

This presentation premiered at WaterSmart Innovations

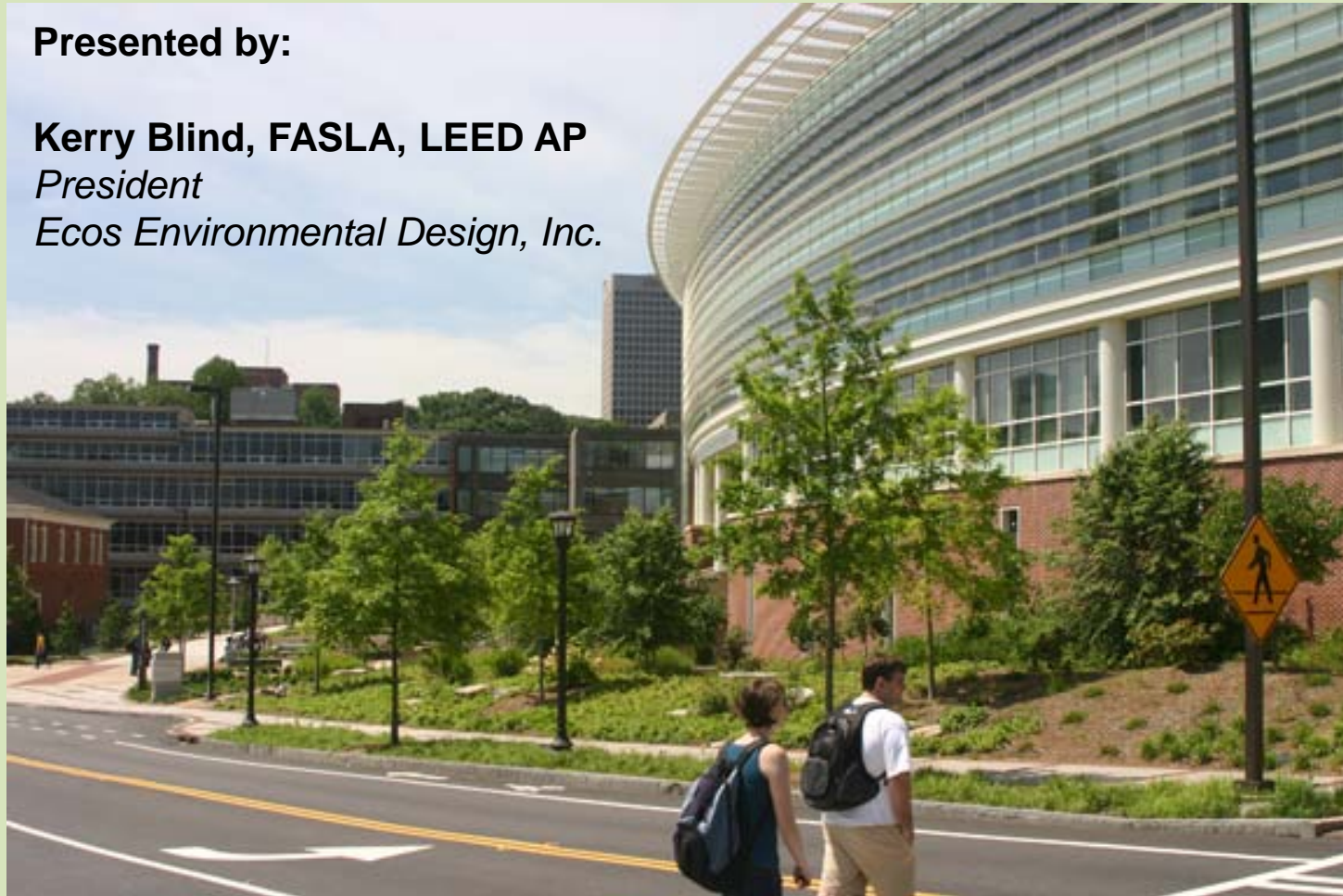
watersmartinnovations.com



WaterSmart Innovations 2009

Presented by:

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President
Ecos Environmental Design, Inc.



WATERSMART INNOVATIONS / Las Vegas, Nevada

A Tale of Two Cities

Comparison of Annual Rainfall

“Which city has the most annual rainfall - Atlanta or Portland?”

- *Portland receives an average of 34” annual rainfall*
- *Atlanta receives an average of 50+” annual rainfall*

Another Factoid:

Portland - water conservation practices are required.
Atlanta - water conservation practices are voluntary.

Stormwater Management Trends

NATURAL SYSTEMS

Interception
Evapotranspiration
Infiltration
Conveyance
Collection
Storage
Treatment
Disposal

CULTURAL SYSTEMS

Collection
Conveyance
Disposal

Collection
Conveyance
Detention
Disposal

Collection
Conveyance
Detention
Infiltration/
Treatment
Disposal

Collection
Conveyance
Detention
Infiltration/Treatment
Storage/Reuse
Disposal

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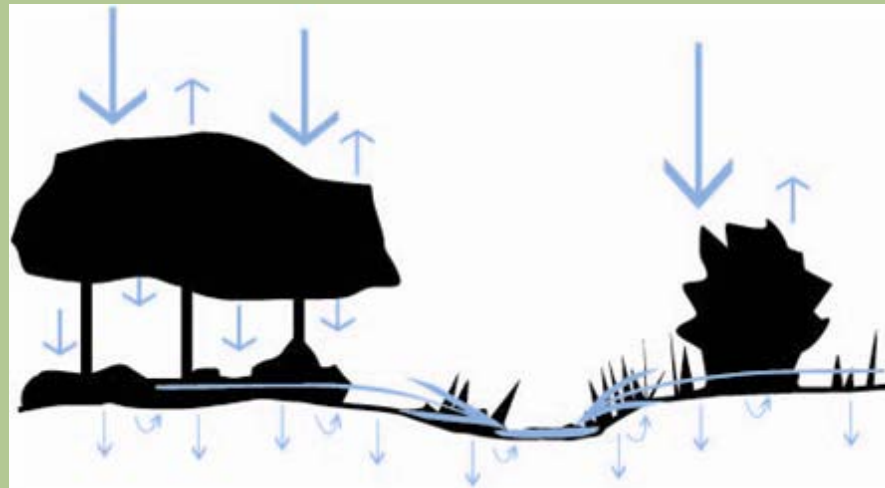
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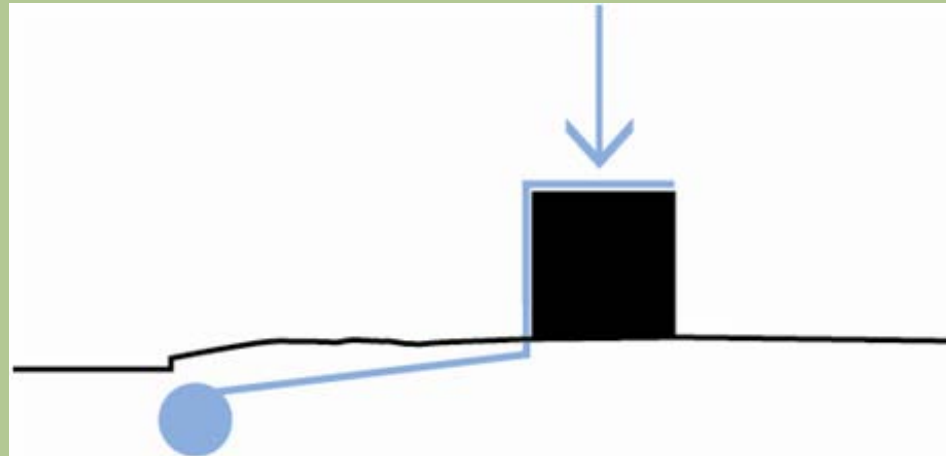
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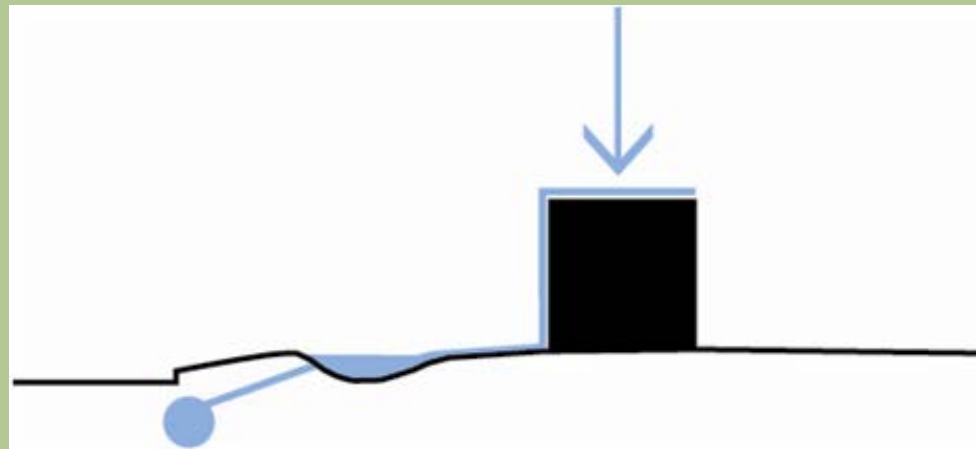
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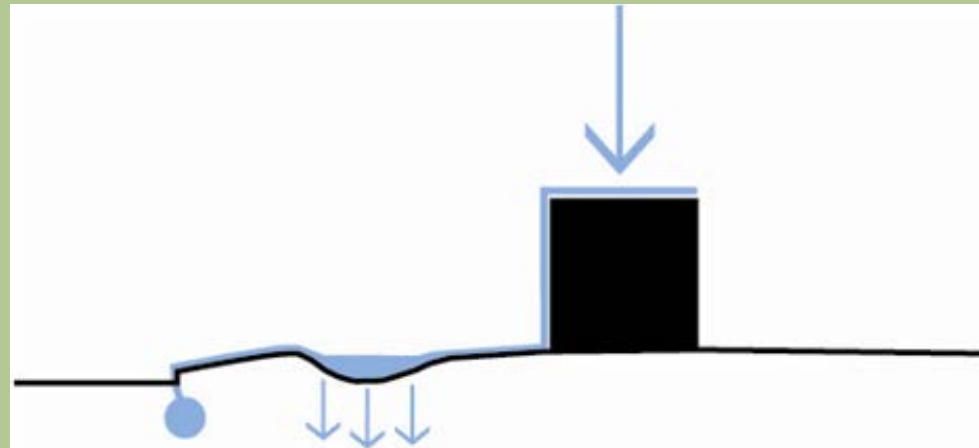
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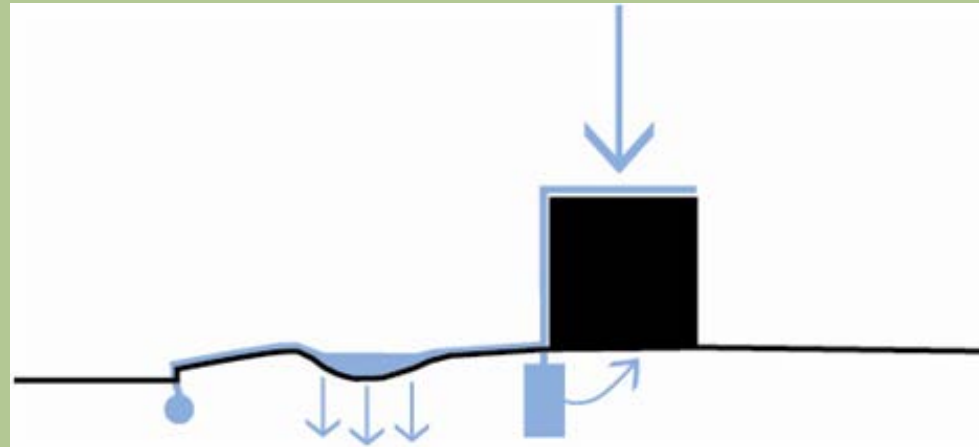
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Private versus Public

*Innovative, creative stormwater management techniques (BMP's) have focused on **private** development in recent years. The trend is to address **public** infrastructure as a source of non-point source pollution.*

Private Development

Private Development: Impervious Surfaces:

- *Rooftops*
- *Parking Lots*
- *On-site Paving*

Public Development: Impervious Surfaces:

- *Streets and Walkways*

Methodologies

- *Raingardens / Bio-infiltration*
- *Bio-swales*
- *Water Harvesting / Recycling*
- *Green Roof / Eco-roof*
- *Porous Pavements*
- *Sub-grade Infiltration*
- *Structural Soil*
- *Green Streets*

Raingardens / Bio-infiltration

***Heart of Lancaster Regional Medical Center
Lancaster, Pennsylvania***



Raingardens / Bio-infiltration

Carlos Middle School / Woodward Academy
College Park, Georgia



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Raingardens / Bio-infiltration



*Carlos Middle School
Campus / Woodward
Academy*

Bio-swales

The first stormwater swales were grass-lined, irrigated, mowed, fertilized, sprayed and highly maintained lawns.



Bio-swales



Southshore Corporate Park / Portland, OR

Water Harvesting / Recycling

Water harvesting has its roots in agriculture, where farmers created stockponds or other methods of storing water for crops and cattle and through the use of cisterns to capture rainfall for domestic purposes. Today, water harvesting has similar goals but takes many forms.

From the simple . . .

To more complex . . .

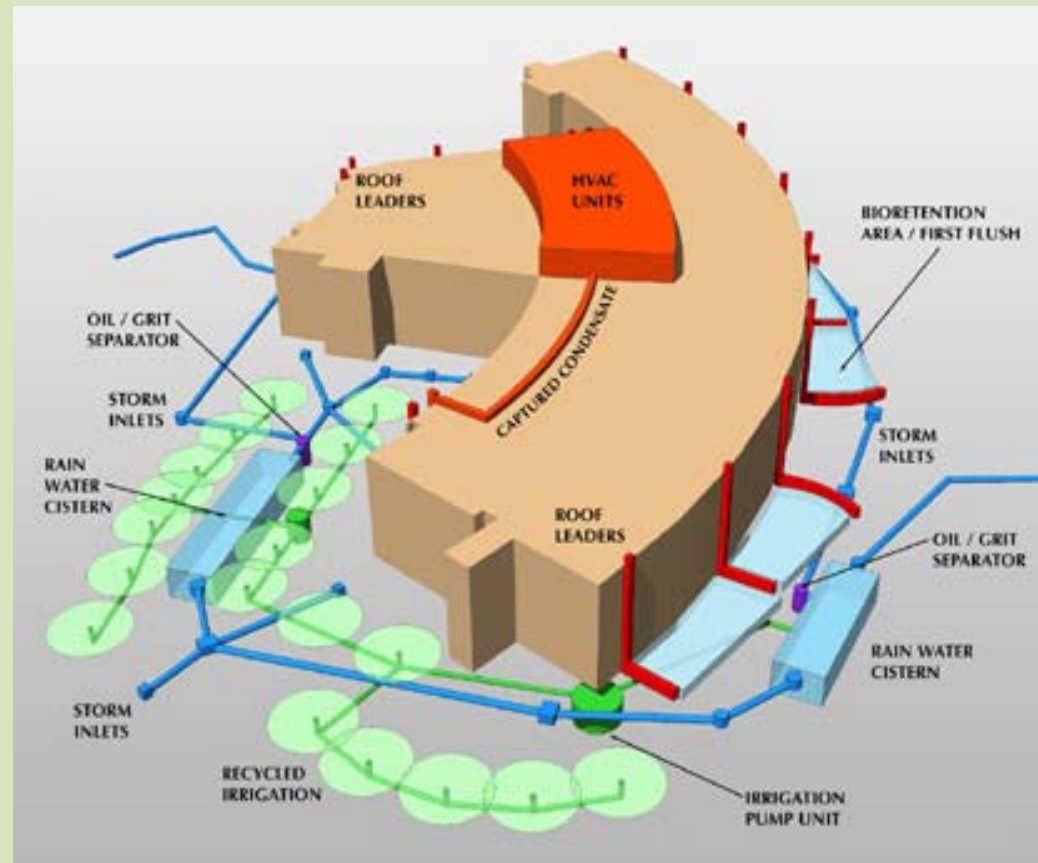


Water Harvesting / Recycling

Klaus Advanced Computing Building, Georgia Tech

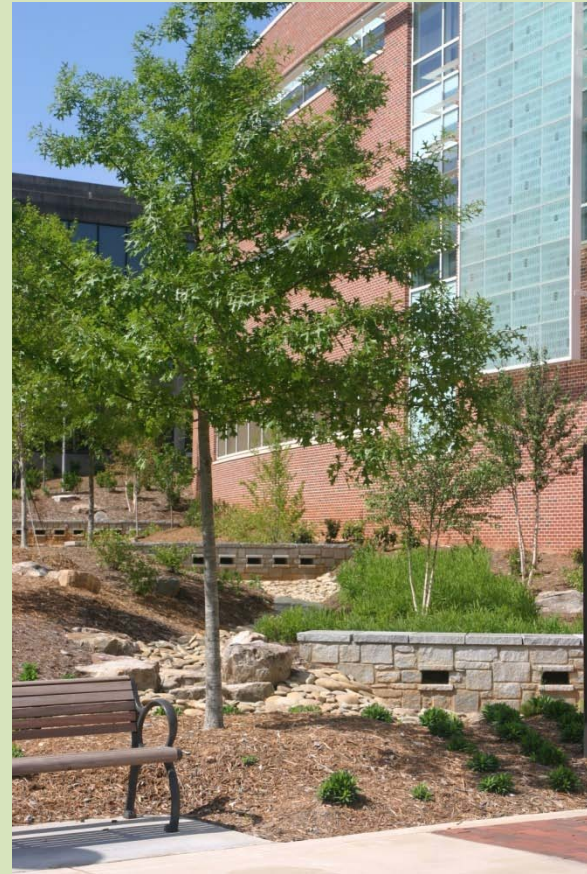
The Klaus project had a goal to reduce the net run-off to zero. This was to be accomplished through a series of raingardens and water harvesting - recycling the water back through the landscape .

The graphic shows the two cisterns and the water collection and re-distribution system.



Water Harvesting / Recycling

Klaus Advanced Computing Building, Georgia Tech



Green Roof / Eco-roof

The concept of using roof tops as gardens or living space go back thousands of years. In the Mediterranean climates, roof spaces allowed for additional garden or living space up in the cooling breezes. In northern climates, earth and plantings were used to help insulate structures from the cold winters.

Green roof treatments can take many forms:

- *Container systems*
- *Shallow or deep soil directly installed on a roof deck*
- *Hybrid systems*

Green Roof / Eco-roof

Carlos Middle School, Woodward Academy / College Park, GA



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Green Roof / Eco-roof

Beranger Condominiums Ecoroof, Gresham Oregon



Porous Pavement

Porous pavements are a great replacement for typical impervious pavement systems. They allow runoff to percolate through the pavement surface, reducing the amount of runoff that would normally travel across the pavement and concentrate in the lowest elevations. Some materials have high albedo, further reducing the heat-island affect.

Typical Materials for Porous pavements include:

- *Concrete Unit Pavers*
- *Concrete Pavement*
- *Asphalt Pavement*
- *Grass-pave Systems*

Porous Pavement

Porous Concrete Pavement



Drano Lake, Skamania County Washington

Porous Pavement

Porous Asphalt Pavement



Terminal 6, Portland Oregon

Porous Pavement

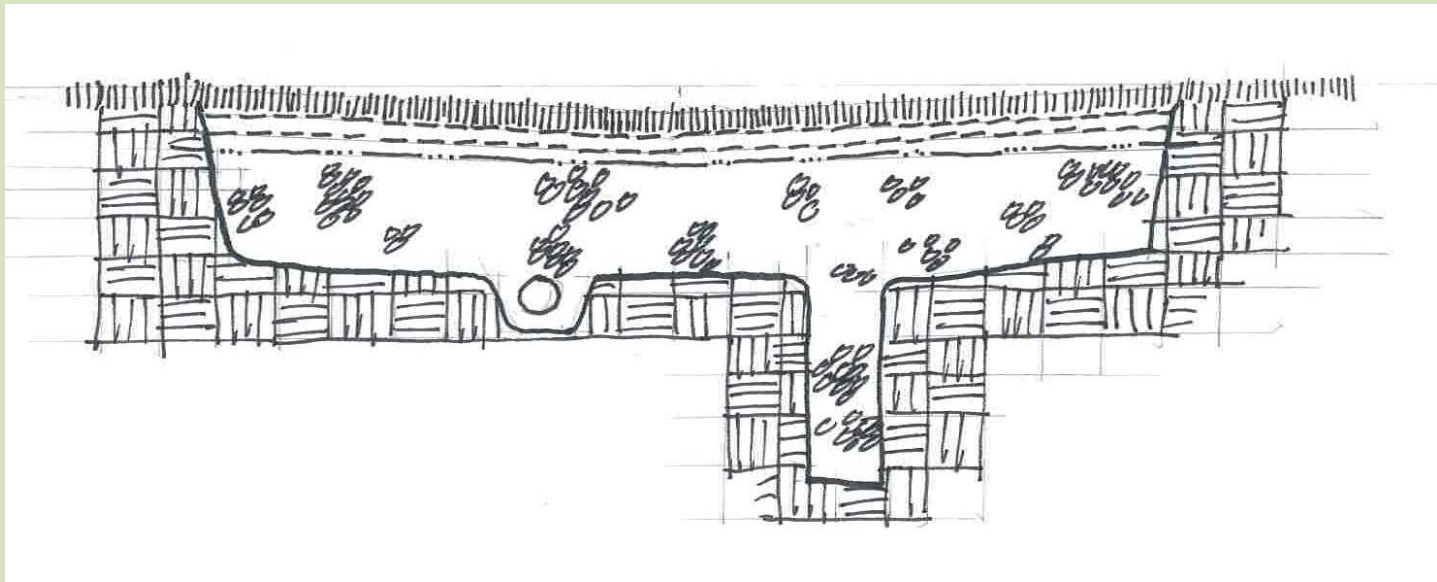
Porous Concrete Pavers



Headwater at Tryon Creek, Portland Oregon

Sub-grade Infiltration

Raingardens and bio-swales generally retain run-off in surface conditions, that is they allow for a certain surcharge to occur prior to infiltration or conveyance. Sub-grade infiltration are those systems that aren't readily apparent - they collect run-off from the surface, often through porous pavements or grass-pave systems, below grade and infiltrate or convey from there.



Sub-grade Infiltration

Carlisle Regional Medical Center / Carlisle, PA



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Sub-grade Infiltration

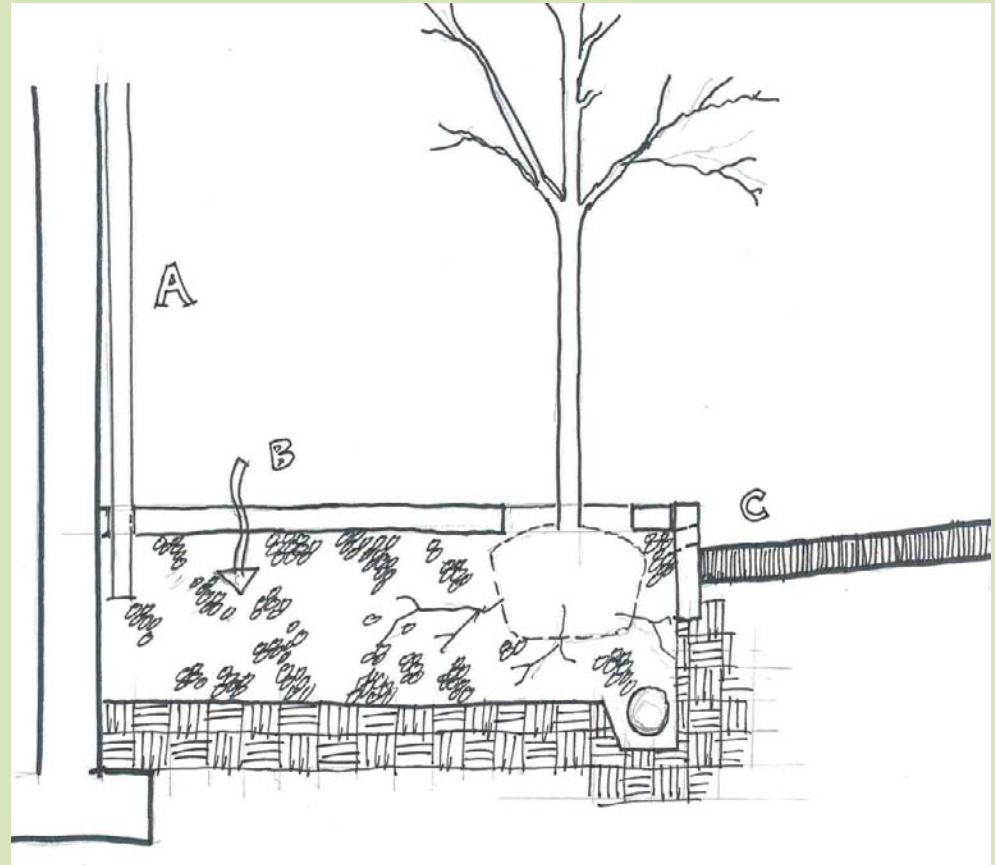
Shambhala Meditation Center / Decatur, GA



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Structural Soil

Structural soil is a sub-grade infiltration system comprised of a granular base material, such as #57 stone, that has been coated with a organic soil material and compacted in the normal manner under sidewalks or other paving. The advantage is that tree roots can expand into the structural soil material rather than being confined within a tree pit.



Green Streets

Green Streets are public transportation infrastructure projects that manage urban runoff with infiltration and treatment techniques.

- Issues:*
- *Space Requirements*
 - *Maintenance Requirements*
 - *Public Access*

What is a Green Street?

A green street:

is one component of a larger watershed approach to improving water quality

is designed to incorporate a system of stormwater management with ROW

minimizes the quantity of water piped

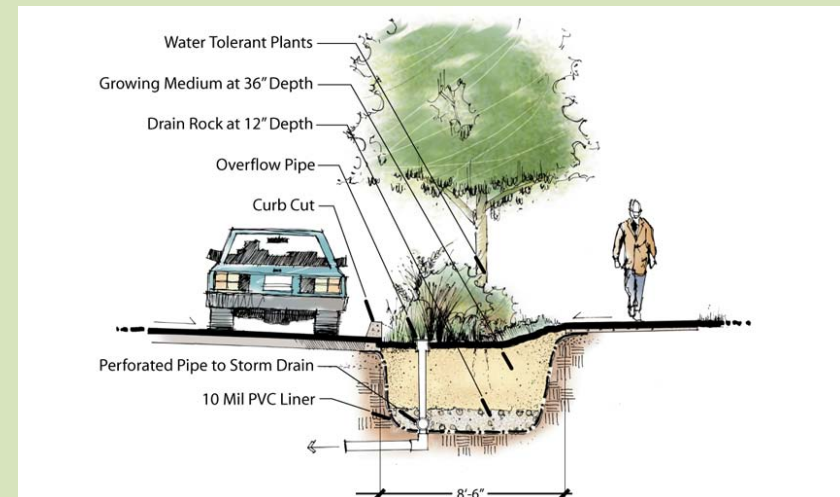
directly into streams and rivers

makes a visible system of green

infrastructure

incorporates the stormwater system into

the aesthetic of the community



What is a Green Street?

A green street:

maximizes the use of street tree coverage for stormwater interception

at points where it crosses a stream a green street is designed to minimize impact

requires more broad-based alliance for its planning, funding, maintenance and monitoring

**from METRO: Green Streets – Innovative Solutions for Stormwater and Stream Crossings*



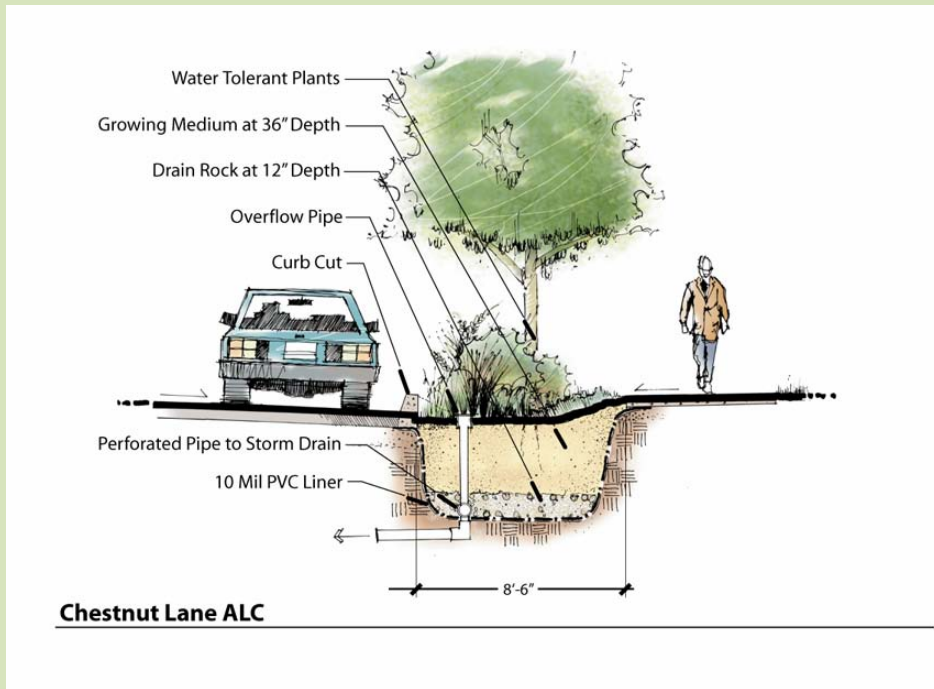
Green Street Issues

- Access
- Shared Facilities
- Maintenance
- Retrofitting
- Stormwater Elements:
Collection, Conveyance,
Treatment, Infiltration,
Detention, Disposal
- Stormwater as Art
- Design Manuals



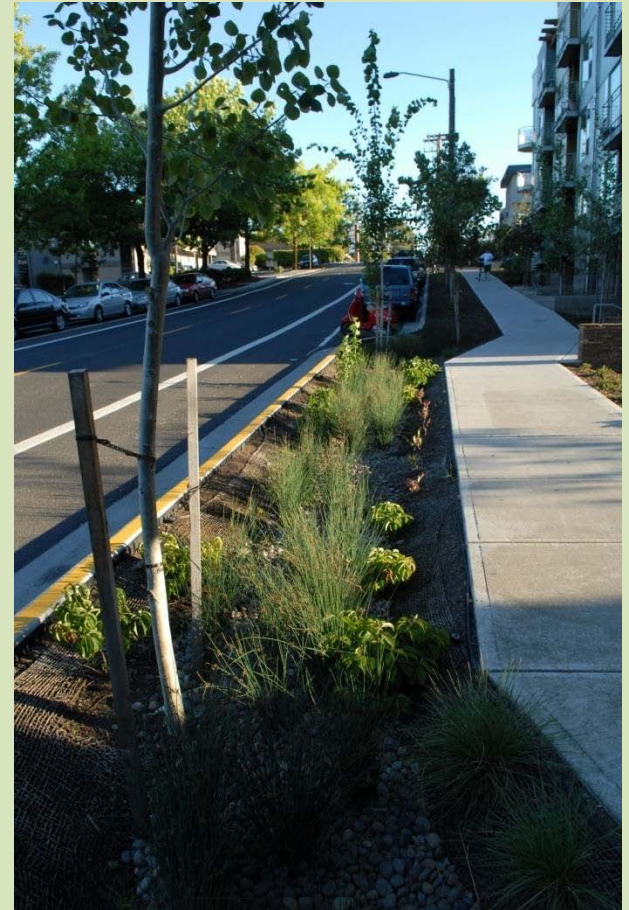
Green Street Example

Chestnut Lane, Portland Oregon



Green Street Example

Headwaters at Tryon Creek, Portland Oregon



Green Street Example

Pringle Creek Community, Salem Oregon



Green Street Example

Holman Building, Portland Oregon



Green Street Example

Siskiyou Street, Portland Oregon



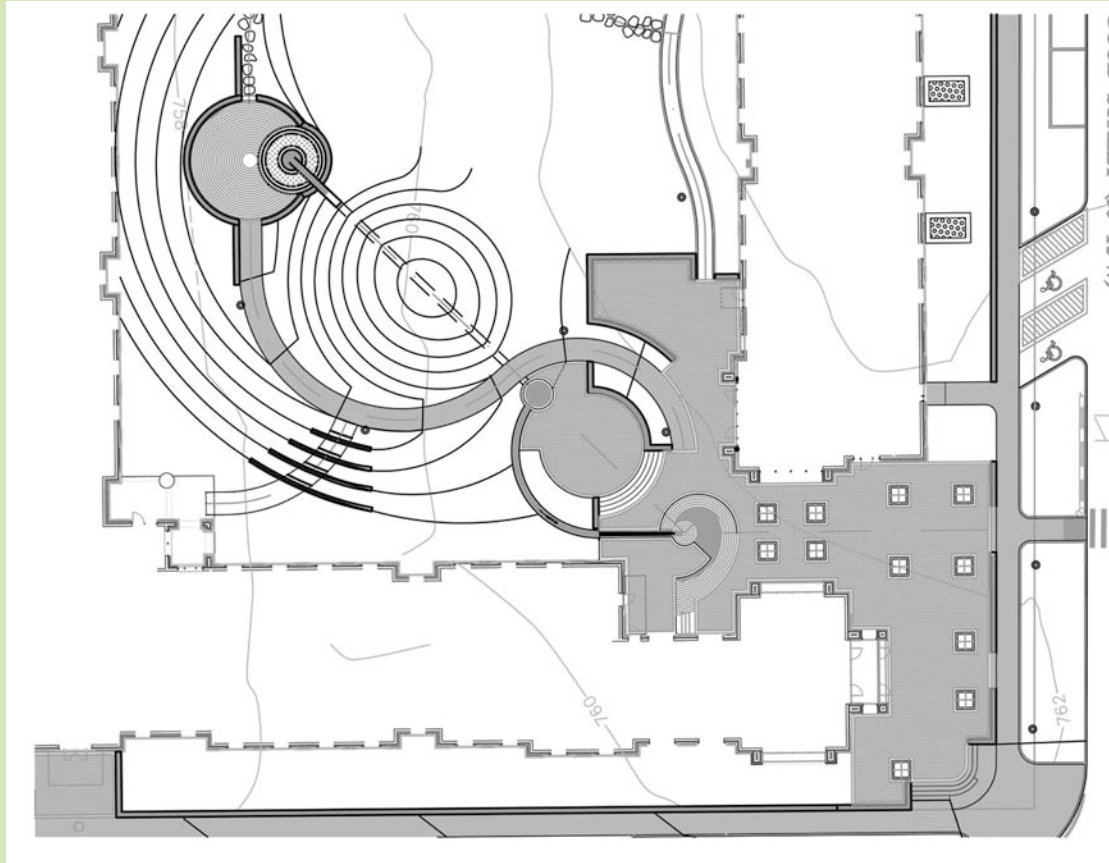
Green Street Example

12th and Montgomery, Portland Oregon



Stormwater as Art

Residence Hall / Oxford College



*Currently
under
construction*

Questions?

Innovative and Integrated Stormwater Management Strategies

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