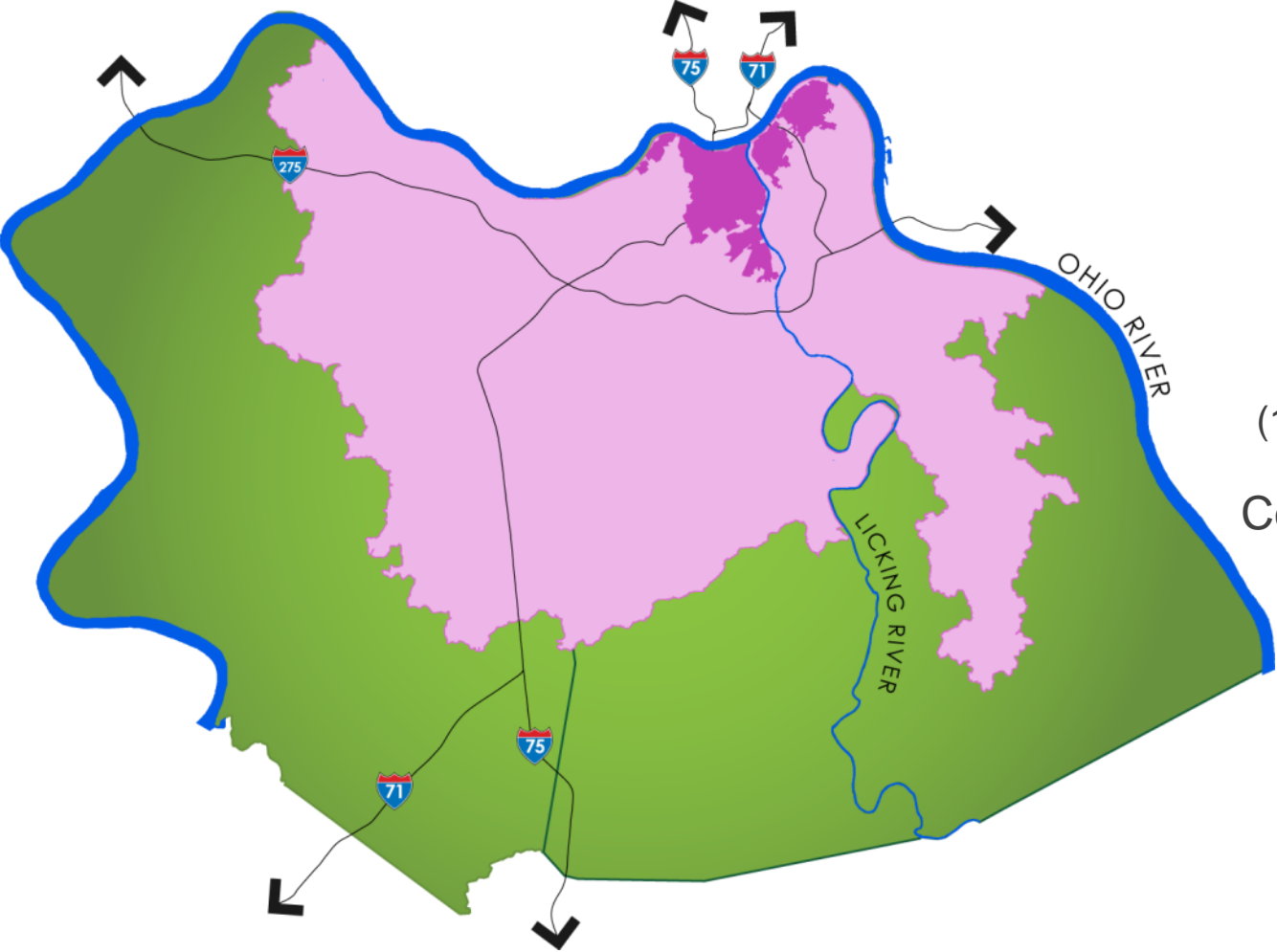


Sustainable Storm Water Management

Samantha Brown
Environmental Engineer
SD1



SD1's Service Area



SD1 Service Area
(146,640 acres / 172 sq. mi.)

Combined Sewer System
(6,036 acres / 9.8 sq. mi.)



Primary Challenges

Combined Sewer Overflows (CSOs)

2 billion gallons annually

97 CSO locations

Sanitary Sewer Overflows (SSOs)

80 million gallons annually

126 SSO locations

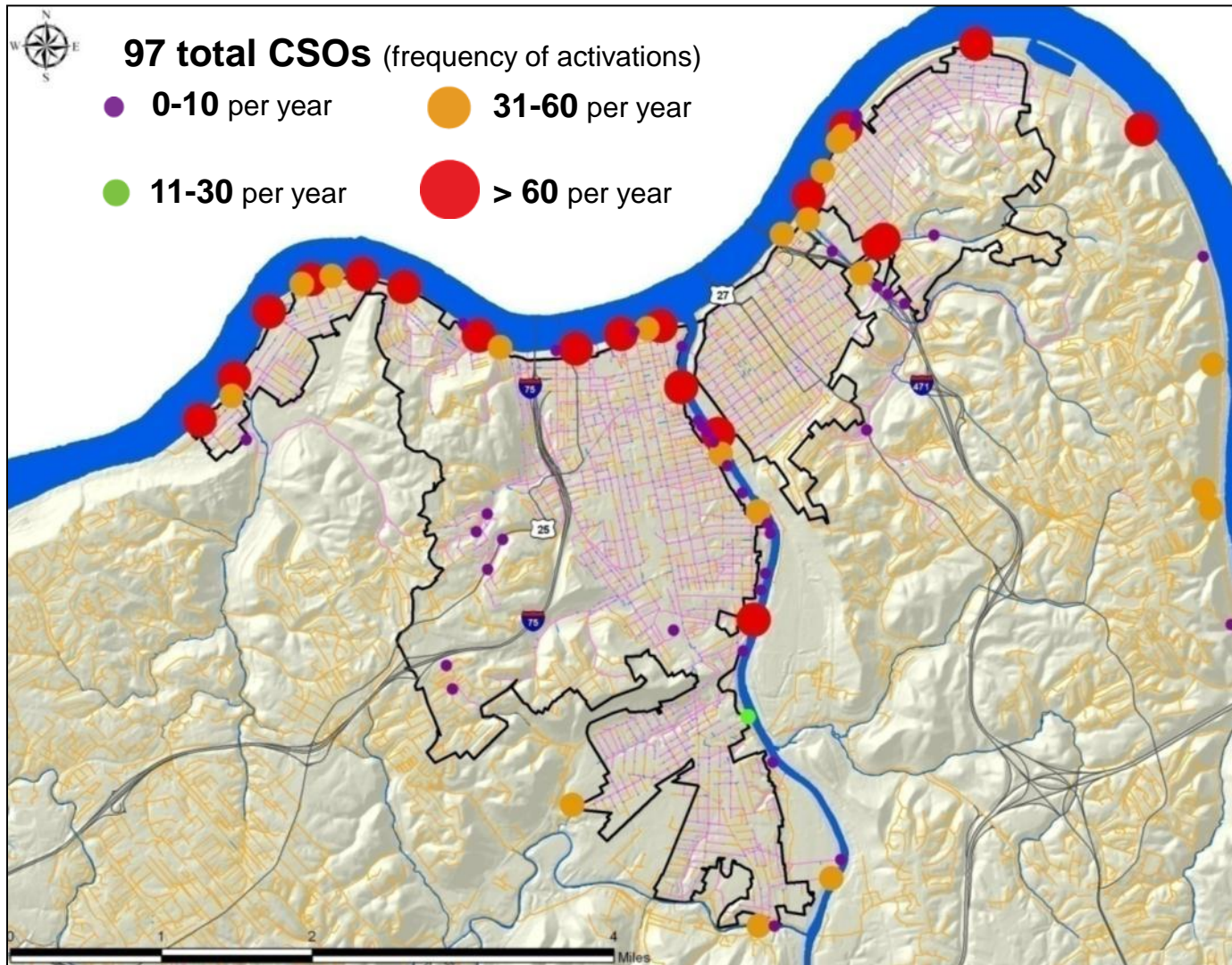
Storm Water Runoff (NSP+MS4)

70 billion gallons annually

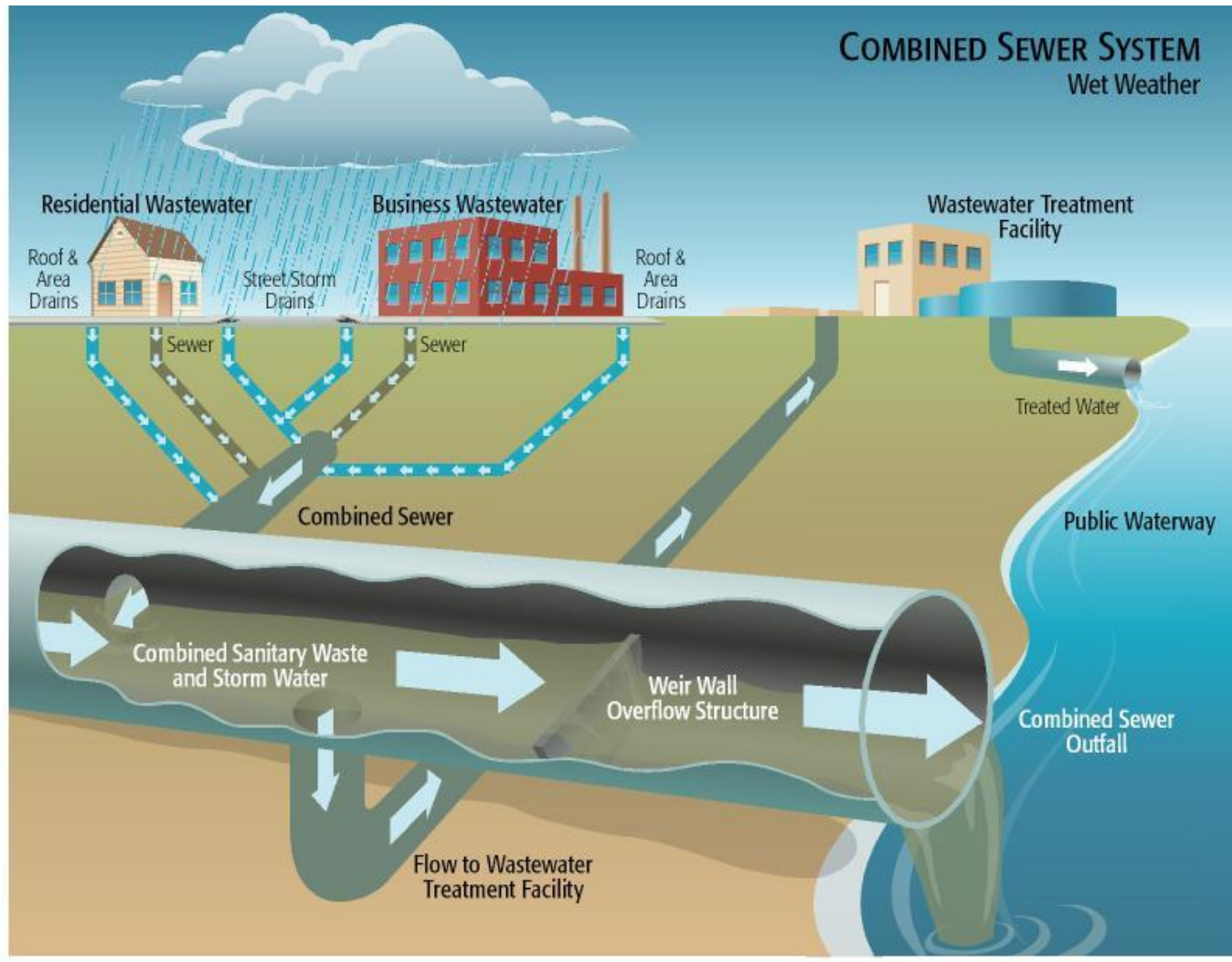
Hydromodification

209 miles of sewer infrastructure adjacent to rivers and streams

Combined Sewer System (CSS)



Combined Sewer Overflows





SD1's Watershed Based Consent Decree

- Federal Court Order signed and entered in April 2007
- Requires SD1 to develop and implement Watershed Plans
 - Address CSOs and SSOs
 - Update Watershed Plans every 5 years
- First Watershed Plans submitted June, 2009
 - Resubmitted March, 2010
- Final Plan Completion: December 31, 2025

Watershed Based Approach

- Integrate green/gray/watershed controls to improve water quality
- Establish priorities based on regional objectives
- Address overflows in context with other sources of pollution
- Utilize 5-year planning cycles to identify affordable solutions that are targeted towards highest priorities



Sustainable Stormwater Management Projects

Integrated Planning Leads to Multi-faceted Solutions:

- CSO Reduction
- Stormwater Quality Improvements
- Flooding
- Community Revitalization
- Water in Basements
- Hydromodification
- Community Connectivity

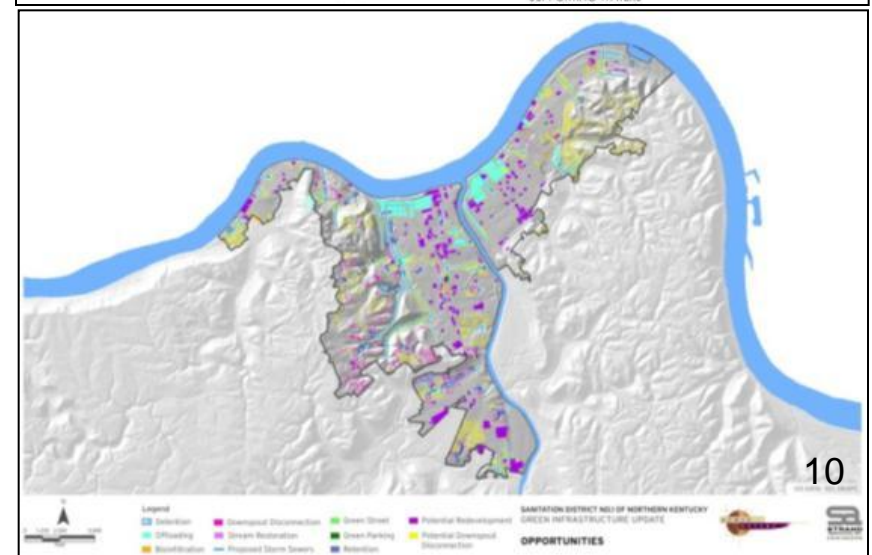
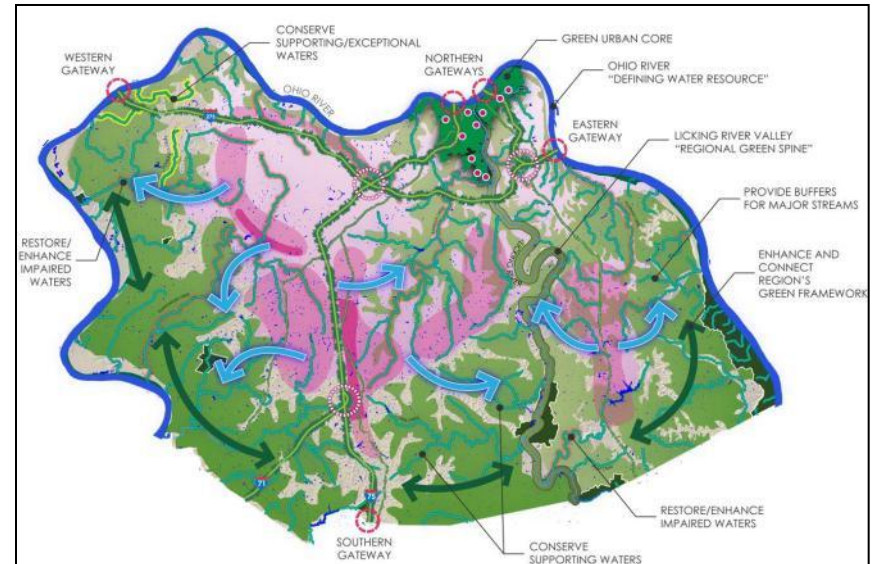


Triple Bottom Line Benefits

- **Environmental**
 - Improves the quality of storm water runoff entering the region's streams and rivers by reducing CSO volumes
 - Opportunity for Covington to introduce landscaping into an urban environment
 - Improves habitat
- **Social**
 - Improves aesthetics
 - Signs can be incorporated to serve as gateways
 - Recreational opportunities
- **Economic**
 - Less expensive than traditional gray infrastructure
 - Communities can apply for funding SD1 has set aside for public/private partnerships

Identifying Implementation Opportunities

- System-wide Opportunities
 - High level, long-term strategies for water quality improvement
 - Include both separate and combined systems
- Partnering Opportunities
 - Needed for large-scale implementation
 - Partnerships can build public support, advance water quality goals



GrIPP

- Green Infrastructure Partnership Program
 - Partnerships with non-residential properties (private or city/county)
 - Separate Storm Sewer and Combined Sewer Systems
 - Business-case evaluations



Memorial Parkway Biofiltration Swales – Ft. Thomas



St. John Church Rain Garden - Bellevue

Project Examples

- SD1 & City of Covington Partnerships
 - I-75/71 R/W Terraced Reforestation
 - Prisoner's Lake Water Harvesting
 - 12th Street Biofiltration Swale
 - MainStrasse Gateway
 - Madison Avenue Streetscape
 - Brent Spence Bridge Coordination
 - Eastern Avenue
 - Church Street/Holy Cross

Terraced Reforestation of Interstate 75-71 ROW



Existing Conditions

17 Acre drainage area
Gateway to KY

Estimated Benefits

3.1 MG CSO reduction
annually
71% reduction in peak
flow



Looking South

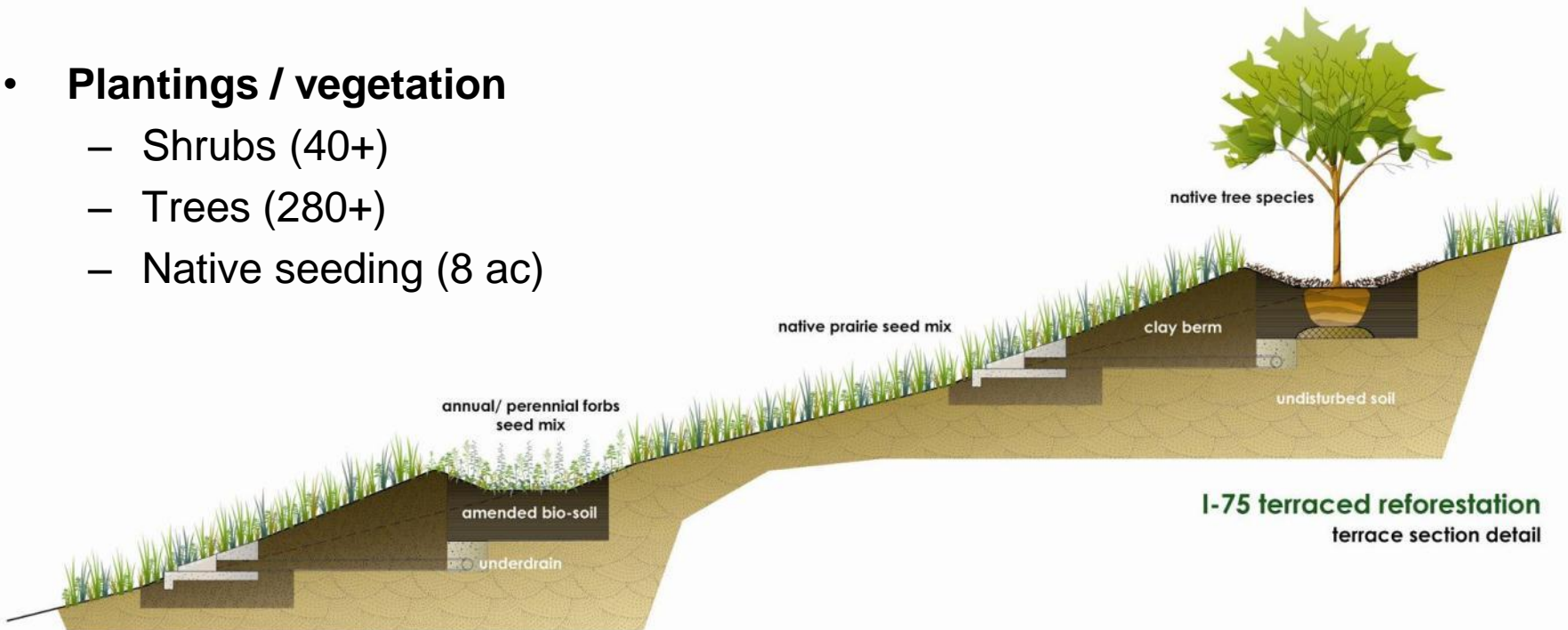


Looking North

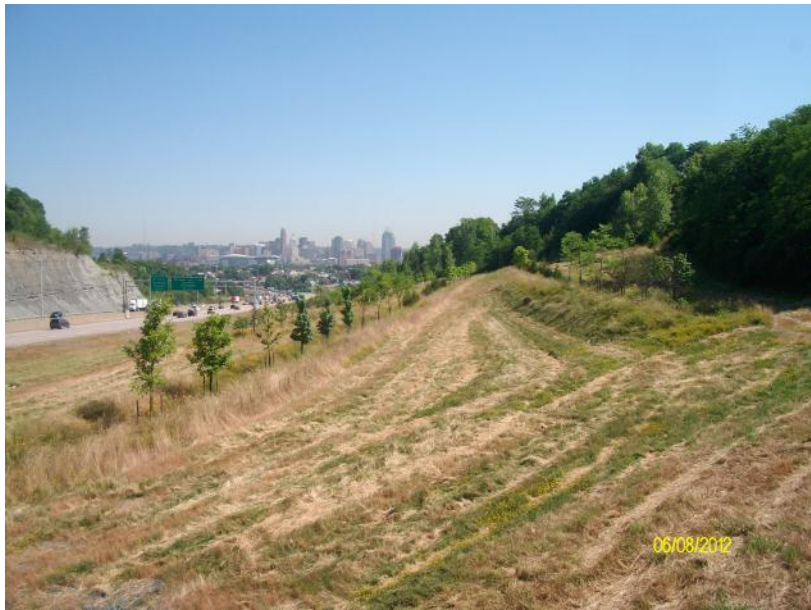


Final Design Elements

- **Bioretention**
 - 12 Linear cells, 4,900 ft total
 - Soil mix (3,800 cys)
 - Underdrain system
- **Plantings / vegetation**
 - Shrubs (40+)
 - Trees (280+)
 - Native seeding (8 ac)
- **Erosion / sediment control**
 - Erosion control blanket (3,900 sqy)
 - Straw wattle (4,700 ft)

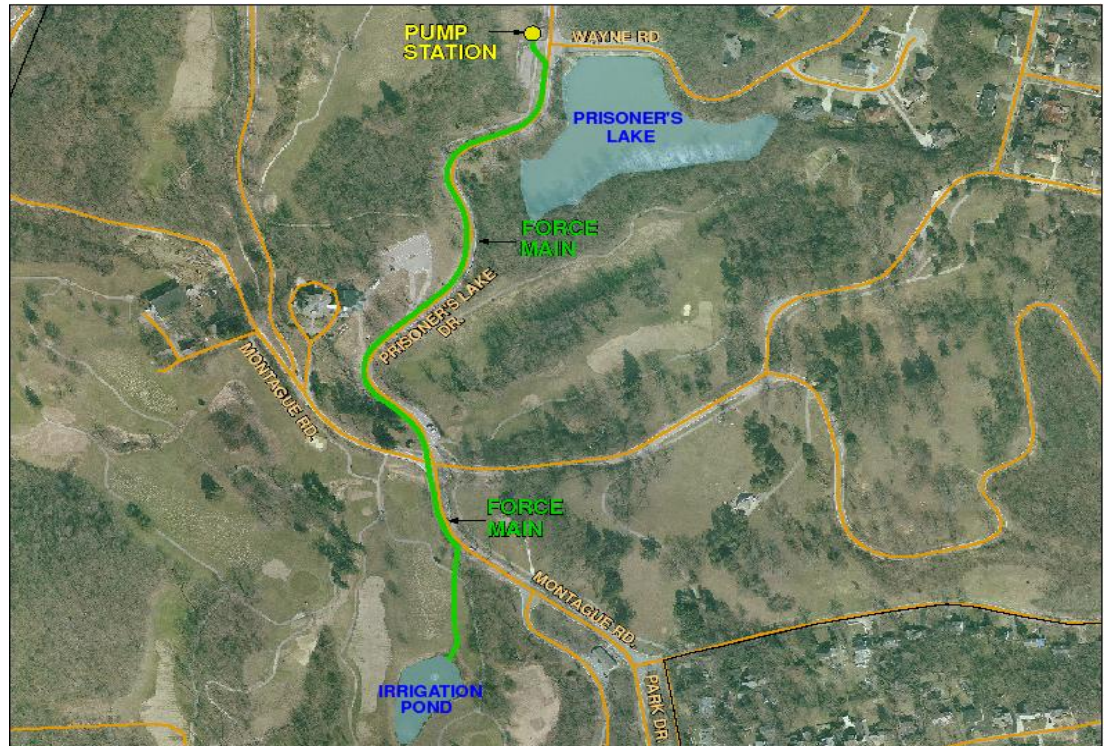






Prisoner's Lake Water Harvesting

- Drainage Area = 57 acres
- Prisoner's Lake = 4 acres
- Removal of Sedimentation
- Clay Liner
- Embankment Repair
- Golf Course Water Usage = 10M gal/year



Prisoner's Lake Water Harvesting

- CSO Reductions
 - Removes 425,000 gallons from the combined sewer system
- SD1 Rate-Payer Benefits
 - A typical storage facility would cost \$5/gallon, totaling to \$2.2 Million
 - Rain Water Harvesting = \$1.2 Million for Design and Construction
 - 50% Stimulus Grant
- City of Covington Irrigation Costs
 - Devou Park G.C. previously spending \$20,000/year for potable water for irrigation

12th Street Biofiltration Swale



Existing Conditions

1 acre of street and hillside runoff enters the combined system

Proposed Features

Bioretention planter boxes
Bioswale and rain garden

Estimated Benefits

300,000 gallon CSO reduction annually

Costs

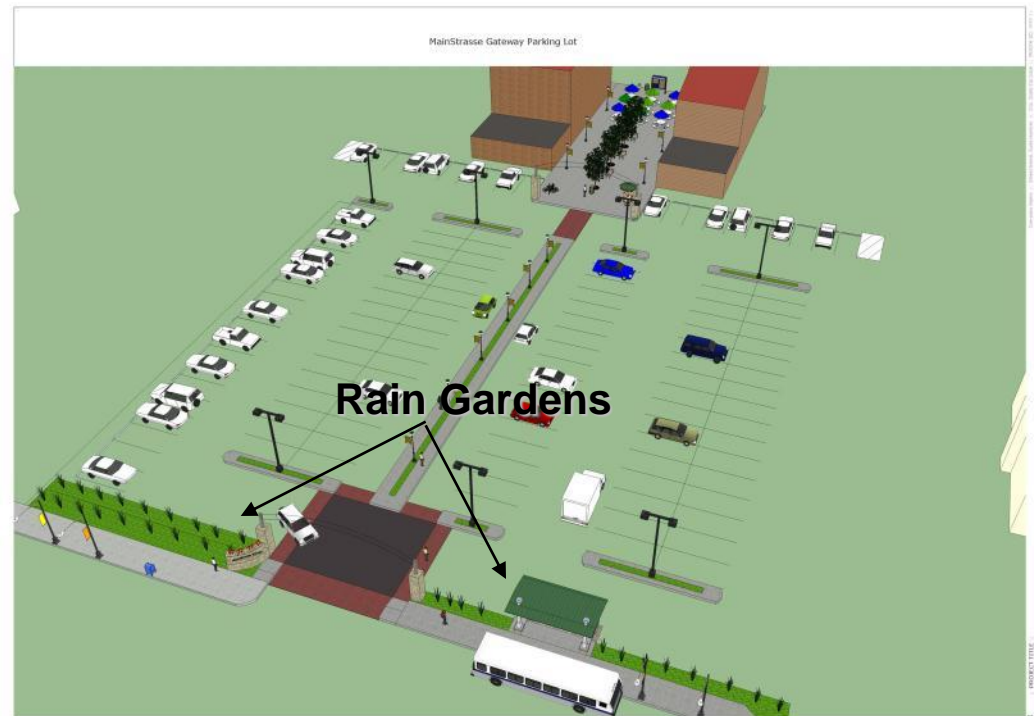
\$77,500
\$0.26/gallon of CSO reduction

12th Street Biofiltration Swale



MainStrasse Gateway

- Parking lot improvement project
- Incorporate rain gardens to capture storm water runoff
- Estimated 0.5MG CSO reduction
- Provides economic and social green street benefits
- Gateway into MainStrasse Village



MainStrasse Gateway



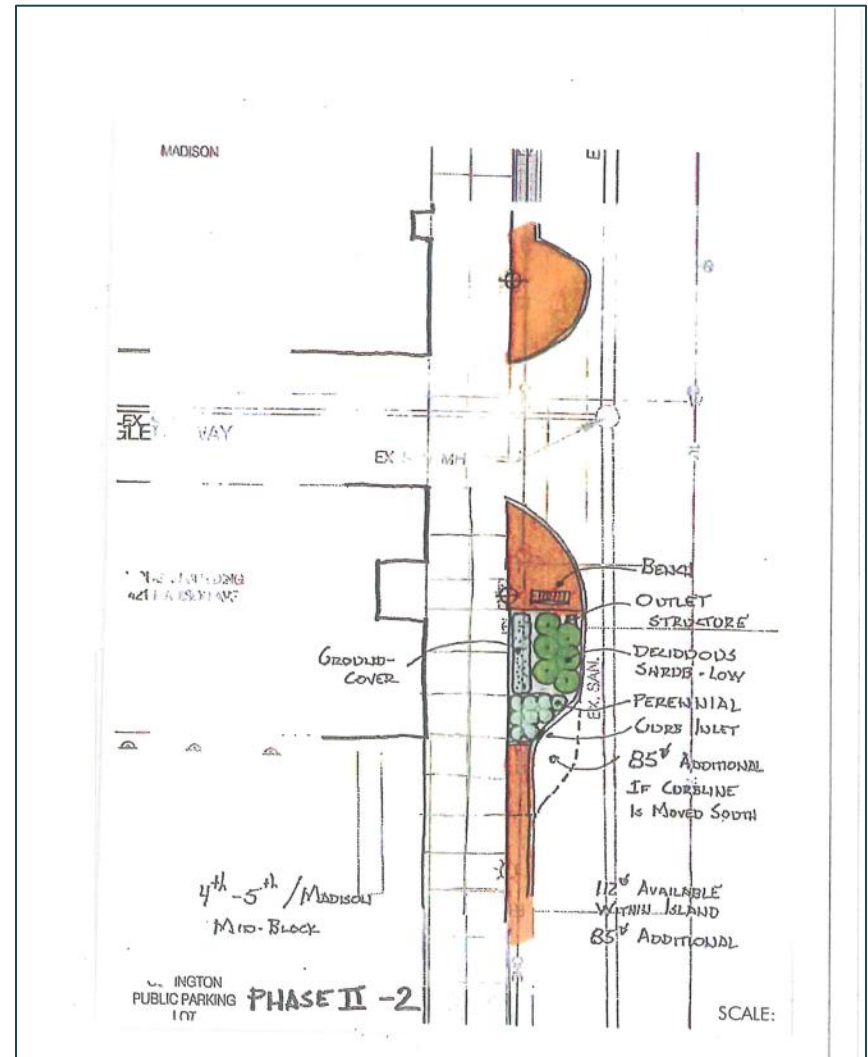
Madison Avenue Streetscape

- City has completed two phases of a three phase streetscape project along Madison Avenue
- Green Infrastructure included in Phase III design
 - Retrofit existing bump-out with a rain garden
 - Install a new bump-out with a rain garden



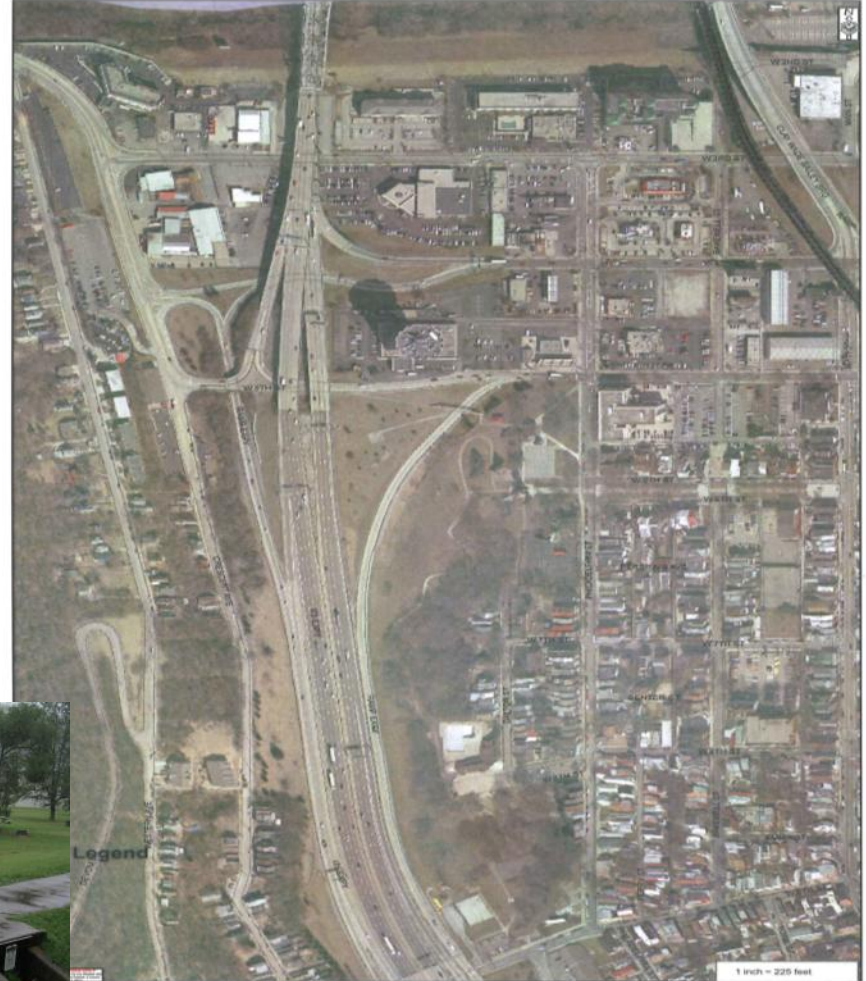
Madison Avenue Streetscape

- Solves current standing water issue
- Improves aesthetics of a primary street through the City
- Bump-out provides safe gathering space for patrons of the Madison Theater
- Cost savings



Brent Spence Bridge – Goebel Park

- Impacts to Goebel Park will need to be mitigated when the Brent Spence Bridge project is constructed
- Willow Run is the largest CSO in the area
- Overflow areas currently located within the park



Brent Spence Bridge – Goebel Park



LEGEND
--- Future Interstate Limits

PRELIMINARY CONCEPT
FOR INTERNAL REVIEW PURPOSES

CITY OF COVINGTON
SANITATION DISTRICT NO.1 OF NORTHERN KENTUCKY
GREEN INFRASTRUCTURE UPDATE

GOEBEL PARK: PRELIMINARY CONCEPTS



GIS DATA: SDI, KYTC

Eastern Avenue

- Partnering with Covington Schools to install a rain garden in the parking lot
- Water ponds near catch basin on Eastern Avenue during large rain events



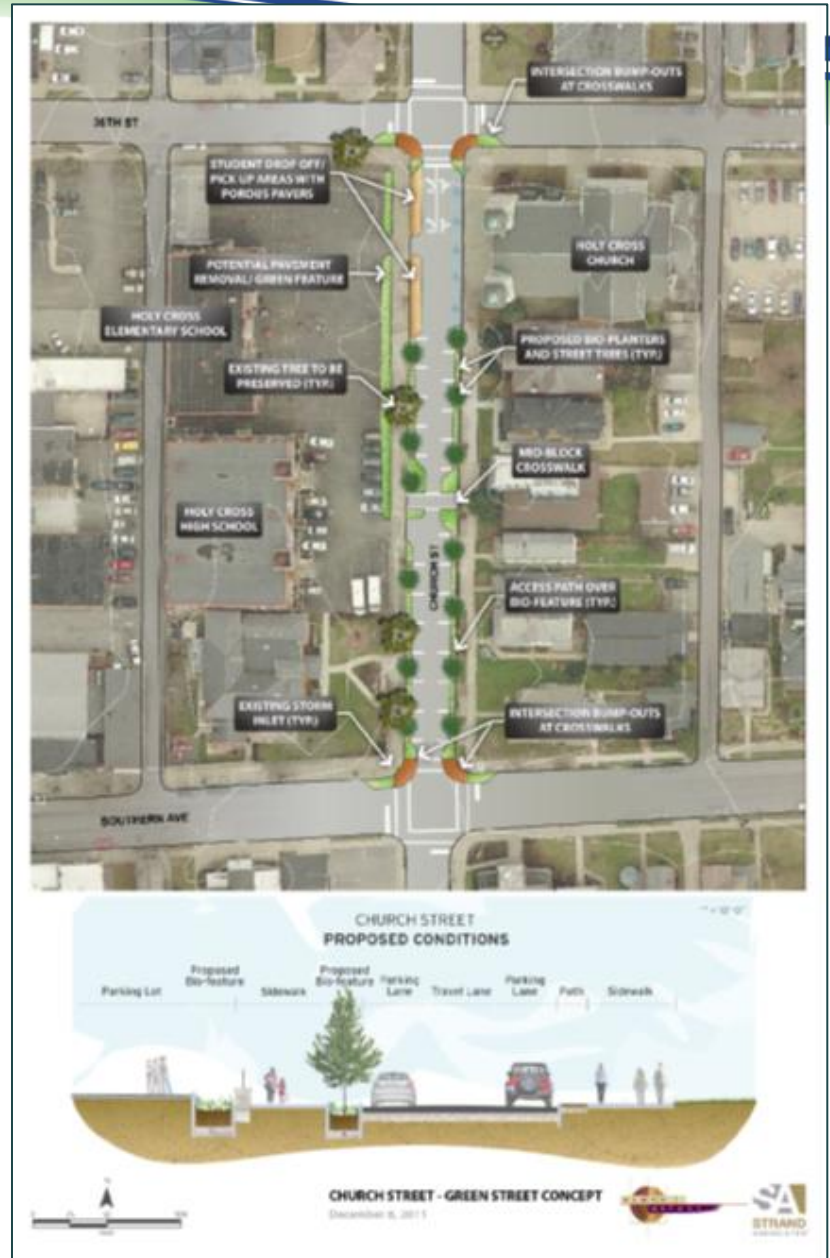
Eastern Avenue

- Reduces amount of water entering the combined system
- Enhances the aesthetics of the school
- Prevents water from ponding in the street



Church Street

- Safety concerns with students crossing the street
- Converting to one-way street
- Examining opportunities to incorporate green elements
 - Performing business-case evaluations





Moving Forward

- Monitoring effectiveness of pilot projects
- Continued partnerships with private and public entities
- Continued coordination between Covington and SD1 to identify opportunities for green infrastructure

QUESTIONS?

Mike Yeager, P.E., MPA
Assistant City Engineer
City of Covington
myeager@covingtonky.gov
(859) 292-2153

Samantha Brown
Environmental Engineer
SD1
sbrown@sd1.org
(859) 547-1666

