Green Infrastructure for Localized Flood Management

Tuesday, December 2nd , 2014
1:00 – 2:30pm EST

Speakers:

- **Lori Cary-Kothera,** Operations Manager, National Oceanic and Atmospheric Administration's (NOAA) Office for Coastal Management
- **Patekka Bannister,** City of Toledo, Division of Environmental Services
- **Tony V. Demasi,** City Engineer, City of Cuyahoga Falls, OH
- **Kari A. Mackenbach**, URS Corporation, National Green Infrastructure Practice Leader

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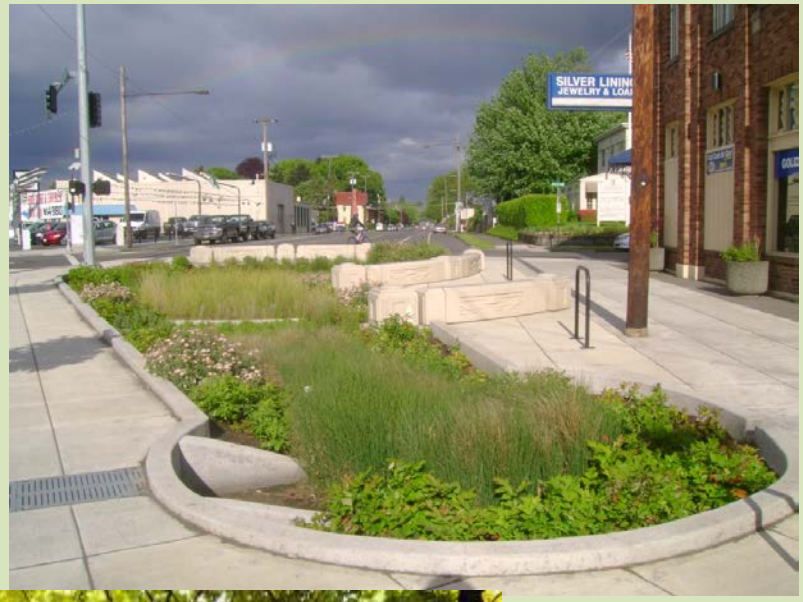
  - Call **GoToWebinar** support:[1-800-263-6317], and give conference ID# 411756976

Webcast Agenda

- **Introduction**
- **Toledo, Ohio and Duluth, Minnesota,** Patekka Bannister and Lori Cary-Kothera
- **Rain Garden Reserve: Managing Flooding with Green Infrastructure Solutions in Cuyahoga Falls,** Tony V. Demasi and Kari Mackenbach
- **Q&A session**
- **Wrap up**



Assessing Green Infrastructure Costs and Benefits

Patekka Pope Bannister
City of Toledo

Lori Cary-Kothera
NOAA's Office for Coastal Management

Basement and Street Flooding Complaints 2007 - 2012

Toledo Research Area

Complaints

- WATER IN THE BASEMENT
- WATER STANDING IN STREET
- WATER STANDING OTHER

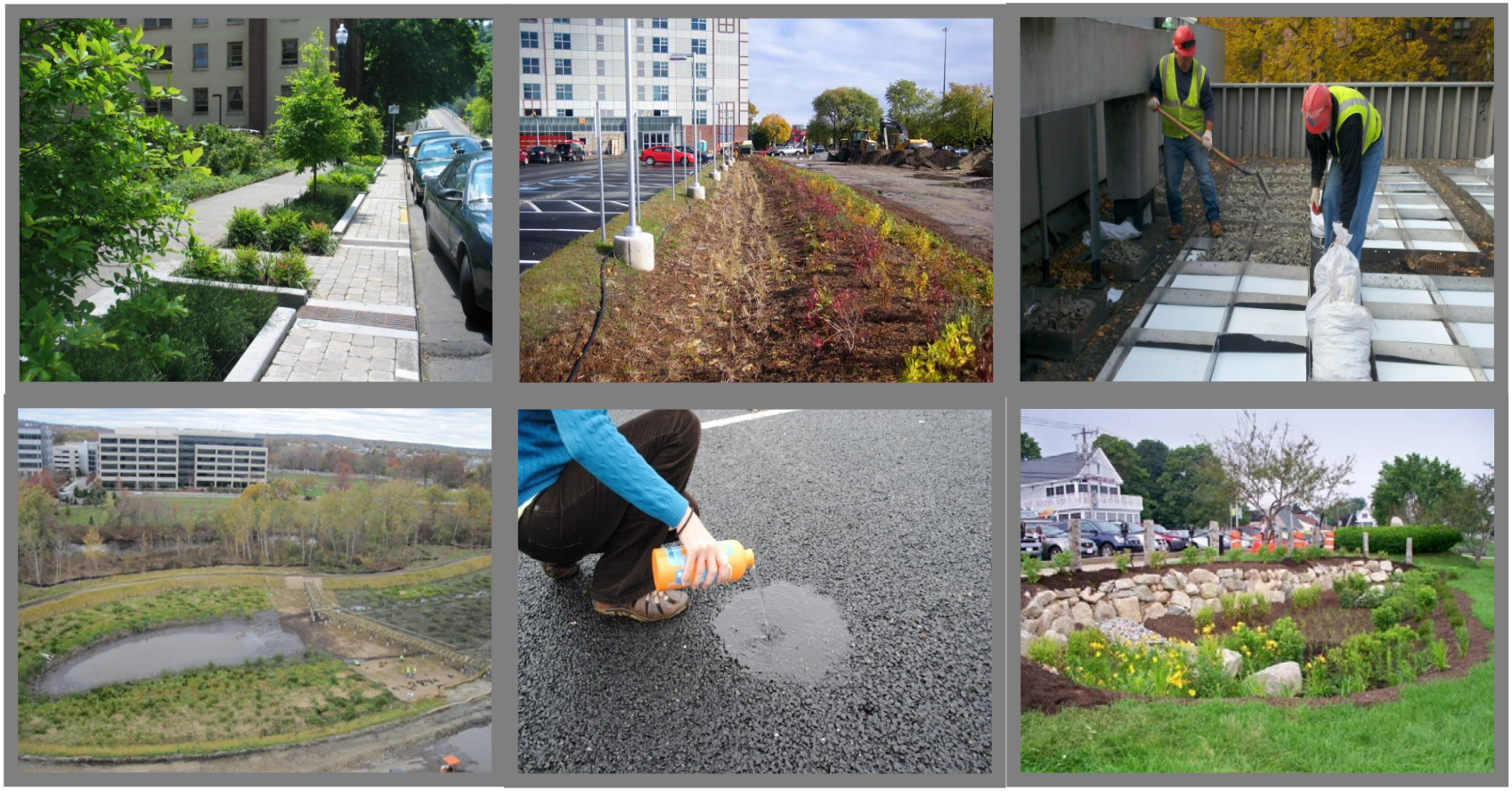
0 0.75 1.5 3 4.5 6

Toledo Proof of Concept GI Projects

Maywood Avenue Volume Reduction

- Revitalize neighborhood
- Community involvement
- Reduce stormwater runoff entering the CSO
- Compare green verse grey costs

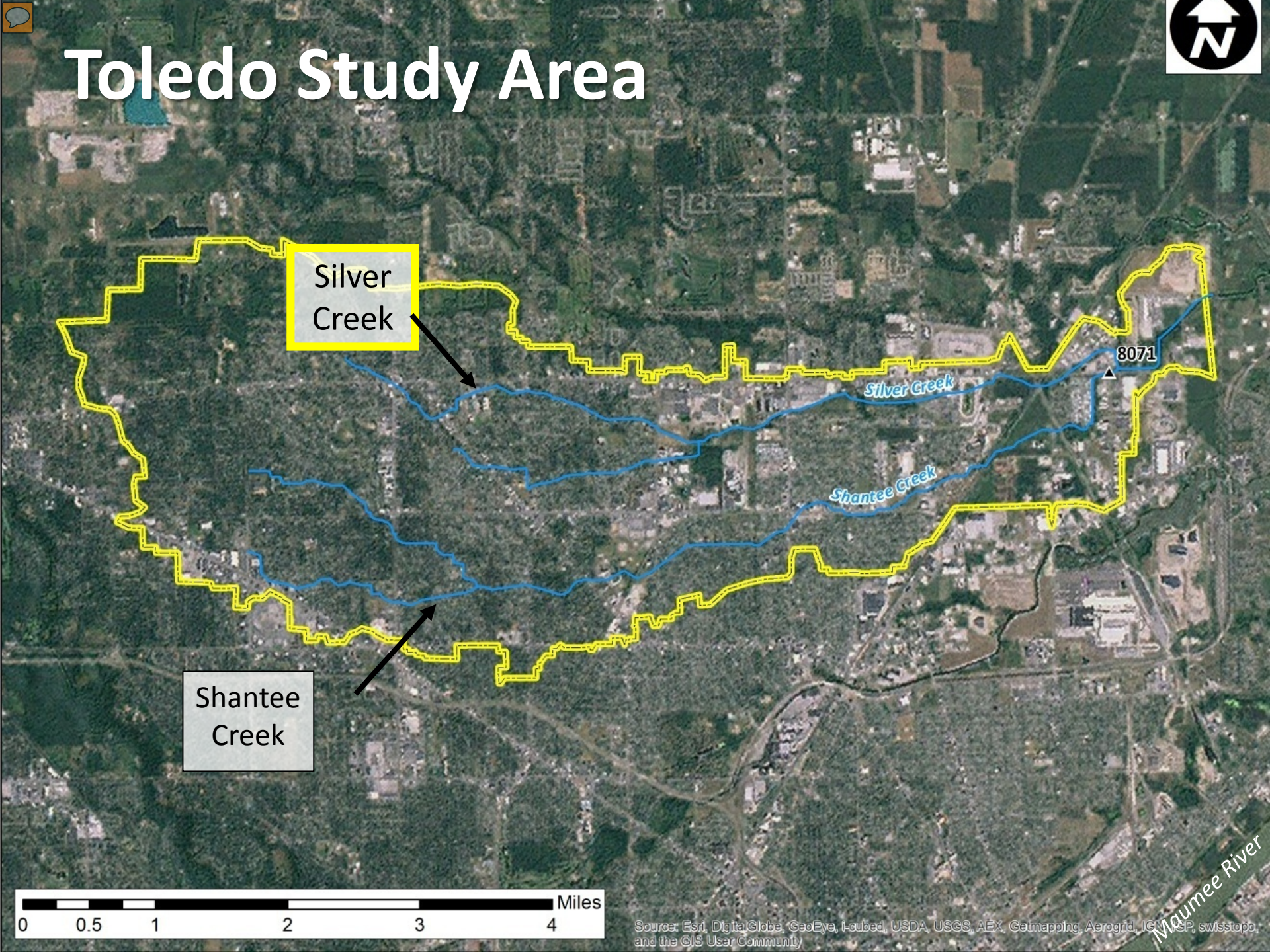
We need help with green infrastructure long-term planning



Economic Assessment Steps

1. Define flood problem
2. Assess current and future flooding
3. Identify flood reduction options using GI
4. Assess flood scenarios with GI options
5. Compare benefits and costs
6. Develop approach to implementation
7. Communicate assessment results

Toledo Study Area



Flood Impact Scenarios

1. Current precipitation and current land use

2. Future precipitation and future land use

Flood Reduction Scenarios

3. Current precipitation and current land use using GI

4. Future precipitation and future land use using GI

1. How much rain now and in the future?

2. How much water could cause flooding?

3. Where could flooding occur?

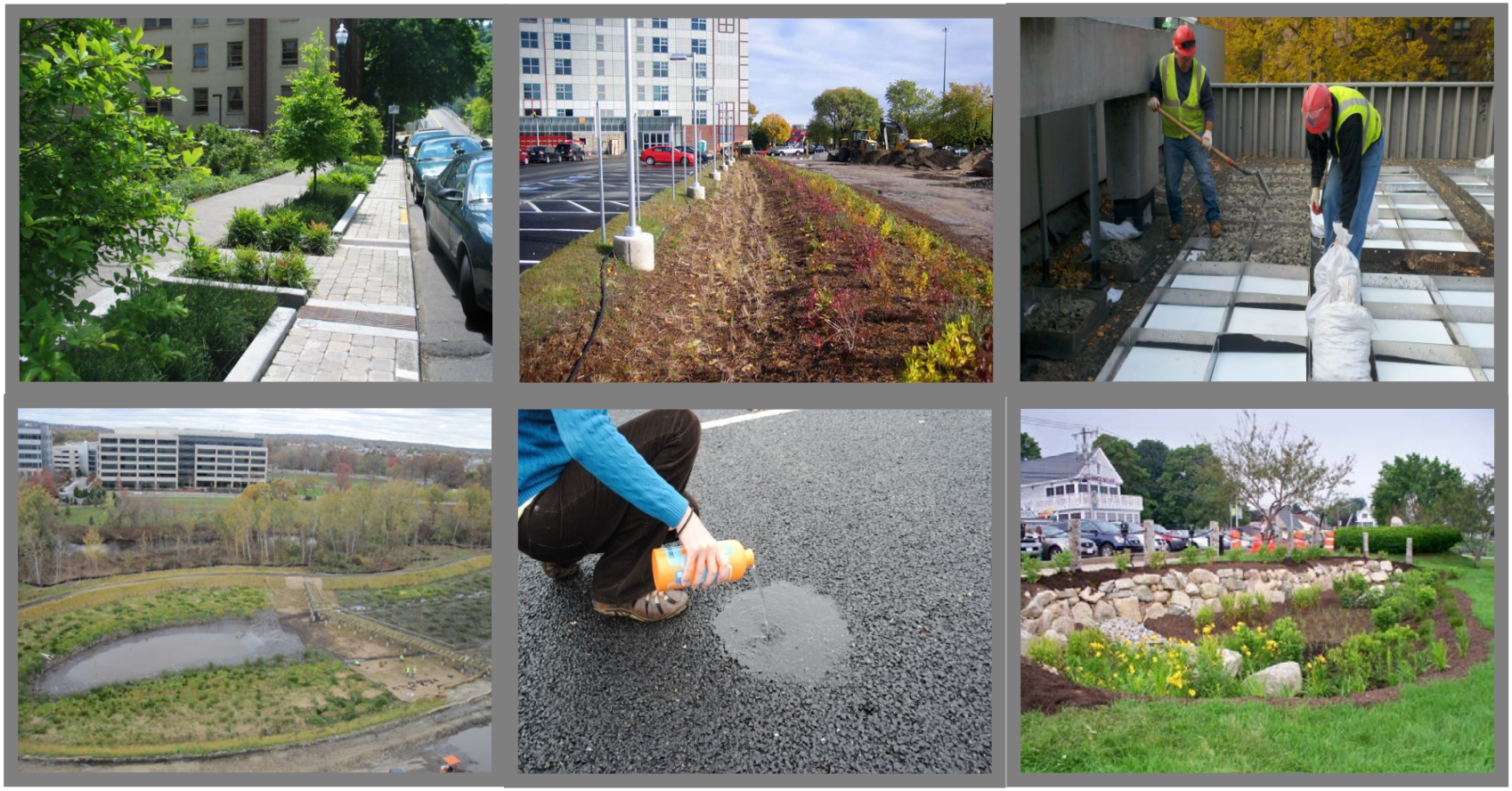
Flood damage costs

Flood damage to buildings = $740K

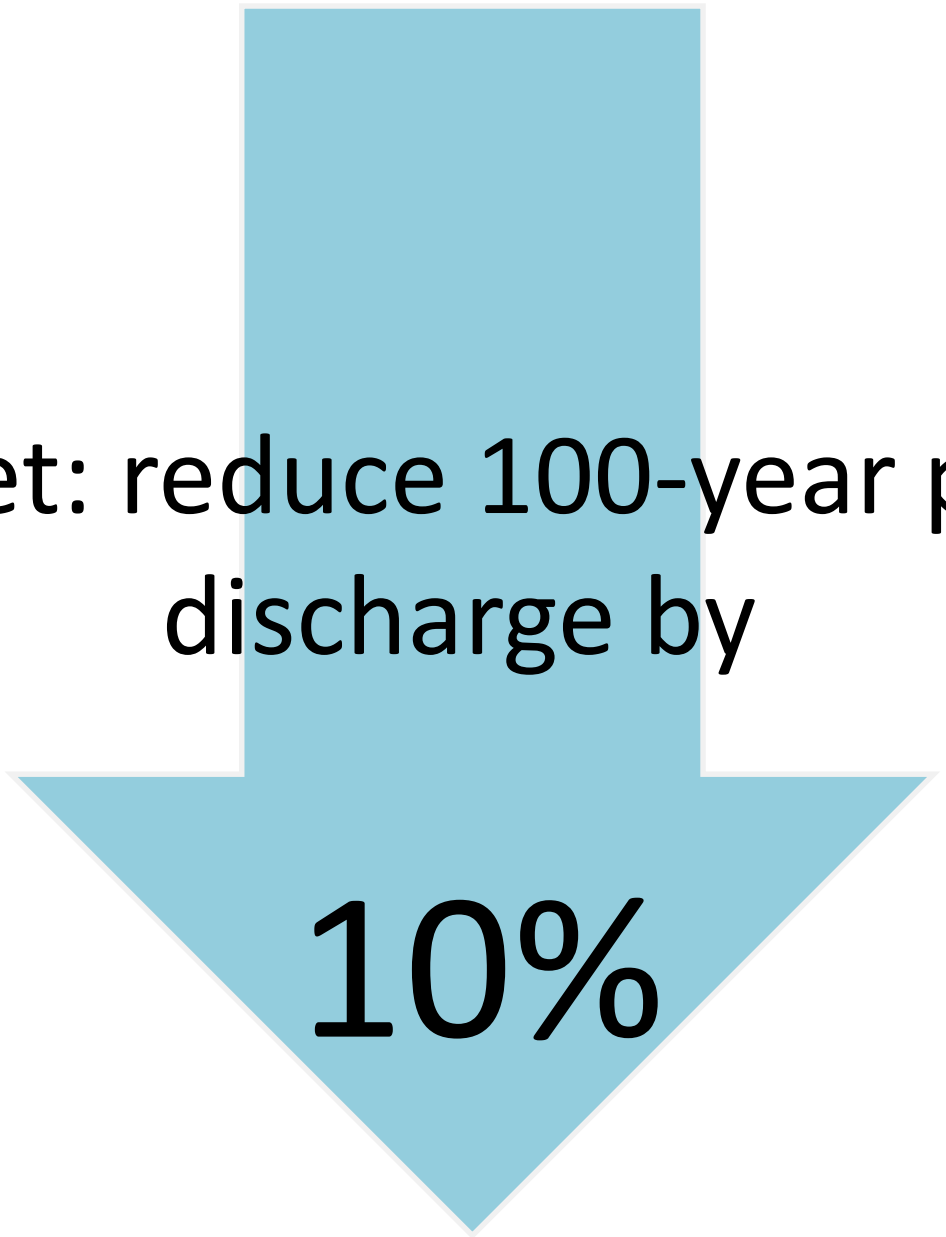
Flood damage costs

Flood damage to buildings = $930K

Many options



Target: reduce 100-year peak discharge by

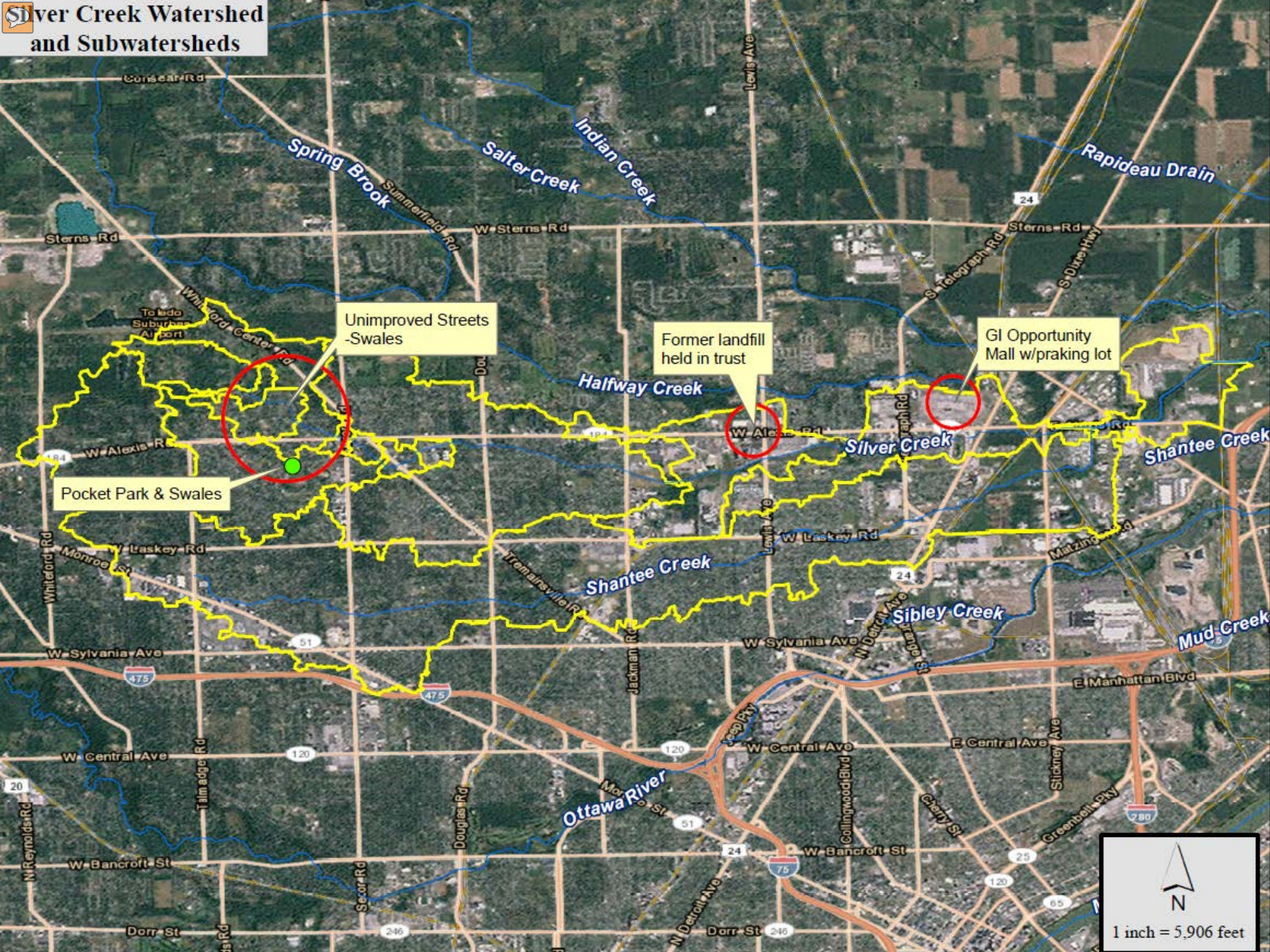


How much green infrastructure <u>storage</u> is needed to reach this target?

30 acre-feet
(current conditions)

32 acre-feet
(future conditions)

What and how much of each?


Silver Creek Watershed and Subwatersheds
Unimproved Streets -Swales
Former landfill held in trust
GI Opportunity Mall w/praking lot
Pocket Park & Swales
Spring Brook
Salter Creek
Indian Creek
Rapideau Drain
Halfway Creek
Silver Creek
Shantee Creek
Sibley Creek
Mud Creek
Ottawa River
Sterns Rd
W Sterns Rd
W Alexis Rd
W Laskey Rd
W Sylvania Ave
W Central Ave
E Central Ave
E Manhattan Blvd
W Bancroft St
Dorr St
Summerfield Rd
Whiteford Center Rd
Toledo Suburban Airport
Whiteford Rd
Monroe St
Tremainsville Rd
Jackman Rd
Douglas Rd
Talmadge Rd
Secor Rd
N Reynolds Rd
N Detroit Ave
Lewis Ave
S Telegraph Rd
S Dixie Hwy
Collingwood Blvd
Cherry St
Stickney Ave
Greenbelt Pky
Jeep Pky
N
1 inch = 5,906 feet

GI Options of Interest

- Bioretention/bioswales along unimproved roads
- Blue Roofs Permeable Pavement (Unimproved Roads)
- Permeable Pavement (Unimproved Roadways Sidewalk)
- Underground Storage
- Parcel Buy-outs (for on site detention)

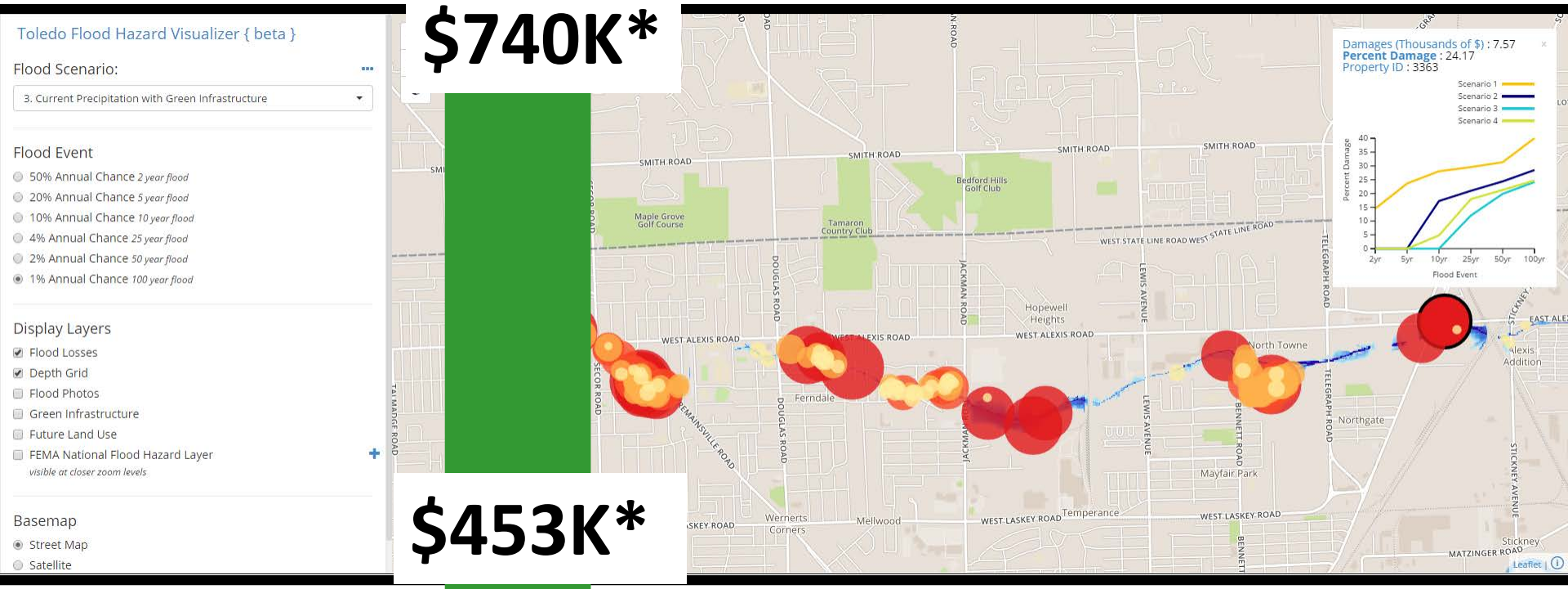
Step 4. Assess how much flood damages are reduced using GI

Flood Reduction Scenarios

3. Current precipitation and current land use using GI

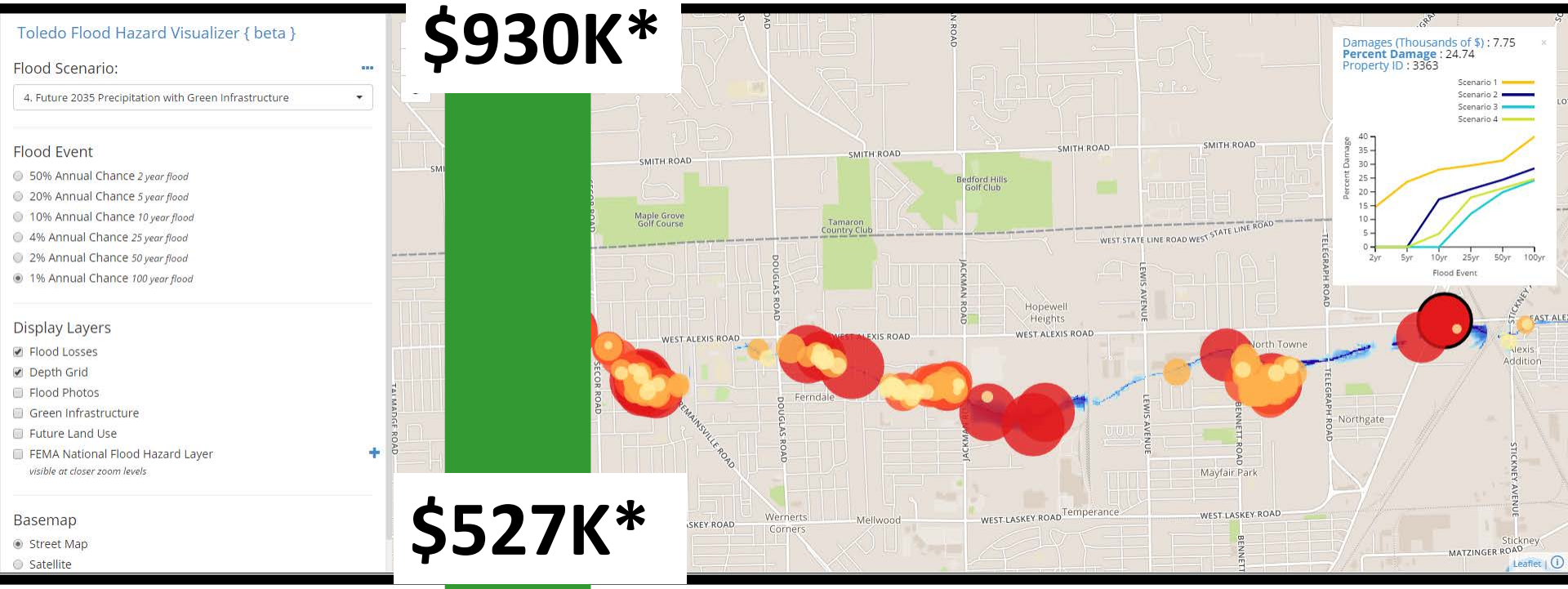
4. Future precipitation and future land use using GI

How much are flood damages reduced using GI?



*Flood damage to buildings

How much are flood damages reduced using GI?



*Flood damage to buildings

Step 5. Estimate costs and benefits


Costs = Flood Damages


Benefits = Damages Avoided

Toledo's Benefits

- For 20-year period: $700K not spent on flood damages to buildings

- For 50-year period: $1.77M not spent on flood damages to buildings

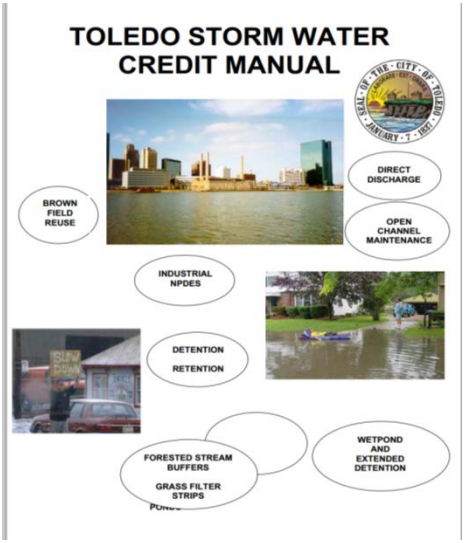
You need…

- Buildings
- Roads, bridges
- Stormwater infrastructure
- Recreation
- Wages
- Land damages

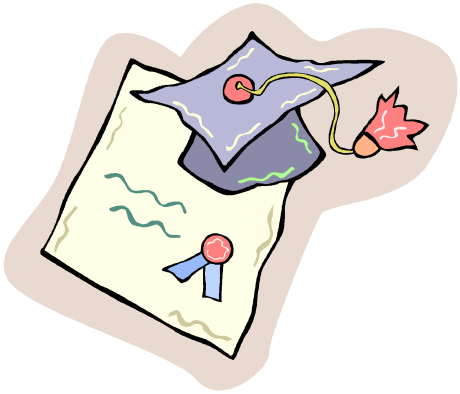
We had…

- Buildings
- ~~Roads, bridges~~
- ~~Stormwater infrastructure~~
- ~~Recreation~~
- ~~Wages~~
- ~~Land damages~~

How Toledo is Using Results



Lessons Learned



- Committed communities and reliable partners
- Choose longer lasting green infrastructure
- Collect data on public infrastructure repair/replacement
- Implement GI over time
- Leverage other infrastructure investments
- Look to partnerships and other people's money to help
- Look at bigger picture, not just small projects that could impair hydrology (make things worse) – Need to look at full implementation
- Local partners – get a champion that is not elected or works for the city – nonprofit, coordinator-type- like Sea Grant or NERR

What's next for NOAA

- Process Guide
- Outreach
- More community technical assistance
- Products to support use of assessment

Digital Coast

coast.noaa.gov/digitalcoast/

coast.noaa.gov/digitalcoast/publications/climate-change-adaptation-pilot

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Rain Garden Reserve, Managing Flooding with Green Infrastructure Solutions in Cuyahoga Falls

Tony Demasi, PE
City of Cuyahoga Falls,
City Engineer

Kari Mackenbach, CFM BCES
URS Corporation
Project Manager

Presentation Topics:

- Overview of GI and Flooding
- Project Background
- Process Followed
- Benefits of Project
- Obstacles
- End Results
- Lessons Learned

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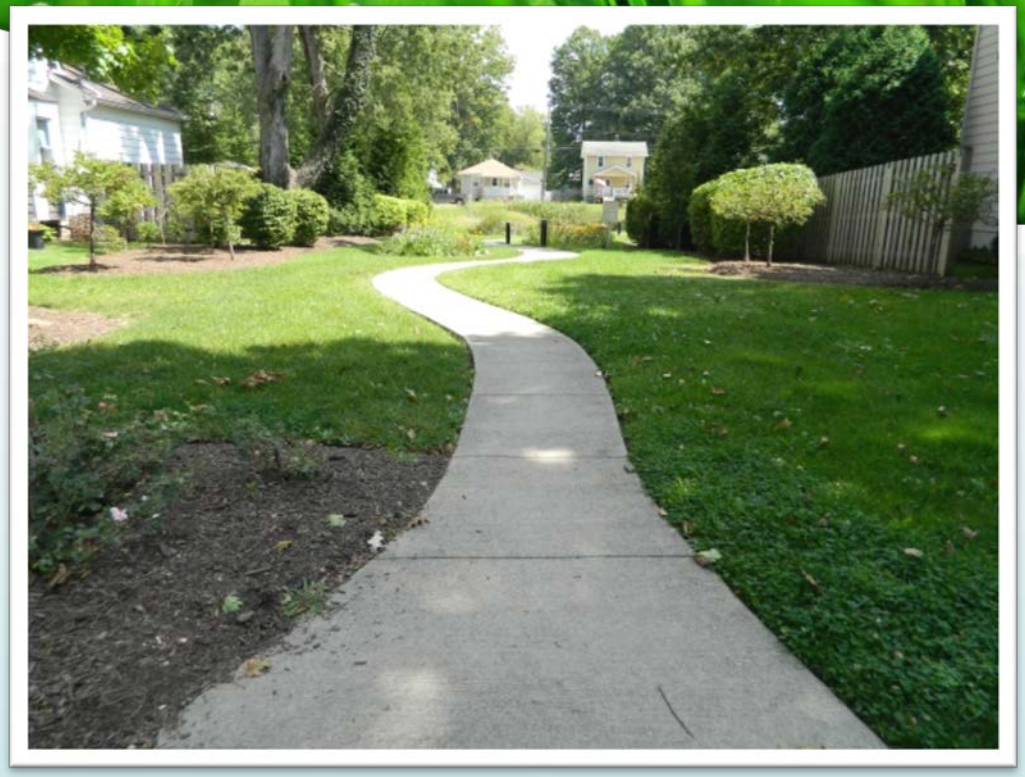
The Rain Garden Reserve



- Innovative Approach to Mitigation
- First FEMA V Approved GI Project
- Stormwater/Flooding Solutions
- Neighborhood Amenity
- Public Outreach Tool for GI

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How is Green Infrastructure & Flooding Connected?

Seeing the Significance of the Hydrologic Impacts of Urbanization Over Time

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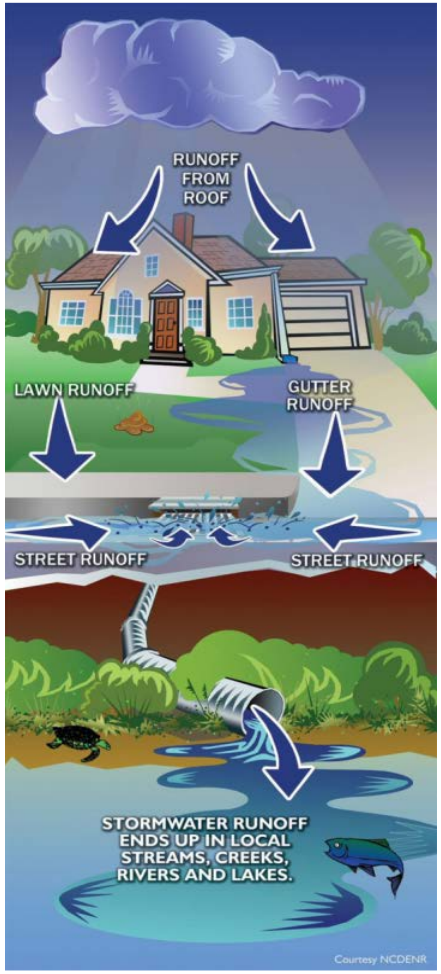
Can GI Solve Localized Flooding?



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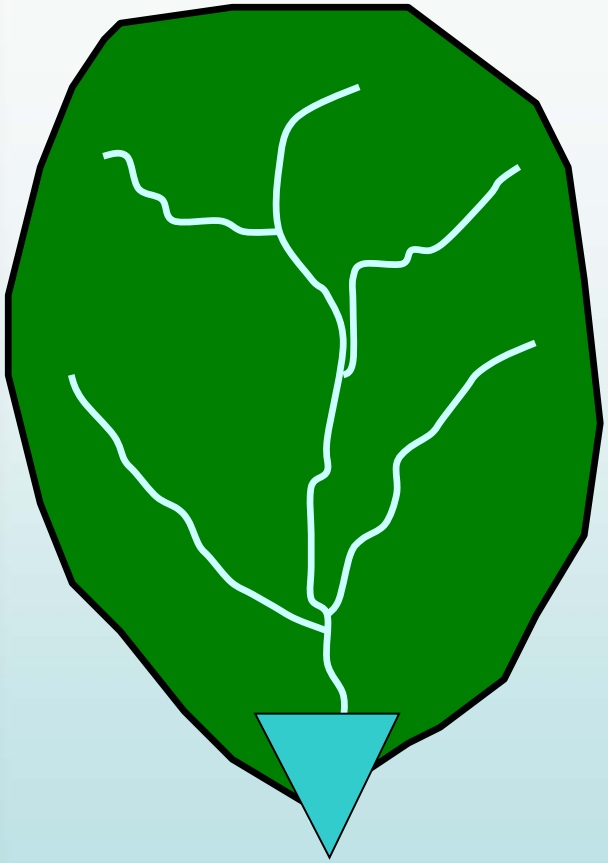
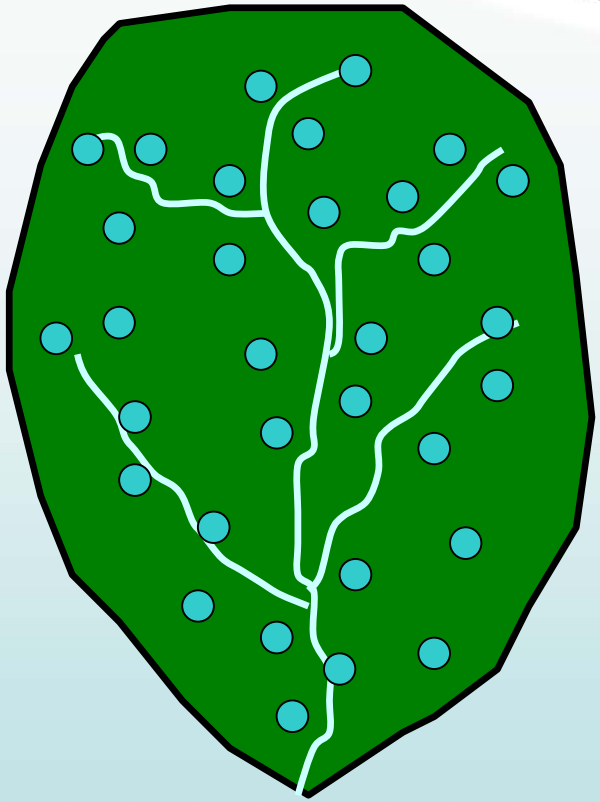
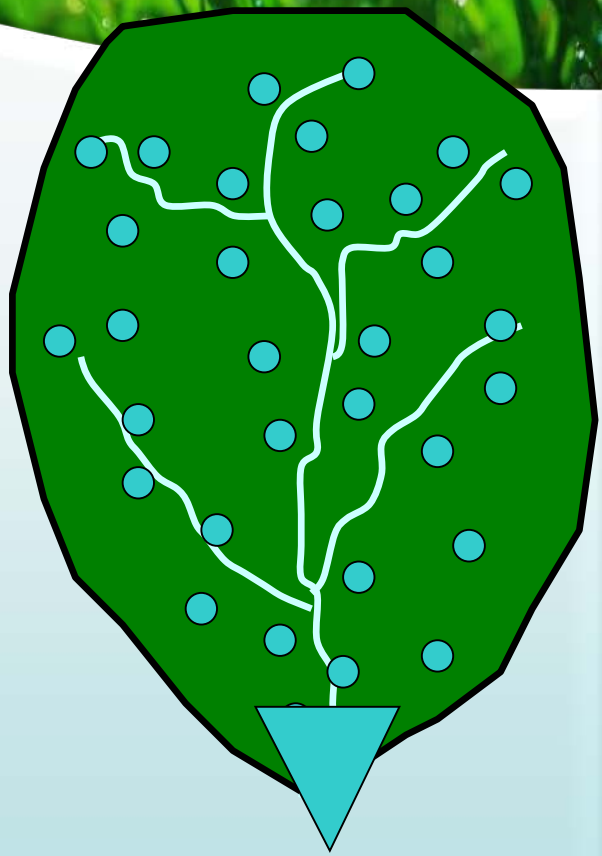
Distributed Stormwater Controls Close to Runoff Sources



Traditional Regional Technique



Distributed Stormwater Features



Integrated Stormwater Controls

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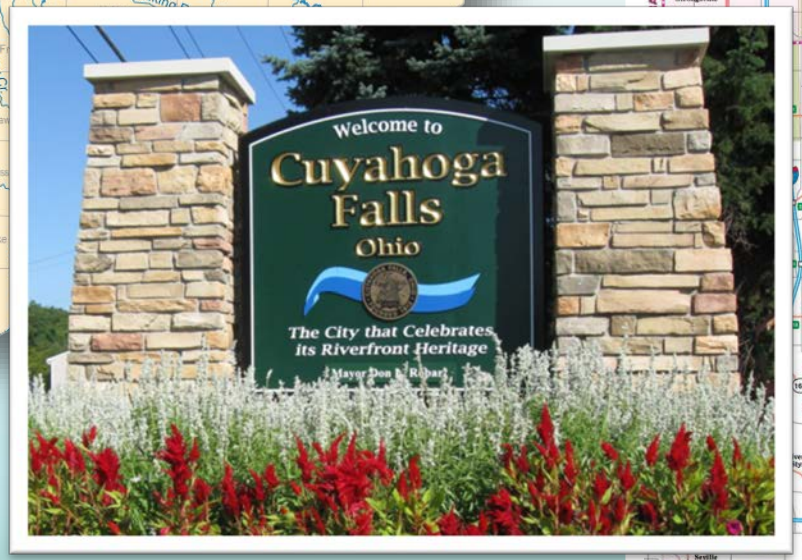
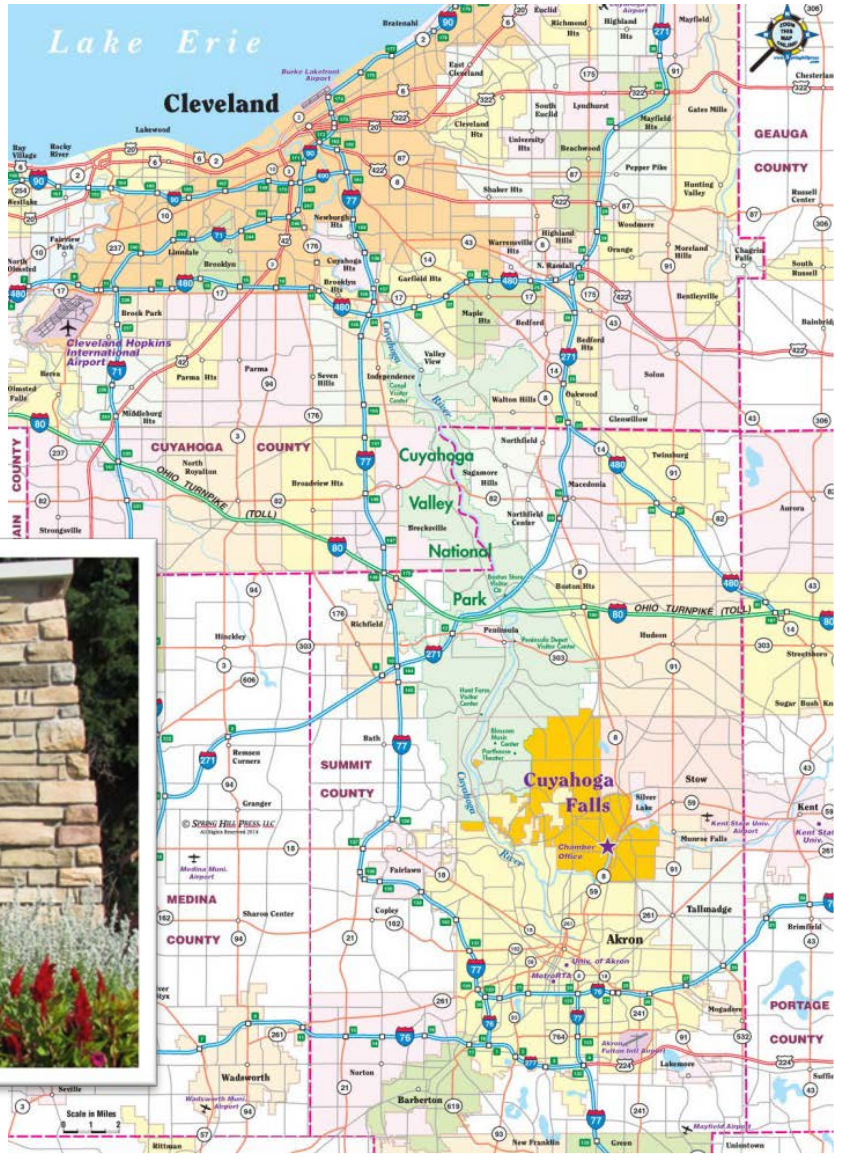
Project Location





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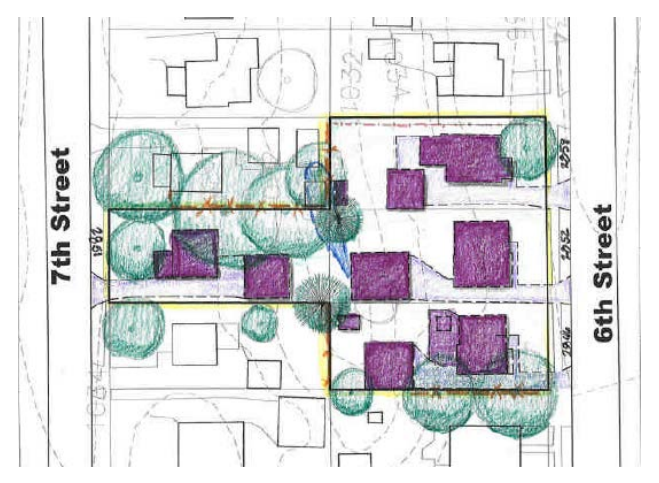
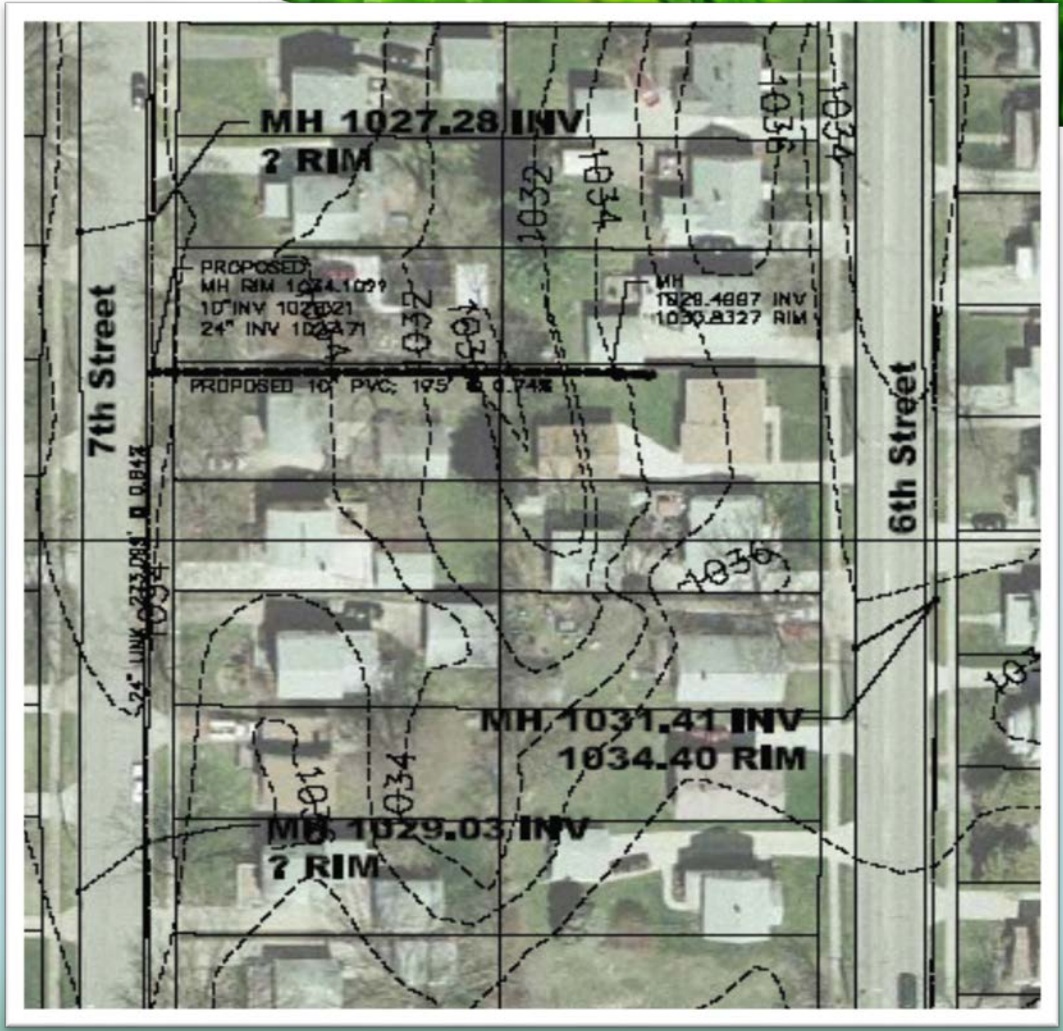
Project Area:

- Background
- Events Occurred
- Size of Project Area
- Traditional Solutions
- Innovative Solutions





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History of Flooding

- Repetitive loss area
- 2004 flooding severe ($122,000)
- Up to 9 ft. deep
- 4 homes participated
- Area acted as a drainage point
- No direct surface flow flooding

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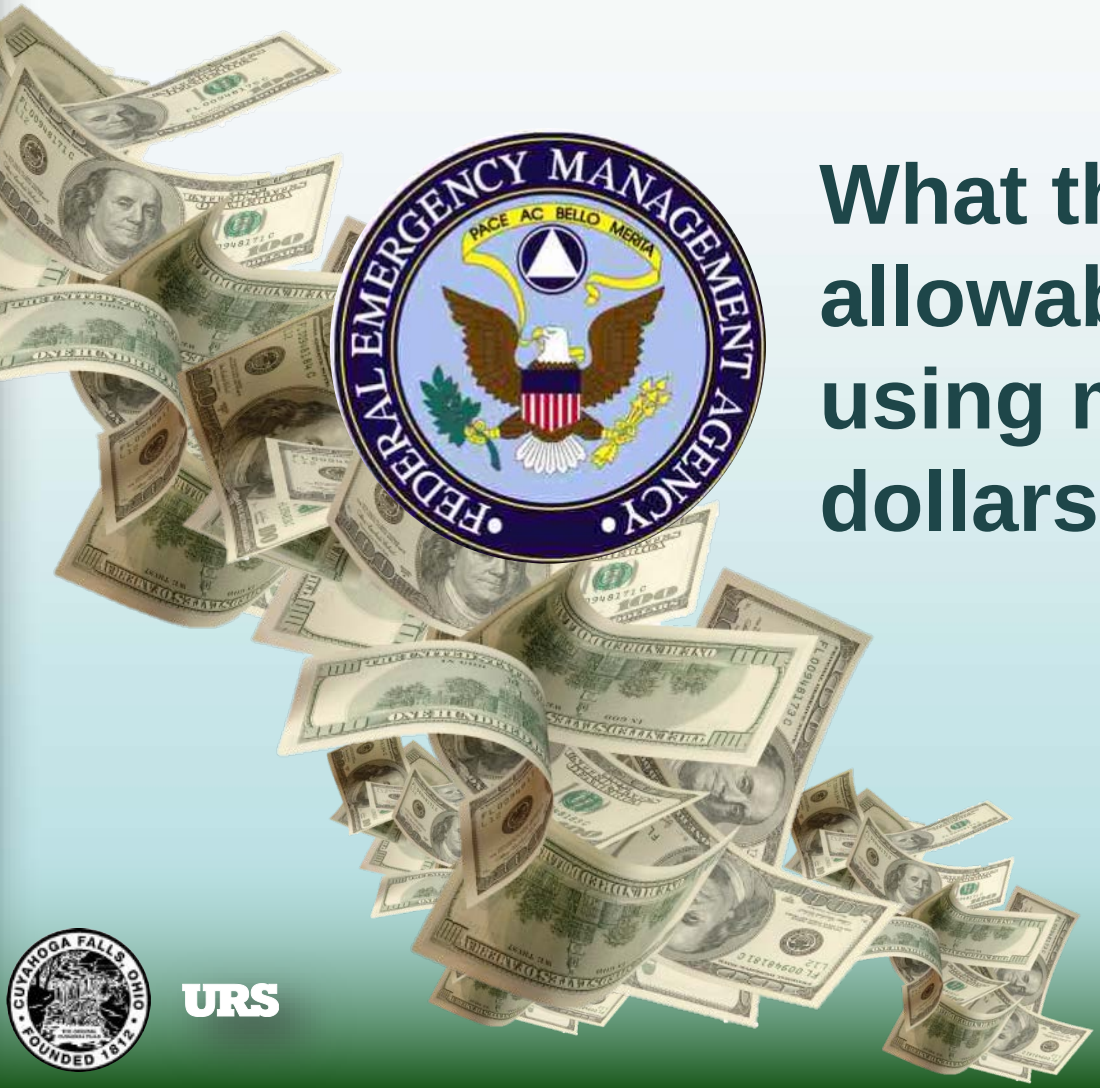

What the typical allowable use was after using mitigation dollars from FEMA

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Allowable Uses

- Open Space in Perpetuity
- Loss of Revenue and Tax Payers
- Can be an Eye Sore
- Extra Costs to Maintain Property

Benefits of the Project

- Localized Flood relief
- Reduce imperviousness of drainage area
- Increase storage capacity
- Increase water quality
- Demonstrate how GI works!
- Neighborhood garden/amenity
- Create an alternative to standard FEMA flood mitigation solution

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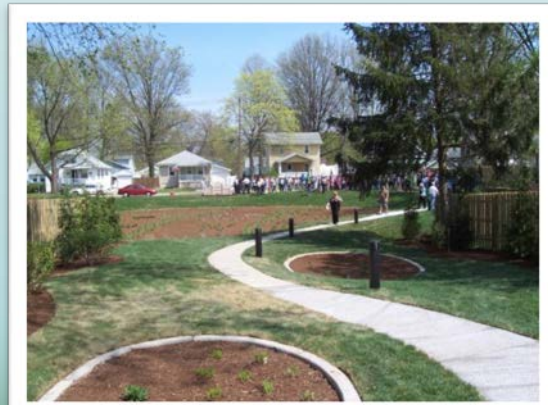
Debunking Myths/Public Outreach

- No one had done this before! Even FEMA had concerns!
- Public has a lot of questions….all the time.
- There were loitering concerns.
- Was it going to look unkempt?



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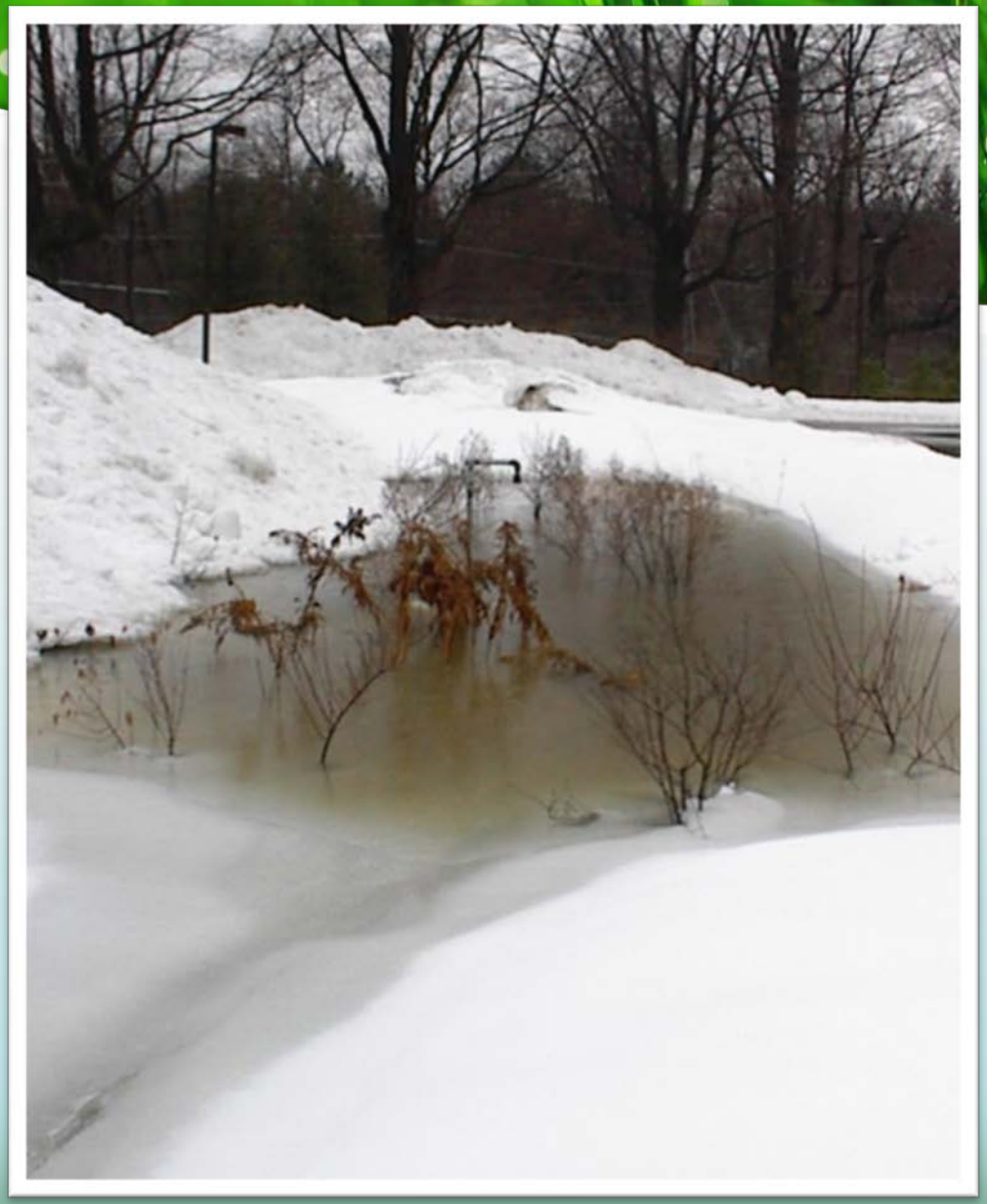
Myth:

They only work in the Summer



Mosquito Traps

- Properly designed rain gardens are mosquito traps
- Designed to dry out in 24 hours
- Mosquitoes lay eggs in the water, then they dry out and die

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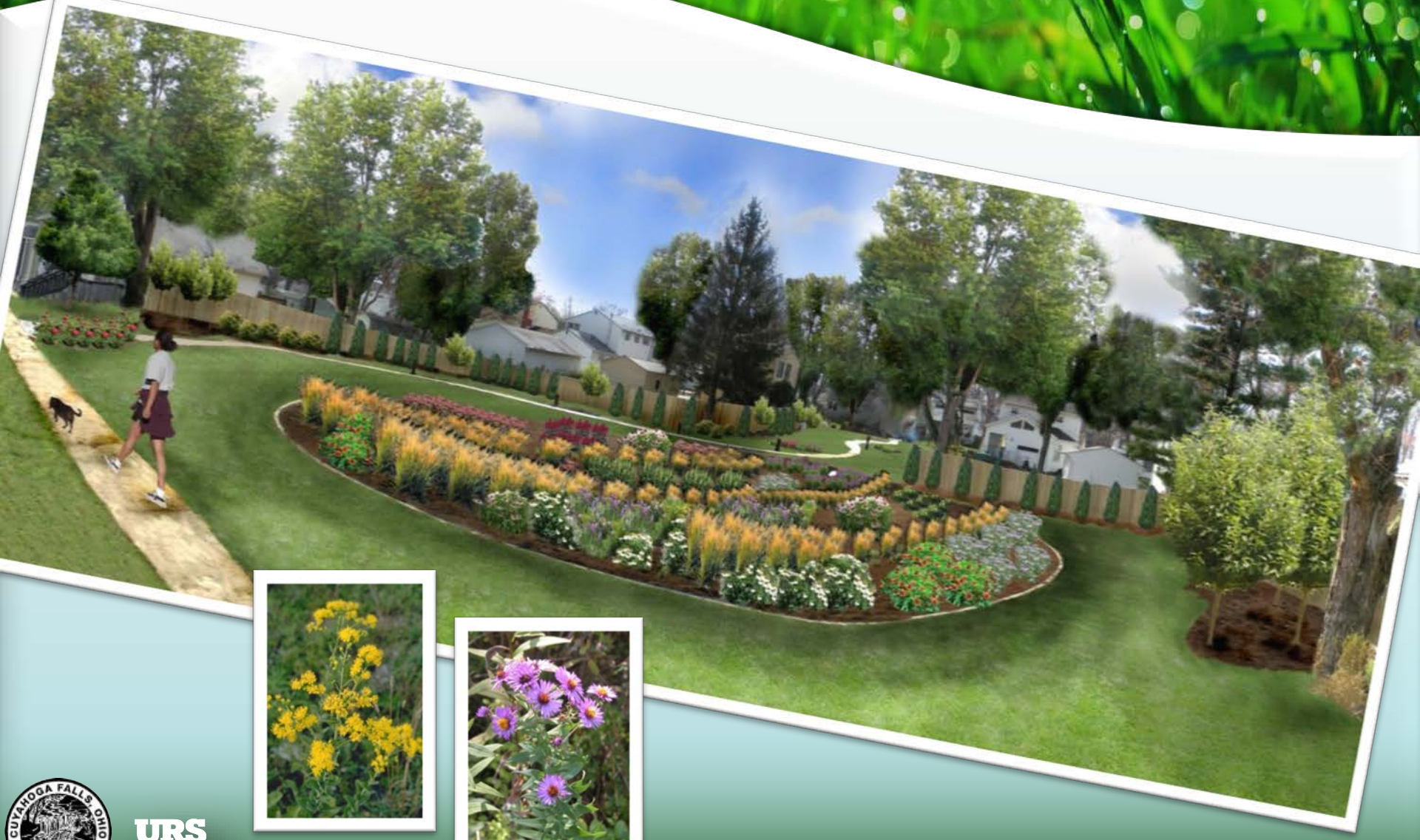
Visualization was Key…



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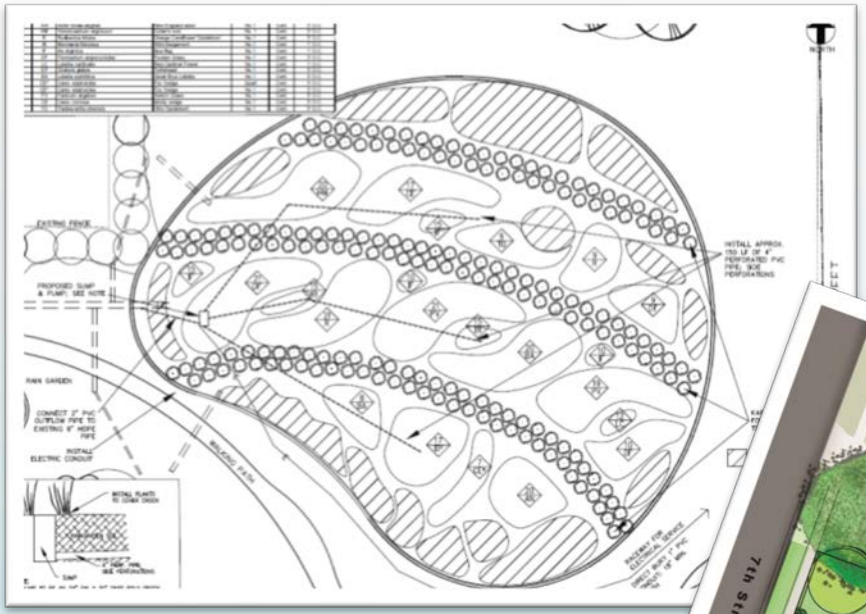
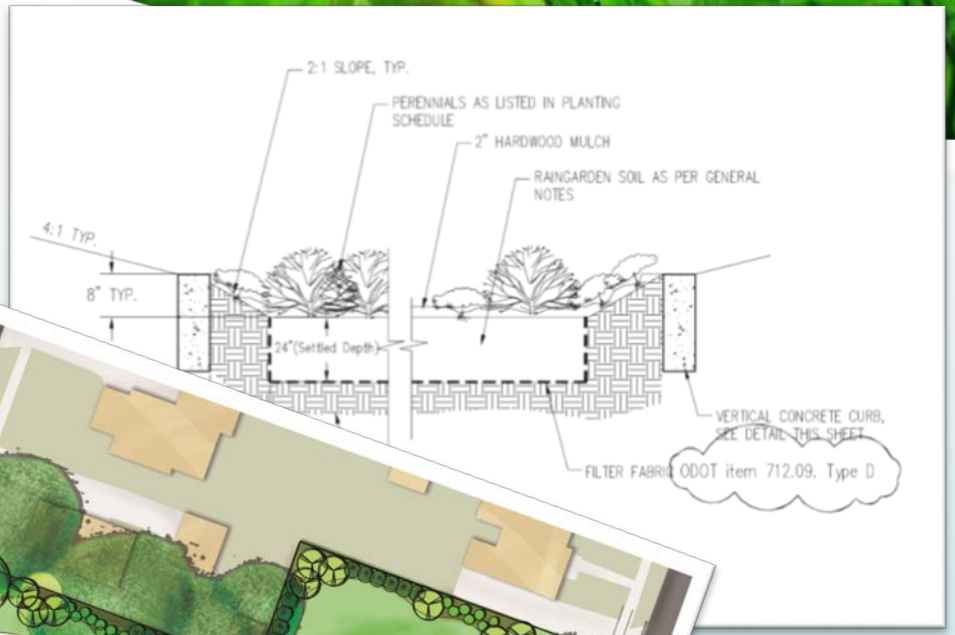
Designing the Raingardens





- Drainage Area
- Soil
- Slope/Runoff Coefficient
- Storm Event

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Project Implementation

- Demolition
- Grading
- Drainage
- Soil Upgrade

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Infrastructure Improvements Spring 2008

- Building neighborhood park
- Walking path connection
- Curbs added around gardens
- Storm sewer overflow

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Planting Spring 2008

- 13 specific plants chosen
  - Blue Flag Iris
  - Fountain and Switch Grass
  - Sedge, Culver's Root, Aster
- Fluctuating water levels
- Can withstand primarily sun
- Layout and spacing important

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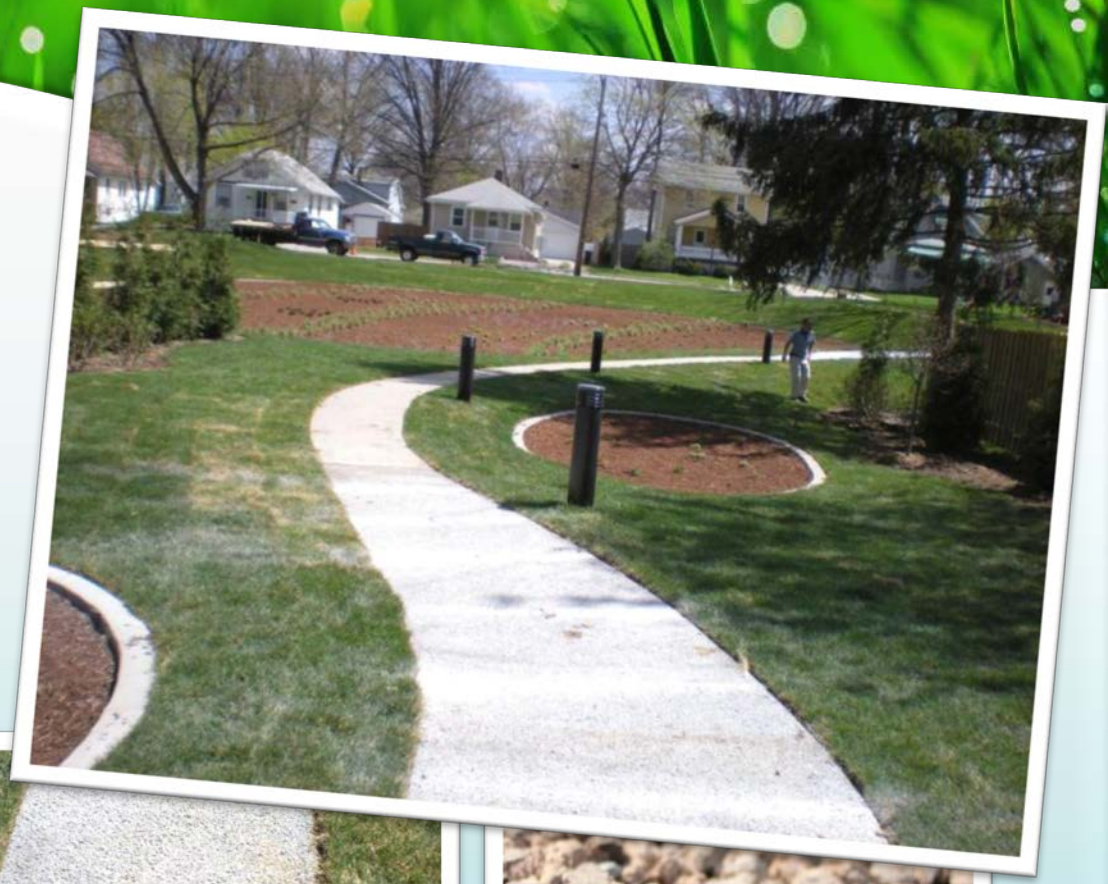
Finishing Touches

- Pervious Sidewalk
- Low lighting bollards
- Sod
- Mulch



Open for Business

- Opened April 25, 2008
- Arbor Day Celebration
- Planted Swamp Oak tree
- School and EPA visits

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Summer 2014

- Low maintenance
- Refresh mulch as needed
- Remove invasive plants
- No need to water

Fall 2014

- Blooming year round
- Storm water management
- Storm water BMP
- No issues with 2014 storms

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Lessons Learned Locally

1. Geotechnical reconnaissance is critical for success!
2. Maintenance is similar to other pocket parks in CF.
3. Public needs involved early and often.
4. Green Infrastructure helps us with stormwater management.

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Lessons Learned Nationally

1. Floodplain Management and Stormwater Management are intimately connected.
2. Resiliency Strategies should connect to our local infrastructure (streams and rivers)
3. Green Infrastructure can be a cost-effective solution for flooding and stormwater management.

Questions?

Contact Information

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For questions about EPA's Green Infrastructure Webcast Series:

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Resource: Build Green Infrastructure to Manage Flood Risk

http://water.epa.gov/infrastructure/greeninfrastructure/climate_res_flooding.cfm