Cost Effective Low Impact Development

An Introductory Guide to Conserve Land, Restore Resources, Protect Water, and Save Money in Massachusetts

Stefanie Covino
Shaping the Future of Your Community Program
scovino@massaudubon.org

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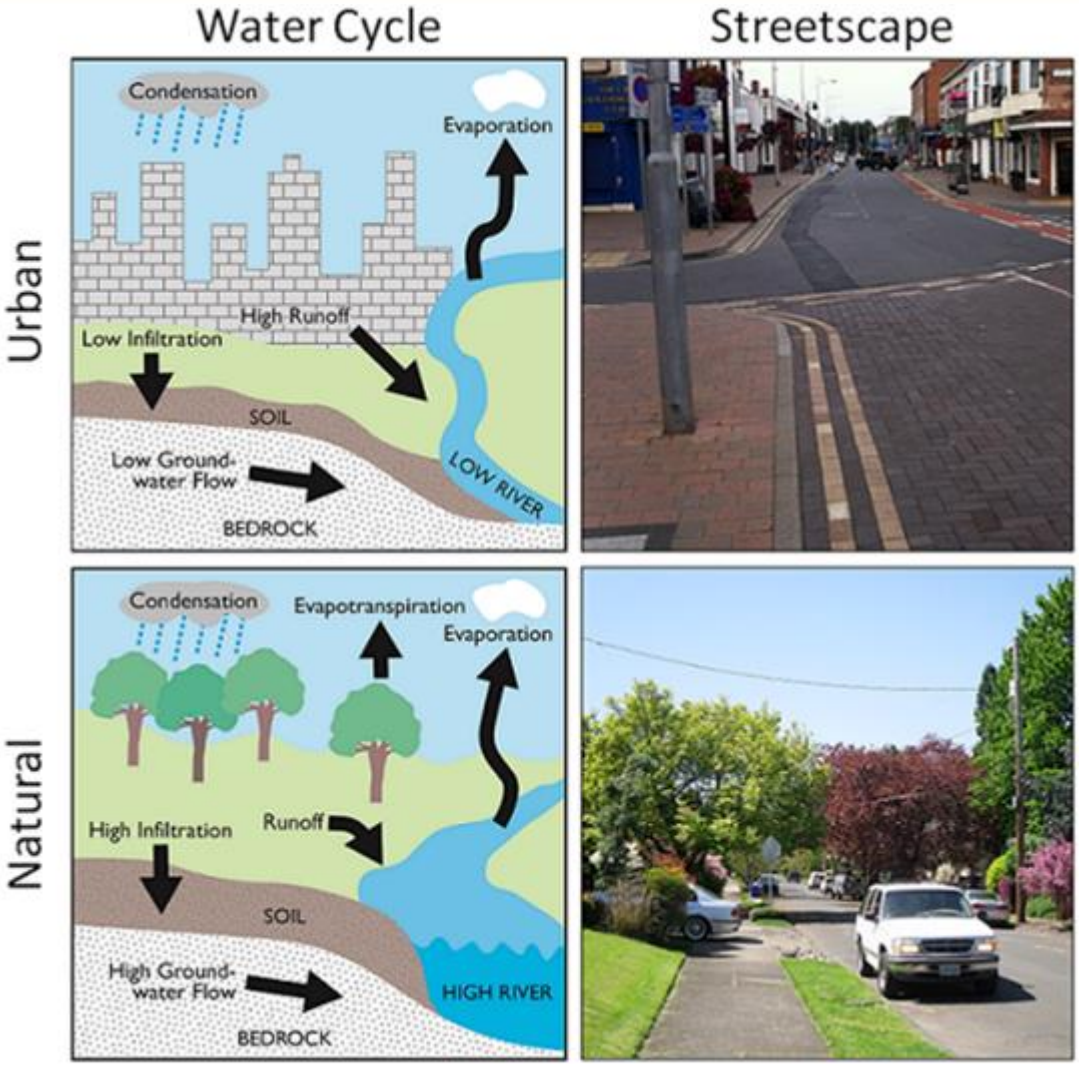
When it rains…

…most of us reach for an umbrella or run to close our windows, but we may not think about **where all that water is heading**.

For communities facing **flooding** and the high costs of **water quality regulations**, this is increasingly important - especially as forests and farmlands are converted to pavement.

The Problem

Slide credit: MAPC



Impervious surfaces

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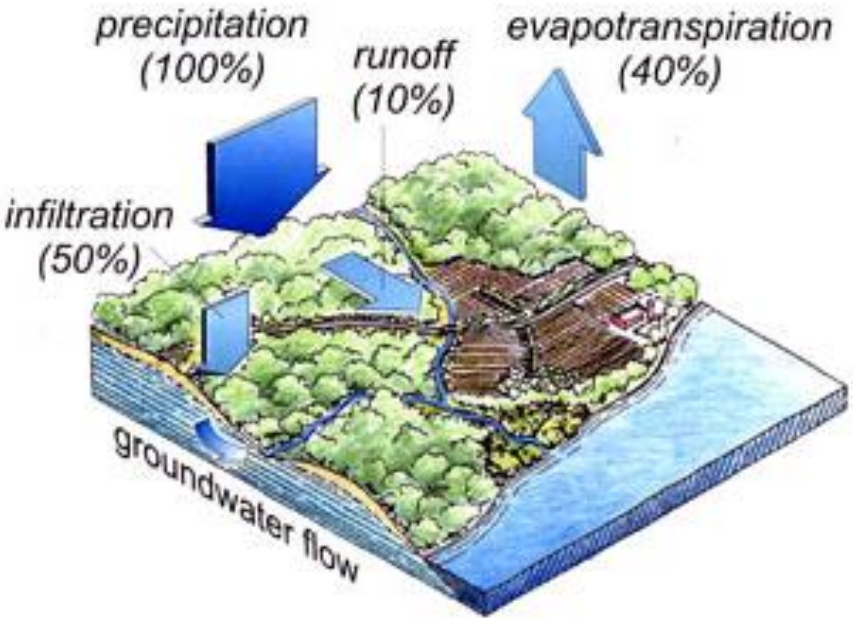
Environmental & Community Impact

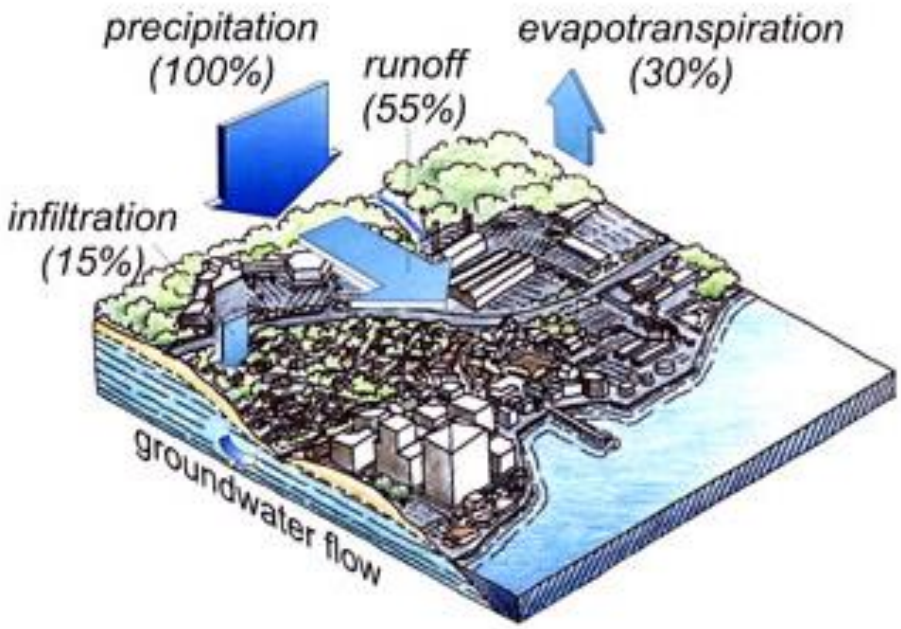
Local Hydrologic Cycle



Minimally impacted

↑ Infiltration

↓ Runoff

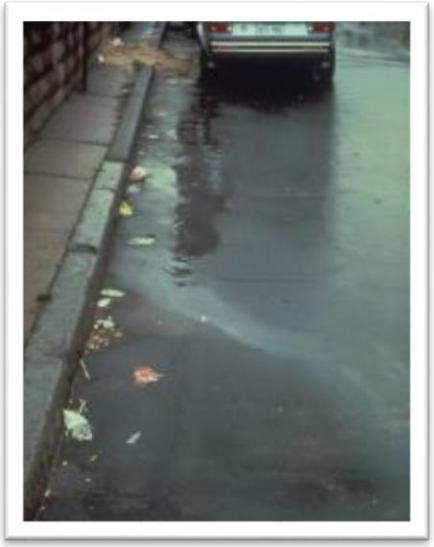


Highly impacted

↓ Infiltration

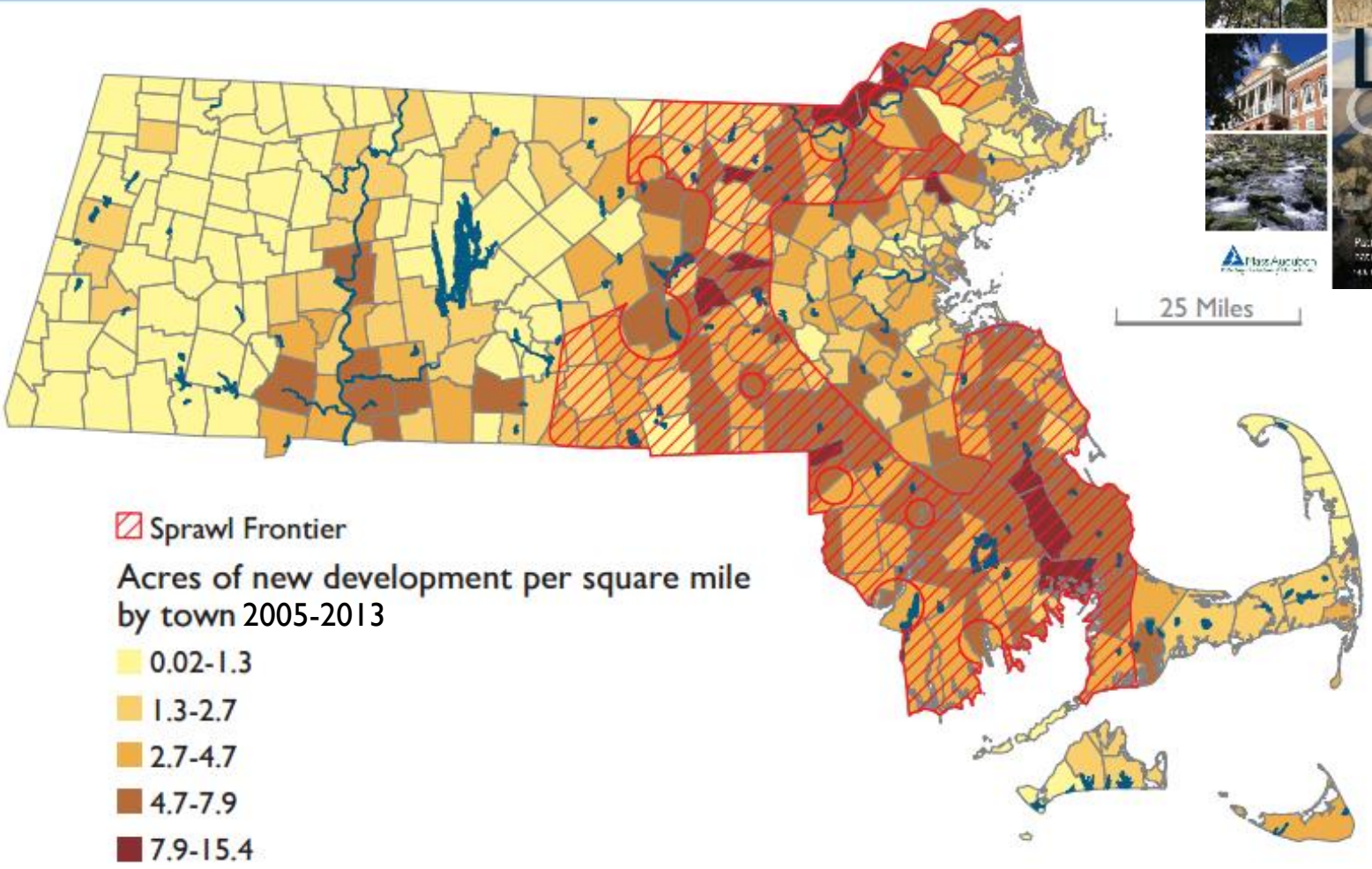
↑ Runoff

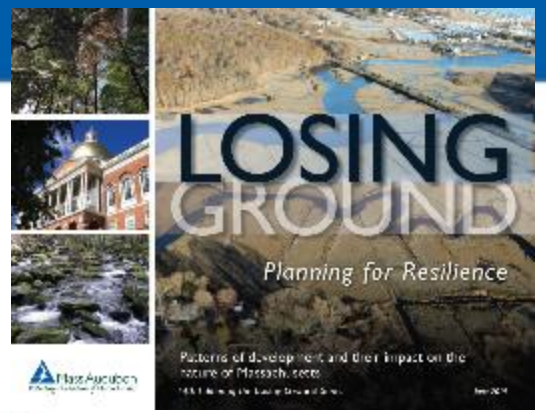
Poorly Managed Stormwater Creates Serious Issues



- Pollution: nutrients, bacteria, chemicals
- Erosion and sedimentation
- Loss of stream habitat
- Flooding: culvert and road failure
- Loss of recharge to aquifers
- Steams drying up

As we Develop More, We Increase the Problem





See more at: www.massaudubon.org/LosingGround

We're Teaming Up to Address Stormwater Through Low Impact Development (LID)

- Central Mass. Regional Planning Commission (CMRPC)
- Mass Audubon
  - Shaping the Future of Your Community Program
- The Blackstone River Coalition
- Scott Horsley, Horsley & Witten Group, Inc.

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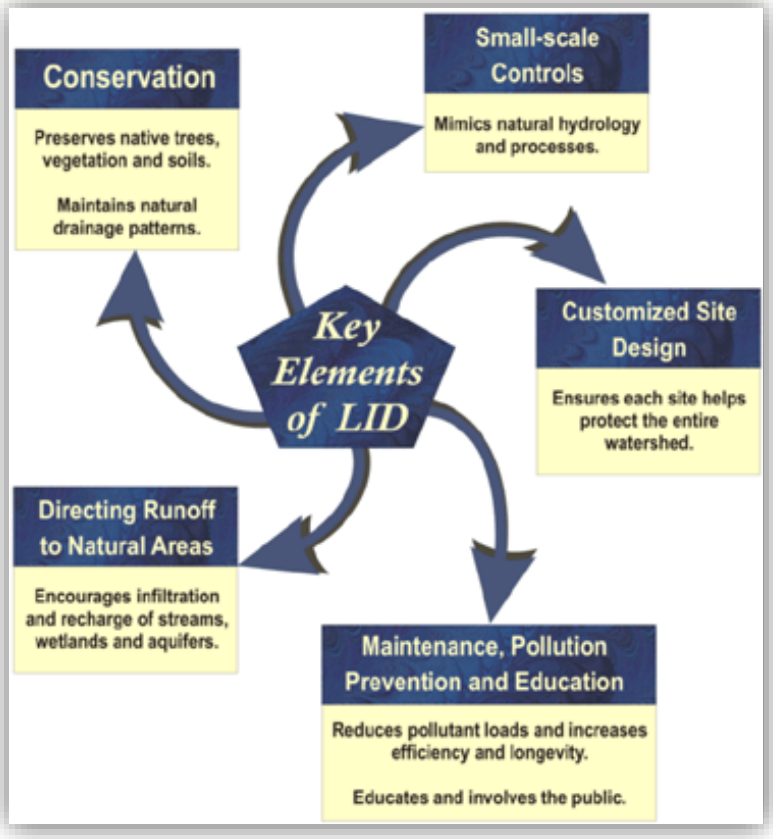
What are Green Infrastructure & Low Impact Development?

- **Green infrastructure (GI)**

  incorporates natural features such as floodplains, forests, wetlands, and buffer areas. GI also refers to a designed landscape that puts natural systems to work like soil and vegetation and mimics those natural processes.

- **Low Impact Development (LID)**

  is a category of green infrastructure that works with nature to manage stormwater and decrease the impact of development on surface and groundwater.



Source: Whole Buildings Design Guide, wbdg.com

Benefits of Green Infrastructure & LID

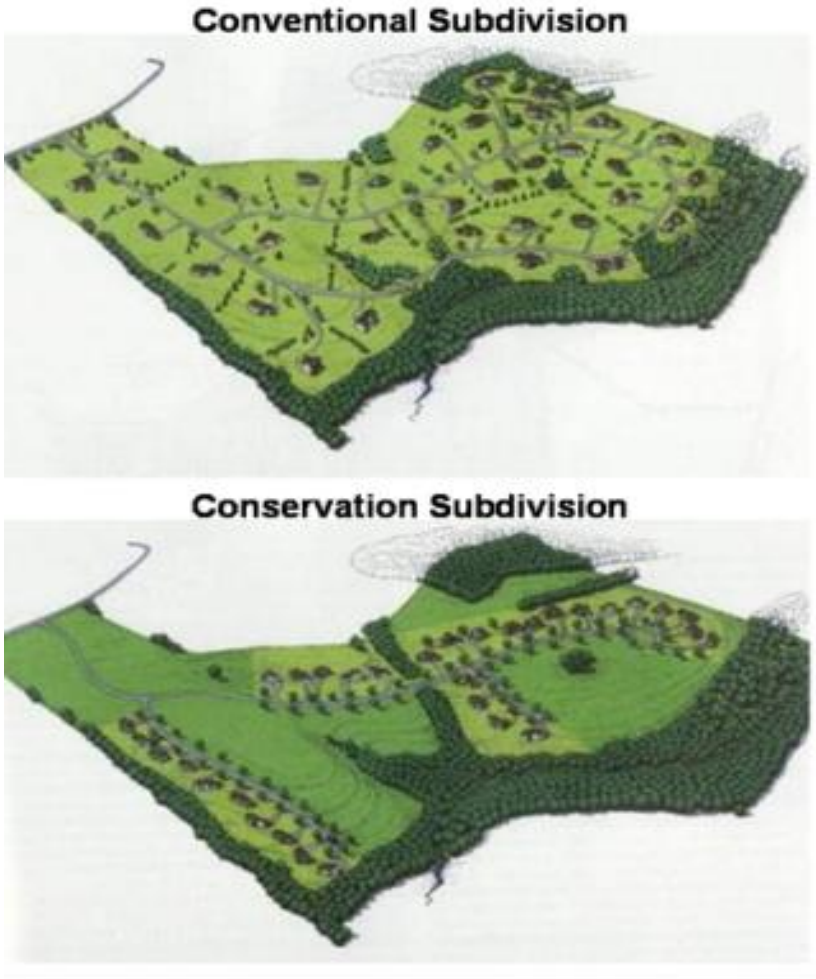
- **Cost Savings**
  - Reduced development costs for infrastructure and maintenance
  - Reduced energy costs for residents
- **Public safety**
  - Reduced flooding
  - Improved water quality
  - Increased climate change resiliency
  - Reduced urban heat island effect
- **Quality of Life**
  - Protect and restore natural features for improved aesthetics
- **Value**
  - Increased property values
- **Regulatory**
  - Assistance in meeting regulatory requirements

Ten Ways to Improve Stormwater Management Through LID

1. Swap some lawn space for a rain garden
2. Install a green roof
3. Replace pavement with permeable surfaces
4. Collect water with a rain barrel
5. Plant a tree box
6. Implement a pet waste management plan
7. Use bioswales instead of storm drains
8. Install bioretention vs traditional retention areas
9. Consider hydrology with green street design
10. Install stormwater curb bump outs

Protecting Existing Green Infrastructure

- **Protecting** existing green infrastructure
  - Forests, wetlands, floodplains, buffers
- **Creating** green infrastructure instead of grey
  - Bioswales, rain gardens, tree boxes, etc.
- **Reducing sprawl** by developing where it makes sense and conserving more land
  - Narrower roads and smaller clustered plots
  - Reduced clearing and maintenance costs
  - Improved views
  - Greater sense of community



Traditional Regulations vs LID Regulations: Zoning, Lot & Roadway Dimensions

	Traditional Regulations	LID Regulations
Maintenance Costs*	↑ $$$	↓ $
Impervious Surface Cover	↑ Worse	↓ Better
Vegetated Cover	↓ Worse	↑ Better

* Road & stormwater maintenance costs may include: plowing, salting, outfalls, and stormwater basins

Sources of Phosphorus in Stormwater
Upper Charles River Watershed

Source	Annual Phosphorus Input (kg yr^{-1})	Annual Phosphorus Loading (kg yr^{-1})	Percent of Total Load
Turf and Fertilizer Runoff	174.13	24.33	18%
Dog Waste	232.22	23.22	18%
Leaf Litter (Street Trees)	27.92	20.94	16%
Atmospheric Deposition	126.19	19.00	14%
Other	unknown	13.08	10%
Forest Runoff	unknown	12.41	9%
Winter Road Treatments	6.64	6.64	5%
Car Washing	8.03	6.43	5%
Motor Vehicle Traffic	4.01	4.01	3%
Grass Clippings	569.06	1.48	1%
Total	1,148.20	131.54	100%

EPA Summary of Cost Comparison:
Conventional vs. LID Approaches

Project	Conventional Development Cost	LID Cost	Cost Difference[b]	Percent Difference[b]
2nd Avenue SEA Street	$868,803	$651,548	$217,255	25%
Auburn Hills	$2,360,385	$1,598,989	$761,396	32%
Bellingham City Hall	$27,600	$5,600	$22,000	80%
Bellingham Bloedel Donovan Park	$52,800	$12,800	$40,000	76%
Gap Creek	$4,620,600	$3,942,100	$678,500	15%
Garden Valley	$324,400	$260,700	$63,700	20%
Kensington Estates	$765,700	$1,502,900	–$737,200	-96%
Laurel Springs	$1,654,021	$1,149,552	$504,469	30%
Mill Creek[c]	$12,510	$9,099	$3,411	27%
Prairie Glen	$1,004,848	$599,536	$405,312	40%
Somerset	$2,456,843	$1,671,461	$785,382	32%
Tellabs Corporate Campus	$3,162,160	$2,700,650	$461,510	15%

USEPA, Reducing Stormwater Costs Through Low Impact Development (LID) Strategies and Practices, December 2007

Conventional vs. LID Costs:
Biofiltration Islands in Parking Lot in Devens, MA



Total Traditional Project Cost:	**$1,004,000**
LID Reduced site paving	-$32,000
LID Reduced curbing	-$50,000
LID Reduced stormwater piping	-$14,000
LID Reduced stormwater structures	-$68,000
LID Increased landscaping	+$12,000
LID Increased site preparation	+$10,000
LID Increased soil mix	+$18,000
Total Estimated LID Savings:	**-$124,000 (12%)**

- Devens Enterprise Commission

Conventional vs. LID Cost: Bioretention system in Leominster, MA

Comparison of Present Value Costs: LID vs Conventional (Average)		
Type of Cost	**Phosphorus ($/lb)**	**Nitrogen ($/lb)**
LID		
Bioretention systems	2,935	339
Conventional		
Dry detention	21,143	4,597
Dry extended detention	10,571	1,149
Average detention	15,857	2,873

Team Project Schedule

- **Summer 2015**
  Developing case studies
- **Fall 2015**
  Conducting workshops
- **Fall/Winter 2015/6**
  Offering competitive technical assistance program
- **2016**
  Showcasing Broad Meadow Brook demonstration project
- **Ongoing**
  Networking and technical advice

Cost Effectiveness Case Studies

1. **Local Land Use Rules**: Open Space Design Zoning and LID regulations for new and redevelopment

2. **Stormwater Utilities** and Other financing

3. **Urban Stream Restoration** with LID retrofits

4. **Pond Water Quality Improvement** with LID retrofits

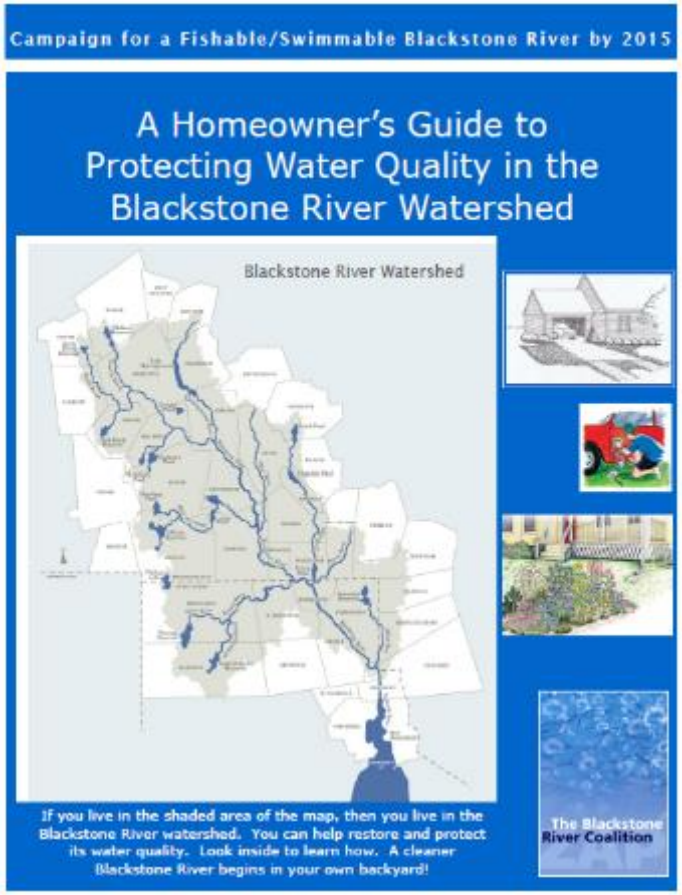
5. **Parking Lots** implementing LID

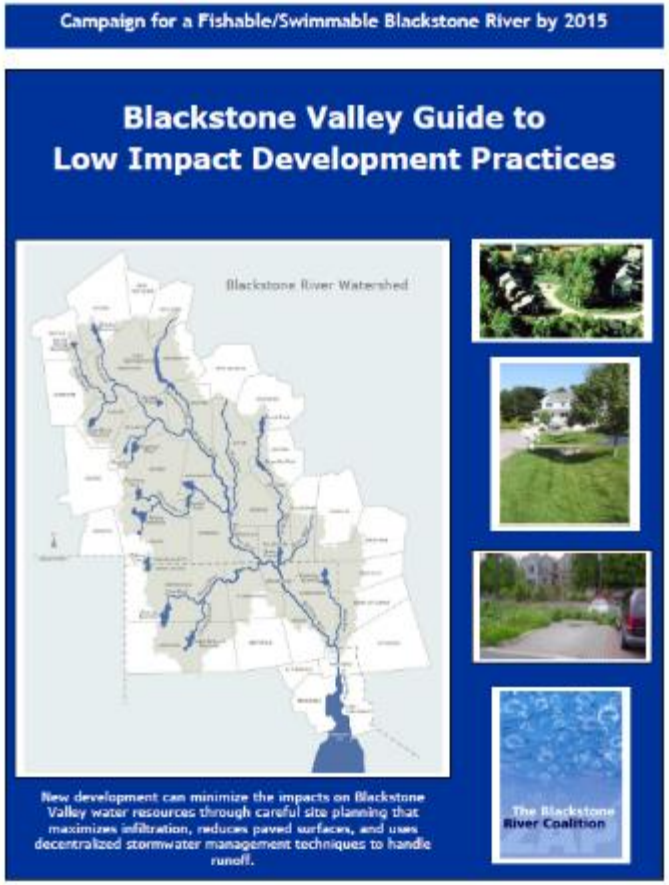
Potential Topics for Local Assistance Projects

- Comparing current municipal land use regulations vs. recommended best practices
- Reviewing planning and conservation rules for alignment
- Mapping green infrastructure
- Identifying LID opportunities in redevelopment sites
- Determining what the new MS4 permit will mean and how to minimize and address associated costs

Resources

The Blackstone River Coalition





www.zaptheblackstone.org

Additional Resources

- Shaping the Future of Your Community
  - www.MassAudubon.org/ShapingTheFuture
- Losing Ground
  - www.MassAudubon.org/LosingGround
- CMRPC Data Common
  - www.cmrpc.org/CentralMassDataCommon
- EPA's website on Green Infrastructure
  - http://water.epa.gov/Infrastructure/GreenInfrastructure
- UNH Stormwater Center
  - www.unh.edu/unhsc
- Narragansett Bay Estuary Program
  - www.nbep.org

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

University of New Hampshire

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For more information, please visit www.massaudubon.org/LIDcost

- Stefanie Covino, Mass Audubon
  - scovino@massaudubon.org, 508-640-5618
- Eric R. Smith, AICP, CMRPC
  - esmith@cmrpc.org, 508-459-3322
- Scott Horsley, Horsley Witten Group, Inc.
  - shorsley@horsleywitten.com, 508-833-6600
- Peter Coffin, Blackstone River Coalition
  - peter.coffin@zaptheblackstone.org, 508-753-6087

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