

# Aging Water Infrastructure Research Program SAB Consultation Advanced Design Concepts

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# Advanced Drainage Concepts

## Goal:

To foster implementation of innovative approaches and green technology for urban drainage.

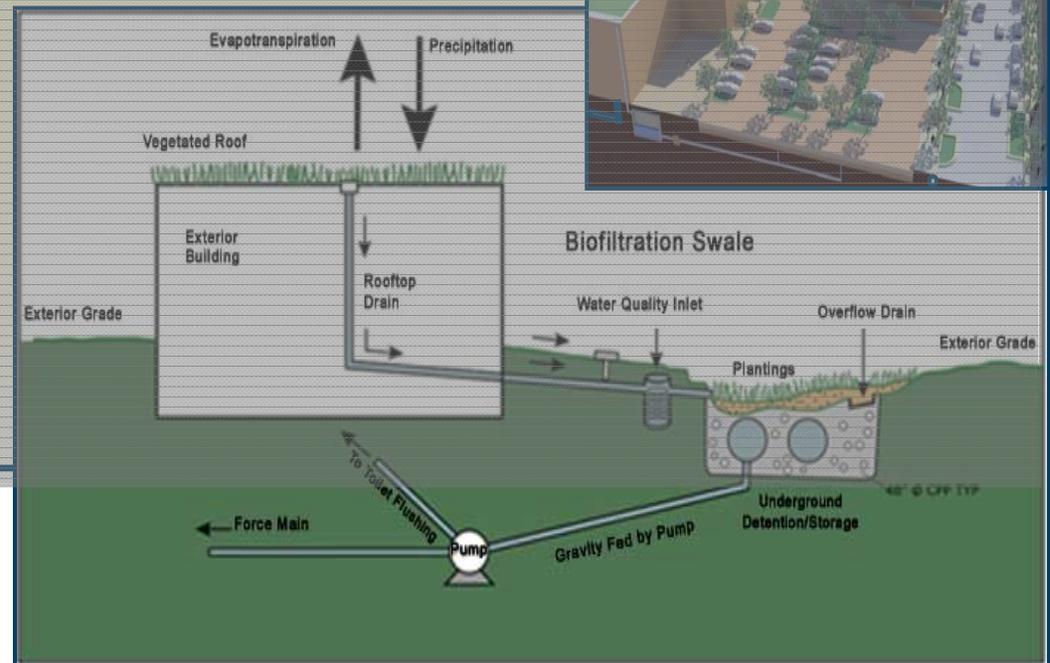
## Approach:

- Identify state of the technology (SOT) via literature search and international forums.
- Demonstrate optimal system designs for new and retrofitting existing urban areas.



# Project Areas

- Advanced Drainage Concepts: SOT
- Green Infrastructure Development
  - Integrated Green/Gray Infrastructure for CSO Control
  - Green Roofs
  - Porous Pavement
  - SUSTAIN Framework
- Total Water Management



## State of Technology Findings

- Innovative combined sewerage system designs (larger diameter/steeper slopes, larger WWTPs, combine green/gray)
- Sociology...success depends on social reaction...
- Aesthetics...part of criteria
- Tailored solutions...no “one-size-fits-all”
- Dual water distribution systems (fire fighting, graywater, irrigation vs. potable water)
- Emerging contaminants ...R&D in stormwater needed
- Multi-functional strategies/TWM...beneficial stormwater use/conservation/black-graywater separation

### Research Partners

Tetra Tech  
ACR, LLD. (Dr. Charles Rowney)

## Planned Outputs

### Interim Report:

- “*WWF Control: SOT*” - 7/2009
- Final Report - 2/2010
- Presentation/Proceedings  
“*Innovative Approaches for Urban Watershed WWF Mgmt & Control*”  
33<sup>rd</sup> IAHR Congress, Vancouver, BC - 8/2009

### State of Technology Report

*Challenging the State-of-Practice in Water Quality Mgmt: Where Should We Drive the Technology Next*  
9/2008

## Next Steps

### Full-scale demonstrations of advanced designs

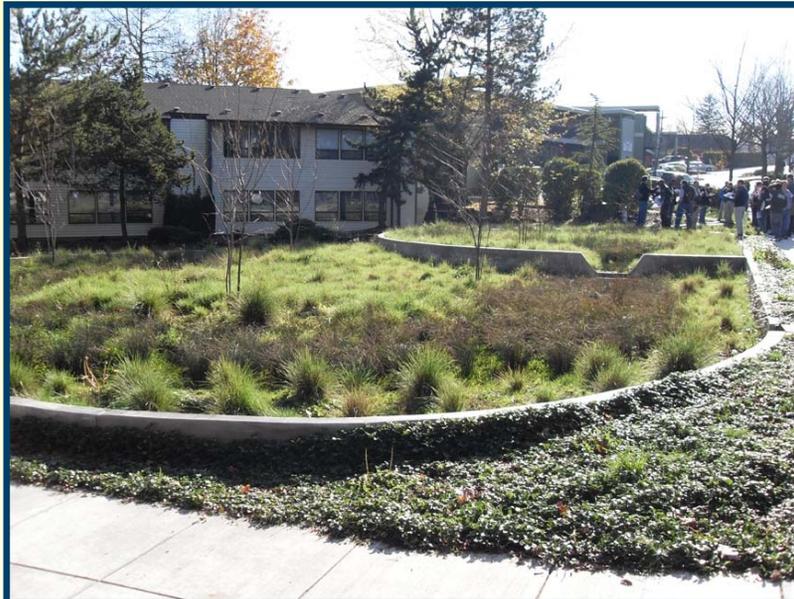
- Integrated green/gray infrastructure for CSO control & stormwater management (KC/others)
- Beneficial use of stormwater (KC/others)
- Combined sewerage systems
- Steeper slopes, bottom cross-sections, cunettes, grit traps, larger diameters, intermittent storage
- Larger WWTPs
- RTC
- Total water management



## Demonstration of Green/Gray Infrastructure for Combined Sewer Overflow Control

### Kansas City, Missouri

Will provide guidance on integrating  
green with gray solutions for CSO  
& stormwater control



### Research Partners

- Tetra Tech
- University of AL
- University of MO-KC
- MARC
- Bergmann Assoc

### Collaboration

- EPA: NRMRL & Region 7
- KCMO WSD (leveraged > \$6M)
- KCMO Parks Dept
- Neighborhood & watershed levels

# Demonstration of Green/Gray Infrastructure for Combined Sewer Overflow Control

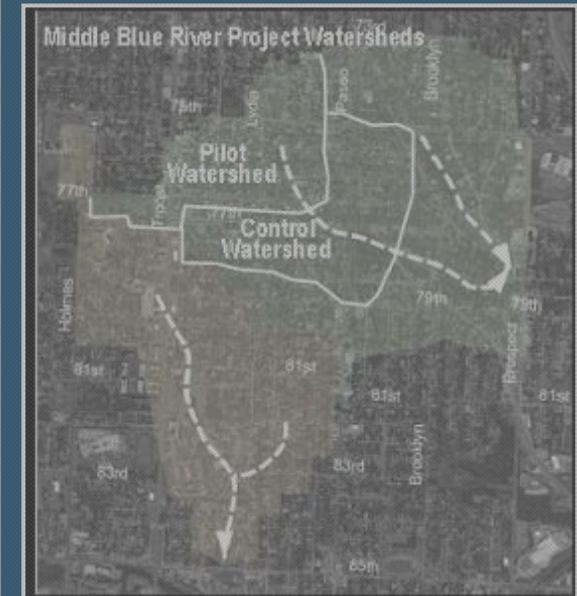
## Objectives:

Demonstrate value of integrated green infrastructure to alleviate WWF problems in a combined sewer system.

- Design & placement for “best” performance
- Monitor/model multiple practices (Win SLAMM, SWMM, SUSTAIN)
- Economic analyses
- Community education & outreach

## Status:

- Pilot & control subwatersheds selected
- Monitoring devices installed
- SWMM model for sewers calibrated
- WinSLAMM calibration/studies ongoing
- Detailed land use characterized



## Planned Outputs

- “Cost Comparison of Conventional Gray CSO Control Infrastructure vs. Green/Gray Combination”  
ASCE Journal (pending publication)
- Final Report on KC Demonstration  
- 4/2011
- Presentations/Proceedings  
National and International

### Guidance Manual

#### *Green/Gray Integration*

For Region, Nation, OECA, OW  
4/2011

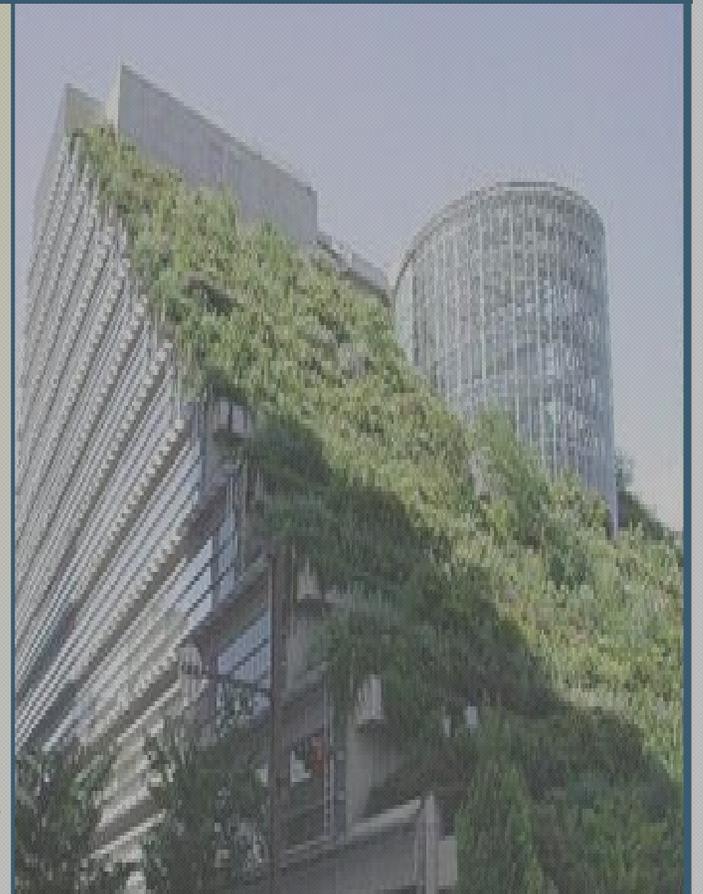
## Research: Green Roofs

### Penn State field studies:

- Evaluated runoff volume, pollutant control, energy usage
- Final EPA report on specifications for vegetation & media (2/2010)
- Recommended evaluating larger roofs, more water quality & site specific plantings

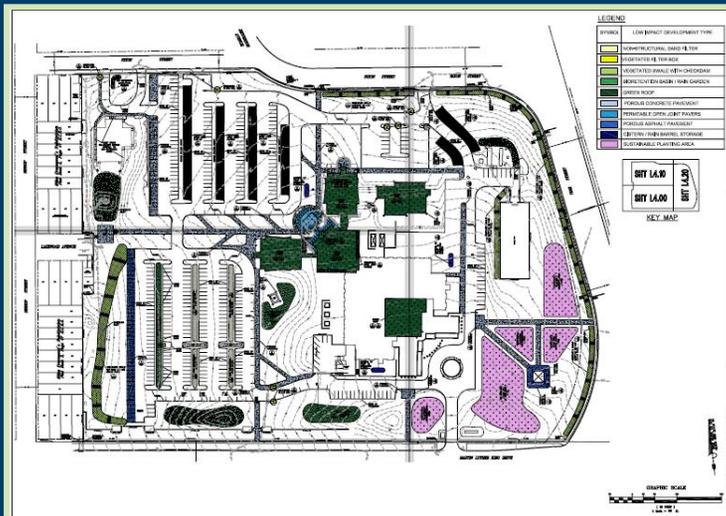
### Next Steps:

- Full-Scale Demonstrations
  - Collaborating with Regions 2, 3, 8
  - Leveraging w/Sichuan University on green vs blue roof



# Green Infrastructure

## Demonstration: EPA AWBERC Green Infrastructure Site



SYMBOL	LOW IMPACT DEVELOPMENT TYPE
[Light Yellow]	NON-STRUCTURAL SAND FILTER
[Yellow]	VEGETATED FILTER BOX
[Light Green]	VEGETATED SWALE WITH CHECKDAM
[Dark Green]	BIORETENTION BASIN / RAIN GARDEN
[Black]	GREEN ROOF
[Light Blue]	POROUS CONCRETE PAVEMENT
[Medium Blue]	PERMEABLE OPEN JOINT PAVERS
[Dark Blue]	POROUS ASPHALT PAVEMENT
[Dark Purple]	CISTERN / RAIN BARREL STORAGE
[Pink]	SUSTAINABLE PLANTING AREA



### Collaboration:

- Cincinnati Metropolitan Sewer District
- City of Cincinnati Parks
- University of Cincinnati

## Green Infrastructure

### Research Facility: Edison Environmental Center



# Green Infrastructure

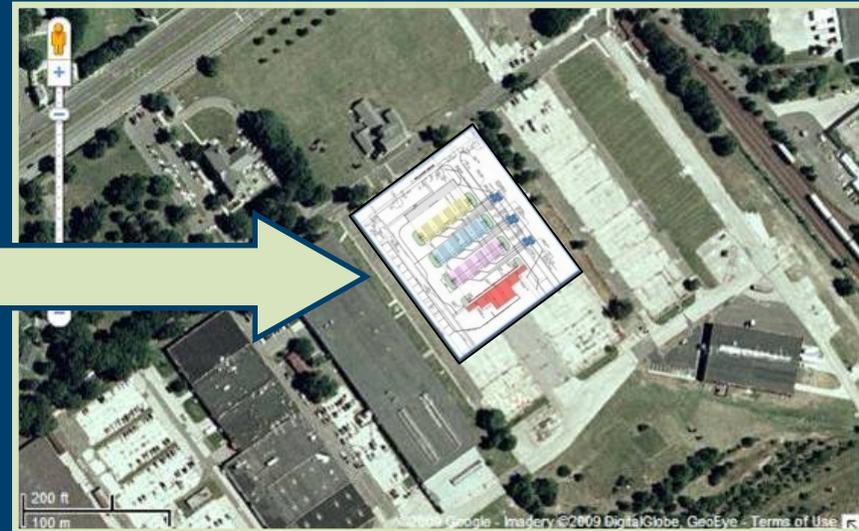
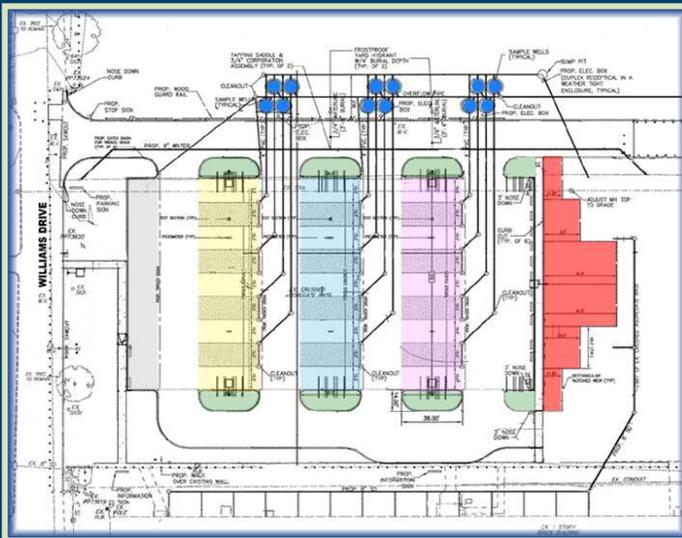
## Permeable Pavement Demonstration: Edison Environmental Center



### Side-by-side demonstration of 3 permeable pavement systems

- Paving Stones
- Porous Concrete
- Porous Asphalt

- Installing in a heavily used parking lot.
- Measuring (among other things) relative infiltration changes with time (use).
- Measuring the performance of each surface under similar climatic conditions and operation.



### **SUSTAIN: System for Urban Stormwater Treatment & Analysis INtegration**

- GIS-based framework to support performance evaluation & decision-making
  - Four 1-day workshops conducted (300 attended)
  - Public release this fall
    - Edison 12/08, Chicago 1/09, Atlanta 3/09, Seattle 5/09
- Two-day training 3/09 to 10 beta testers (2 from UK)

#### Immediate Applications

- **Kansas City, MO** - Determine best cost-effective mix of GI for tunnel storage reduction goals
- **Univ. of Sheffield, UK** - Investigate Brownfield recovery

## Total Water Management (TWM)

**Goals:** Improve water resource management and reduce waste streams.

### Strategies:

- Evaluate approaches for water reuse/recycle
- Evaluate TWM of potable, wastewater, WWF

### Products:

- Systems model
- Case study

### Expected Impacts:

- Improved understanding of performance, limitations, & costs of TWM systems
- Improved guidance on water reuse technologies

## Advanced Water/Energy Design for Sustainable Infrastructure

### New project to address:

- TWM strategies research
  - Reduce drinking water demand
  - Increase water reuse
  - Reduce burden on water/wastewater treatment
- Comprehensive energy strategy
  - Energy recovery/savings
- Integrate “green” water & energy saving/recovery at household & community level

# Questions?