SUSTAINABLE RETURN ON INVESTMENT (SROI)

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

New Partners for Smart Growth Conference, San Diego, CA, Feb 2-4, 2012

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

City	Pop decline (1960-2000)	Vacant Units (Percent of Total Units)
St. Louis, MO	53.6 %	16.6 %
Youngstown , OH	51.6 %	13.4 %
Cleveland, OH	45.4 %	11.7 %
Buffalo, NY	45.1 %	15.7 %
Pittsburgh, PA	44.6 %	12 %
Detroit, MI	43 %	10.3 %
Utica, NY	39.6 %	14 %
Harrisburg, PA	38.6 %	15.4 %
Huntington, WV	38.4 %	11.4 %
Binghamton, PA	37.6 %	12 %
Saginaw, MI	37.1 %	9.6 %
Dayton, OH	36.7 %	12.8 %
Flint, MI	36.6 %	12.1 %
Cincinnati, OH	34.1 %	10.8 %
Newark, NJ	32.5 %	8.7 %

New Bern, NC
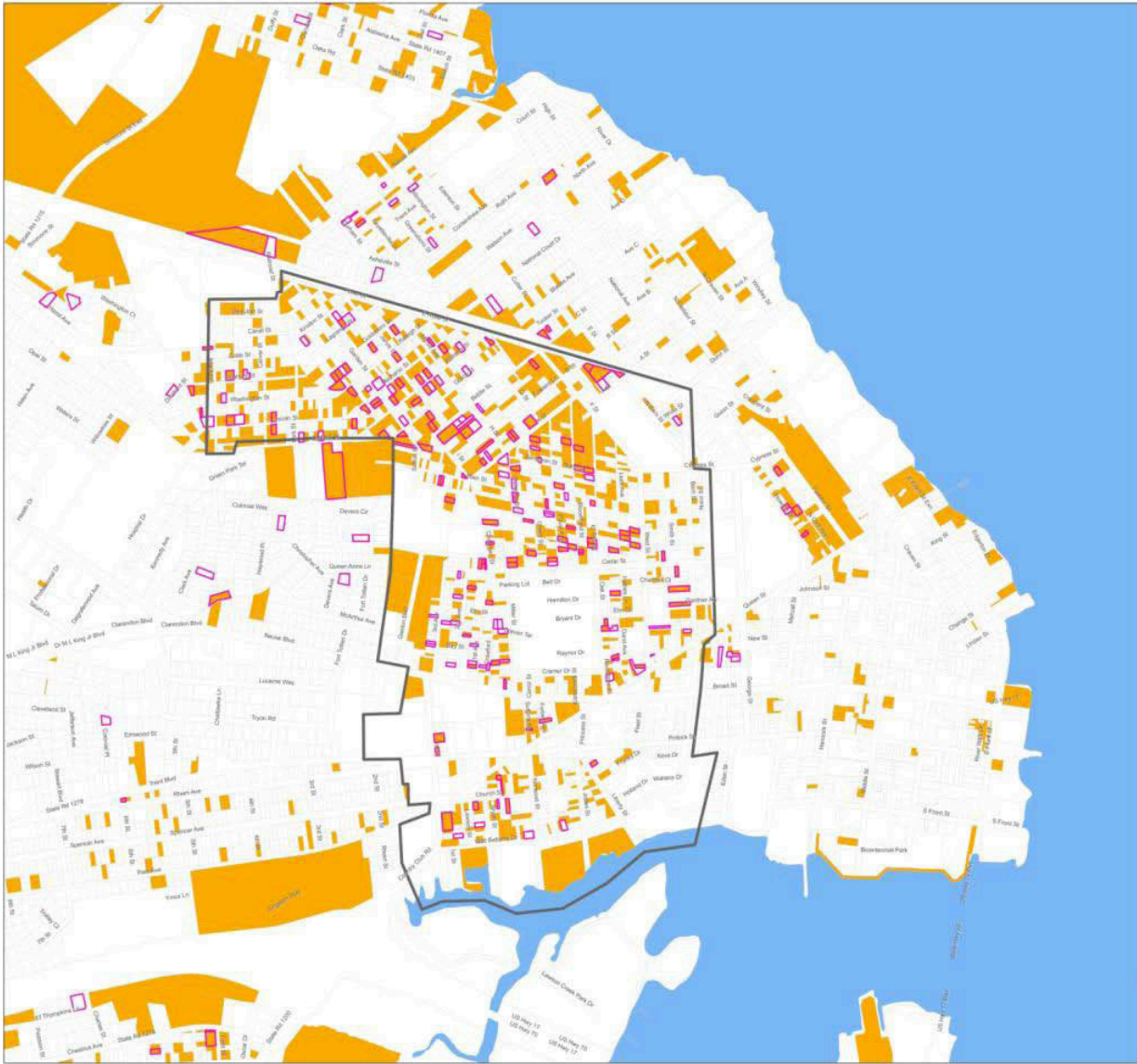
THE NEW BERN GATEWAY
RENAISSANCE PLAN
AN EPA BROWNFIELDS AREA-WIDE PLANNING PILOT PROGRAM

Vacant and Foreclosed Property

Study Area
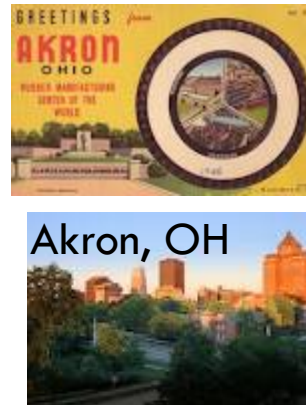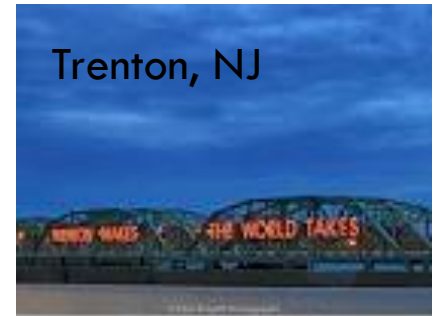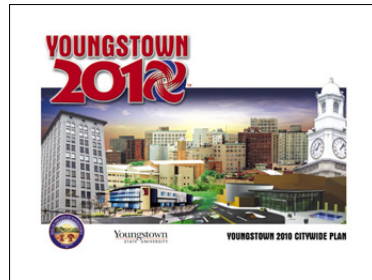Property in Foreclosure (as of 11/9/11)
Vacant Land

Drivers

- Economic changes- manufacturing shift
- Legacy cities and costs
- Foreclosure and housing crisis
- Regional development patterns

Outlook

Greenville, MS

Youngstown 2010

RE-IMAGINING CLEVELAND

Pittsburgh, PA

Trenton, NJ

Chattanooga, TN

FRESNO
THE BEST LITTLE CITY IN THE U.S.A.
VAN NESS AVE

GREETINGS from
AKRON
OHIO

Akron, OH

Buffalo, NY

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
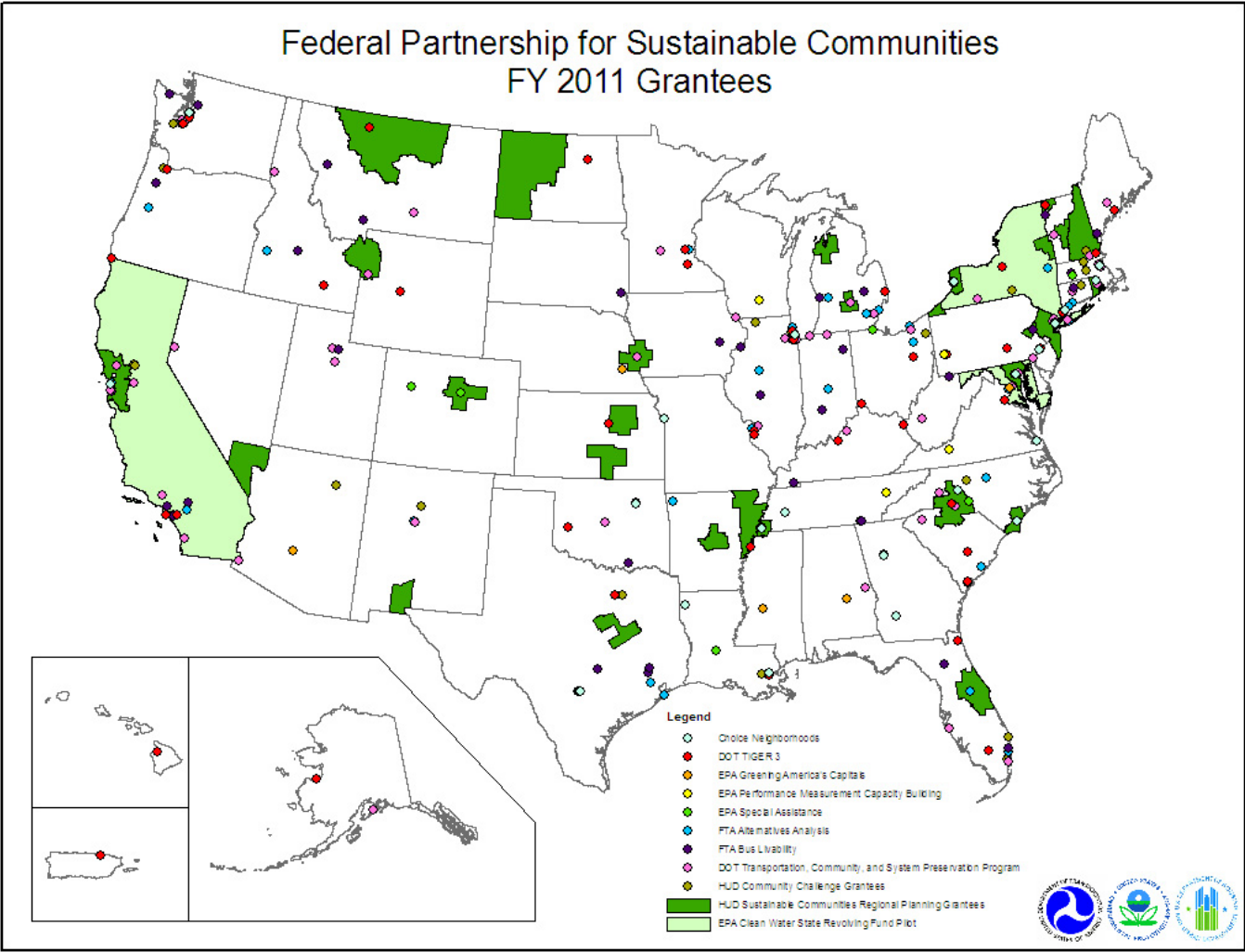
Programs- Area-Wide Planning

- EPA pilot program to provide planning assistance (not for site assessment or cleanup)

- Assistance given for:
  - 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

Cleveland , OH

New Bern, NC

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 traiining on bf 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 us 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

Types of GSI BMPs

Infiltration-Based Green Infrastructure	Non-Infiltration Green Infrastructure
Green streets	Removal of impervious surface
Green parking	Green roof
Permeable pavement	Rainwater harvest and reuse
Bioretention swales	Tree planting/tree retention
Rain gardens	Constructed stormwater wetland

BMP Selection

Parcel-scale

DOWNSPOUT OR OTHER INLET

BUILDING (WATERPROOFED AS NEEDED)

REVERSE BEND TRAP

OVERFLOW PIPE

18" BIORETENTION SOIL

12" MINERAL AGGREGATE, TYPE 26

SLOTTED UNDERDRAIN

GRAVEL OR SPLASH BLOCK

IMPERVIOUS RESERVOIR

SUBGRADE OR EXISTING SOIL

PIPE TO APPROVED DISCHARGE POINT

PERMEABLE WEARING COURSE

LEVELING COURSE (IF REQUIRED)

AGGREGATE SUBBASE (MIN 3 INCH)

NON-WOVEN GEOTEXTILE WRAP (IF REQUIRED)

NATIVE SOIL OR SUBBASE

BMP Selection

Block-scale

BMP Selection

Basin/Regional-Scale

- Integrated riparian/regional stormwater facilities/parks

100' Buffer

Riparian Zone

Regional Stormwater & Parks Zone
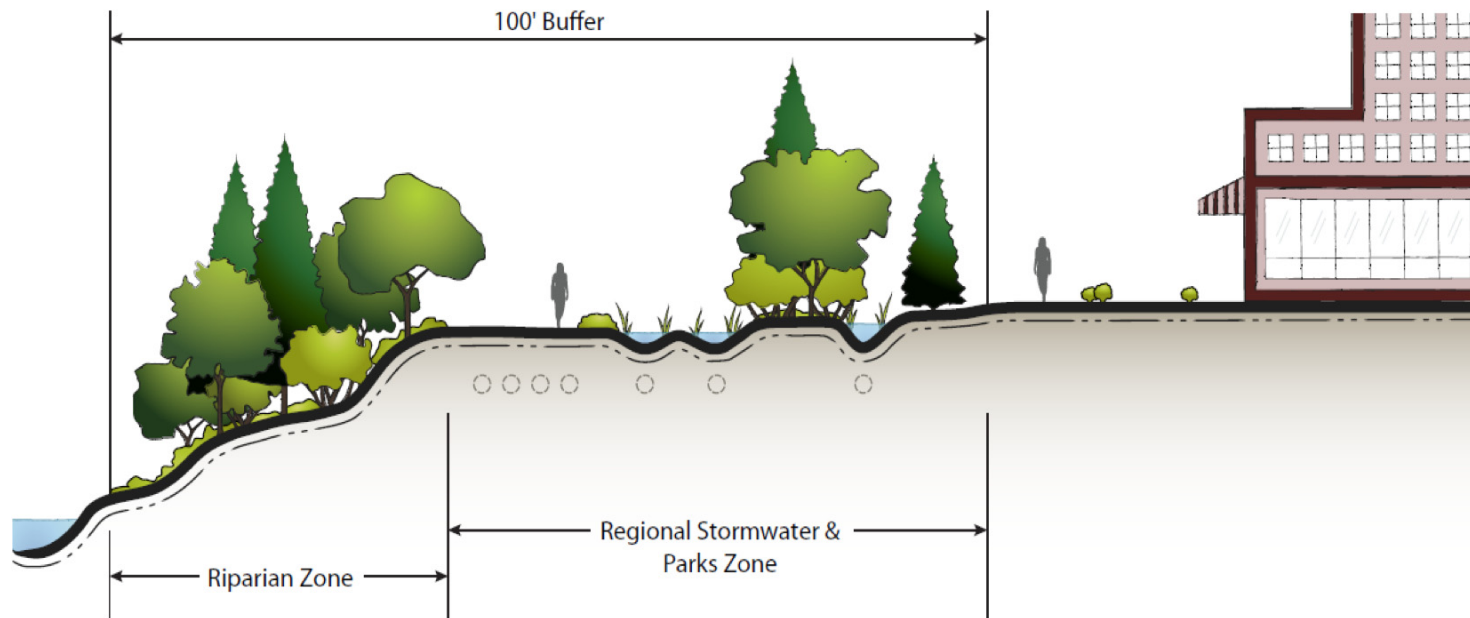
BMP Selection

Basic/Regional-Scale

- Underground detention with co-located parks

BMP Selection

Basin/Regional-Scale

- Off-line water quality channel

Saginaw, MI
The Green Zone
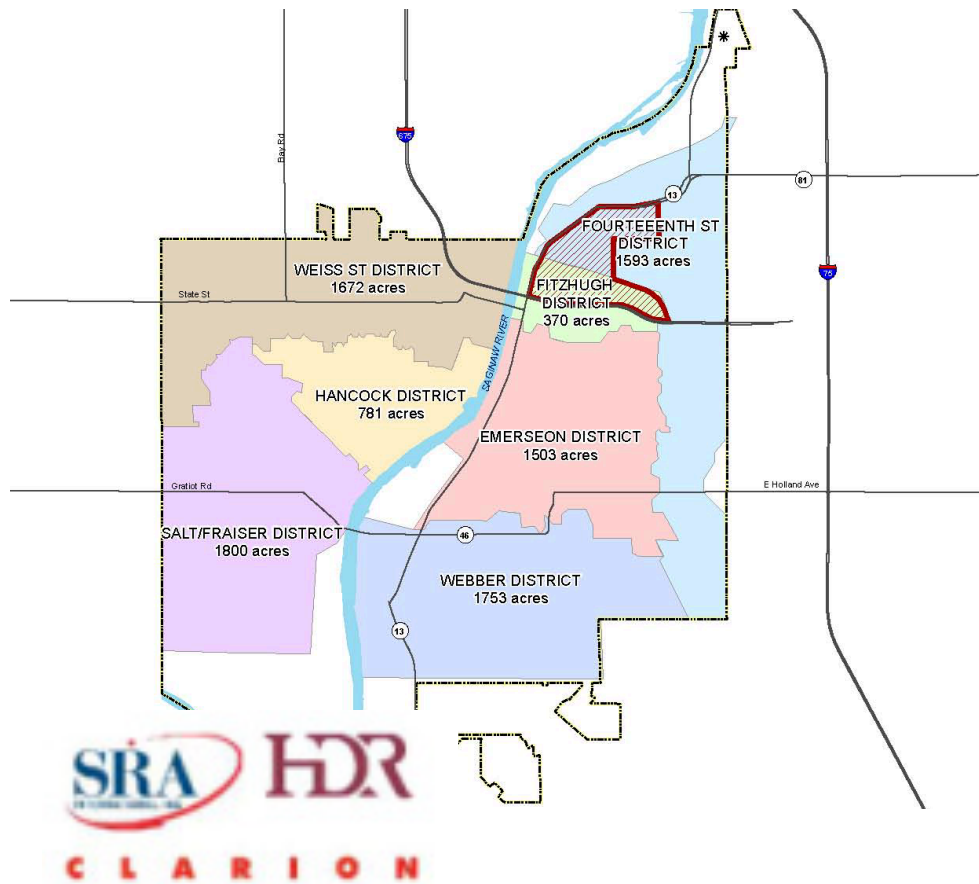
- Approx. 350 acres

- >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

Medium Term Plan: Strategic Planning, Option Assessment Stage

Long Term Plan: Development, Investment, Renewal Stage

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

Report: Needs, Opportunities, Constraints, Costs and Risks

- Alternative land use options assessment
- Implement historic preservation plans
- Community building around centers of consolidation
- Refine Green Zone Master Plan

Option Assessment

Desired Outcomes
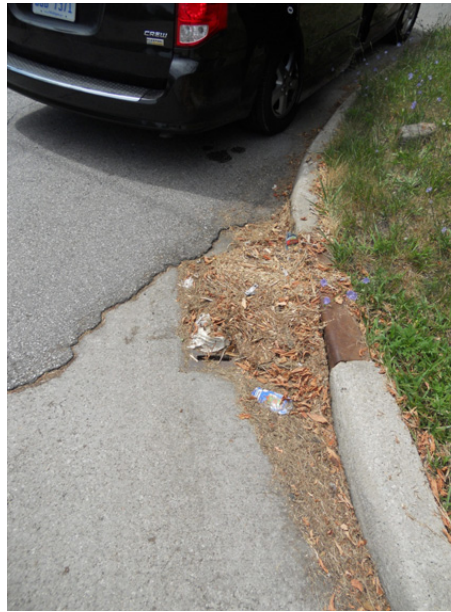
Completion of Green Zone Land Use Plan and Implementation

- Decisions, investment, and stewardship of alternative land uses (e.g. urban agriculture, forestry, parkland, commercial/ industrial)
- Community rebuilding and revitalization

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

Strategic Planning

Re-Location and Decommissioning Guidelines

- Land Bank as land manager
- Strategic consolidation & Targeted decommissioning
- Pilot alternative land use
- GSI Monitoring and refinement

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

Short Term (Next 5 years)

Medium Term (5-20 years)

Long Term (20+ years)

Critical Infrastructure - Backbone
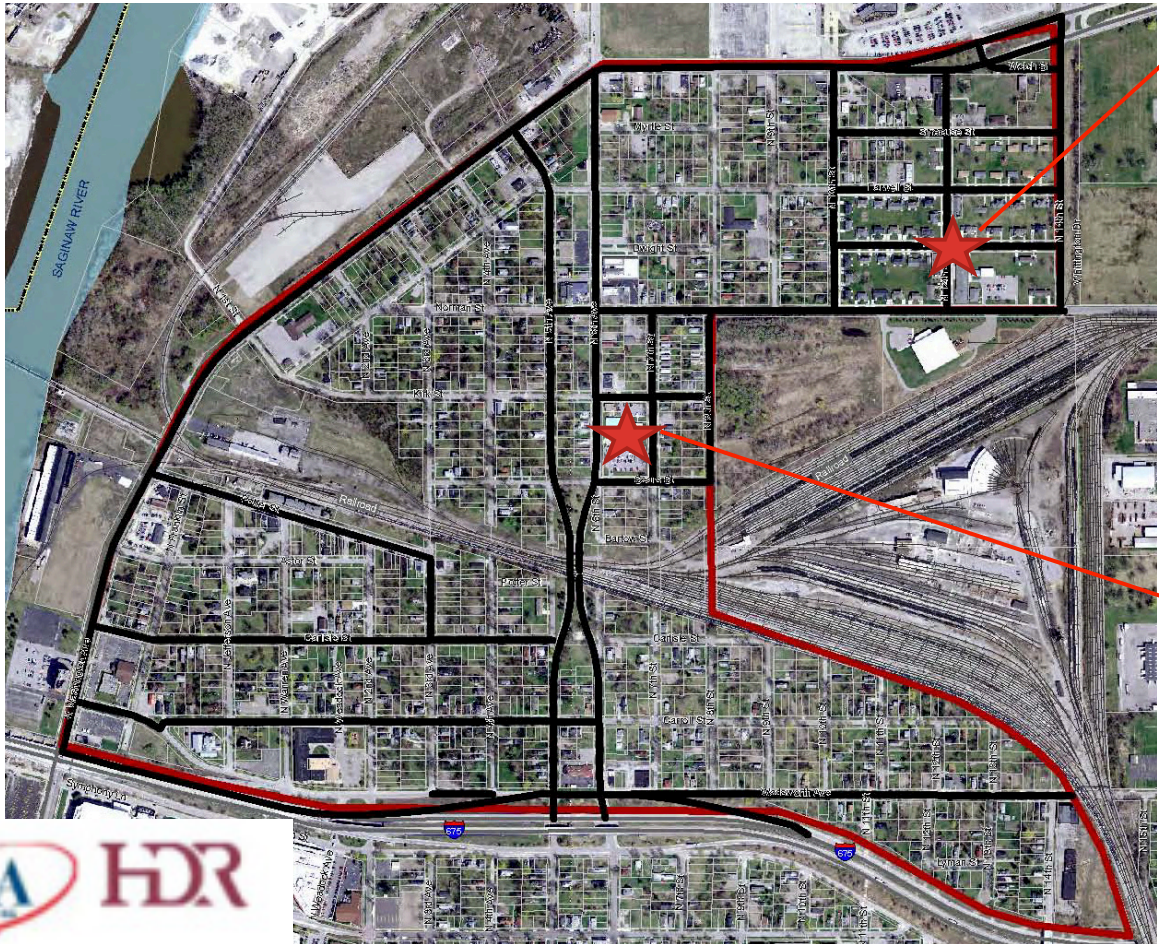
New residential housing

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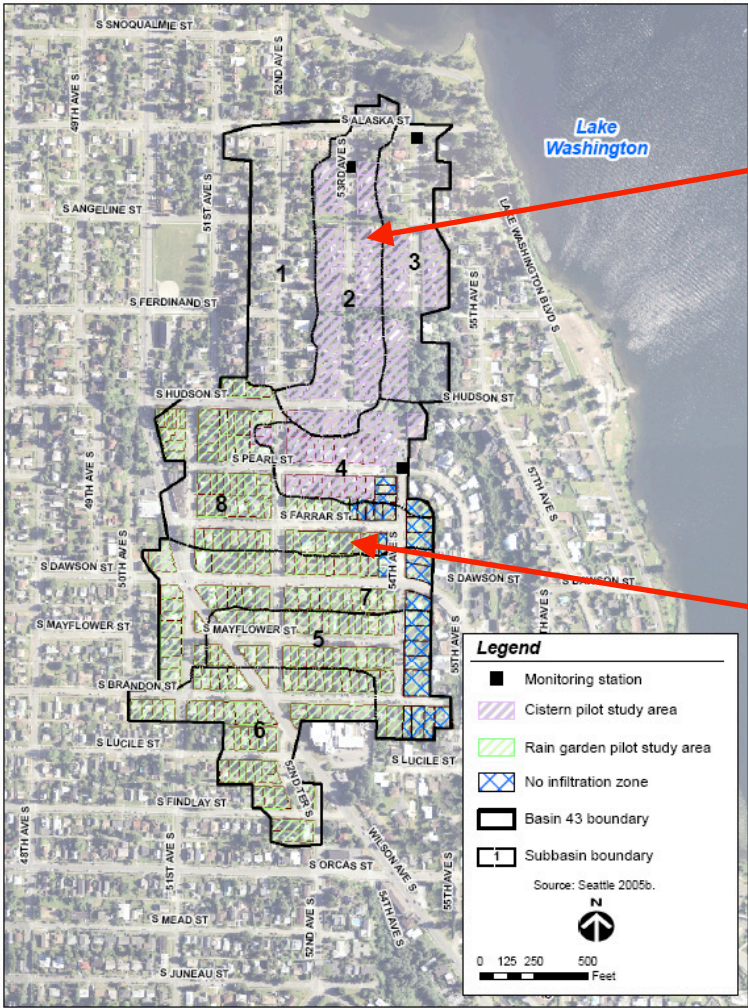 - Grey/green infrastructure plans to sync w/ long-term plans

Lakewood RainCatchers

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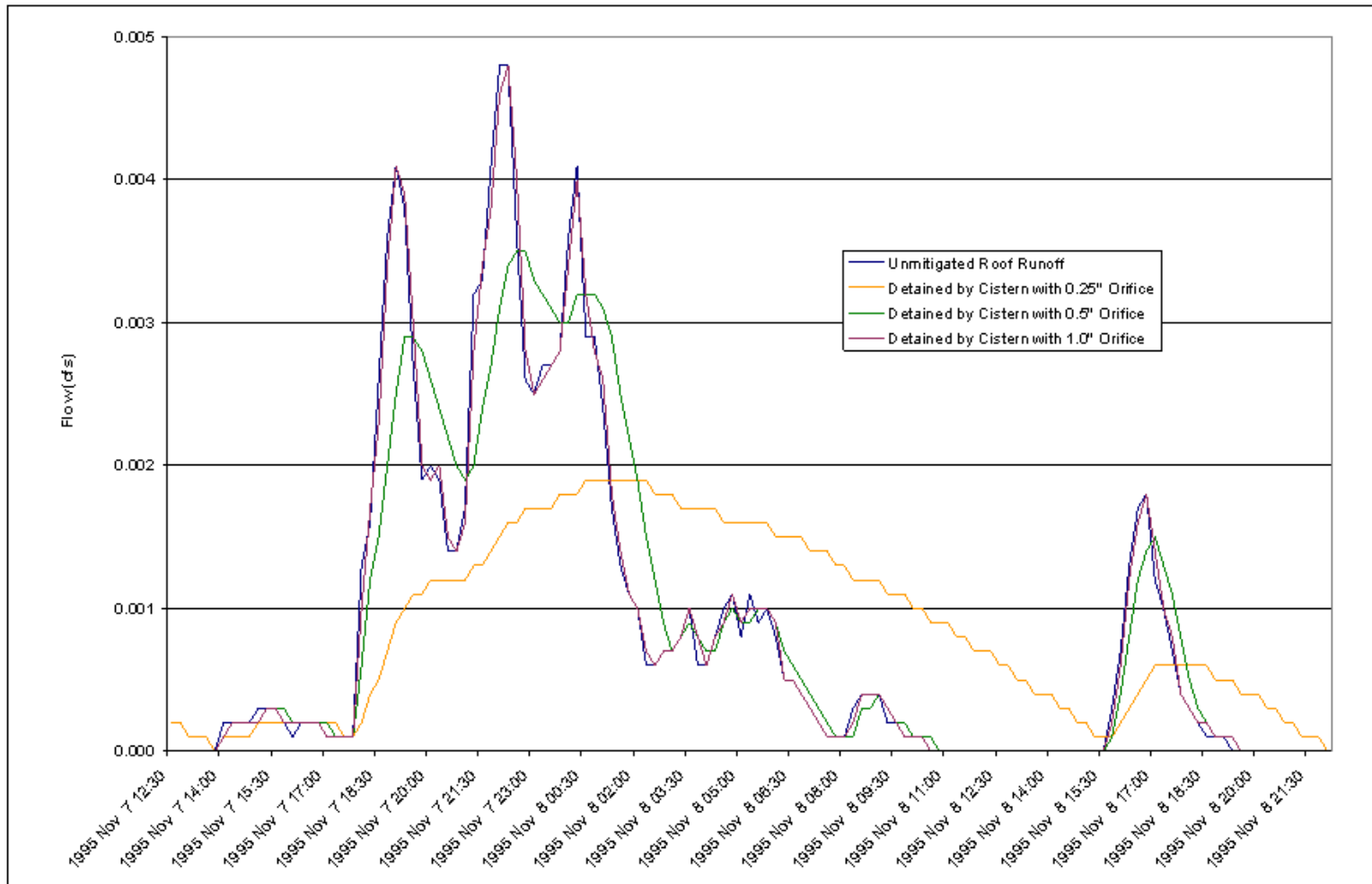- Partially combined system

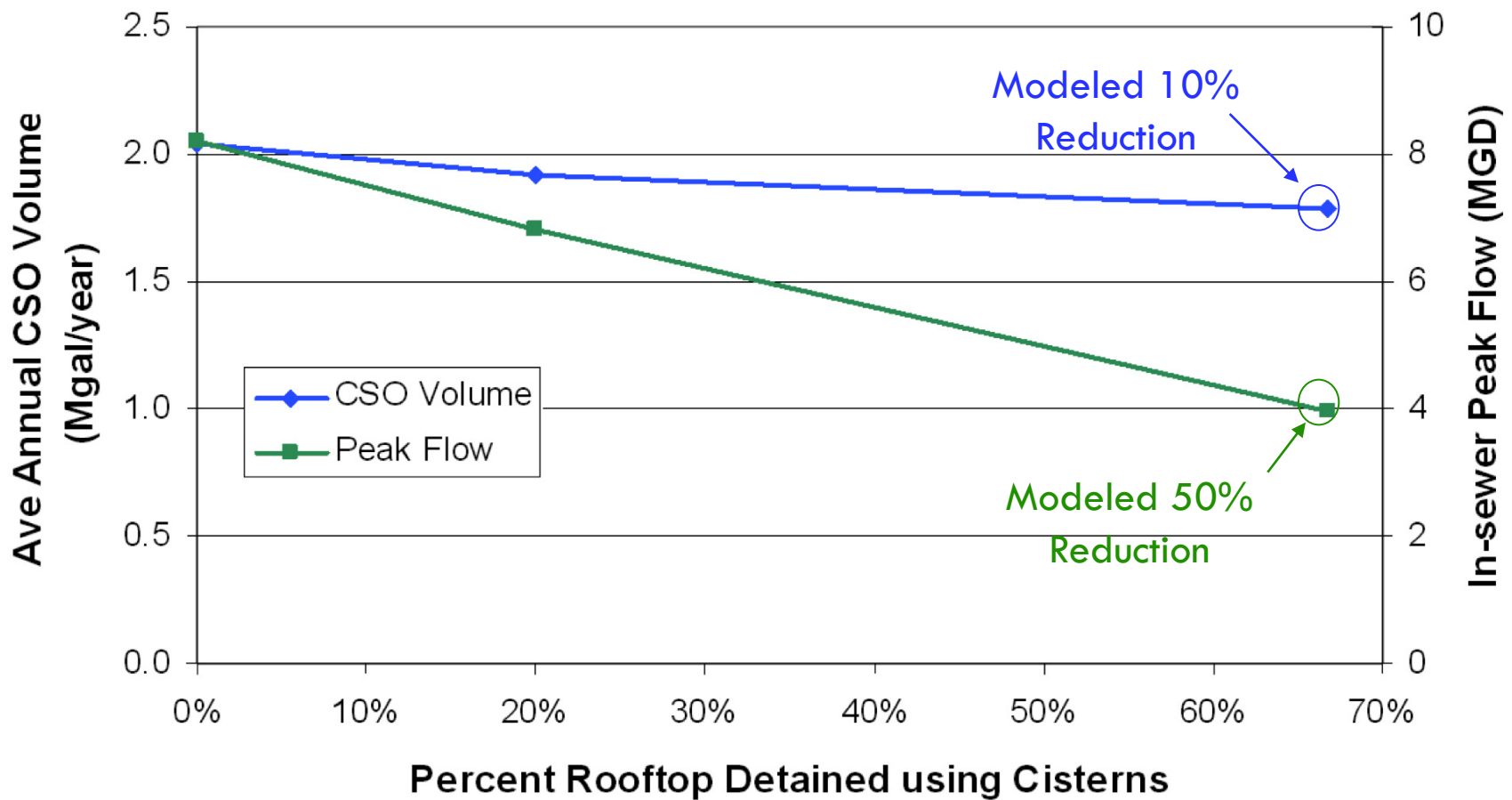# Lakewood RainCatchers

Cistern areas

Rain garden areas

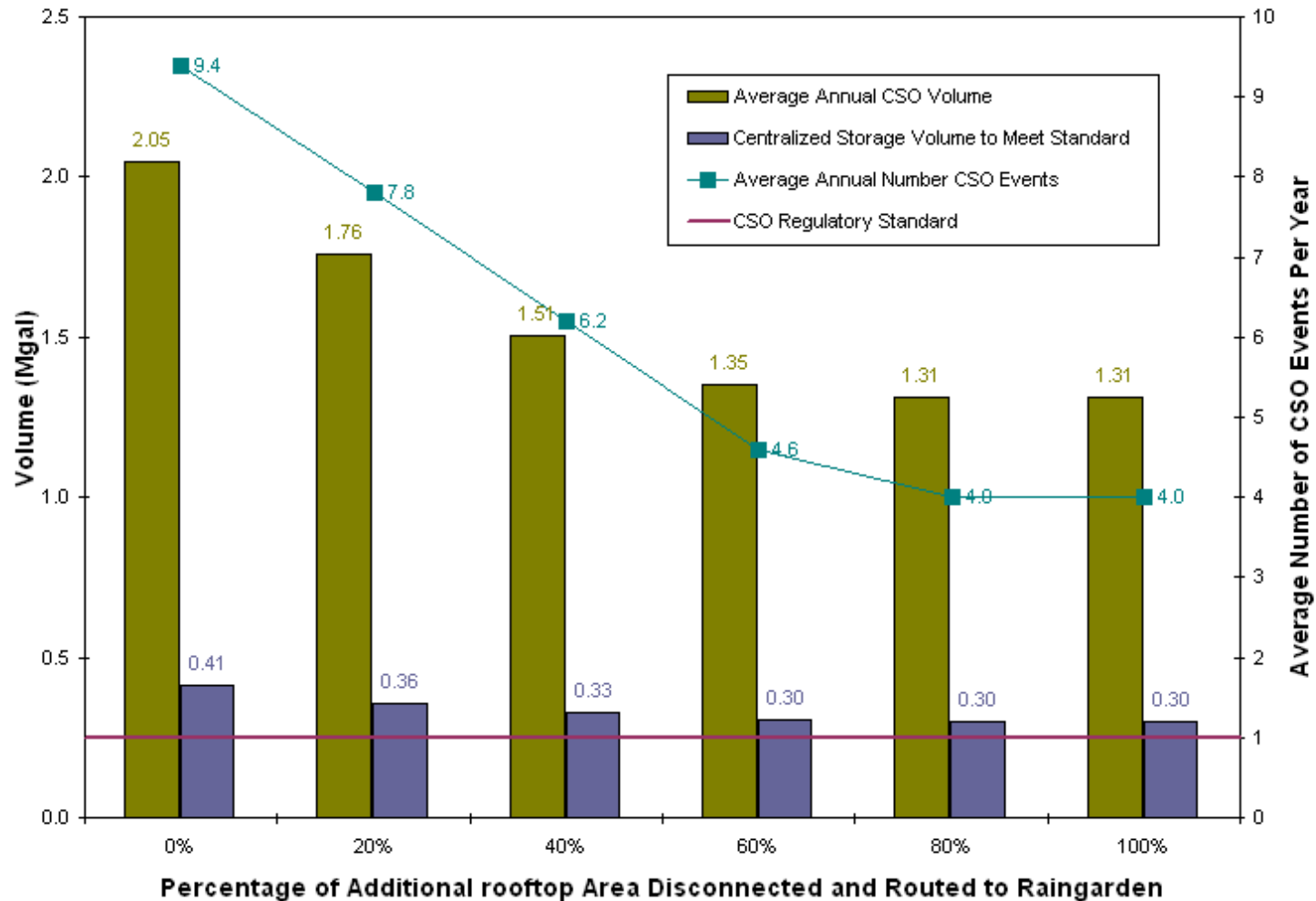# Lakewood RainCatchers
Modeled Cistern Performance - Parcel

Lakewood RainCatchers
Modeled Cistern Performance - Basin

Lakewood RainCatchers
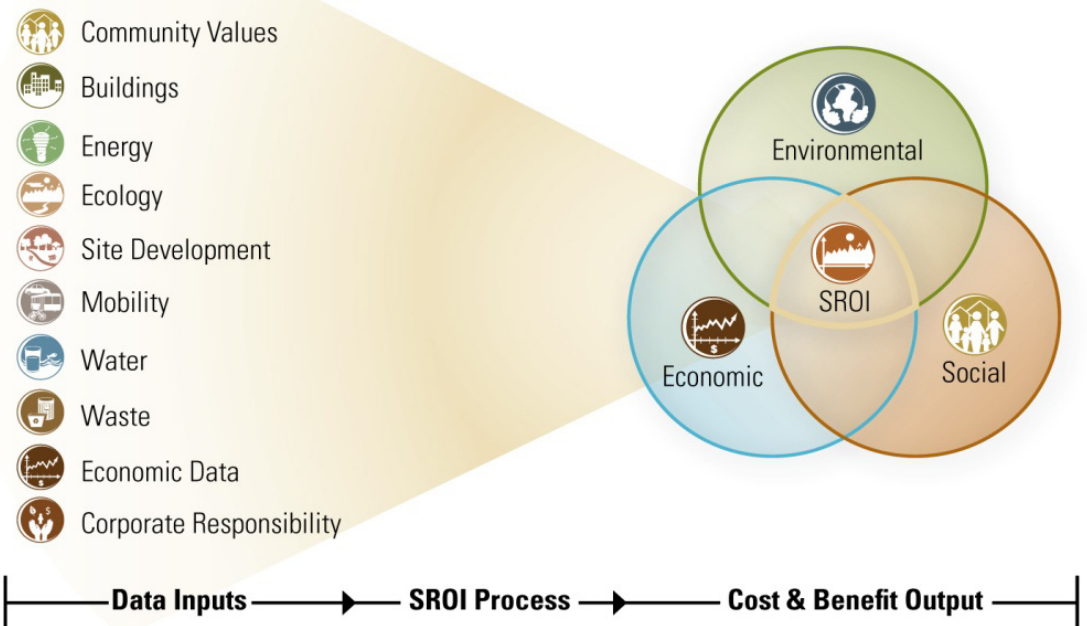## Modeled Rain Garden Performance - Basin

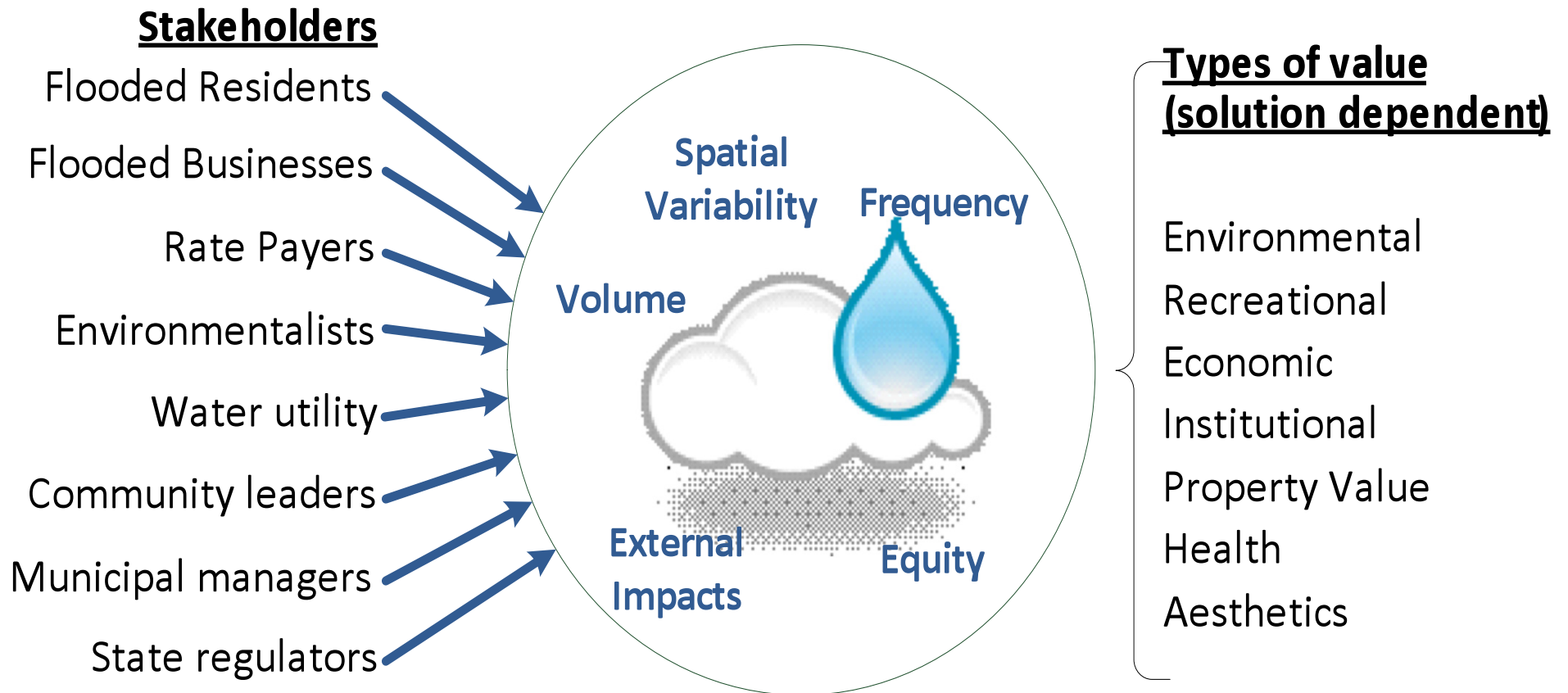# Sustainable Return on Investment Process

- ☐ 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

Complexity in Assessing Full Value of Stormwater Control

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

Spatial Variability
Frequency
Volume
External Impacts
Equity

Types of value (solution dependent)

Environmental
Recreational
Economic
Institutional
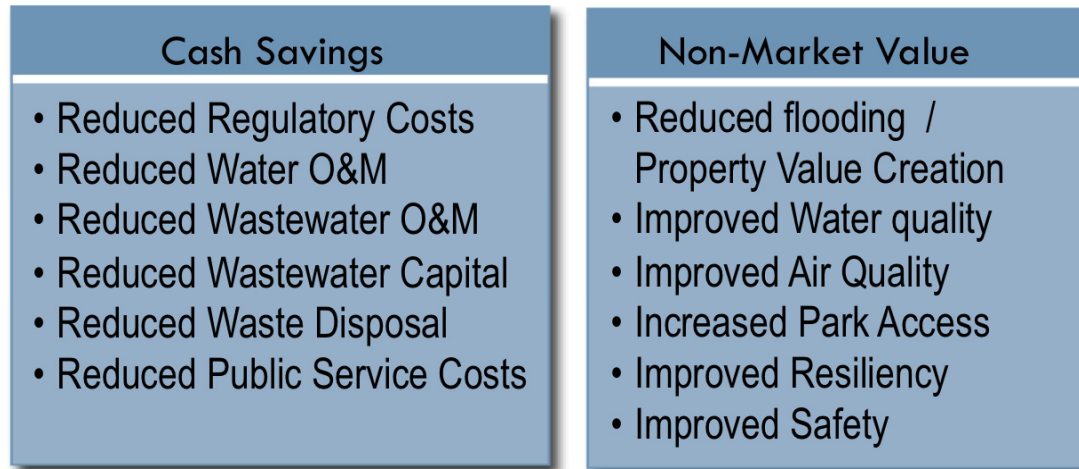Property Value
Health
Aesthetics

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
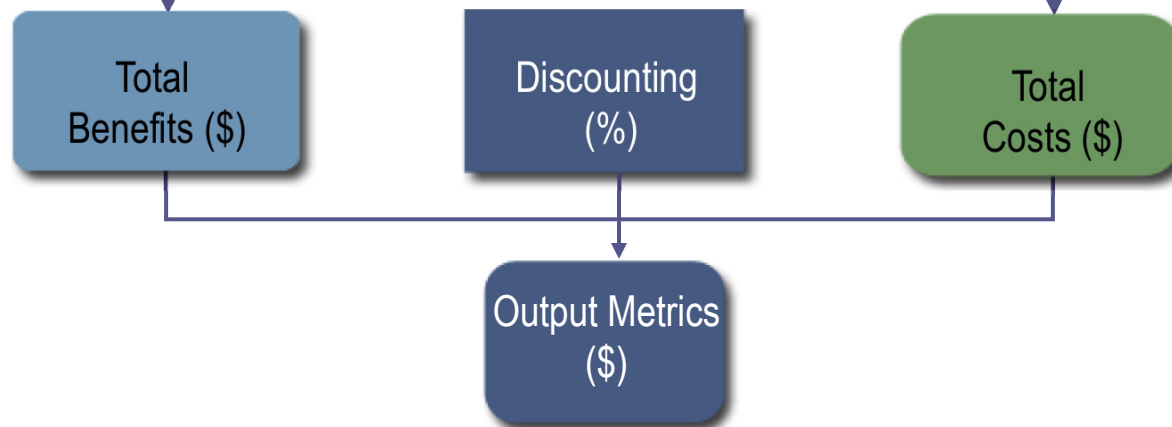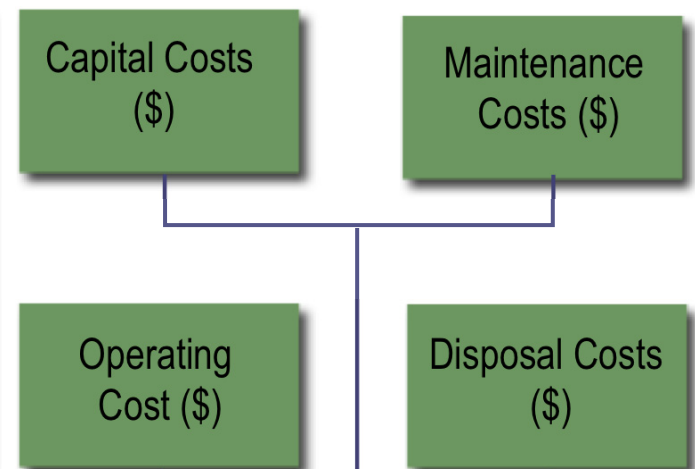- Step 4: Quantitative Analysis
  - Generate results for decision making

Develop Transparent Framework to Explain Key Drivers

Example of Benefits

Costs

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

Capital Costs ($)

Maintenance Costs ($)

Operating Cost ($)

Disposal Costs ($)

Total Benefits ($)

Discounting (%)

Total Costs ($)

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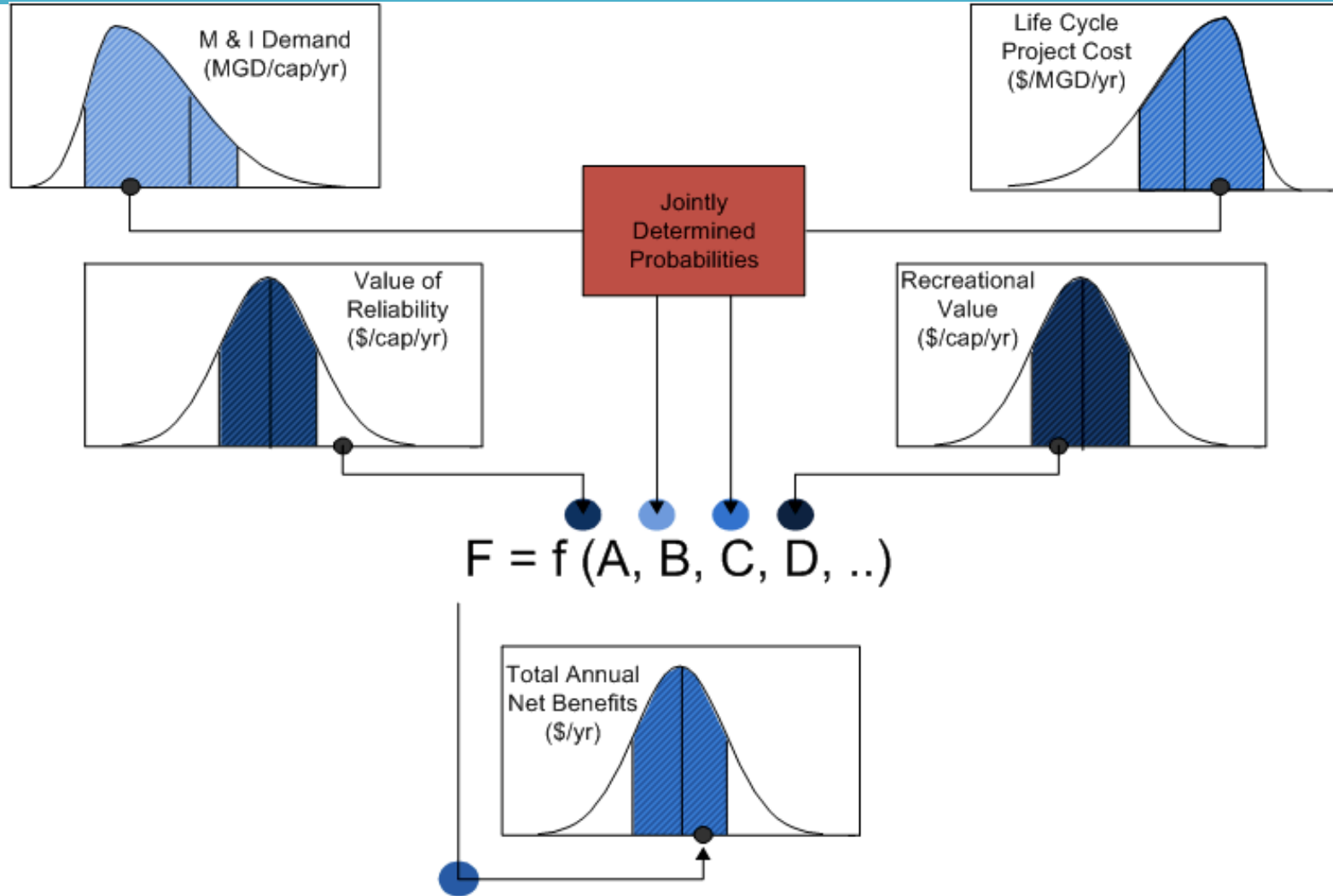
Convene SROI Workshops
to Build Consensus and Credibility

- Facilitated, multi-day workshops

- Participants include experts, agency managers, and analysts

- Goal: reach consensus on analytical framework, measurement and valuation
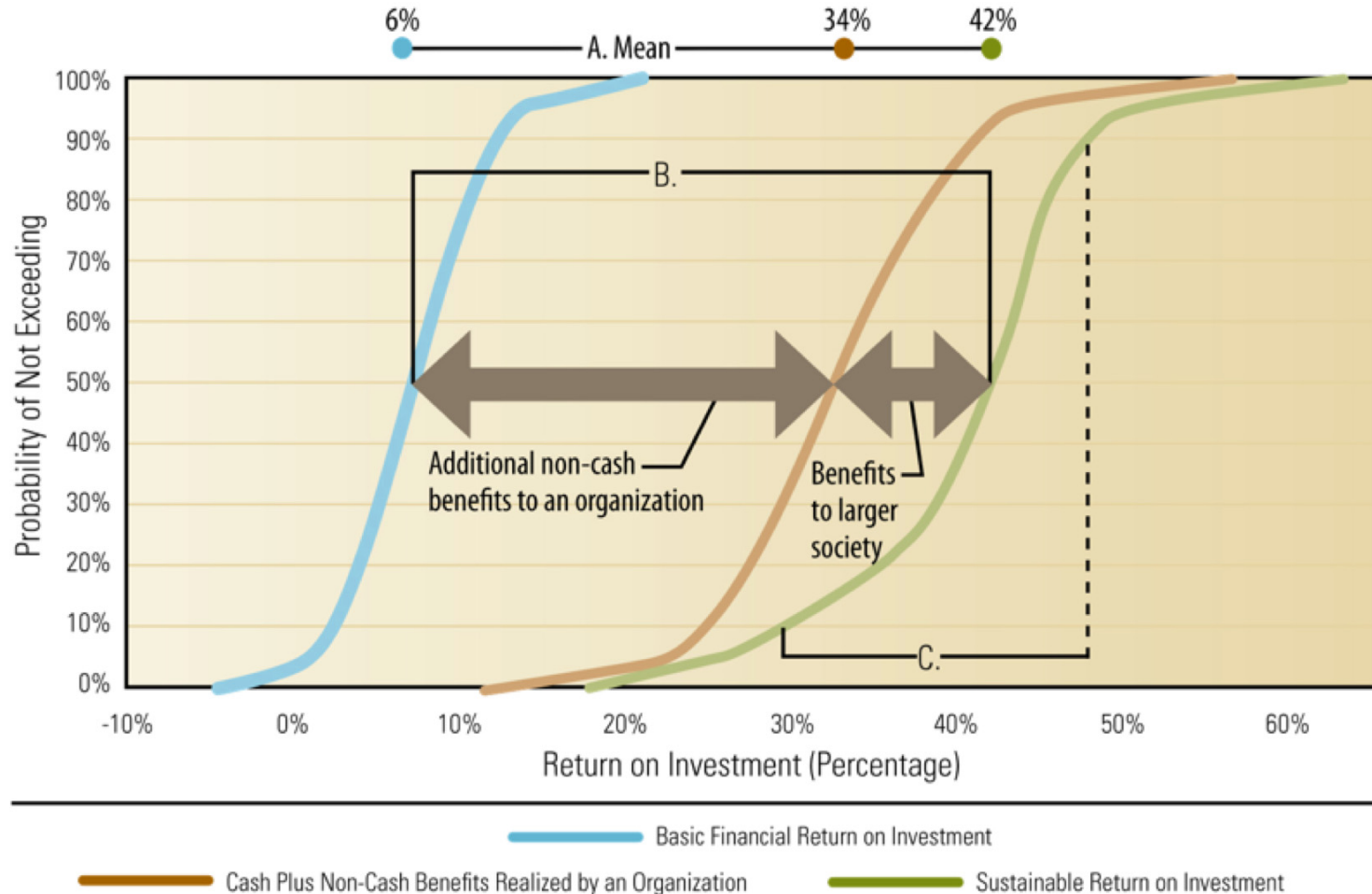
- Discussions generate local perspectives

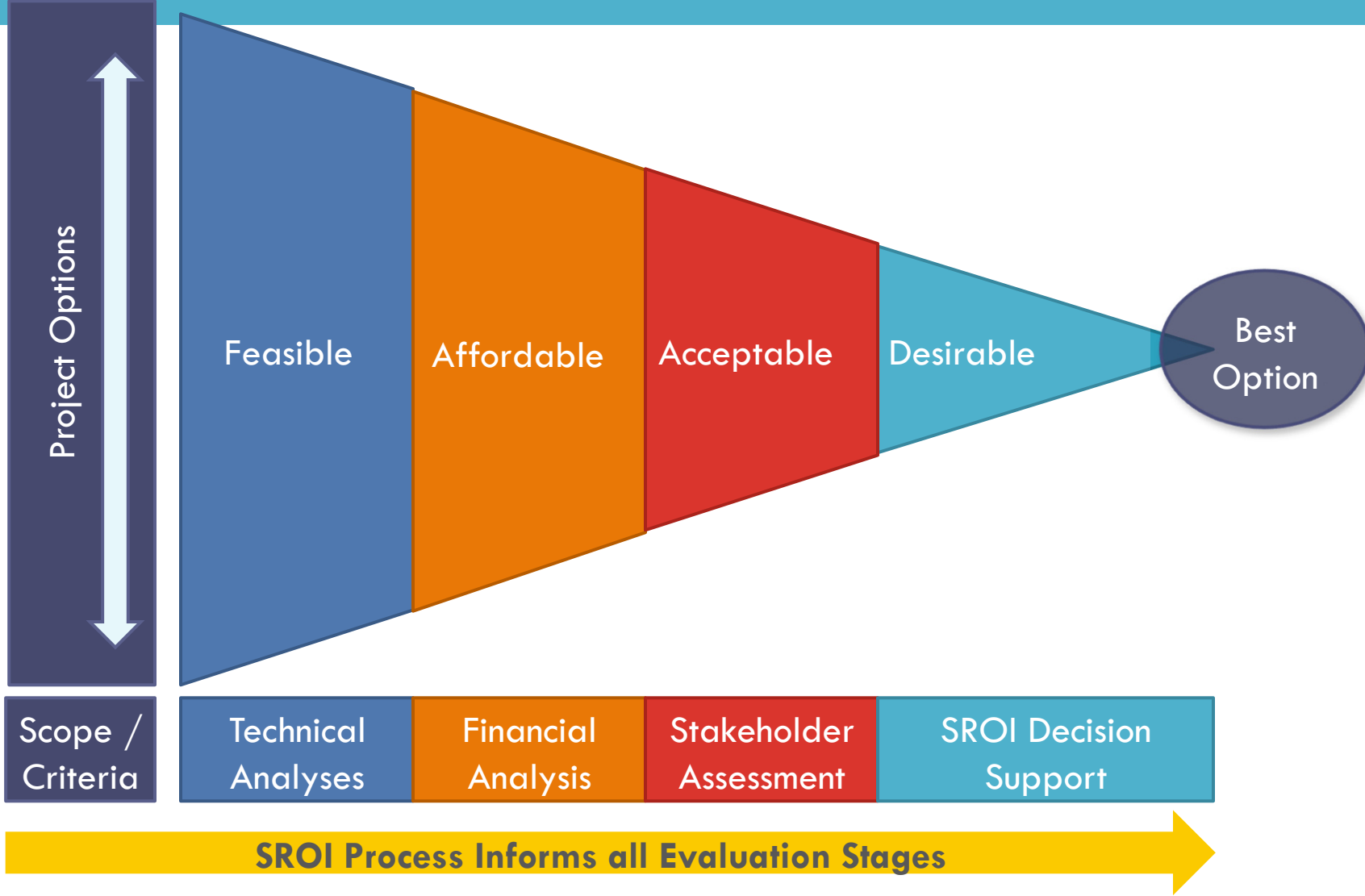# Build SROI Alternatives Analysis Model to Incorporate Risk and Uncertainty

Present SROI Results
to Effectively Inform Decision Making

Integrate SROI Analyses in Evaluation to Identify Best Value Option

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 a stormwater management project?

- What are the key drivers of benefits?

- What are the key drivers of costs?

# Summary of Key Drivers of Green Infrastructure Alternatives Analysis

- 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:
Structure & Logic Review – Facility Benefits
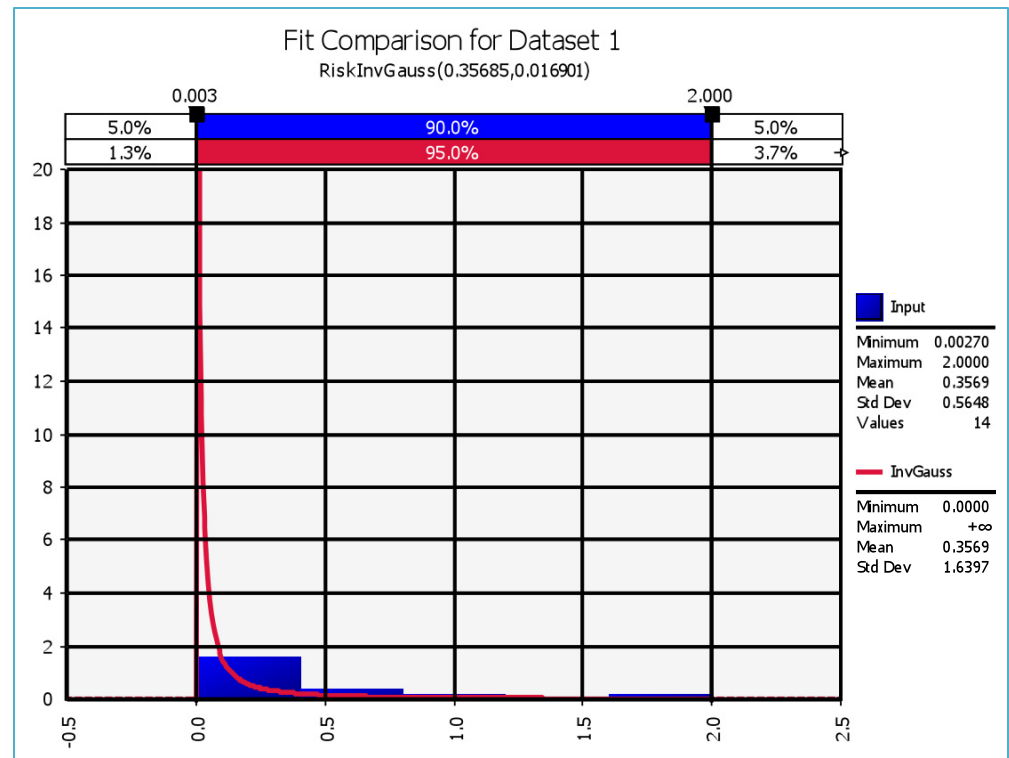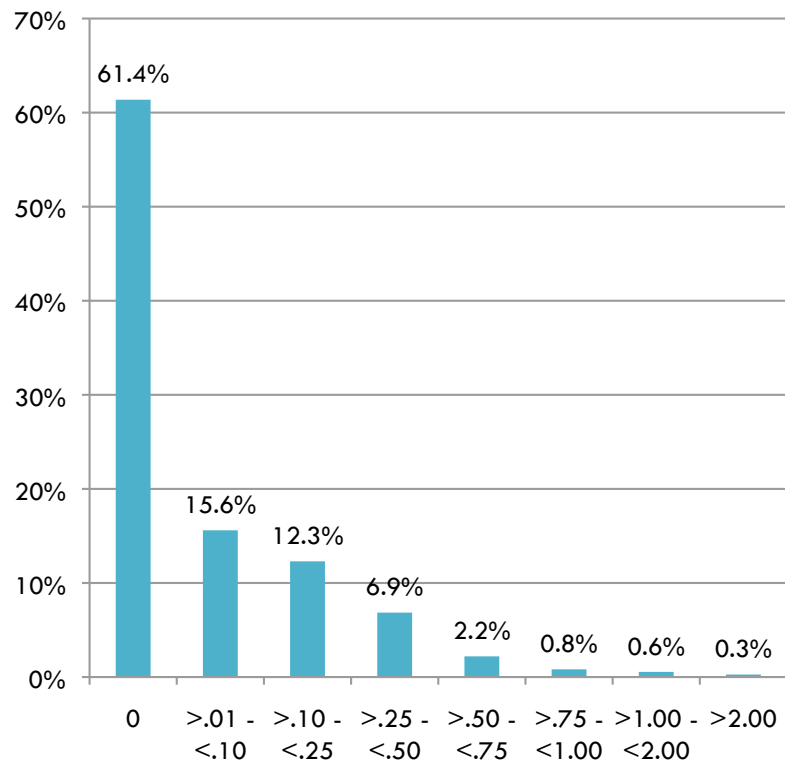

Stormwater Facility Benefits
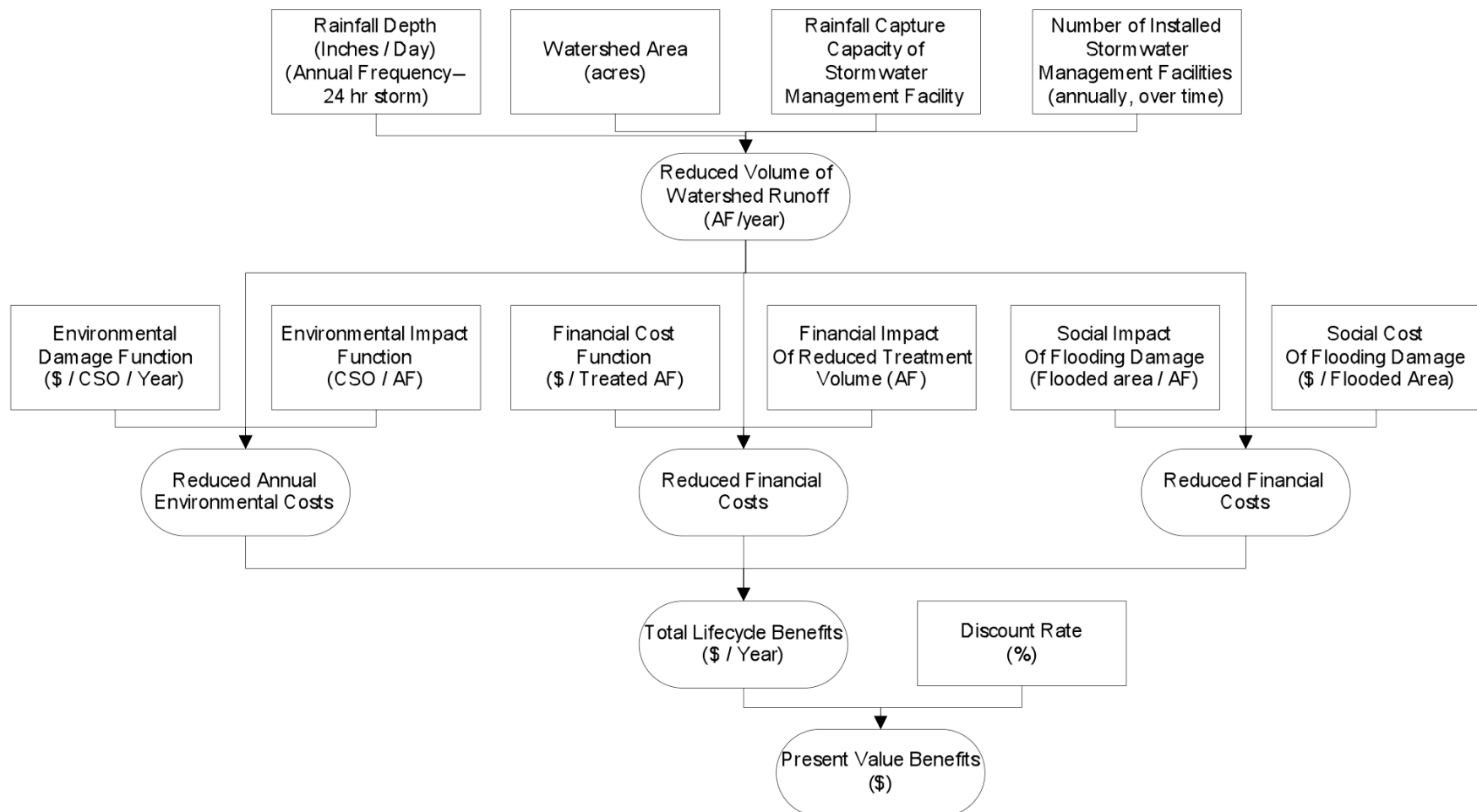
Workshop Setting:
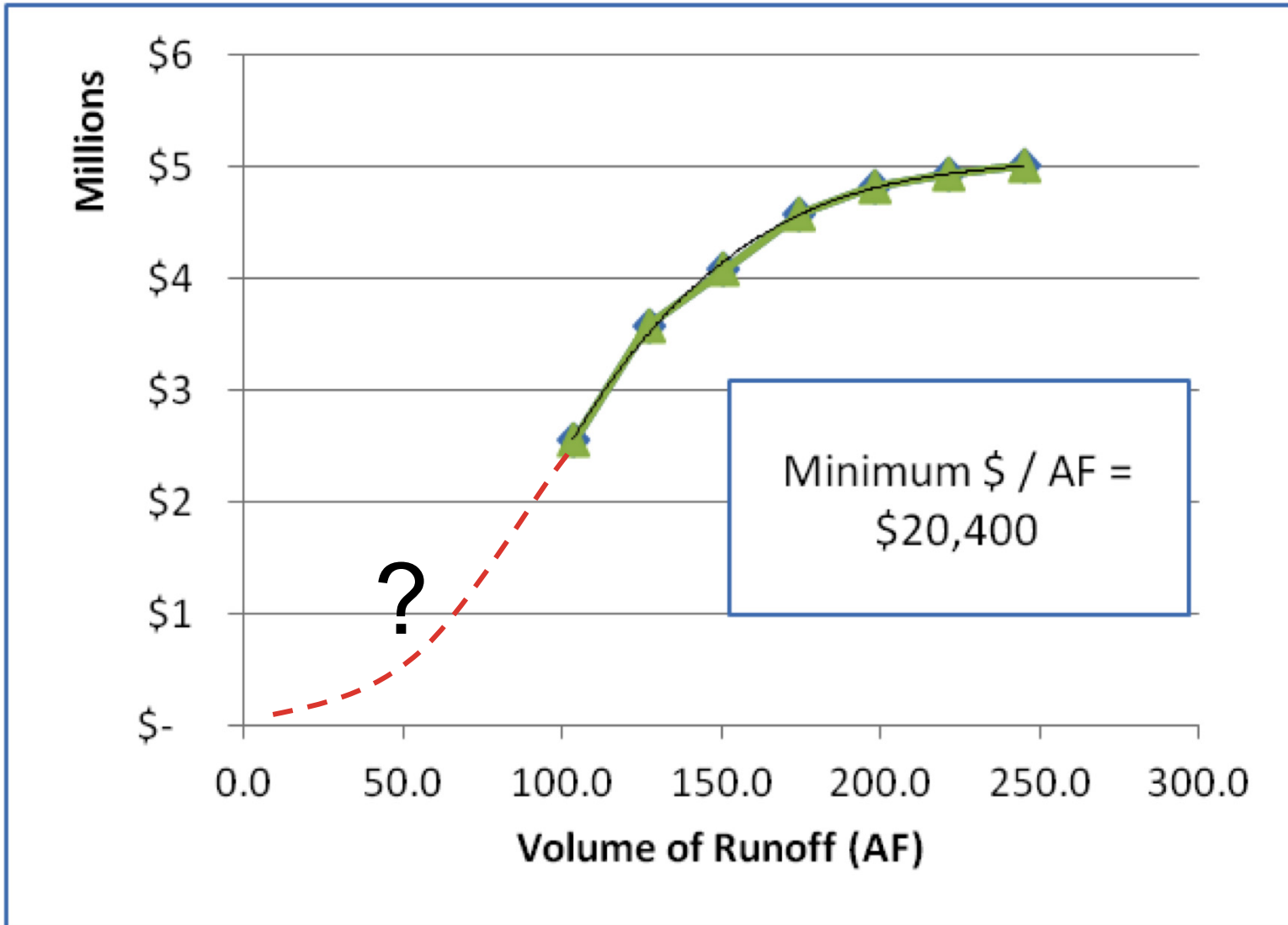## Data Review – Probability Distribution of Daily Rainfall

Annual Frequency of Daily Rainfall

- 61.4% (0)
- 15.6% (>.01 - <.10)
- 12.3% (>.10 - <.25)
- 6.9% (>.25 - <.50)
- 2.2% (>.50 - <.75)
- 0.8% (>.75 - <1.00)
- 0.6% (>1.00 - <2.00)
- 0.3% (>2.00)

Fit Comparison for Dataset 1
RiskInvGauss(0.35685,0.016901)

	Input	
Minimum	0.00270	
Maximum	2.0000	
Mean	0.3569	
Std Dev	0.5648	
Values	14	

	InvGauss	
Minimum	0.0000	
Maximum	+∞	
Mean	0.3569	
Std Dev	1.6397	

Workshop Setting:

## Data Review – Flood Damage Function

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
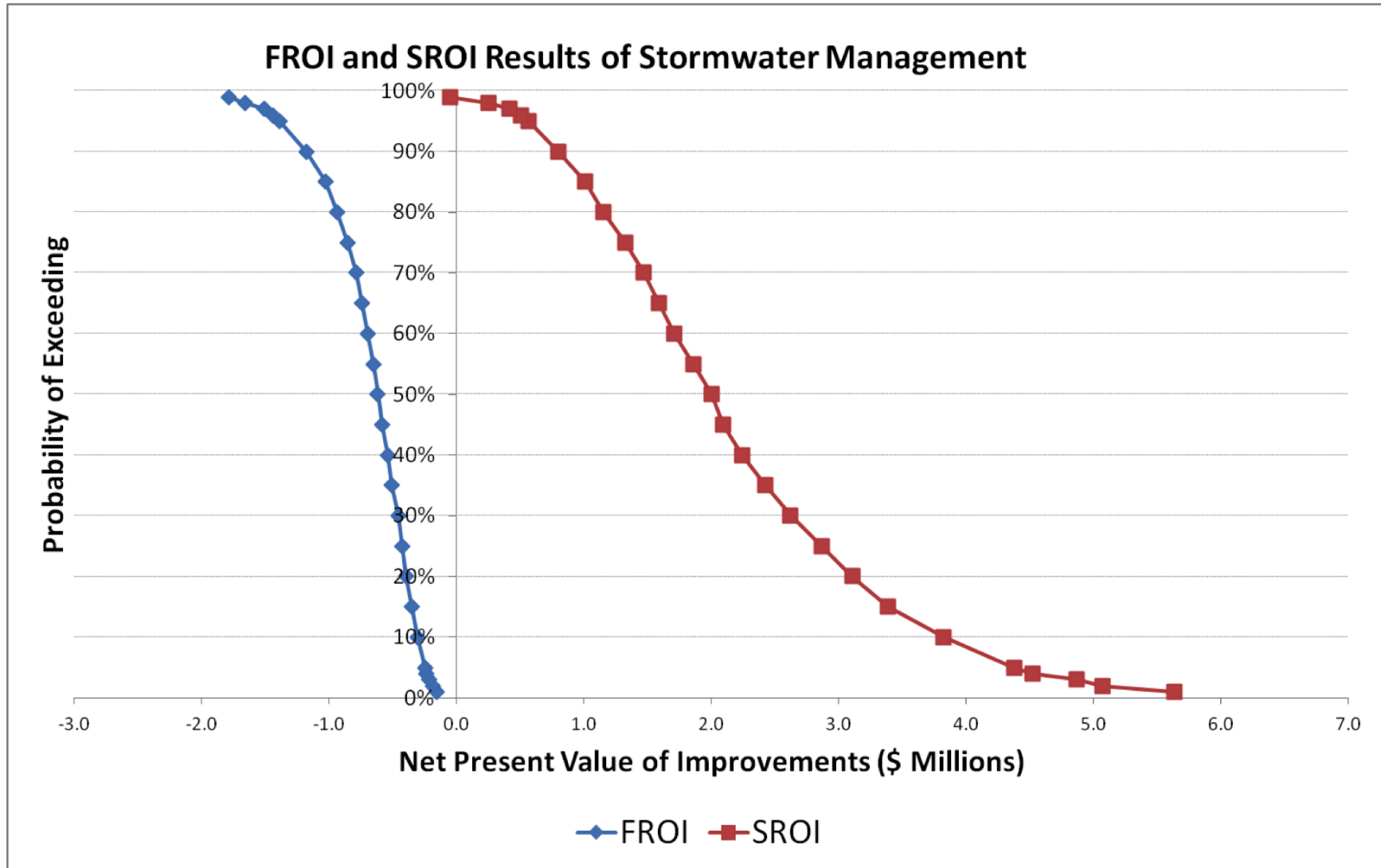
Workshop Setting:
Scenario Testing

- 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?