Bioretention Installation Training, Roger Williams Park

Providence, RI
Stormwater Management and Bioretention Context
April 11-12, 2012

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Presentation Agenda

- Very Brief Stormwater Management Intro;
- Bioretention components and applications;
- Roger Williams Park Water Quality Management Plan; and
- Site Selection Factors

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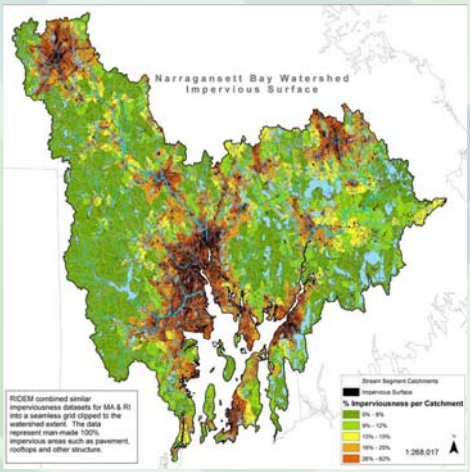
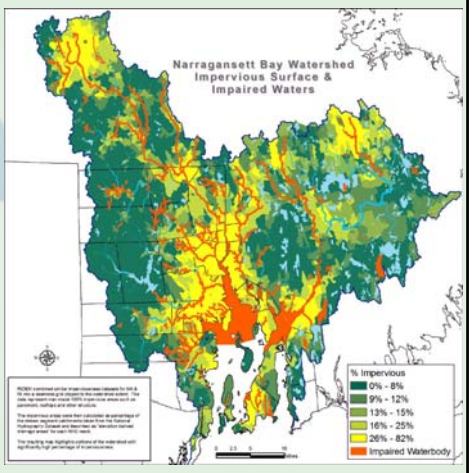
Impervious Cover Indicator





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Stormwater Impacts

At < 10% impervious we begin to see:

- Water quality issues
- Impacts to biological communities
- Increased flooding
- Stream erosion
- Loss of recreational uses
- Shellfish bed closures
- Reduced baseflow and recharge

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The Effects of Urbanization

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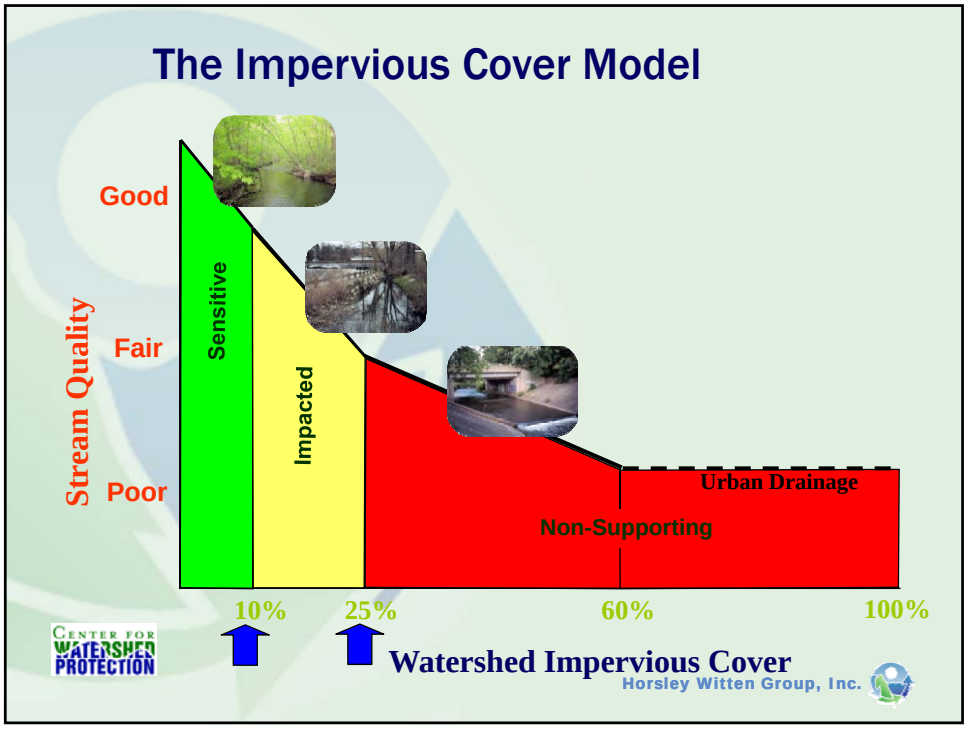
The Impervious Cover Model
Good
Fair
Poor
Stream Quality
Sensitive
Impacted
Non-Supporting
Urban Drainage
10%
25%
60%
100%
Watershed Impervious Cover
CENTER FOR WATERSHED PROTECTION
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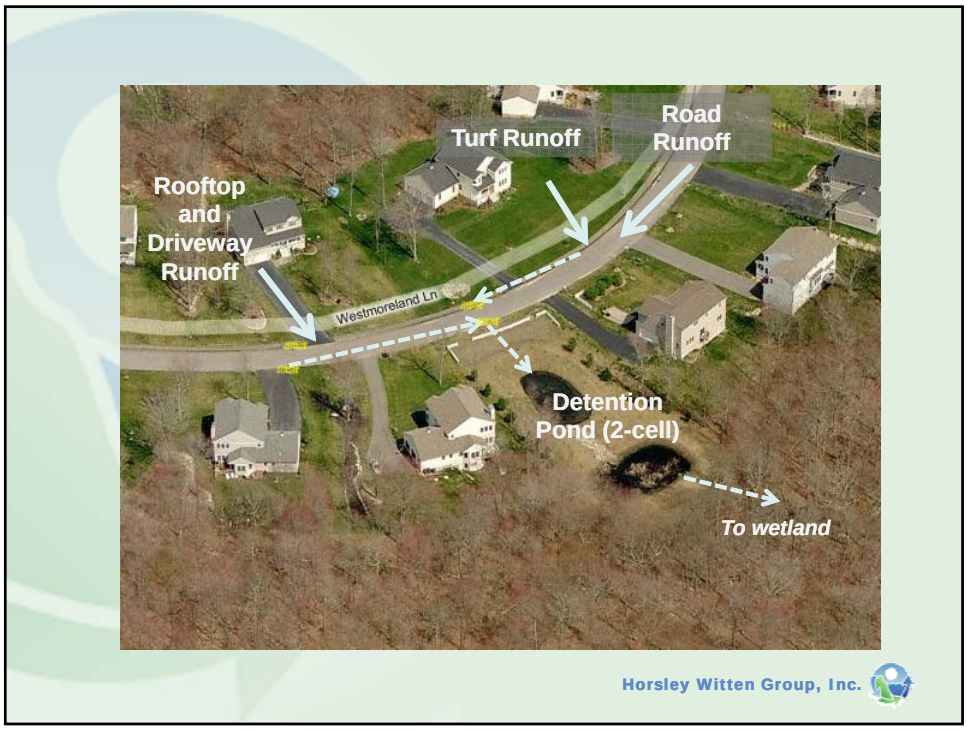
OYSTER
SURF CLAM
HARD CLAM
SOFT CLAM
RAZOR CLAM
SCALLOP
MUSSEL
NOT HARVEST SHELLFISH FROM THIS UNCERTIFIED AREA.
CLOSED AREA
NO SHELLFISHING
Due to fecal coliform bacterial contamination
PER ORDER OF
MASSACHUSETTS DIVISION OF MARINE FISHERIES
PAUL S. MONTAGUE, SHELLFISH CONSTABLE
508-548-7611 ext. 334
GATHERING OYSTERS, CLAMS, AND MUSSELS PROHIBITED BY LAW
FINES UP TO $100.00 OR 30 DAYS IN JAIL FOR EACH VIOLATION
WARNING
PROHIBITED AREA
THE CONSUMPTION OF OYSTERS, CLAMS, AND MUSSELS FROM THIS AREA MAY CAUSE SERIOUS ILLNESS.
RELAYING OR TRANSPLANTING ALLOWED BY SPECIAL PERMIT ONLY.
S.C. DEPT. OF HEALTH &


Turf Runoff
Road Runoff
Rooftop and Driveway Runoff
Westmoreland Ln
Detention Pond (2-cell)
To wetland
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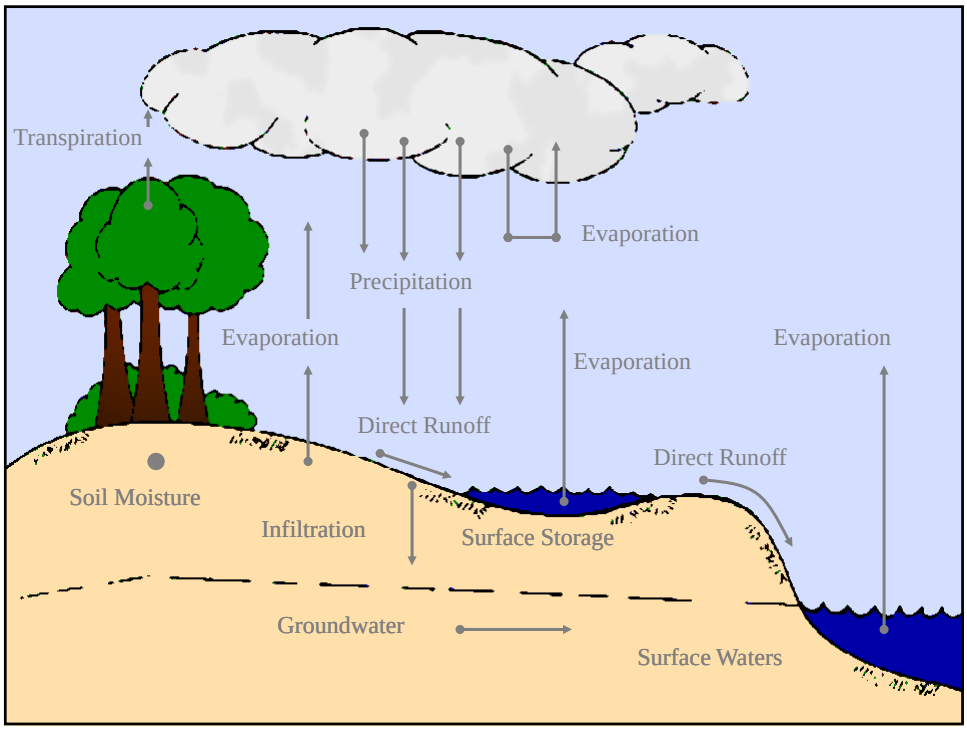
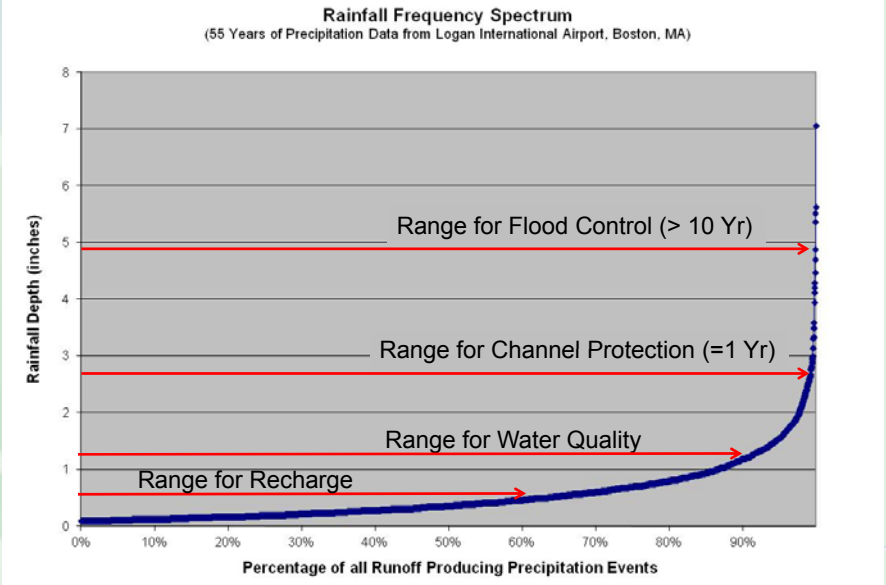

Transpiration
Evaporation
Precipitation
Evaporation
Evaporation
Evaporation
Direct Runoff
Direct Runoff
Soil Moisture
Infiltration
Surface Storage
Groundwater
Surface Waters

Stormwater Management is Really Precipitation Frequency Management



Typical Stormwater Performance Criteria

- Groundwater Recharge/Runoff Reduction
  - Ave. annual natural recharge (soils/geology)
- Water Quality
  - 90% storm for high quality waters & hotspots
- Channel Protection
  - Extended detention for 1-year storm (~2.7-2.8″)
- Flood Control
  - Peak rate control for 10, 25, & 100-year storms (range from about 5-8.7″ in RI)

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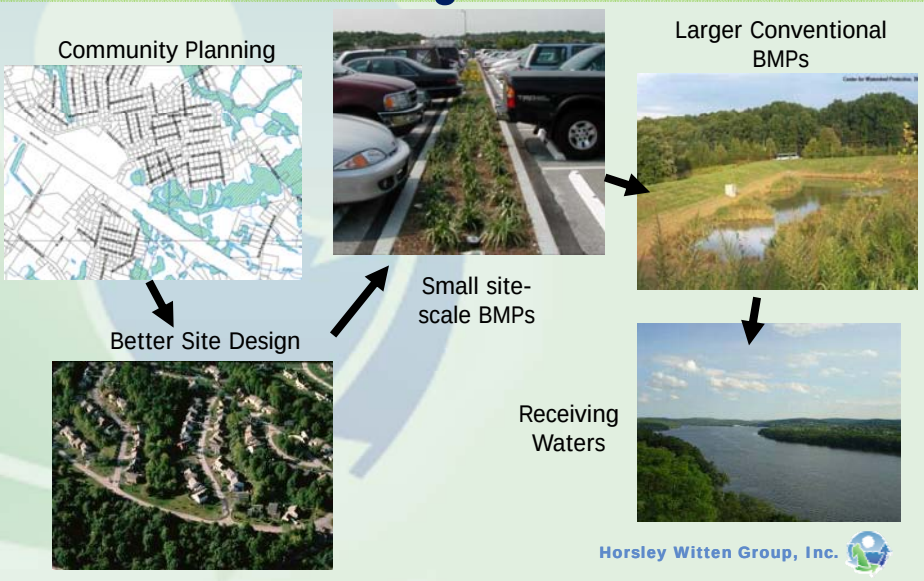
State of the Practice for Stormwater Management



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Evolving Site Design
Evolving Control Practice Design

	Traditional	LID
Site Design		
BMPs		

Bioretention Definition

Bioretention basins are landscaped depressions used to slow, treat and/or infiltrate stormwater runoff. Stormwater is directed to the basin and then percolates through the soil system where it is treated by a number of physical, chemical and biological processes. The stormwater is allowed to infiltrate into native soils and/or collected in an underdrain system and directed to a nearby drainage system or receiving waters. (*adapted from Lake Superior Streams.org*)

Dennis Ave Health Center, Wheaton, MD - Wikipedia

Ann McCrary Park, Wilmington, NC

What is a bioretention area?

"A bioretention area, ~~also called a rain garden~~, is a stormwater treatment system that is a depression integrated into the landscape."

(NC State Coop. Ext. website)

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Bioretention or a Rain Garden?

- Bioretention involves:
  - Amended soils;
  - Complex sizing calculations (e.g. modeling);
  - Detailed engineering specifications;
  - Sophisticated conveyance devices (flow splitters, underdrains, overflow inlets, etc).

- Rain Garden:
  - Generally doesn't involve the above- usually a shallow depression in native soils, or modestly amended soils (but might contain some of the above features)

Beware of what something is called: One person's Bioretention is another person's Rain Garden

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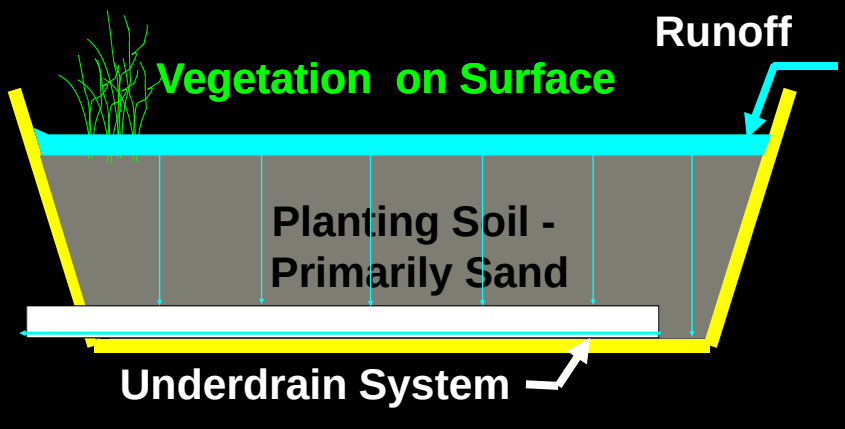
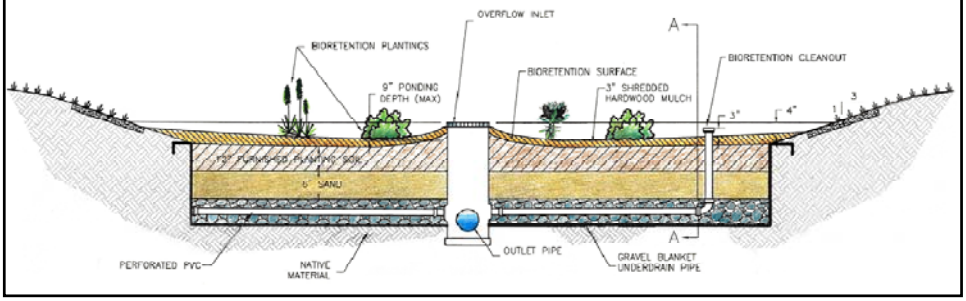
Bioretention (A Filtering Practice)

Bioretention Schematic



Components of Bioretention
(per RI Manual)

- Off-line design preferred
- Pretreatment
  - Pea gravel filter diaphragm
  - Grass filter strip/swale
  - Forebay
- Ponding area
- Organic layer (mulch)
- Planting soil bed
- Sand vs Pea gravel layer
- Plant materials
- Underdrain system?
- Overflow system



Bioretention – Many Applications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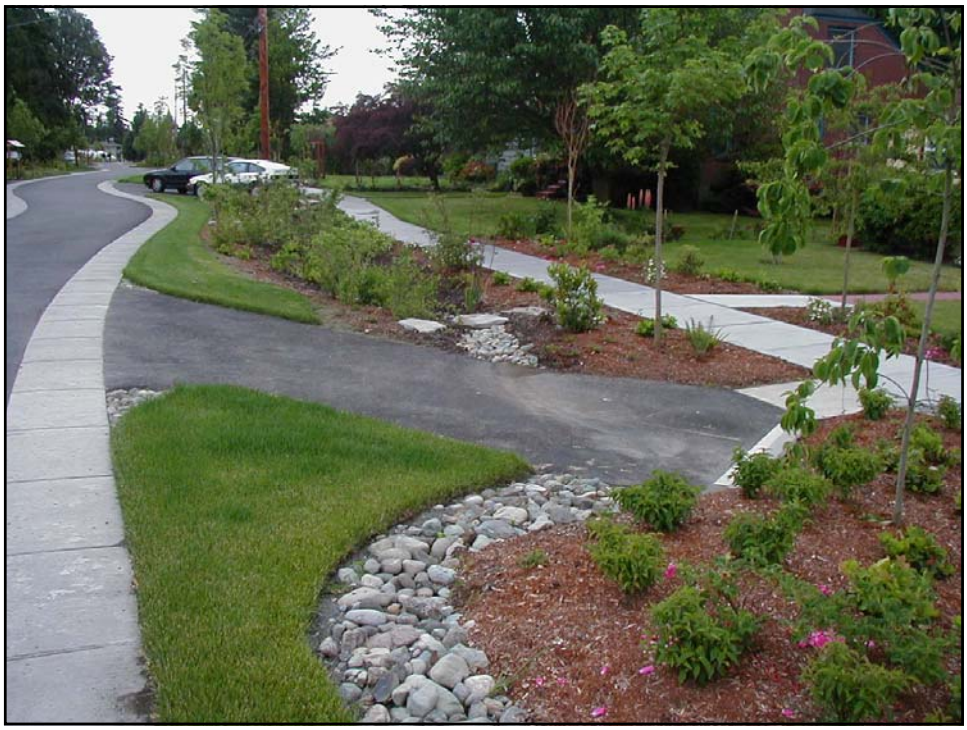


Tree pits


Source: City of Portland, OR
Source: City of Portland, OR

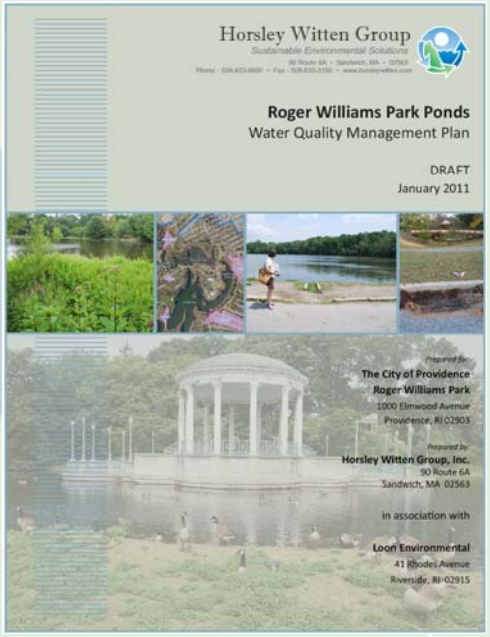
Retrofit Application

Roger Williams Park Ponds Draft Water Quality Management Plan

Watershed Management Plan

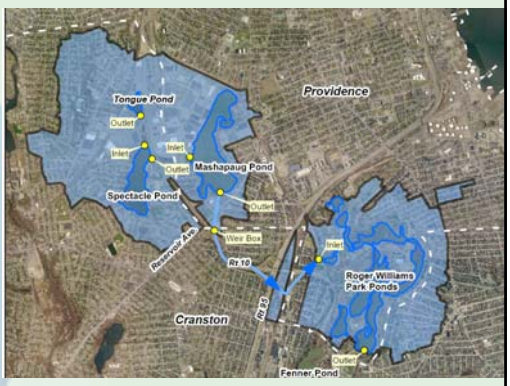
Goals:

- Water Quality Improvement of the RWP Ponds;
- Restoration of Biodiversity of Ponds;
- Improvement of Public Health of Fish Consumption; and
- Promotion of Outreach, Engagement and Stewardship.



Roger Williams Park Ponds Water Quality Management Plan

- 1,625 ac watershed
  - 2 subwatersheds divided by I-95
  - Upper 977 ac (**60% Impervious**)
  - Lower 649 ac **(~35 % I**)
- Upper: 3 Ponds/Lakes
Teague Spectacle and Mashapaug
- Lower: 7 Ponds/Lakes
Roosevelt, Willow, Polo, Pleasure, Edgewood, Cunliff, and Elm.
- All ponds identified on 303(d) list as impaired for phosphorus, fecal coliform bacteria; TMDL requires TP reductions as much at 78%



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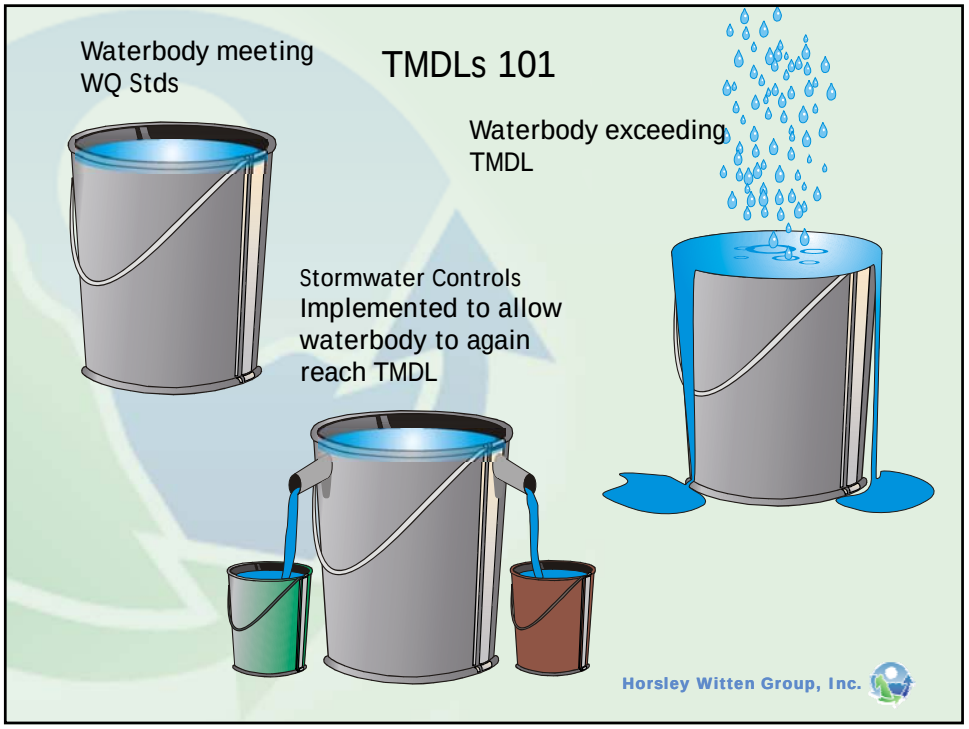

Project Approach

- Existing Park Ponds Characterization
  - Water Quality
  - Pond physical conditions
  - Phosphorus sources
- Management Options
  - In-pond
  - Stormwater Retrofits
  - Upland sources
  - Riparian restoration
  - Upper Watershed
- Design/Construction of a set of Pilot projects in lower watershed

Final Top Rated Structural Stormwater Sites

Rank	Site	Location
1	RWP-17/18	FC Green Blvd. (Polo Lake) – Shallow Bio
2	RWP-6	FC Green Boulevard (Monument)- WVTS
3	RWP-34	Botanical Center/Stables - Bioretention
4	RWP-24	Deep Spring and Cunliff Lake - Bioswale
5	RWP-3B	Carousel Parking Lot – Bioretention (1/2 lot)
6	RWP-28	Edgewood Intersection-Infiltration Basin
7	RWP-12	Ornamental Bridge-Terraced Swale
8	RWP-14	North Side of Roosevelt Lake-Shallow Bio
9	RWP-9C/9D	Casino Parking Lot-Bioretention
10	RWP-37A	Museum Parking-Dry Swale

Ranking factors include: Pollutant removal, cost, implementation ease, and added benefits (demonstration, habitat, partnering potential)

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Treatment Practice Options

Stormwater Treatment Options

Water Quality Treatment Practices

- Wet Vegetated Treatment Systems (WVTS)
- Stormwater Infiltration Practices (Re_v)
- Permeable Paving (Re_v)
- Filtering Systems (Re_v sometimes)
- Green Roofs
- Open Channel Systems (Re_v Sometimes)

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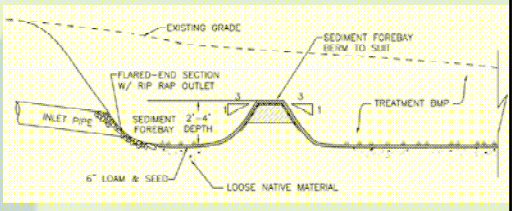
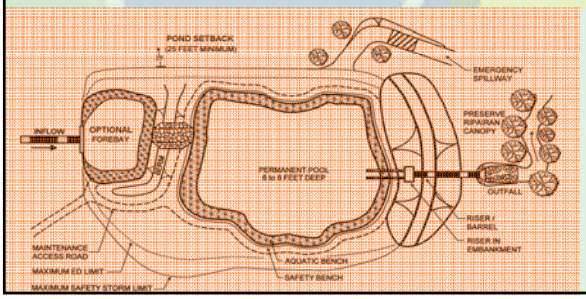
Practices that Meet Other Objectives

- Pretreatment Practices – Chapter 6
  - Grass Channel
  - Filter Strips
  - Sediment Forebay
  - Deep Sump Catch Basins
  - Proprietary Devices





- Storage Practices – Chapter 7
  - Stormwater Basins
  - Underground Storage Devices

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Practice Type and Site Selection Factors

All Practices:

- Land Use;
- Physical Feasibility;
- Watershed Objectives;
- Stormwater Management Control Capabilities;
- Community and Environmental Benefit

Bioretention Siting Factors

- Soils;
- Water Table;
- Drainage Area;
- Site Slope;
- Available Head;
- Site Constraints;
- Adequate Space;
- Control Capability?

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Will A Bioretention Practice Work Here?