 290 homes
- BMPs
  - Cisterns
  - Rain gardens
- Partially combined system
Lakewood RainCatchers

Cistern areas

Rain garden areas

Legend
- Monitoring station
- Cistern pilot study area
- Rain garden pilot study area
- No infiltration zone
- Bottle 43 boundary
- Subbasin boundary

Source: Seattle 2009.
Lakewood RainCatchers
Modeled Cistern Performance - Parcel
Lakewood RainCatchers
Modeled Rain Garden Performance - Basin

Percentage of Additional rooftop Area Disconnected and Routed to Raingarden

- Average Annual CSO Volume
- Centralized Storage Volume to Meet Standard
- Average Annual Number CSO Events
- CSO Regulatory Standard
Sustainable Return on Investment Process

- Robust method grounded in economic principles
- Measures cash and non-cash benefits
- Considers entire triple bottom line
- Assesses whether and when it is justified
- Employs proven Risk Analysis Process

Triple-Bottom Line Framework

- Community Values
- Buildings
- Energy
- Ecology
- Site Development
- Mobility
- Water
- Waste
- Economic Data
- Corporate Responsibility
Complexity in Assessing Full Value of Stormwater Control

**Stakeholders**
- Flooded Residents
- Flooded Businesses
- Rate Payers
- Environmentalists
- Water utility
- Community leaders
- Municipal managers
- State regulators

**Types of value (solution dependent)**
- Environmental
- Recreational
- Economic
- Institutional
- Property Value
- Health
- Aesthetics

**Variables**
- Volume
- Frequency
- Spatial Variability
- External Impacts
- Equity
SROI: A Four Step Process

- **Step 1: Determine Scope of Analysis**
  - Determine goals and key performance metrics
- **Step 2: Preliminary Analysis**
  - Research and analysis of potential project performance
- **Step 3: Stakeholder Workshop**
  - Consensus building on methods, metrics and risks
- **Step 4: Quantitative Analysis**
  - Generate results for decision making
Develop Transparent Framework
to Explain Key Drivers

Example of Benefits

Cash Savings
- Reduced Regulatory Costs
- Reduced Water O&M
- Reduced Wastewater O&M
- Reduced Wastewater Capital
- Reduced Waste Disposal
- Reduced Public Service Costs

Non-Market Value
- Reduced flooding / Property Value Creation
- Improved Water quality
- Improved Air Quality
- Increased Park Access
- Improved Resiliency
- Improved Safety

Costs

Capital Costs ($)
Maintenance Costs ($)
Operating Cost ($)
Disposal Costs ($)

Discounting (%)

Total Benefits ($)
Output Metrics ($)
Total Costs ($)
Convene SROI Workshops
to Build Consensus and Credibility

- Facilitated, multi-day workshops
- Participants include experts, agency managers, and analysts
- Goal: reach consensus on analytical framework, measurement and valuation
- Discussions generate local perspectives
Build SROI Alternatives Analysis Model to Incorporate Risk and Uncertainty

\[ F = f (A, B, C, D, \ldots) \]
Present SROI Results to Effectively Inform Decision Making
Integrate SROI Analyses in Evaluation to Identify Best Value Option

- Feasible
- Affordable
- Acceptable
- Desirable

Project Options

Scope / Criteria

Technical Analyses

Financial Analysis

Stakeholder Assessment

SROI Decision Support

SROI Process Informs all Evaluation Stages
Demonstration of SROI: Green Infrastructure Alternatives Analysis

- Current conditions:
  - Substantial Flooding
  - Combined Sewer Overflows

- Comparison of alternatives:
  - Baseline: Basic maintenance
  - Alternative: Stormwater Management BMPs

- Framework:
  - Comparison of net benefits between alternatives
  - Net benefits accrue over time as land becomes available
Workshop Setting:
Framing the Goals, Issues, Costs, and Benefits

- What are the *Triple Bottom Line* goals and benefits of the stormwater management project?

- What are the key drivers of benefits?

- What are the key drivers of costs?
Drivers of lifecycle infrastructure costs
- Capital costs of installation
- Annual O&M costs
- Periodic refurbishment / rehabilitation / replacement costs
- Costs depend on economies of scale per alternative

Categories of Benefits
- Reduced grey infrastructure costs
- Reduced regulatory costs of TMDL, CSO control
- Reduced flooding and associated loss of property value
- Water quality improvements
- Increased land value from alternative use
- Benefits depend on annual installation rate of green infrastructure
Workshop Setting:
Data Review – Probability Distribution of Daily Rainfall

Annual Frequency of Daily Rainfall

Fit Comparison for Dataset 1
RiskInvGauss (0.35685, 0.016901)

- 5.0% ± 0.00270
- Maximum: 2.000
- Mean: 0.3569
- Std Dev: 0.5568
- Values: 14
Workshop Setting:
Data Review – Flood Damage Function

Minimum $ \$/ \text{AF} = $20,400
Workshop Setting:

Cost and Benefit Uncertainties

- Review key drivers and uncertainties in costs
  - Estimation issues, market conditions, forecasts of O&M
  - Evaluate rate of adoption of green infrastructure
- Review key drivers and uncertainties of benefits
  - Performance of system (quantity of reduction)
  - Values of runoff reduction – economic, social, environmental
- Other factors
  - System durability and failure rate
  - Changes in landscape
  - Changes in climate and weather patterns
Sample Results

FROI and SROI Results of Stormwater Management

- Probability of Exceeding
- Net Present Value of Improvements ($ Millions)

FROI

SROI
Workshop Setting:
Scenario Testing

- Comparison of net present value
- Interpretation of uncertainty
- Recommendations
Wrap-up Discussion Questions

- What can we learn from these analyses?
- Are data limitations preventing effective analysis?
- How can decision making improve with these analyses?
- What are effective ways of presenting results to improve decisions?