Low Impact Development Practices and Smart Growth for the Buzzards Bay Watershed

An Introduction for Planners and Planning Board Members

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Low Impact Development

An innovative, ecosystem-based approach to land development and stormwater management

Presentation Highlights

- Why We Need Low Impact Development
- Goals and Basic Principles
- Common Practices
- Projects and Studies

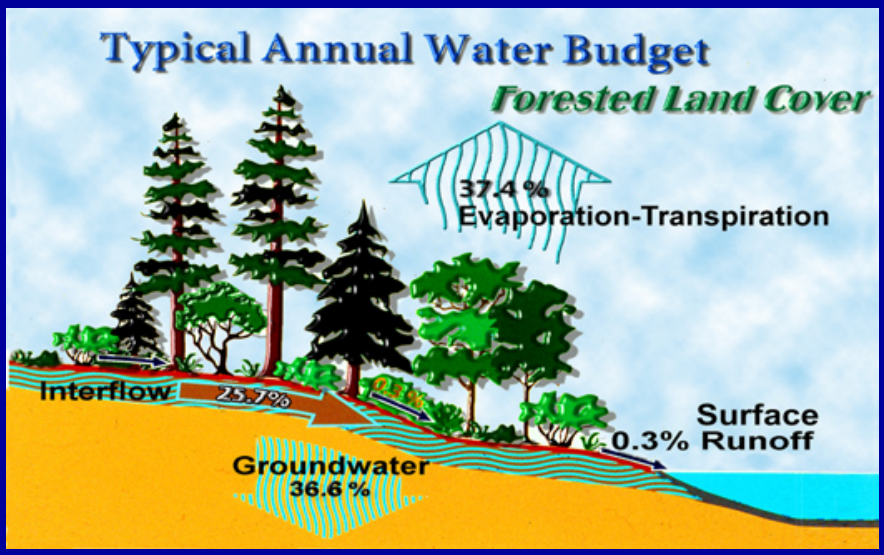
Why We Need Low Impact Development

To better protect our:
- Streams
- Fish and shellfish habitat
- Watershed hydrology
- Drinking water
- Water quality

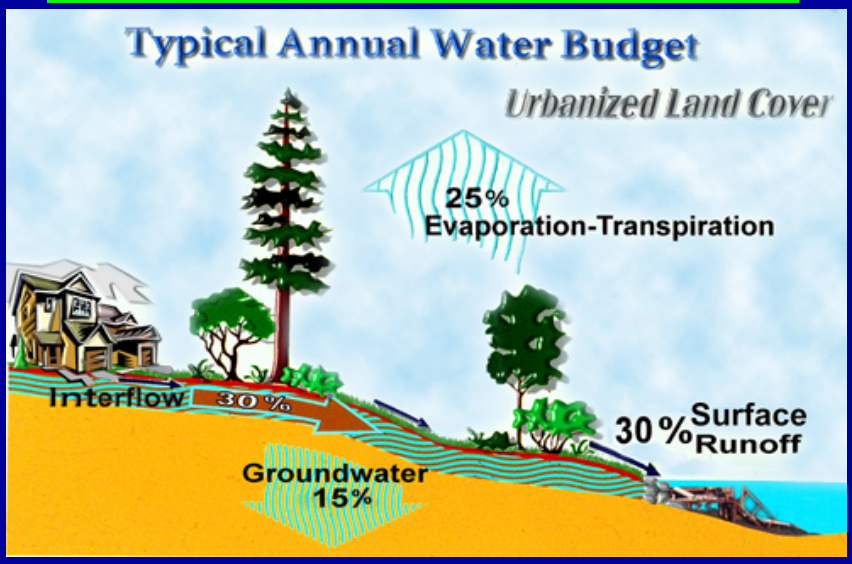
To reduce infrastructure costs

To make our communities more attractive

Natural Conditions

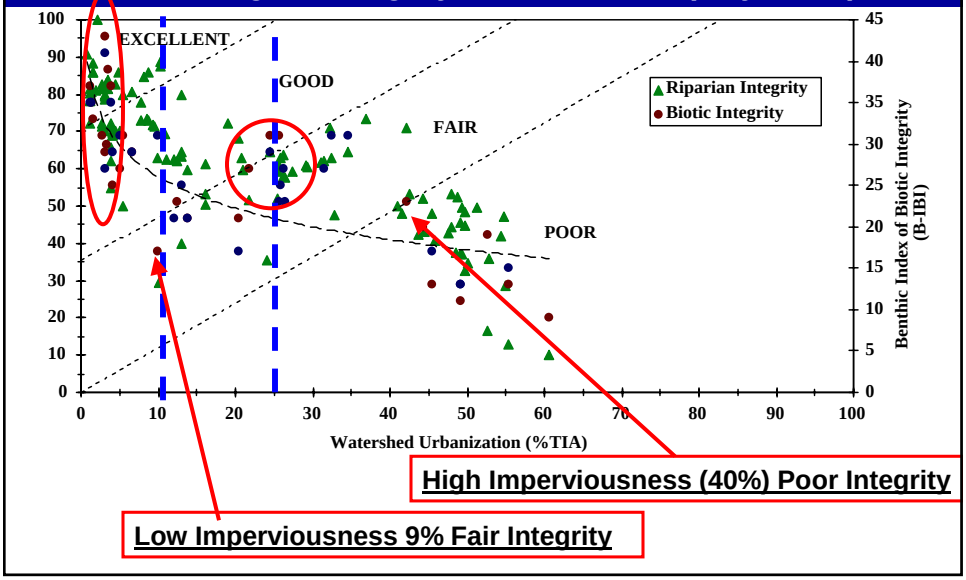


Developed Conditions



Effect of Urbanization on Receiving Waters

Relationship between basin development, riparian buffer width and biological integrity in PSL stream (May, 1998)



Construction Impacts on Soils

Remember this !!!

Roof runoff connected to Driveways, draining to Streets, draining to pipe systems =

dead fish, contaminated shellfish, and thirsty people.

How can we make residential developments function hydrologically like natural systems

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.

Basic LID Principles

1. Conserve natural areas
2. Minimize development impacts
3. Maintain site runoff rate
4. Use integrated management practices
5. Implement pollution prevention, proper maintenance and public education programs

1. Conserve Natural Areas

- Conservation of drainages, trees & vegetation
- Land use planning
- Watershed planning
- Habitat conservation plans
- Stream & wetland buffers

2. 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

3. Maintain Site Runoff Rate

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

4. Integrated Management Practices

- Small-scale stormwater controls
- Distributed throughout site
- Maintain flow patterns, filter pollutants and re-create or maintain hydrology

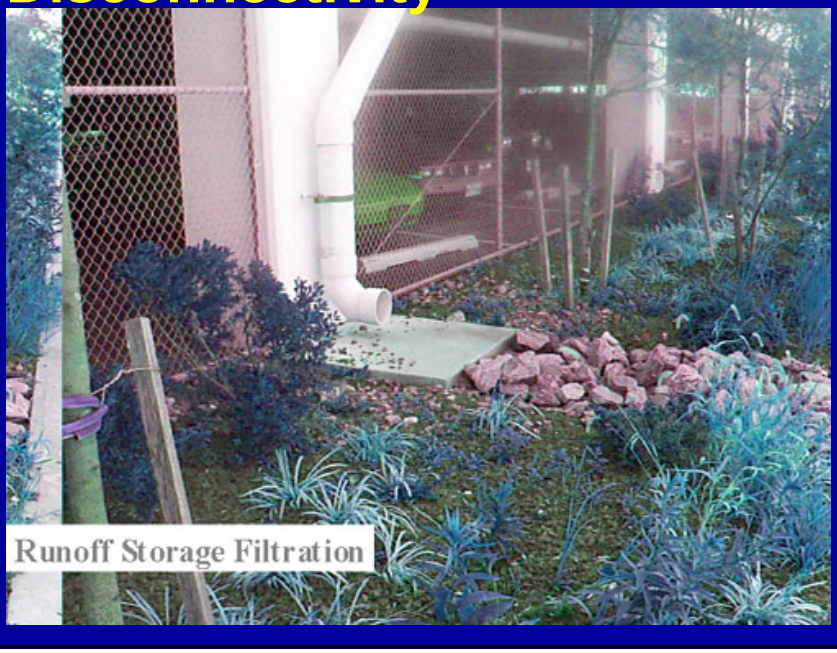
5. Pollution Prevention Maintenance & Education

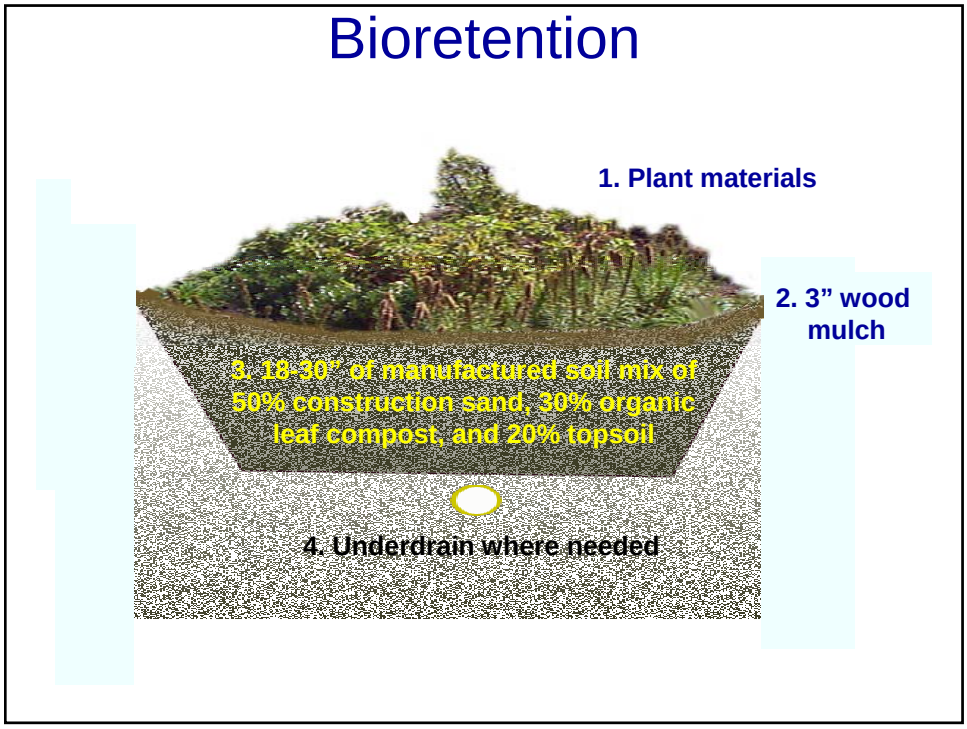
- Homeowners, Industry and Businesses
- Proper use & disposal of hazardous chemicals
- Use of non-toxic alternatives
- Preventive, routine maintenance
- Educational brochures, manuals & workshops

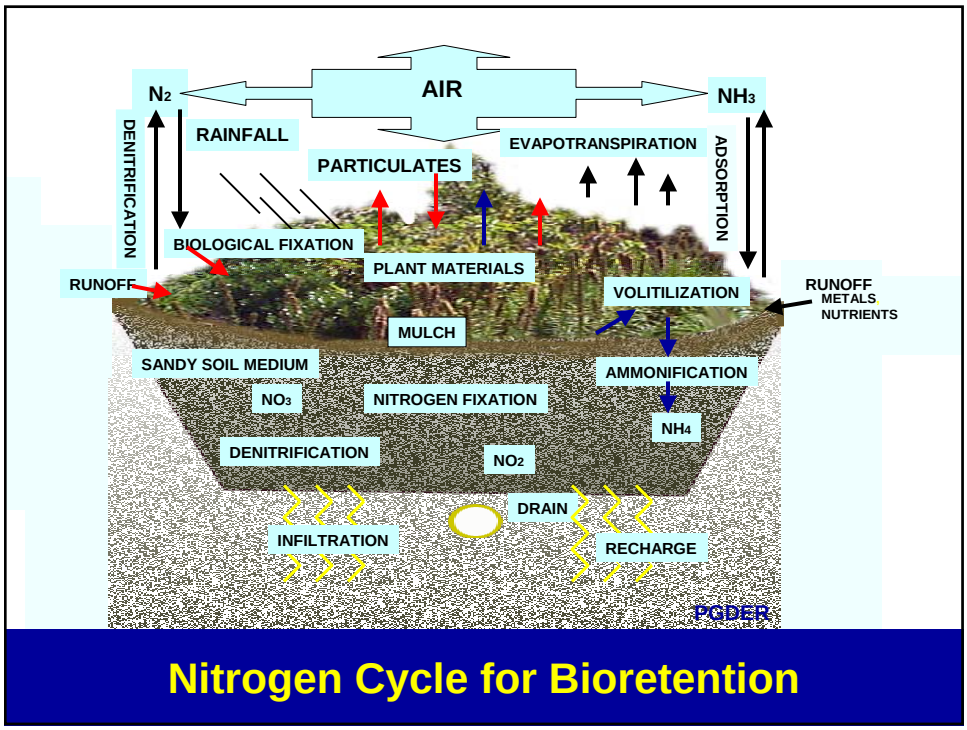
Common Integrated Management Practices

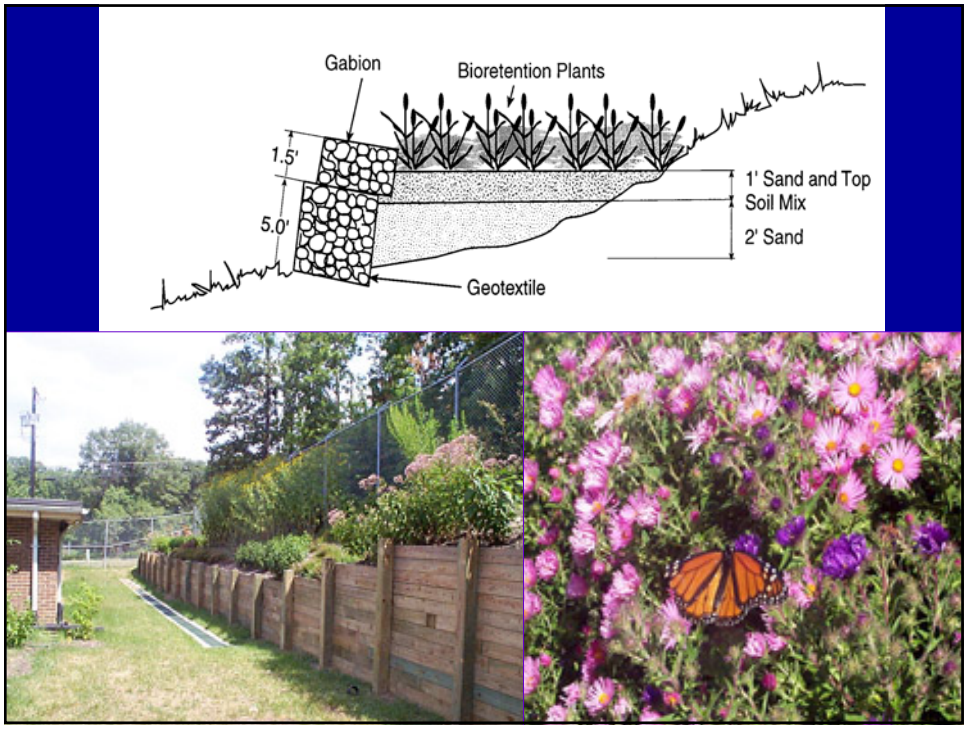
- Disconnectivity
- Bioretention
- Open Swales
- Permeable and Porous Pavements
- Green Roofs
- Planter Boxes
- Soil Amendment
- Sand Filters
- Inlet Retrofits

Disconnectivity

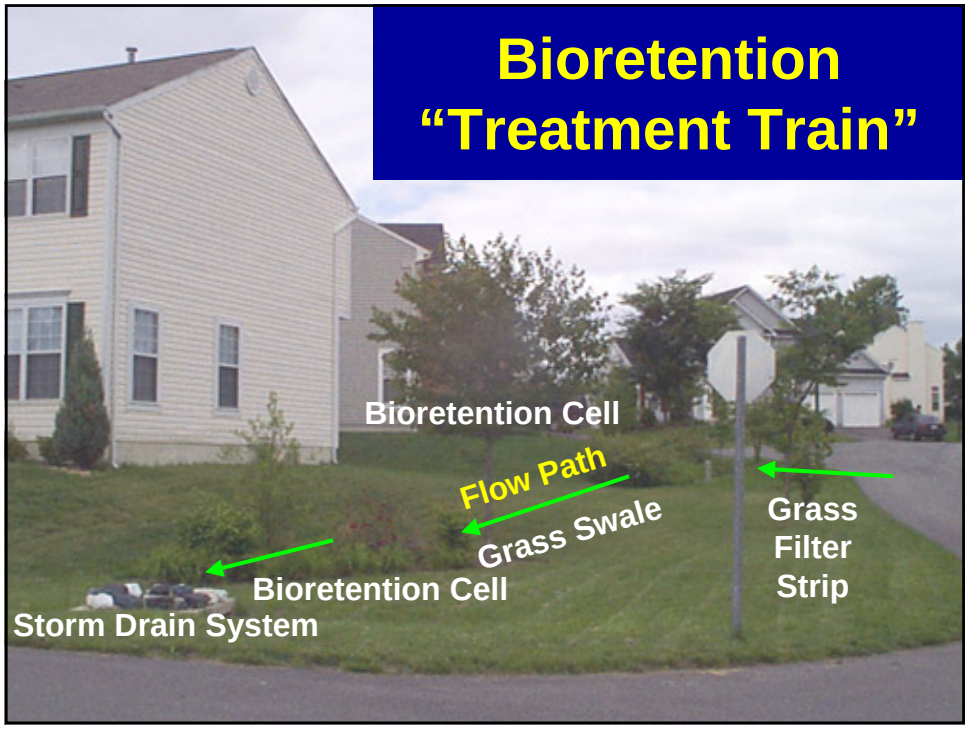



Bioretention
1. Plant materials
2. 3" wood mulch
3. 18-30" of manufactured soil mix of 50% construction sand, 30% organic leaf compost, and 20% topsoil
4. Underdrain where needed


AIR
N2
NH3
RAINFALL
DENITRIFICATION
EVAPOTRANSPIRATION
ADSORPTION
PARTICULATES
BIOLOGICAL FIXATION
PLANT MATERIALS
RUNOFF
VOLITILIZATION
RUNOFF
METALS
NUTRIENTS
MULCH
SANDY SOIL MEDIUM
AMMONIFICATION
NO3
NITROGEN FIXATION
NH4
DENITRIFICATION
NO2
DRAIN
INFILTRATION
RECHARGE
PGDER
Nitrogen Cycle for Bioretention


Gabion
Bioretention Plants
1.5'
5.0'
1' Sand and Top Soil Mix
2' Sand
Geotextile


Urban Revitalization
Retrofit of 1-acre parking lot using bioretention


Bioretention
"Treatment Train"
Bioretention Cell
Flow Path
Grass Swale
Grass
Filter
Strip
Bioretention Cell
Storm Drain System


Seattle's Street Edge Alternatives Program
After Completion - January 2001

SEA Street Today

Permeable Pavement

Green Roofs

Planter Boxes

Soil Amendment

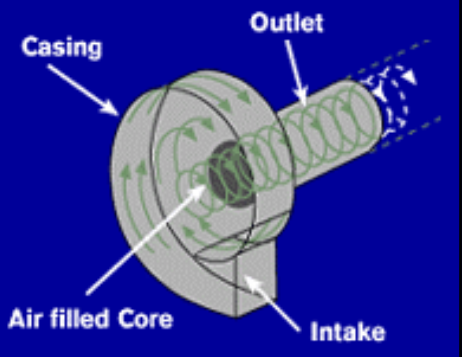
Sand Filters

Rain Barrels, Cisterns and Storage Tanks

Inlet Control Devices

Floatables Removal

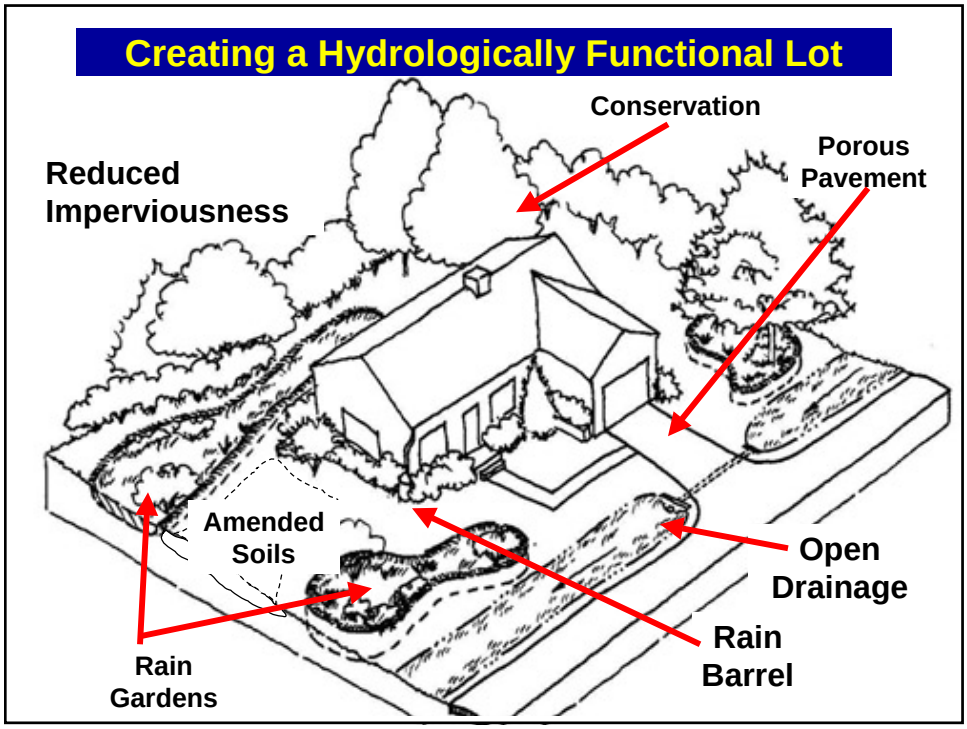
This prevents oils, grease, and trash from entering the storm drain system.

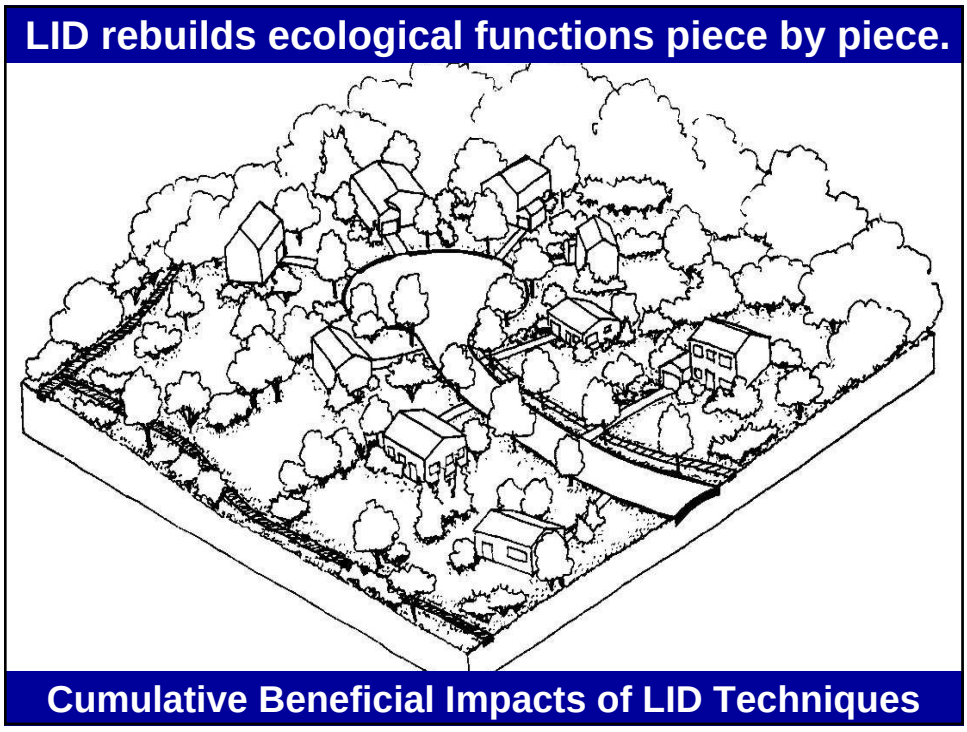


HIL-tech

Vortex Flow Control

The restricted opening reduces the peak flow rate, and eliminates debris from entering the system.


Creating a Hydrologically Functional Lot
Conservation
Porous Pavement
Reduced Imperviousness
Amended Soils
Open Drainage
Rain Barrel
Rain Gardens

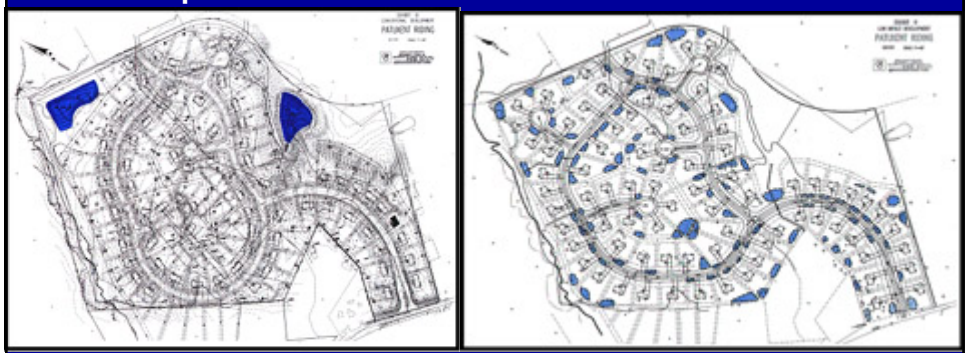

LID rebuilds ecological functions piece by piece.
Cumulative Beneficial Impacts of LID Techniques

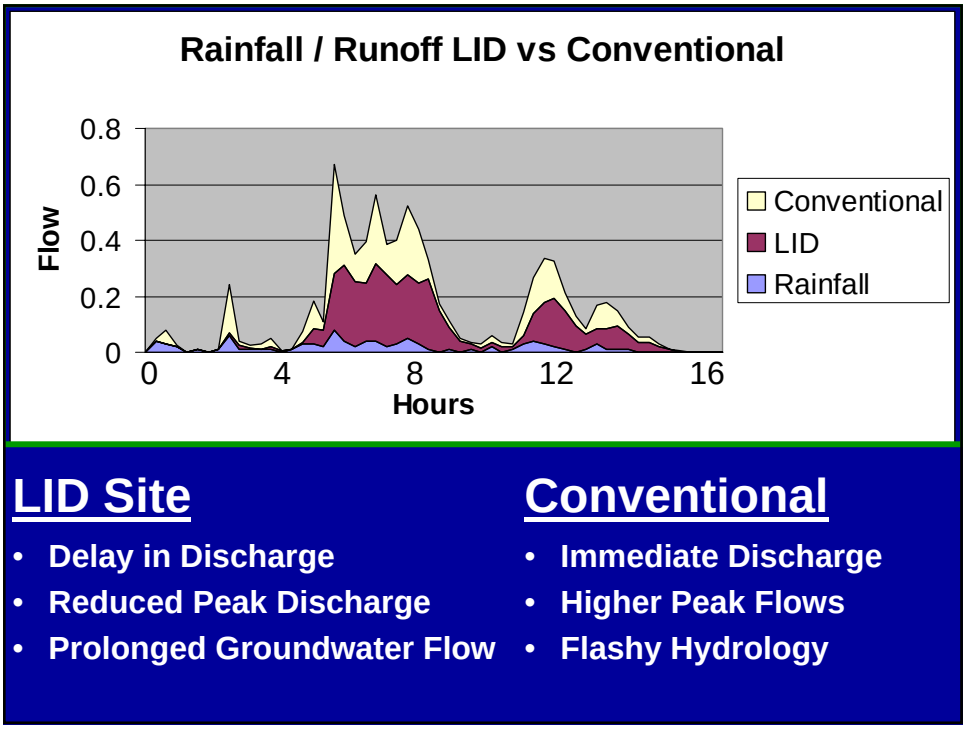
Tree conservation • Rain gardens
Narrower streets • Open drainage
On-lot detention storage and infiltration

Comparing LID and Conventional Development

Conventional Development

LID Subdivision





LID Site

- Delay in Discharge
- Reduced Peak Discharge
- Prolonged Groundwater Flow

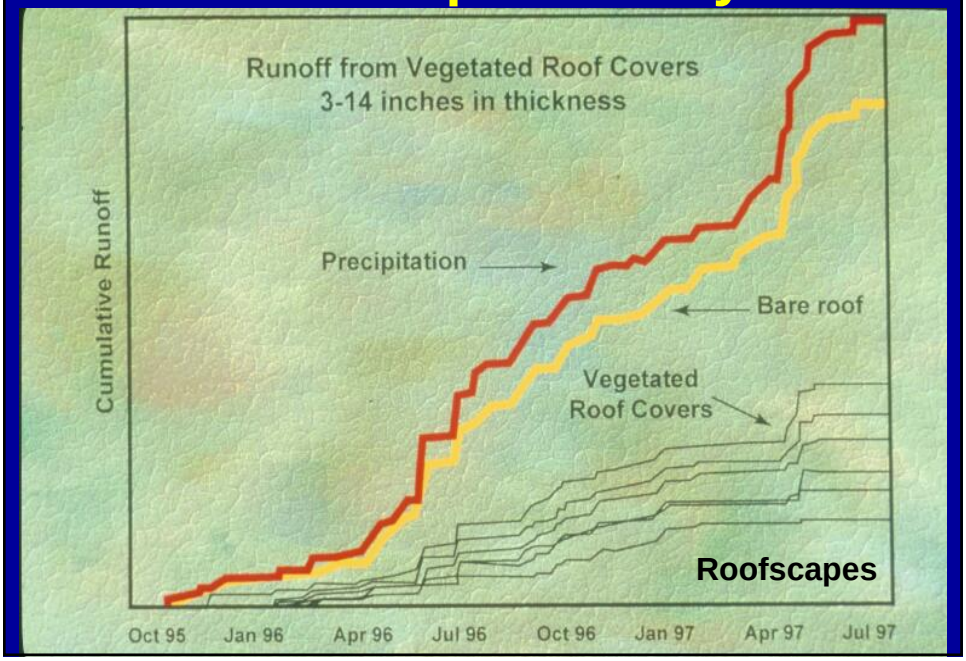
Conventional

- Immediate Discharge
- Higher Peak Flows
- Flashy Hydrology

Construction Cost Comparison

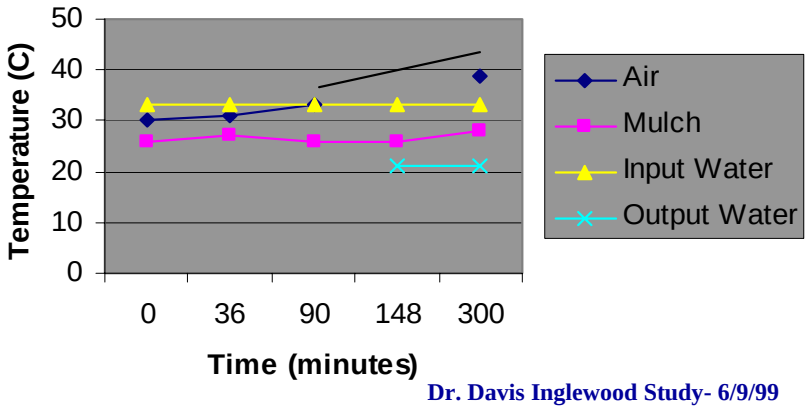
	Conventional	Low Impact
Grading/Roads	$569,698	$426,575
Storm Drains	$225,721	$132,558
SWM Pond/Fees	$260,858	$ 10,530
Bioretention/Micro	—	$175,000
Total	$1,086,277	$744,663
Unit Cost	$14,679	$9,193
Lot Yield	74	81

Philadelphia Study



Bioretention Temperature Data

15-Degree Change



Dr. Davis Inglewood Study- 6/9/99

LID Implementation

- Identify and develop applicable regulations and requirements
- Use drainage/hydrology as a design foundation
- Allow designs that reflect conservation plans
- Reduce site imperviousness and minimize directly connected impervious areas
- Use sustainable integrated management practices
- Develop pollution prevention, maintenance, public outreach and education programs

Summary

- Development and stormwater runoff have degraded streams, fish habitat and water quality in Buzzards Bay.
- LID is a new approach to land development and stormwater management that helps protect water resources and watershed hydrology.
- We're gaining a better understanding of how LID can be used to protect the environment, reduce costs and make our communities more attractive.

For More Information

- **The Low Impact Development Center**
  http://www.lowimpactdevelopment.org
- **Center for Watershed Protection's Stormwater Center**
  http://www.stormwatercenter.net/
- **U.S. Environmental Protection Agency**
  http://www.epa.gov/owow/nps/urban.html
- **UW Center for Urban Water Resources**
  http://depts.washington.edu/cuwrm/
- **Puget Sound Action Team**
  http://www.psat.wa.gov/Programs/LID.htm

Photo Credits

- **MassGIS: slides 4 & 10**
- **Chris May: slides 5, 6, & 7**
- **Low Impact Development Center: slides 8, 12, 20, 24, 25, 30, 32, & 37**
- **Prince George's County: slides 10, 16, 18, 21, 22, 23, 35, 36, 38, 39, & 42**
- **Center for Watershed Protection: slide 14**
- **Seattle Public Utilities: slides 26 & 27**
- **Puget Sound Action Team: slide 28**
- **Roofscapes, Inc.: slides 29 & 41**
- **Len Wright: slide 30**
- **U.S. EPA: slide 31**
- **HIL Technology: slide 34**
- **Charles River Watershed Association: slide 33**