Bioswales, Wetlands, and Trees: How going green can be a part of a Wet Weather Management Plan

Presented by Brian Tornes, PE
Water Management – It all Contributes to the Streams

- Sanitary Sewers
- Storm Sewers
- Combined Sewers
But....When it Rains it Pours!

- Wet Basements
- Flooding
And....Unwanted Discharges!

- Combined Sewer Overflows
- Sanitary Sewer Overflows
The **BIG** Challenge

- End CSOs and SSOs
- 1,233 permitted CSOs in 81 different communities in Ohio
Traditional Solutions – Source Control

- Reduce Sanitary Sewer Loading
  - Eliminate Storm Water Inflow and Infiltration
  - Segregate sanitary and storm sewer systems
Traditional Solutions – Capacity Increases

- Maximize Treatment Plant Capacity
- Flow Equalization/Storage
  - Tunnels
  - Overflow basins
The **BIGGER** Challenge

- **Cost**
  - Capital
  - Operation & Maintenance
How much do we need?

- Columbus - $2.5 Billion (40 years)
- Northeast Ohio Regional Sewer District (Cleveland) - $3.0 Billion (25 years)
- Cincinnati MSD - $1.5 Billion (19 years) – may need more ($3.5 Billion?)
- Akron - $1.0 Billion +
- Toledo - $450 Million
- Springfield - $243 Million
Defining the Problem

Flow to Receiving Water Body

Existing Capacity

Time from Start of Storm (t)

Flow (Q) ↑
Causes of CSOs and SSOs
Conventional Methods

- **Storage**
- **Treatment**

Increase Conveyance

Existing Capacity
What to do with all this water?

INTEGRATED PLANNING
- Eliminate I/I
- Storm water management
  - New or existing storm sewers
  - Green Infrastructure
How can Green Infrastructure help?

- Source control/elimination
  - Reductions in **volume** and **rate** of storm water to be managed by sewers
- Improved water quality
Going **Green** - Solving the wet weather dilemma

- Quantity Reduction
  - Promote infiltration
  - Increase evapotranspiration
  - Storm water reuse
Going Green - Solving the wet weather dilemma

- Reduce the rate of discharge
  - Source Detention/Retention
- Improve water quality
  - Filtration, sedimentation, and bio-treatment
Green Infrastructure Alternatives

Advantages and Pitfalls
Vegetated Filter Strips Source Control

- Linear (roadway) construction
- TSS Reduction
- Inexpensive
Rain Gardens Source Control

- Flexible Design
- Rate and Volume Reductions
- Solids Removal
Green Roof Source Control

- Volume and Rate Reductions
Green Roof - **Structural Issues**

- Expensive
- Maintenance
Pervious Pavements Source Control

- Volume Reduction
  - Soil Dependent

- Runoff Rate Reduction
  - Subsurface Storage

- Suspended Solids Removal (55%)
Pervious Pavements Source Control

Porous Concrete Pavement

Scale: 3/4" = 1'-0"
Infiltration Basins Source Control

- Volume and Rate Reductions

CAUTION – Soil Dependent
Bio-filtration Source Control

- Rate reduction with subsurface storage
- TSS, Nitrogen, Phosphorus, Oil/Grease Reductions
- Groundwater Recharge
Anatomy of a Bioswale

Engineered soil for nutrient uptake

{ 2-inches min.}

Underdrain
Phyto-Treatment Source Control

Rate/Volume reduction
- TSS
- Metals
- Nutrients
Phyto-Treatment Swale Design (Ecolotree, Inc.)
## Phyto-Treatment – Nitrogen Removal

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| Mean       | 0.2 | 0.08 |
| Std. Dev.  | 0.16| 0.148|
Retention Ponds Source Control

- Runoff Rate Control
- Pollutant Reductions
  - Solids 60%
  - Nitrogen 20%
  - Phosphorus 20-45%
- Safety and Real Estate Concerns
**Constructed Wetlands Source Control**

- Pollutant Reductions
  - Solids 60%
  - Nitrogen 20%
  - Phosphorus 45%

- “Green” Solution

- Real Estate Required
The Objective....

- Existing Capacity
- Reduced Discharge

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Not all are the Perfect Solution

Finding the right solution and Cautions of Misapplication
Primary Concerns for Green Infrastructure

- Space/Land
- Maintenance
- Soil Conditions
Space Requirements

- Most Green Infrastructure requires more space than a Traditional System
How to Solve the Space Dilemma

- Scioto Audubon Metro Park
How to Solve the Space Dilemma

- Parks and Green space
- Vacated Properties and Brownfields
- Smaller Drainage Areas
Maintenance – It is doing what it is designed to do!

- Protection during Construction
- Periodic cleaning and long term replacement
Maintenance – It is doing what it is designed to do!

- Build bioretention at end of construction
- Trash removal
- Maintenance/Pruning
  - Facilitates trash removal
  - Allows sunlight into bed for pathogen control
  - Allows water movement across full cell
- Erosion repair
- Partial and full reconstruction
Infiltration? ....Know your soils
.....and Your Utilities
Thank You!
Questions?

Brian Tornes
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