

US EPA ARCHIVE DOCUMENT

# LOW IMPACT DEVELOPMENT SUSTAINABLE REUSE AT BROWNFIELD SITES

## EPA New England Brownfields

## All-Grantees Meeting

## August 10, 2005

Steven P. Roy, M.S. Water Resources Manager

Chairman, Low Impact Development Center

GeoSyntec Consultants, Inc. Acton, MA



GEOSYNTEC CONSULTANTS

# Grant Criteria

Alternative stormwater management

Environmentally beneficial  
landscaping

# Primary Goal of LID

Design each development site to protect, or restore, the natural hydrology of the site so that the overall integrity of the watershed is protected. This is done by creating a “hydrologically” functional landscape.

Promotes the concepts of Smart Growth through greater open space, land preservation and conservation, compact development, green buildings and space

# Minimize Development Impacts

- ◆ Reduce storm pipes, curbs and gutters
- ◆ Preserve sensitive soils
- ◆ Cluster buildings and reduce building footprints
- ◆ Reduce road widths
- ◆ Minimize grading
- ◆ Limit lot disturbance
- ◆ Reduce impervious surfaces

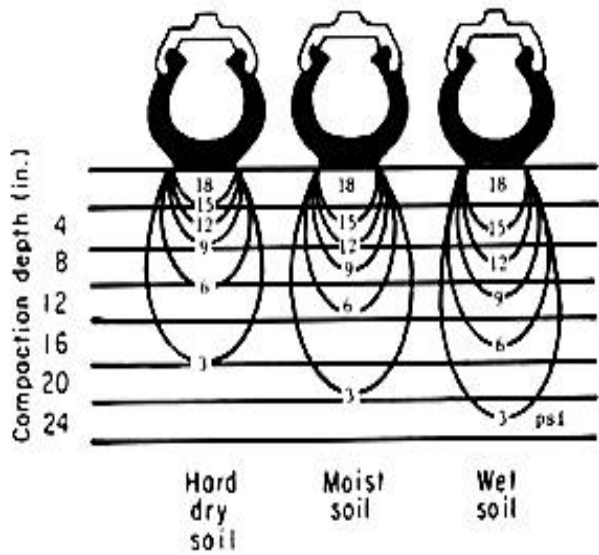


Figure 3. How soil moisture affects soil compaction. The lines in the soil under the tire represent curves of equal pressure. In all three situations the tire size was 11 x 28, the load was 1,650 pounds and the pressure 12 psi. On wet soil, pressures were transmitted to depths of more than 24 inches. (Source—Soehne, Jour. of Agr. Eng., May 1958.)











# *Stormwater Paradigm Shifts*

- ◆ Watersheds to **Ecosystems**
- ◆ Flow Centric to **Volume Centric**
- ◆ Centralized Control to **Decentralized Control**
- ◆ Uni-functional to **Multifunctional**
- ◆ Impact Reduction to **Functional Restoration**
- ◆ Good Drainage to **Functional Drainage**
- ◆ One Size Fits All to **Unique Design**
- ◆ Unsustainable to **Sustainable**

# Conventional vs. LID Approach to Stormwater

## ◆ Conventional

- Collect
- Convey
- Discharge

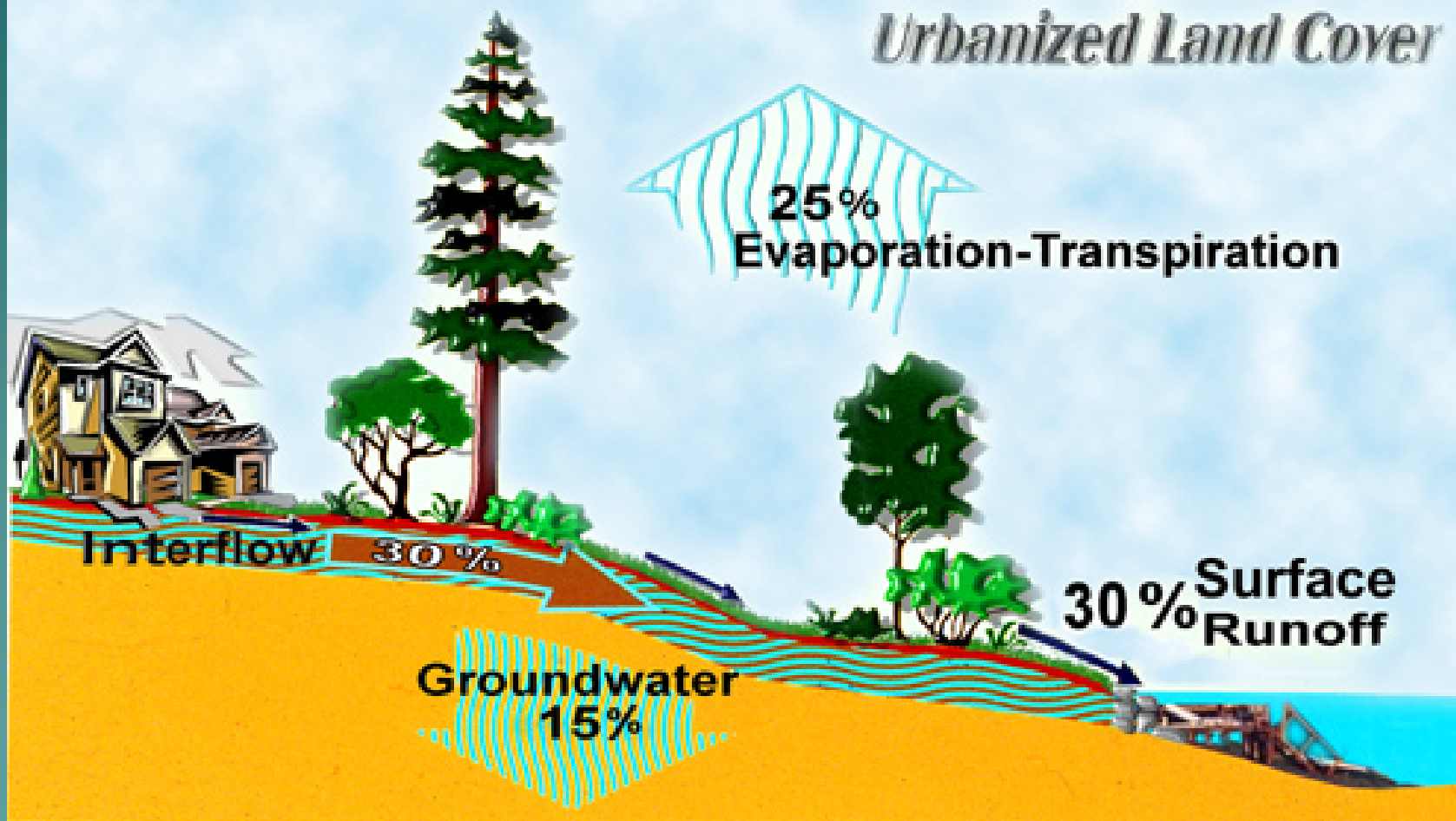
## ◆ LID Approach

- Reduce volume
- Minimize impacts
- Distributed controls
- Treatment trains
- Infiltration
- Hybrid systems
- Mimic the predevelopment hydrology

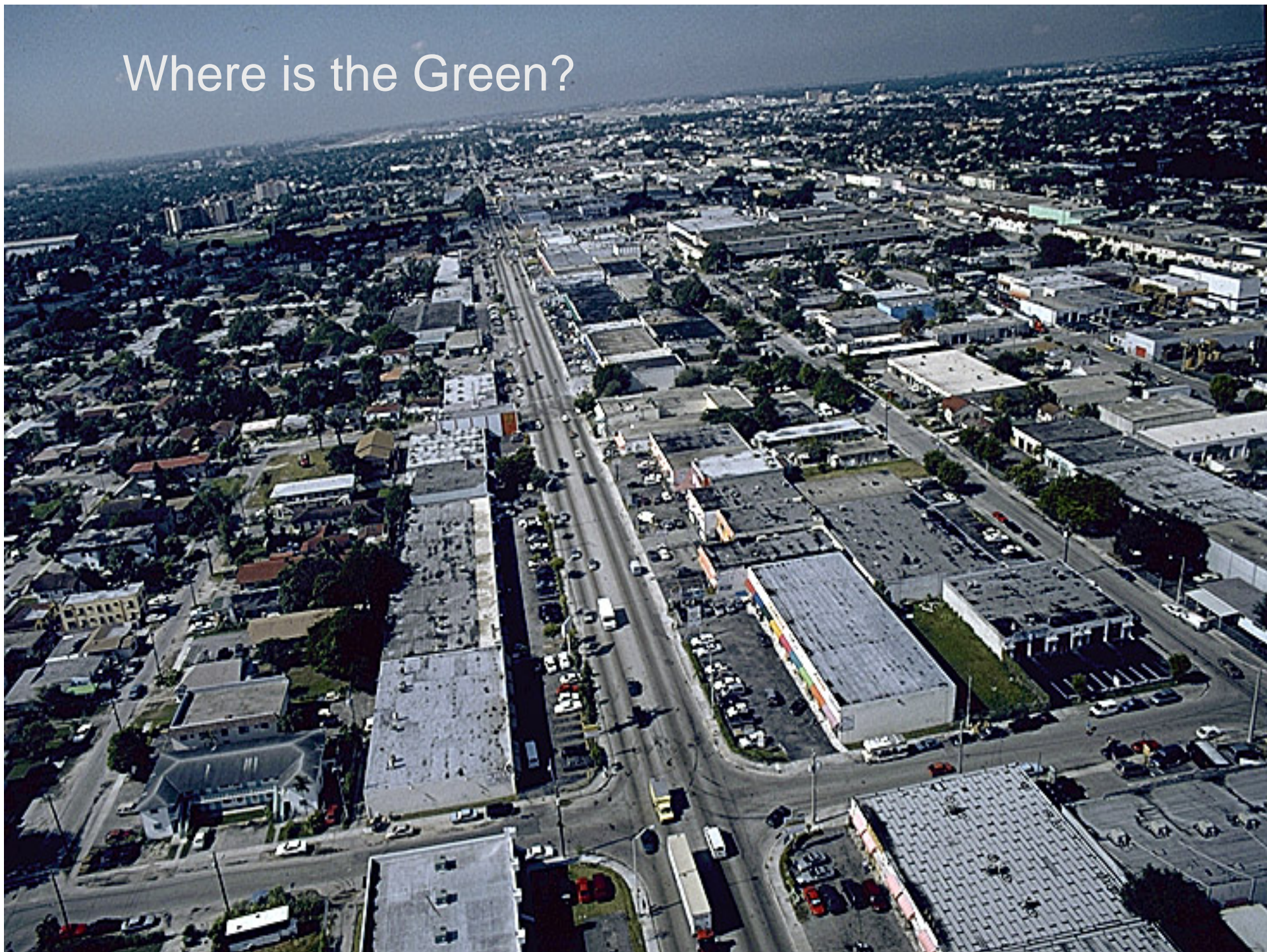
# Developed Conditions

## Typical Annual Water Budget

*Urbanized Land Cover*



Where is the Green?



# Construction Impacts



# Pollution Prevention – Erosion and Sedimentation Controls





*Hydrologically  
Connected*



*Ecologically  
Dysfunctional*

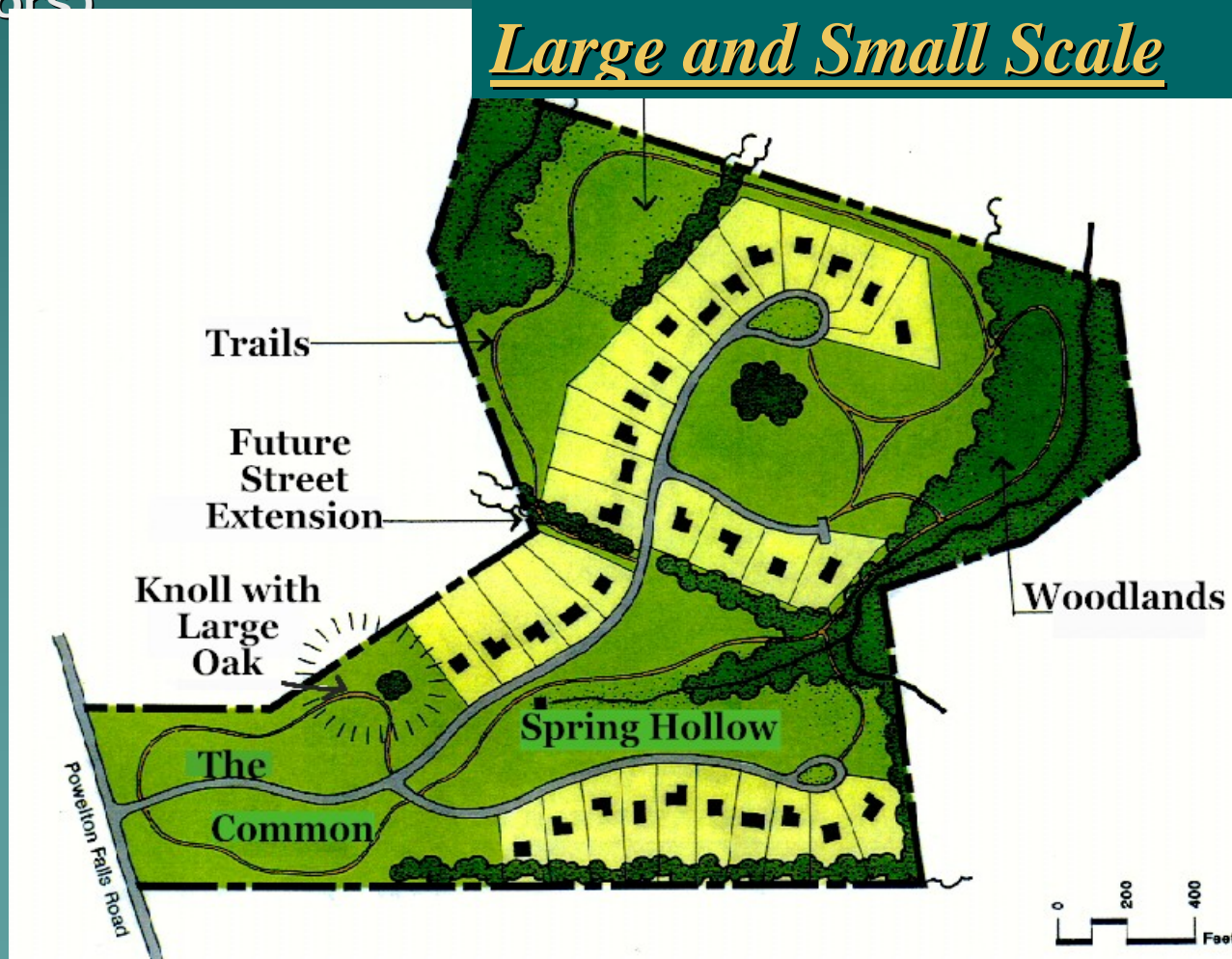


# 1. Conservation Plans / Regulations

## ◆ Local Watershed and Conservation Plans

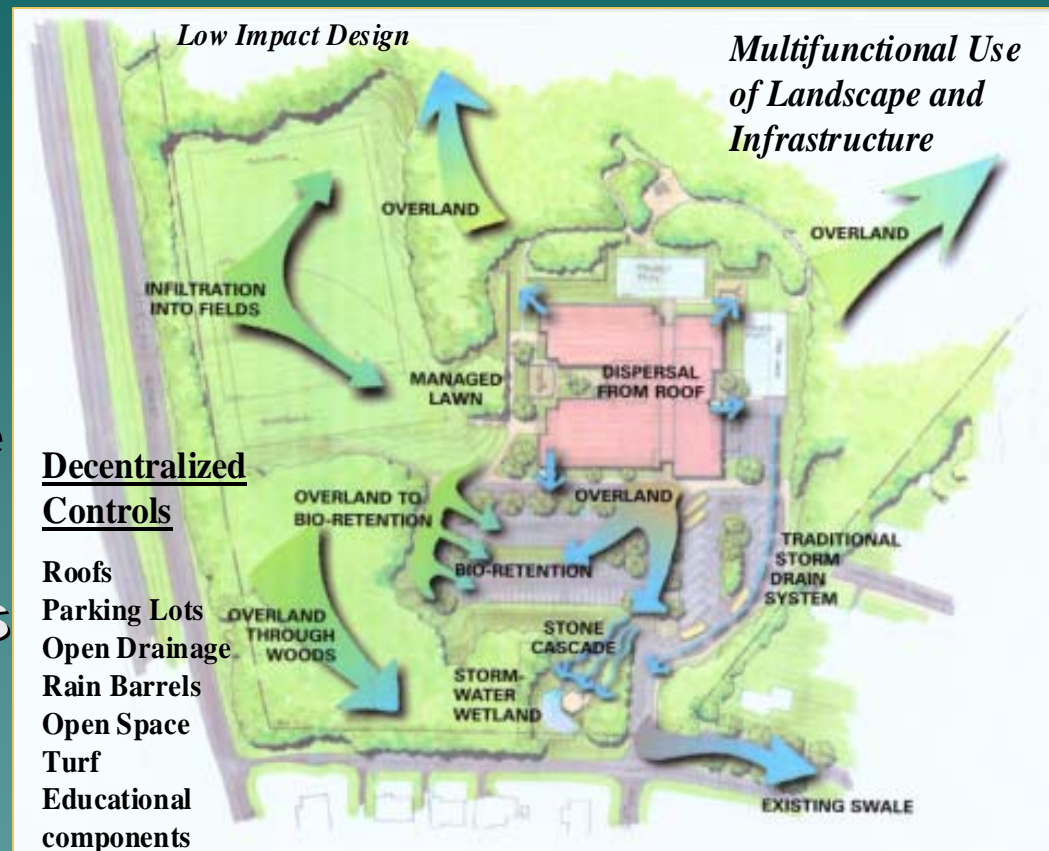
- Forest (Contiguous and Interior Habitat)
- Streams (Corridors)
- Wetlands
- Habitats
- Step Slopes
- Buffers
- Critical Areas
- Parks
- Scenic Areas
- Trails
- Shorelines
- Difficult Soils
- Ag Lands
- Minerals

### Large and Small Scale



## 2. Minimize Impacts

- ◆ Minimize clearing
- ◆ Minimize grading
- ◆ Save A and B soils
- ◆ Limit lot disturbance
- ◆ \* Soil Amendments
- ◆ Alternative Surfaces
- ◆ Reforestation
- ◆ Disconnect
- ◆ Reduce pipes, curb and gutters
- ◆ Reduce impervious surfaces



# “First Define Your Goals!”

Water Quality

Water Supply

Fisheries

Recreational Use

ESA

CSO

Flood Control

# Urban LID Lot Level Control Opportunities

- ◆ Roofs
- ◆ Buildings
- ◆ Down Spouts
- ◆ Yards
- ◆ Sidewalks
- ◆ Parking Lots
- ◆ Landscape Areas
- ◆ Open space
- ◆ Amended Soils

## *Multifunctional Infrastructure*

**Retention**

**Detention**

**Filtration**

**Infiltration**

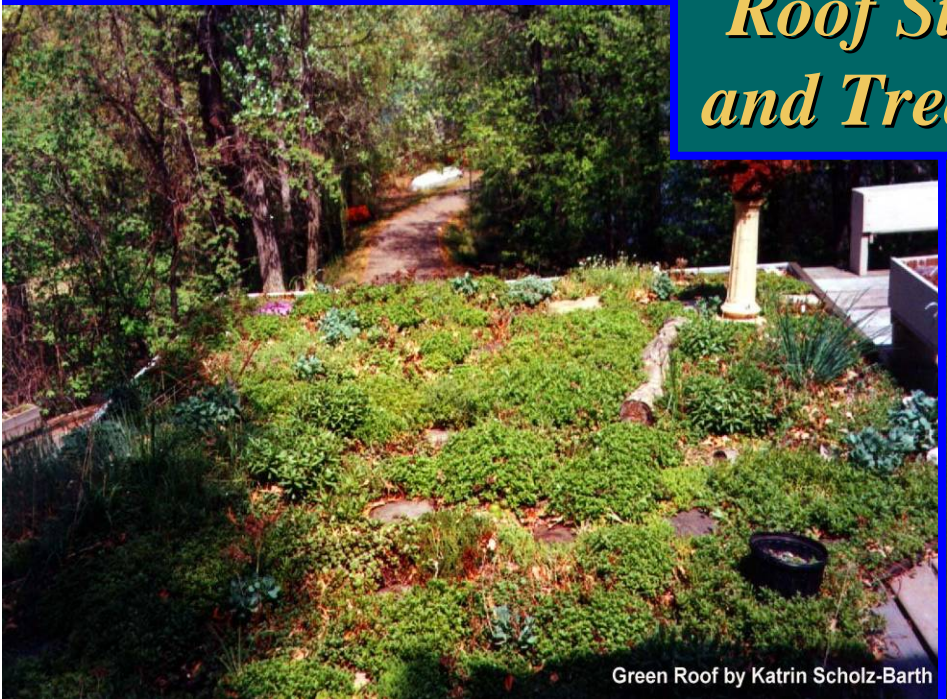
**Timing**

**Water Use**

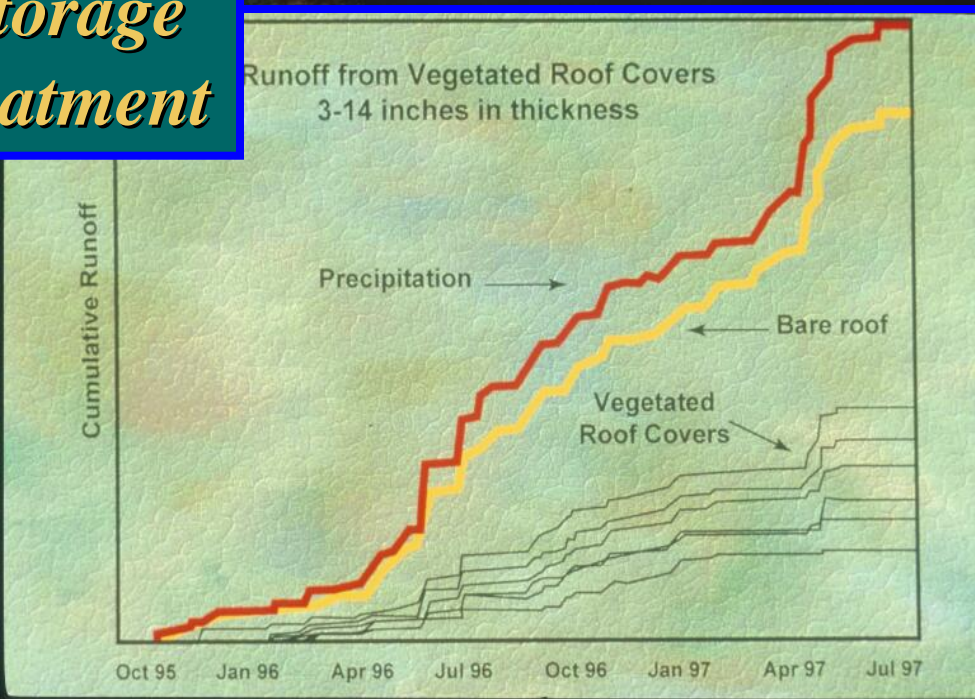
**Prevention**



*Roof Storage  
and Treatment*



Green Roof by Katrin Scholz-Barth



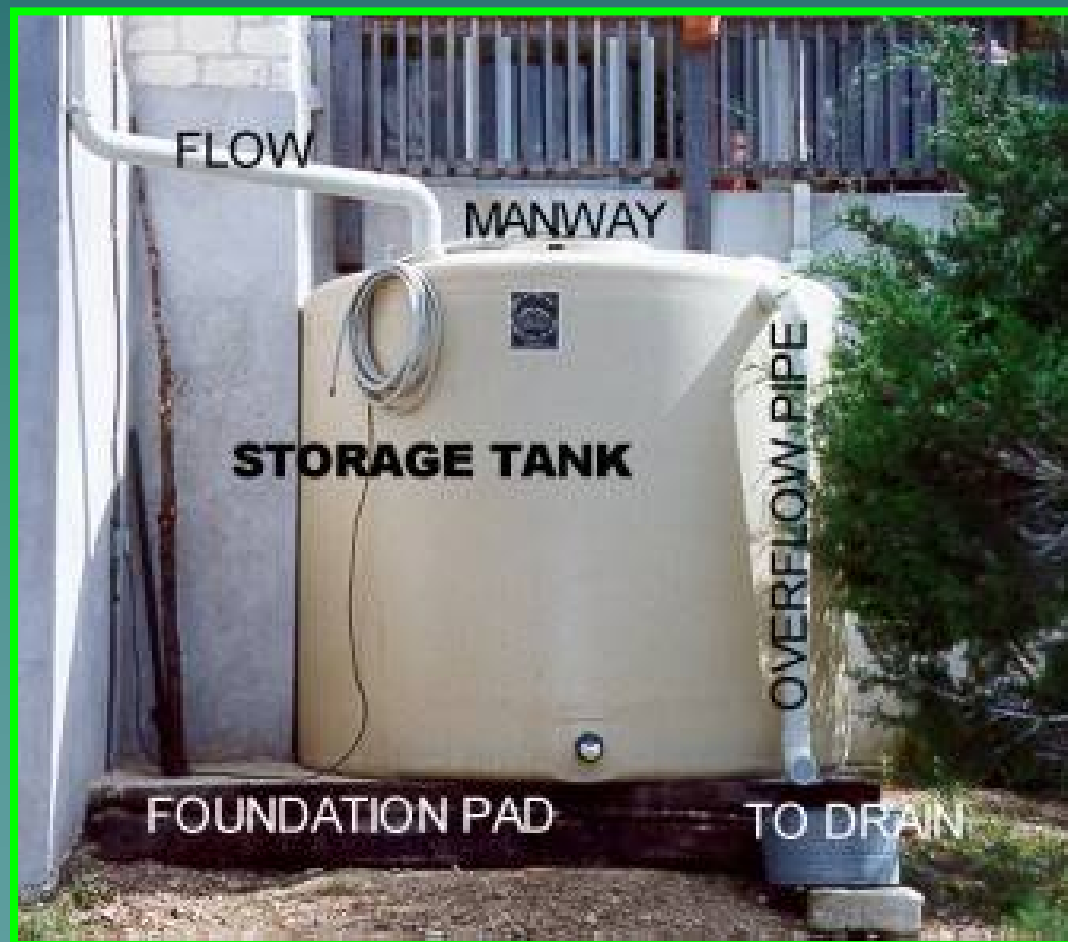


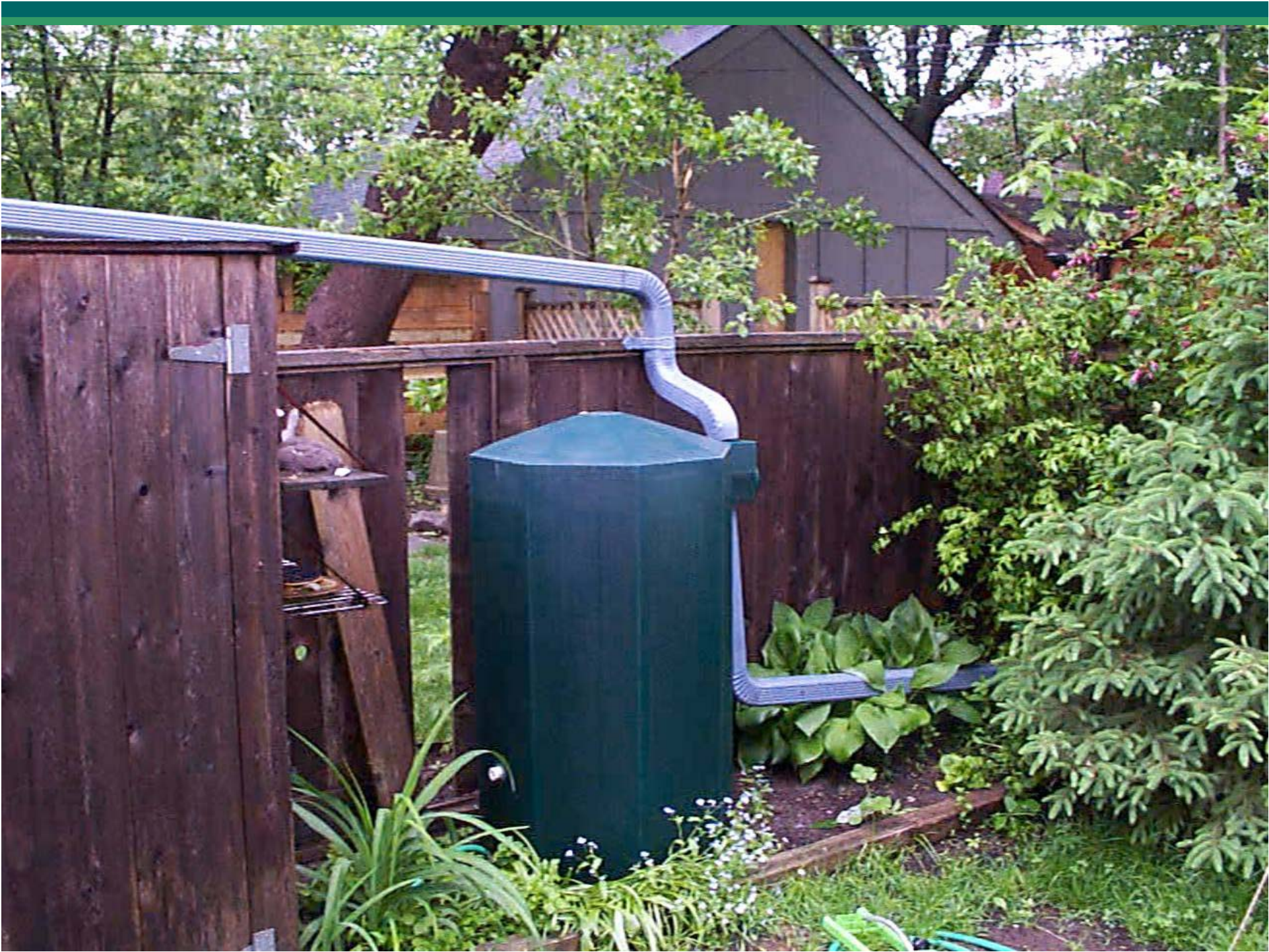
**MAY 29 2001**

# Buildings Design



## Downspouts Disconnect / Water Use







Increasing  
Surface  
Area

Urban  
Canopy



NORTHWESTERN HIGH SCHOOL

7000 ADELPHI ROAD

MYRTLEVILLE, MARYLAND



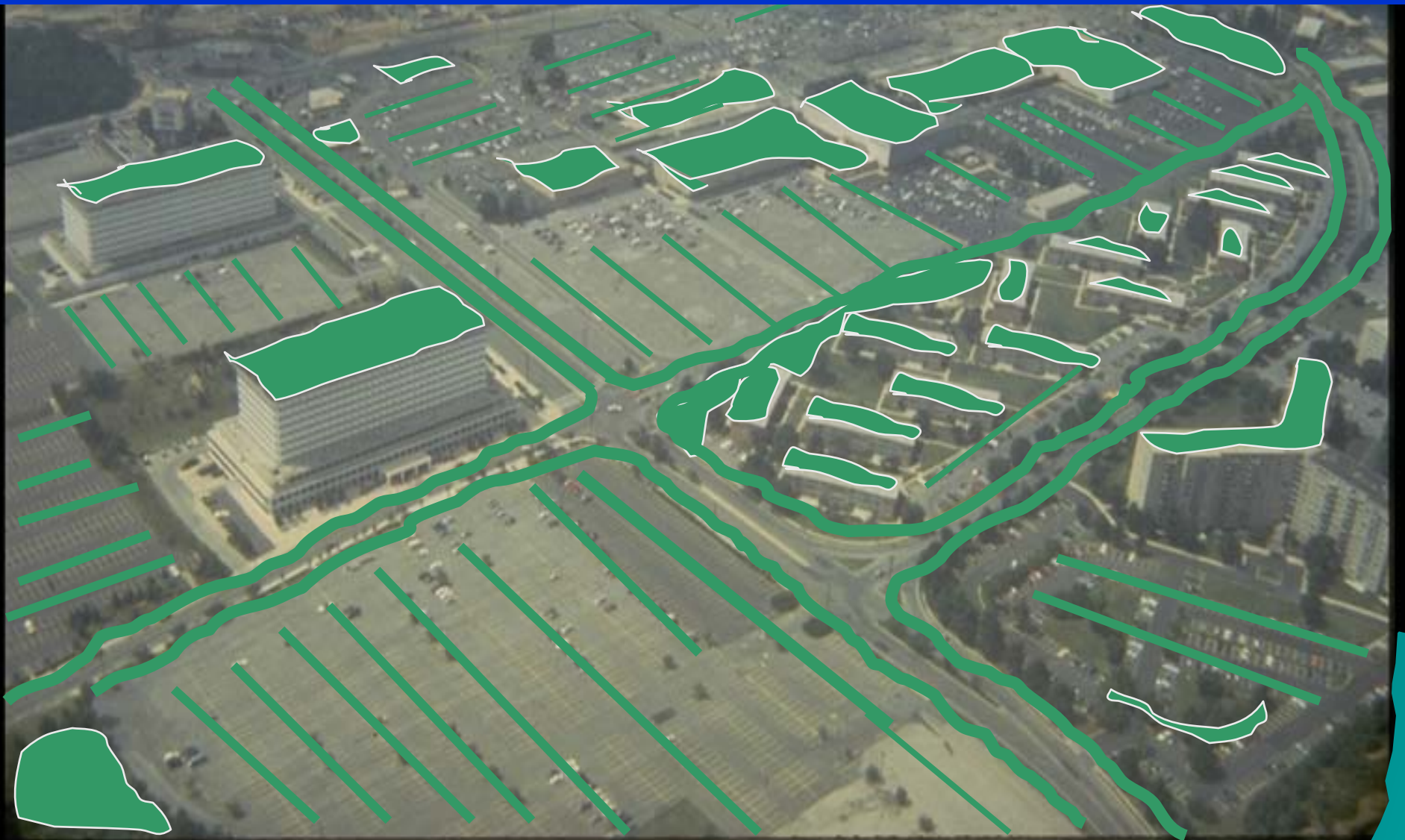




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**Urban LID -- Rooftop Storage, Bioretention Landscaping, Parking Lot Storage, Longer Flow Paths, Swales, Water Use, Pollution Prevention .....**



# *Runoff Use*

## Possibilities & Opportunities





Buttermilk off North Shore



Buttermilk off Ring Road



# Maintain Site Runoff Rate

- ◆ Maintain natural flow paths
- ◆ Use open drainage
- ◆ Flatten slopes
- ◆ Disperse drainage
- ◆ Lengthen flow paths
- ◆ Save headwater areas
- ◆ Maximize sheet flow



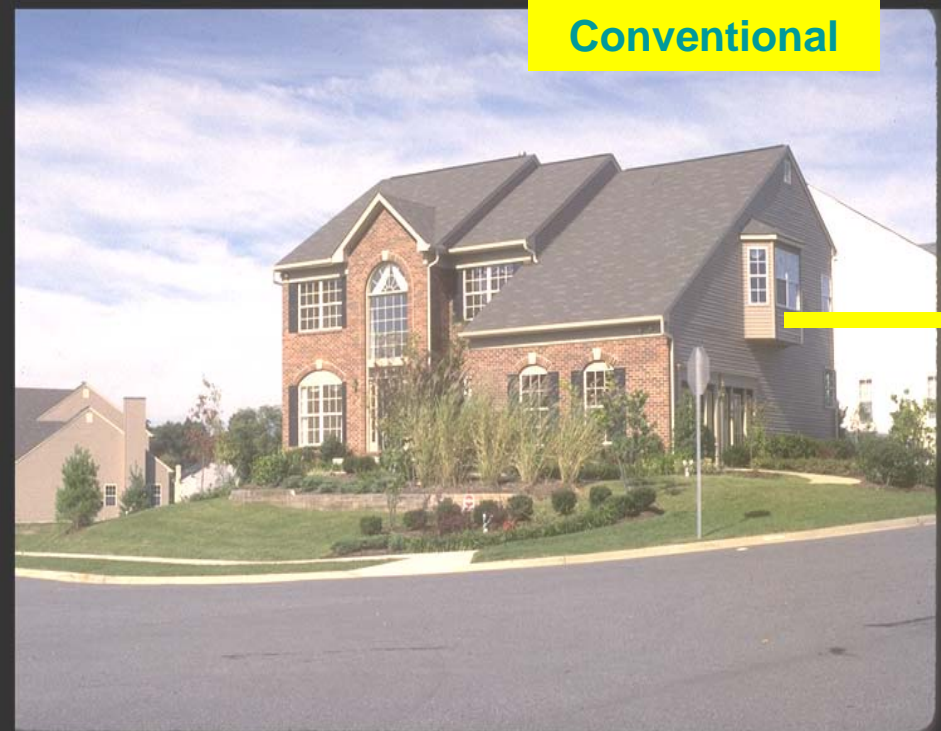


Conventional

Conventional

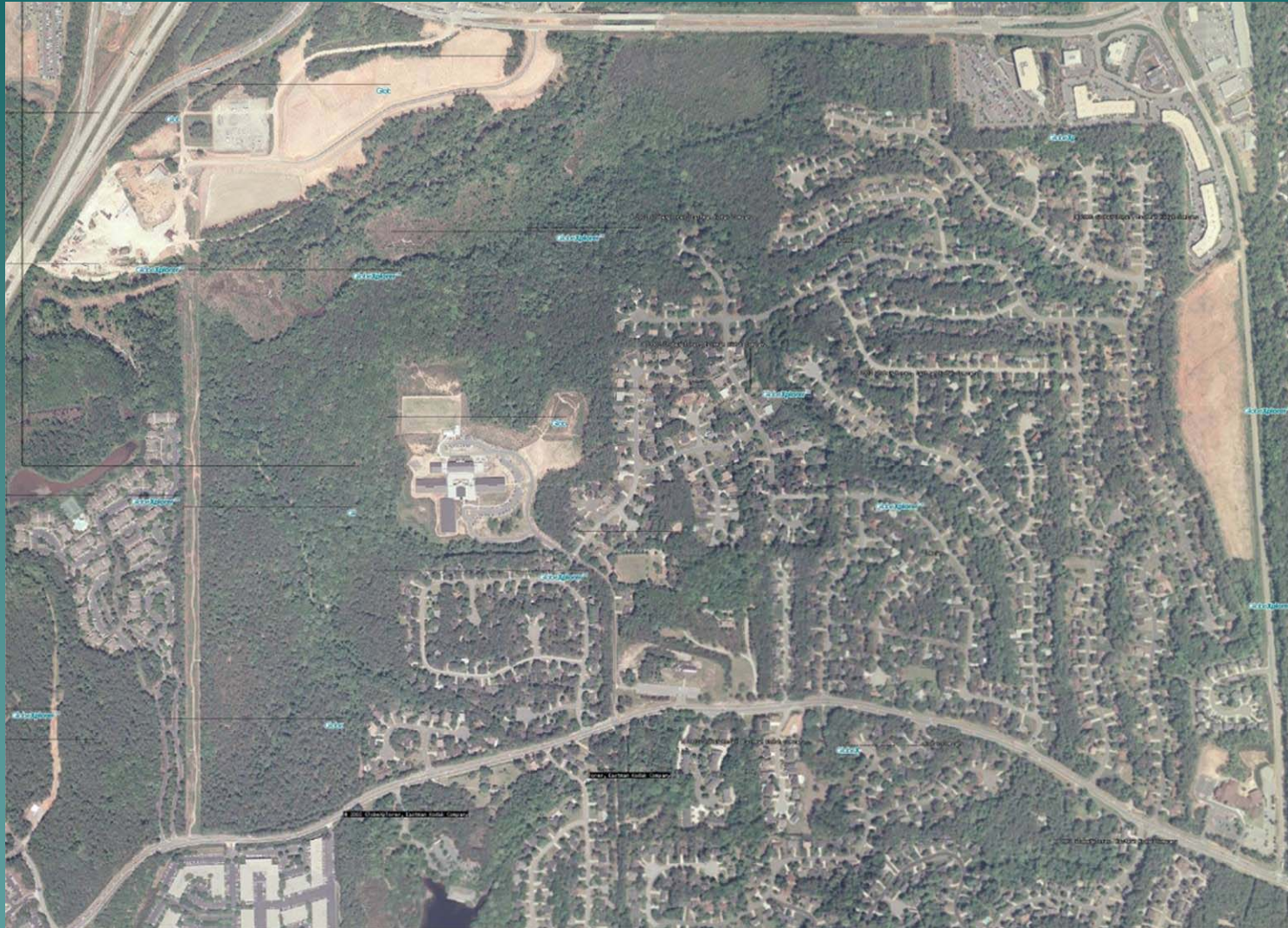


Low Impact



Functional Landscape Design

# Big Creek Park Site Watersheds



# Overlay of Future Park on Watershed





After Completion - January 2001

## Street Edge Alternatives (SEA)

Functional  
Landscape and  
Reduced  
Impervious Area  
98% Stormwater  
volume reduction  
for 2 yr storm  
event



**SEA Streets - After Construction**  
2nd Ave NW - NW 117th St to NW 120th St

# “SEA” Street



elements



# Burnsville, MN Stormwater Retrofit

- ◆ Existing Residential Development, 61 houses
- ◆ Paired Watershed Analysis
- ◆ 17 Raingardens Installed – Private Property
- ◆ **82% Reduction** in Annual Stormwater Volume (25 pre-construction rainfall events, 24 post-construction events)
- ◆ Percent runoff 27% to 5%
- ◆ Barr Engineering Company ([www.barr.com](http://www.barr.com))





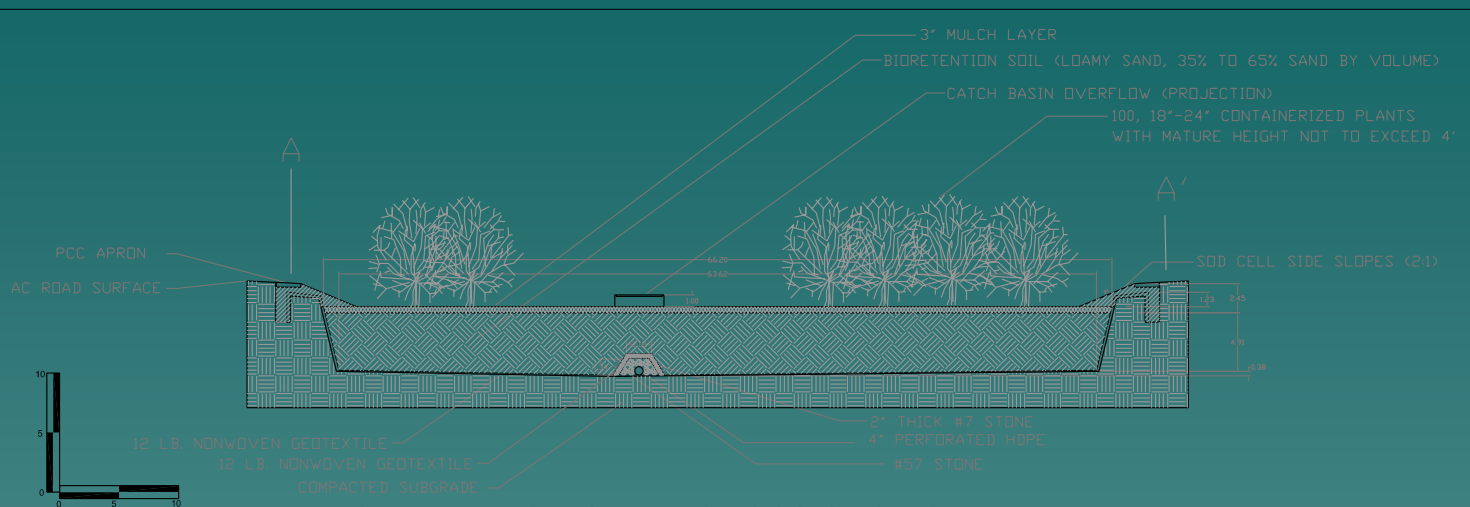


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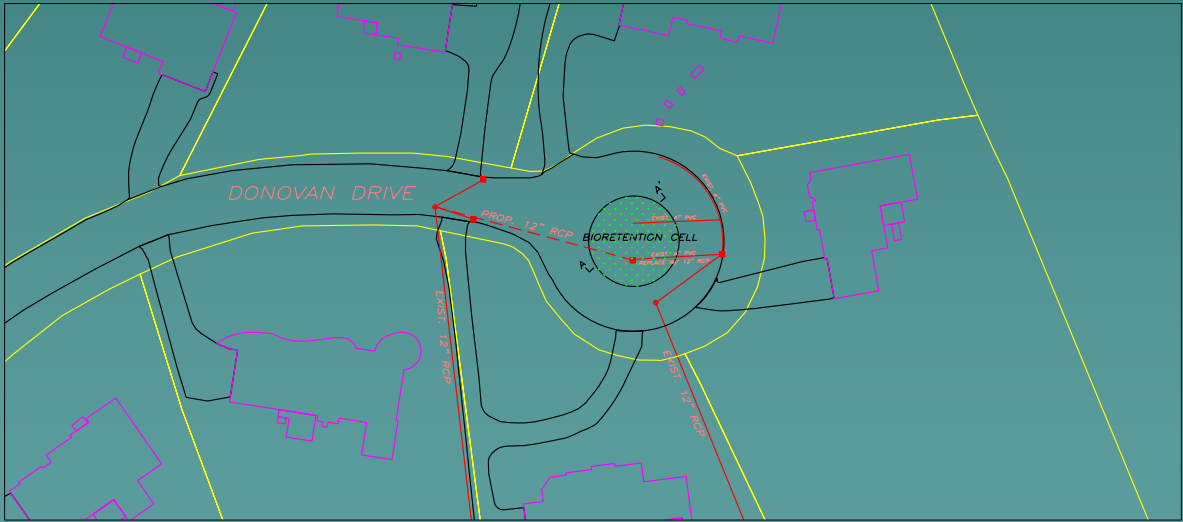
# Reduced Roadway Width 28 – 20ft

## New Roadway Standards Are Necessary!

- ◆ Institute of Transportation Engineers – 20-22 ft
- ◆ AASHTO – 26ft (for all residential)
- ◆ Center for Watershed Protection – 16 ft if ADT is <100
- ◆ Ipswich 20 -18 ft
- ◆ Newbury 20 ft
- ◆ Groton 18 ft (<20 units)



**BIORETENTION CELL - CROSS SECTION VIEW**



**BIORETENTION CELL - PLAN VIEW**

## Bioretention Cell Design

**GEOSYNTEC CONSULTANTS**  
 BOXBOROUGH, MASSACHUSETTS

PROJECT	BR0055	FIGURE	3
DOCUMENT		FILE	BIORETENTION_CELL



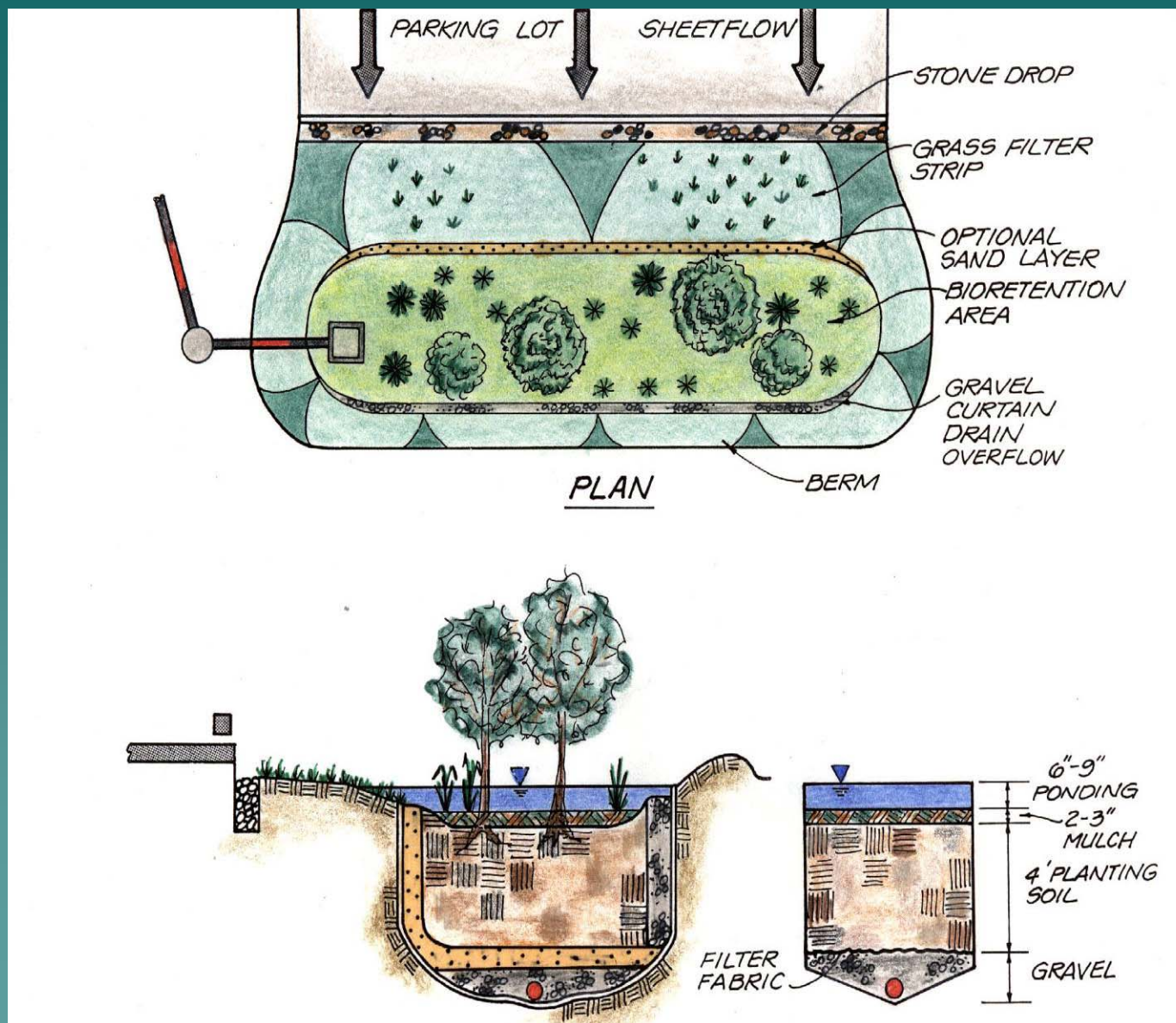
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# 100 ft Bioretention Cell in Parking Lot

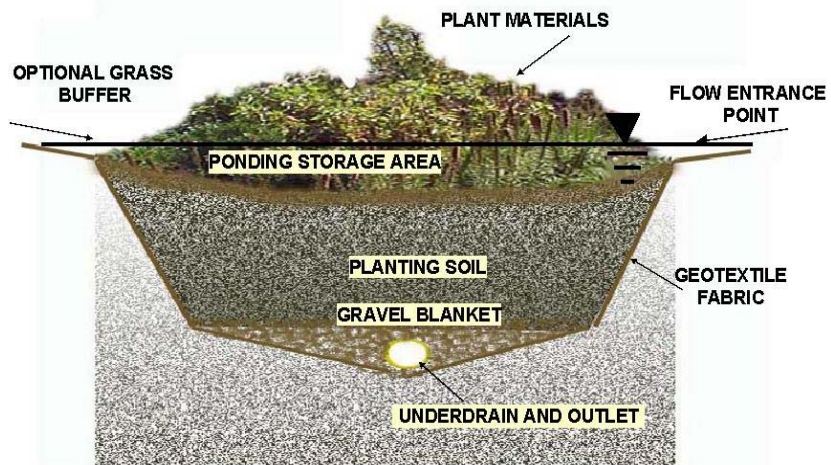




# Bioretention

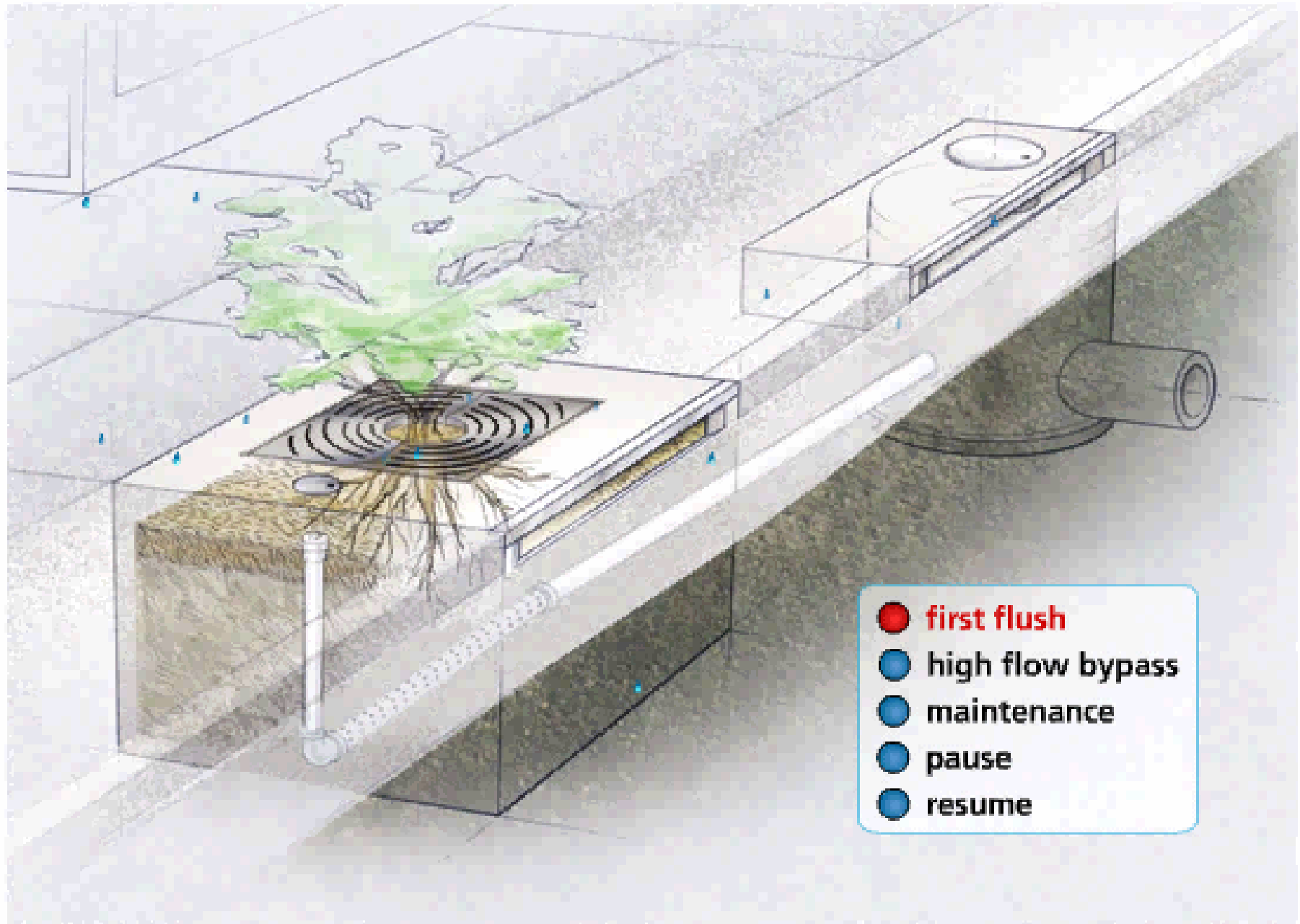


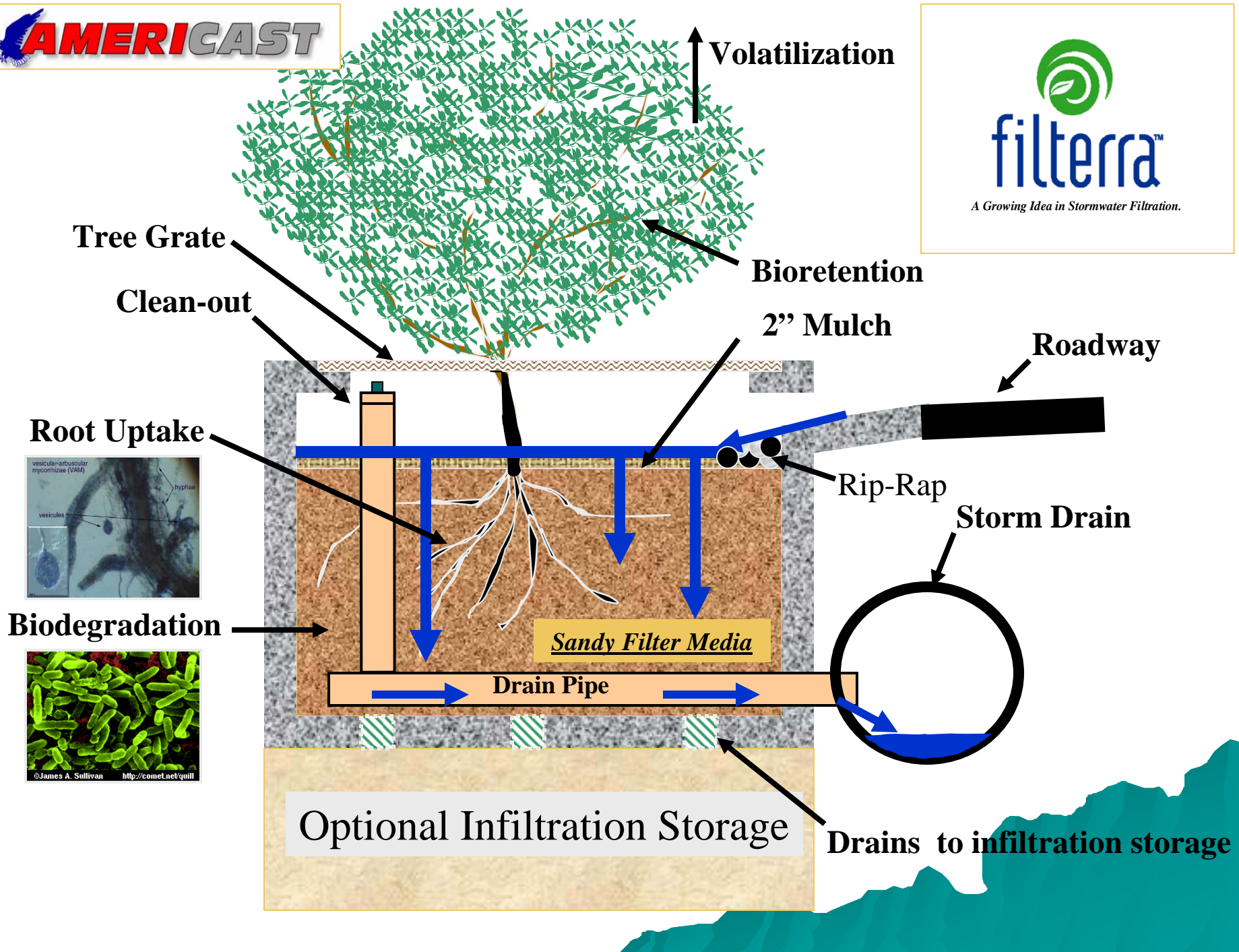
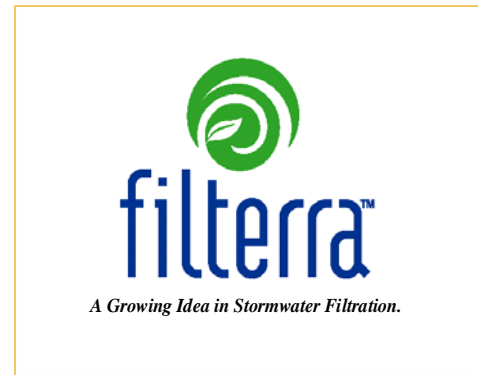
# Bioretention Cells





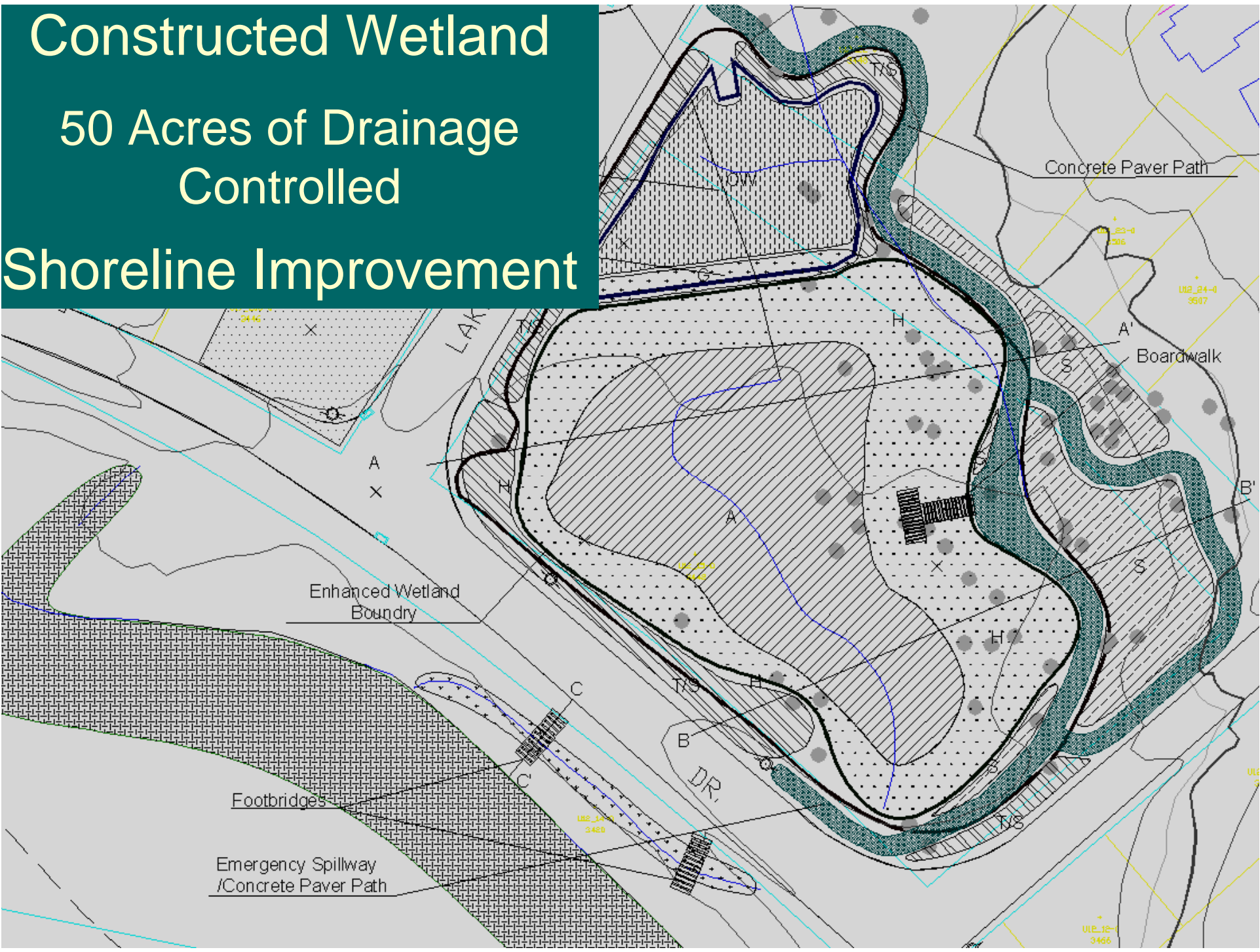
## FILTERRA™ STORMWATER BIORETENTION FILTRATION SYSTEM







# Constructed Wetland 50 Acres of Drainage Controlled Shoreline Improvement











JUN 16 2005









ve™  
is Pavers

# Raingardens – Several Designs

- Sunny – Shady Designs
- Homeowners have options to choose



- Public/Private Partnerships
- Total voluntary







# LID Web Resources

- ◆ The Low Impact Development Center
  - ◆ [www.lowimpactdevelopment.org](http://www.lowimpactdevelopment.org)
- ◆ Stormwater Research Center
  - ◆ [www.lid-stormwater.net](http://www.lid-stormwater.net)
- ◆ Massachusetts LID Website
  - ◆ [www.mass.gov/envir/lid/default.htm](http://www.mass.gov/envir/lid/default.htm)

# Questions...

