

Why treat stormwater runoff if you can eliminate it?



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- **What You Need to Know about LID**
- Top Ten Reasons to do LID
- Advancing LID in NC
- Partnerships and Endorsements
- Successful Projects

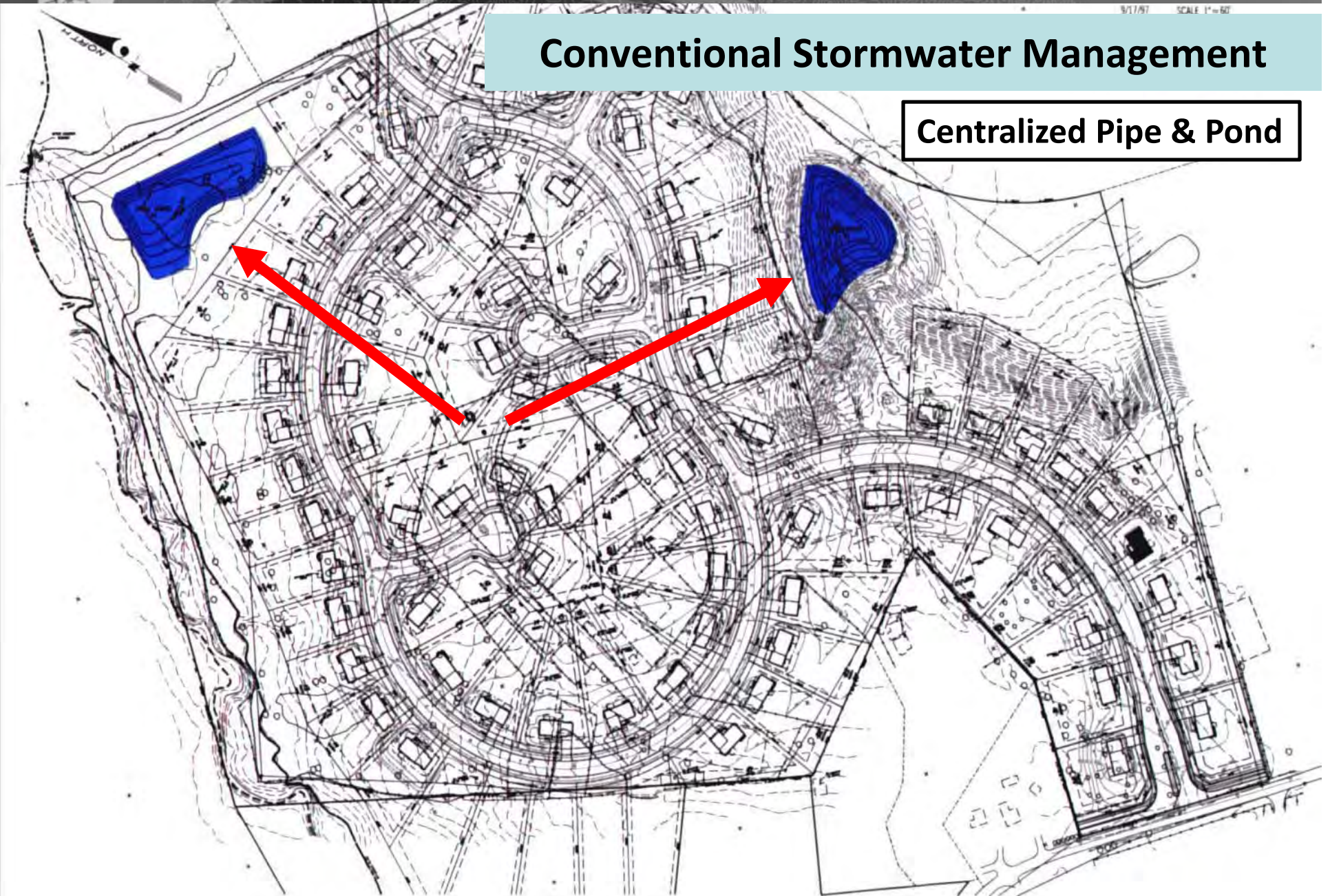
What You Need to Know about LID

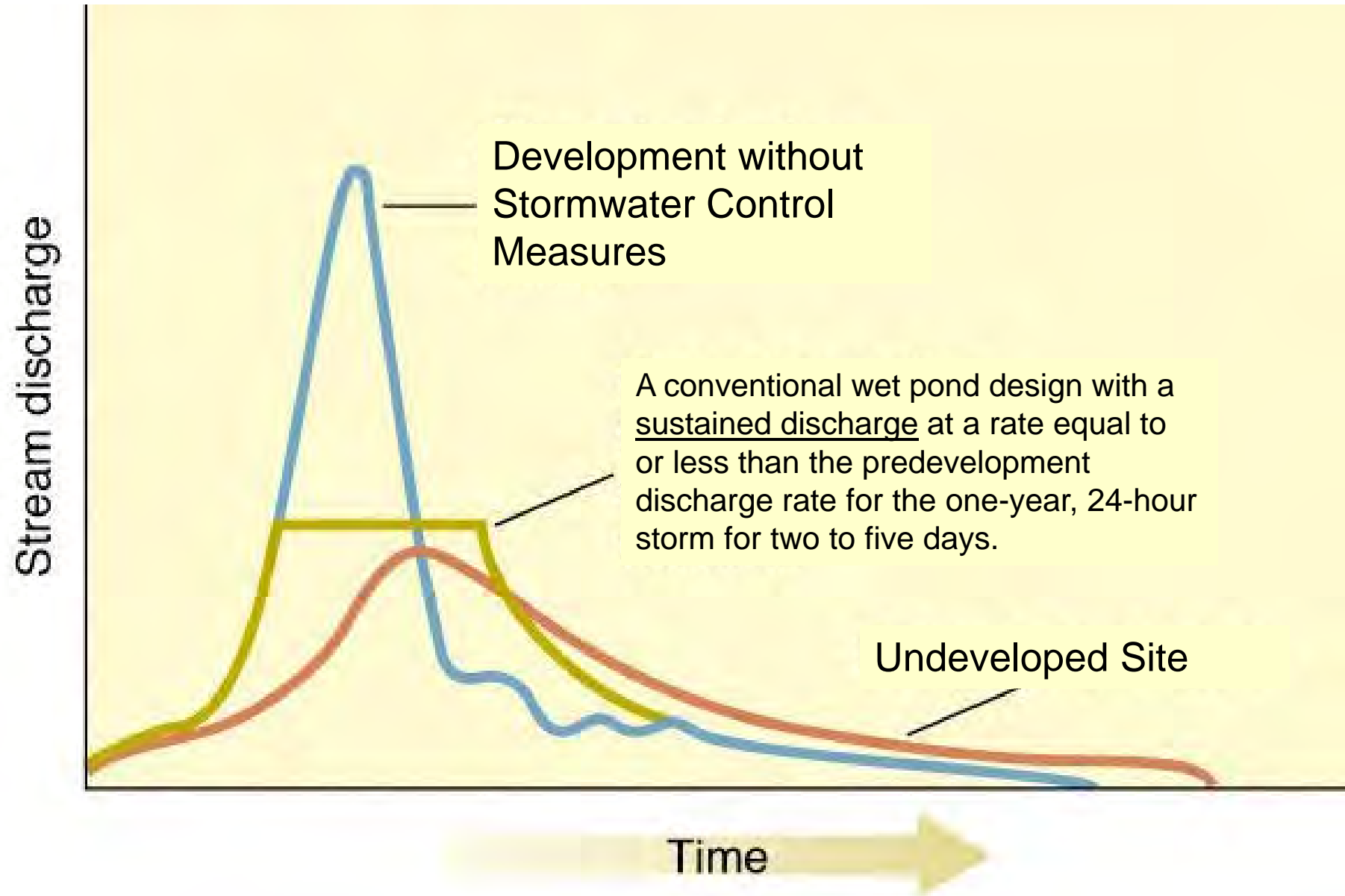
- LID is a collaborative effort supported and promoted by citizens, environmental groups, State and Federal Agencies, local governments, developers, and the business community
- Water quality benefits and economic benefits are based on case studies.
- LID eliminates stormwater runoff or significantly reduces stormwater runoff by minimizing Built Upon Area (BUA), creating opportunities to use and reuse stormwater, and by utilizing the landscape, open space, and tree cover to slow rainwater and soak up it up, preventing polluted runoff from reaching surface waters.

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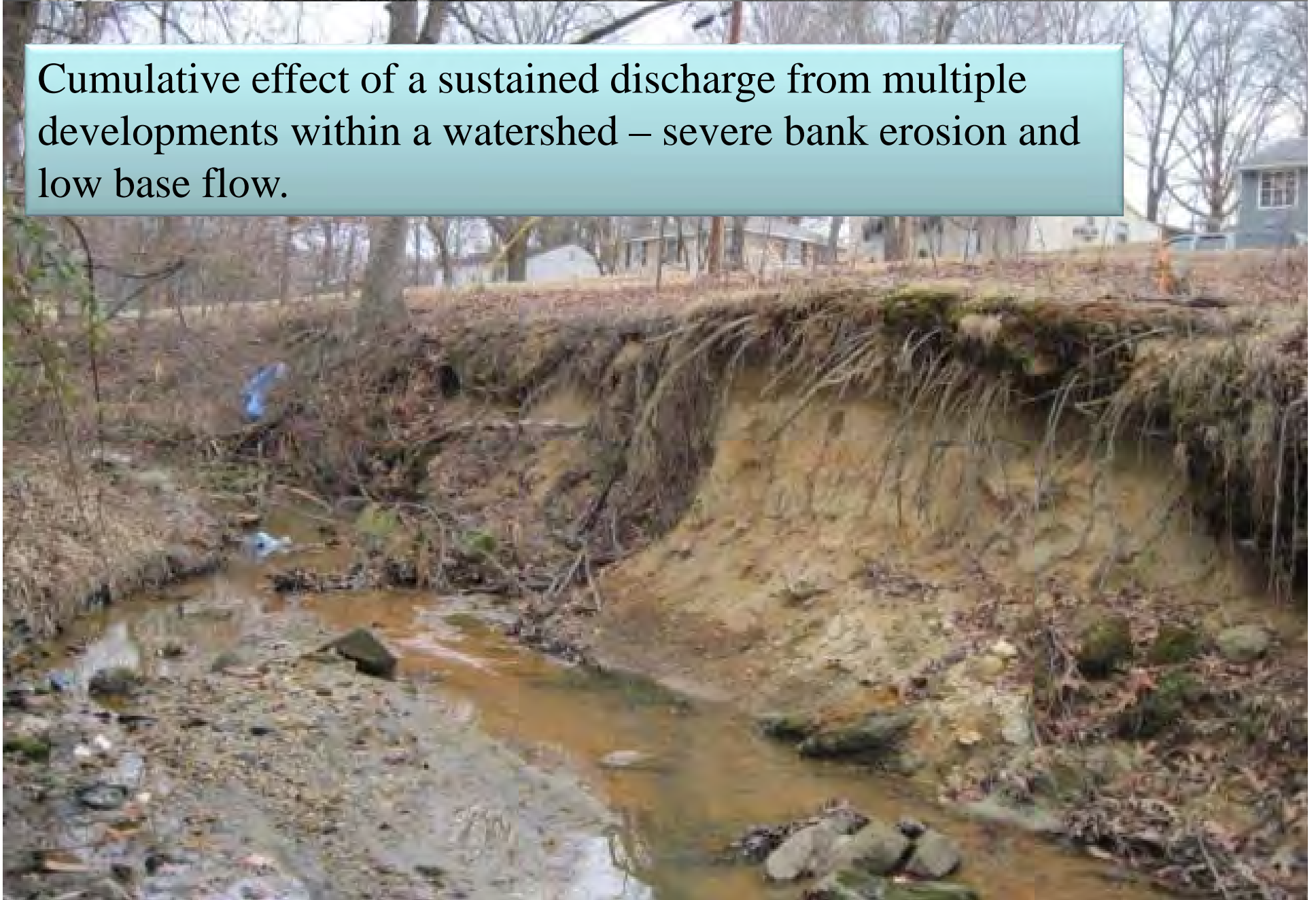
Conventional Stormwater Management

Centralized Pipe & Pond



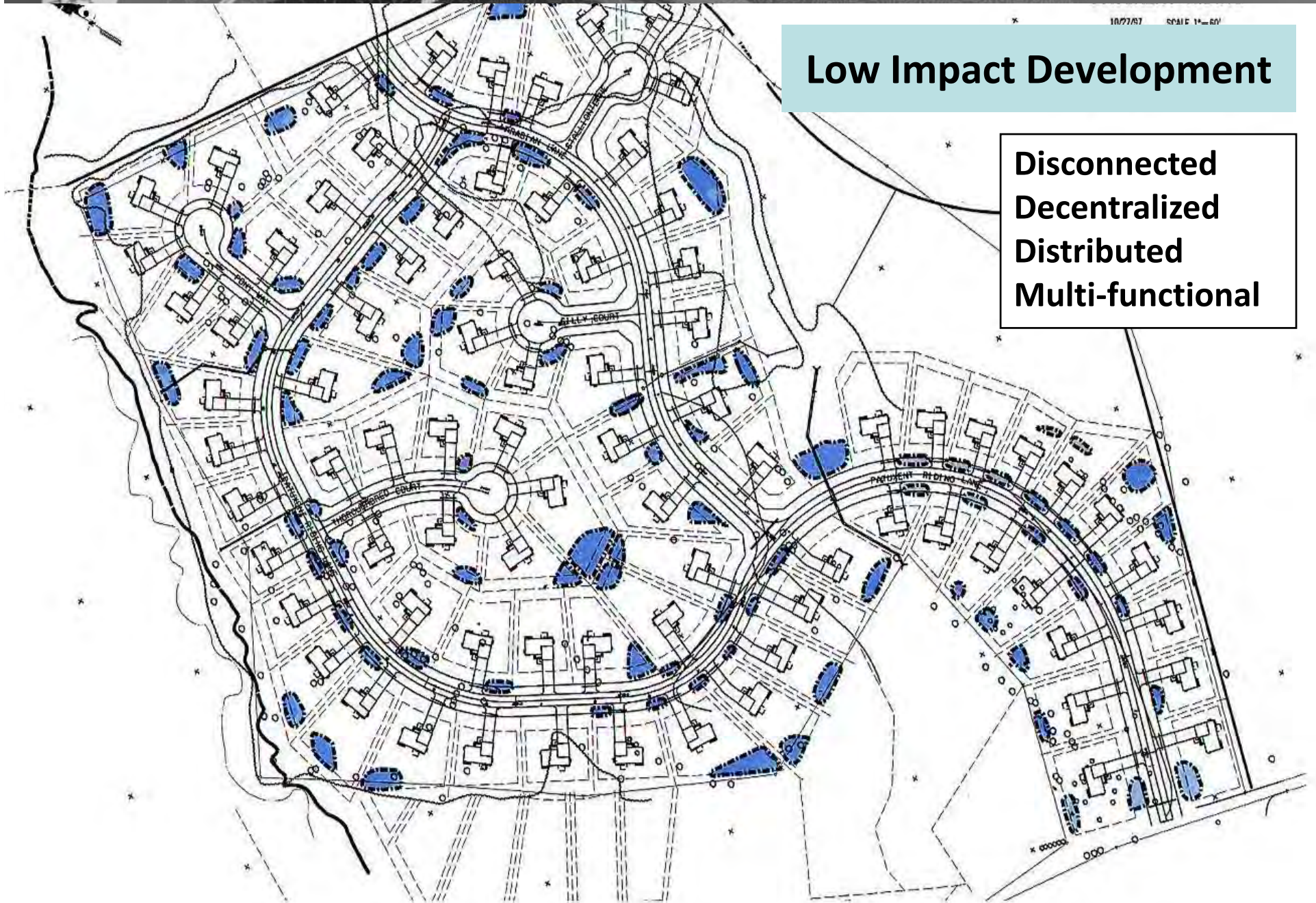


Cumulative effect of a sustained discharge from multiple developments within a watershed – severe bank erosion and low base flow.



Low Impact Development

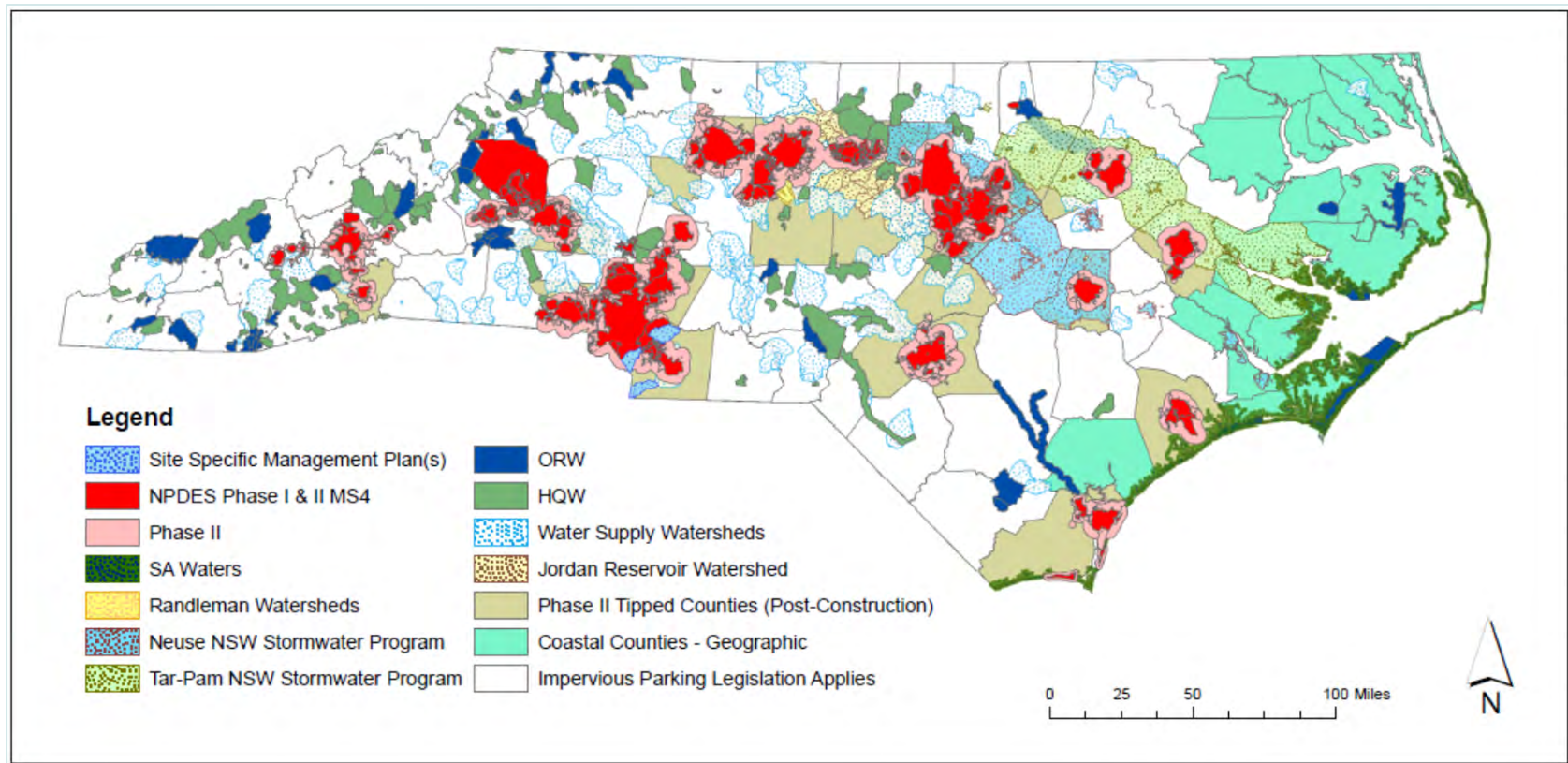
Disconnected
Decentralized
Distributed
Multi-functional



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No. 10: An LID approach meets all existing Federal and State stormwater programs



LID meets Section 438 of the Energy Independence and Security Act - Federal facilities shall maintain or restore the predevelopment hydrology.

No. 9: LID practices work everywhere



- New development, redevelopment, or retrofits
- Roads, commercial, industrial, or residential sites
- High density ultra-urban or low density developments
- Even to restore a watershed's hydrologic and ecological functions

No. 8: LID Practices.....

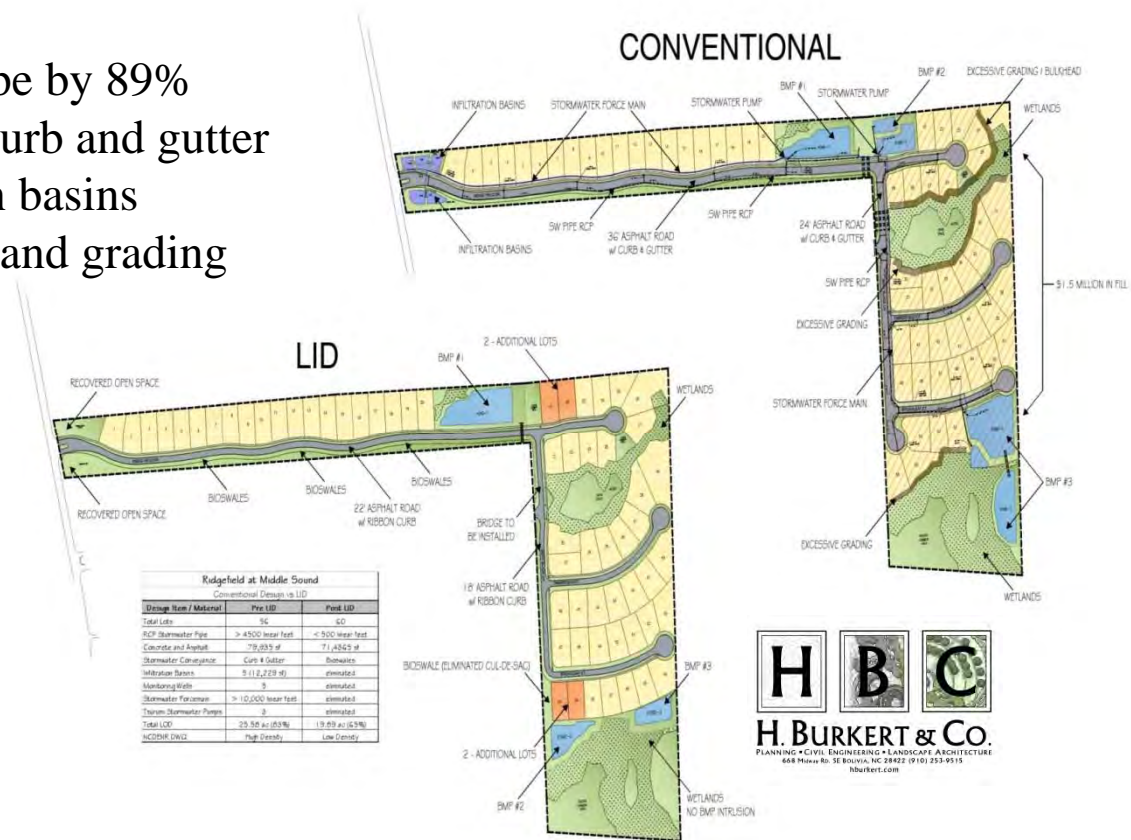
- Cost less to mobilize equipment and manpower during construction
- Don't rely on heavy or specialized equipment for installation or maintenance
- Simplify inspection and maintenance requirements for the property owner
- And if one stormwater control measure fails there is less impact on water quality



No. 7: LID practices can regain valuable land & reduce infrastructure

Economies of LID

- Reduced stormwater pipe by 89%
- Eliminated 9,000 ft of curb and gutter
- Eliminated 5 infiltration basins
- Saved \$1 million in fill and grading
- Gained 4 lots



No. 6: LID expands the number of stormwater management controls that developers may choose to use

- LID practices are practical, flexible, and cost effective. They include:
 - Disconnected Built Upon Area (BUA)
 - Soil Amendments
 - Rainwater Harvesting
 - Blue and Green Roofs
 - Infiltration Swales
- LID practices are based the eliminating or reducing stormwater runoff – significantly reducing the size of conventional BMPs that may be required



No. 5: LID Practices improve aesthetics and increase marketability & value



Stormwater Amenity vs. Stormwater BMP

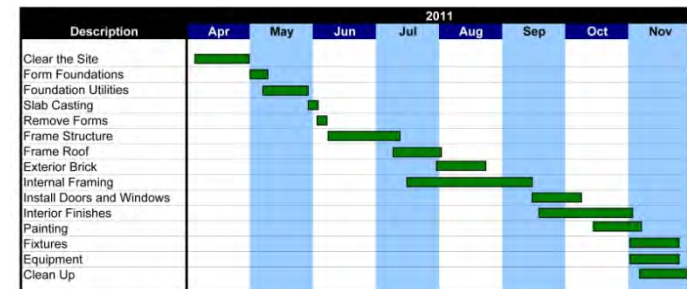
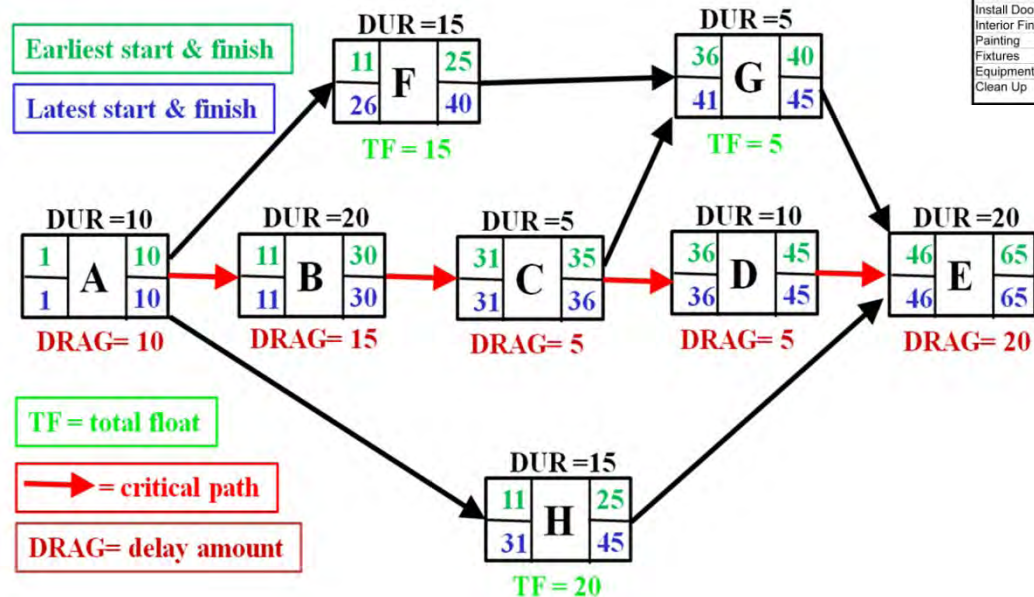
No. 4: LID Practices preserve open space and tree cover

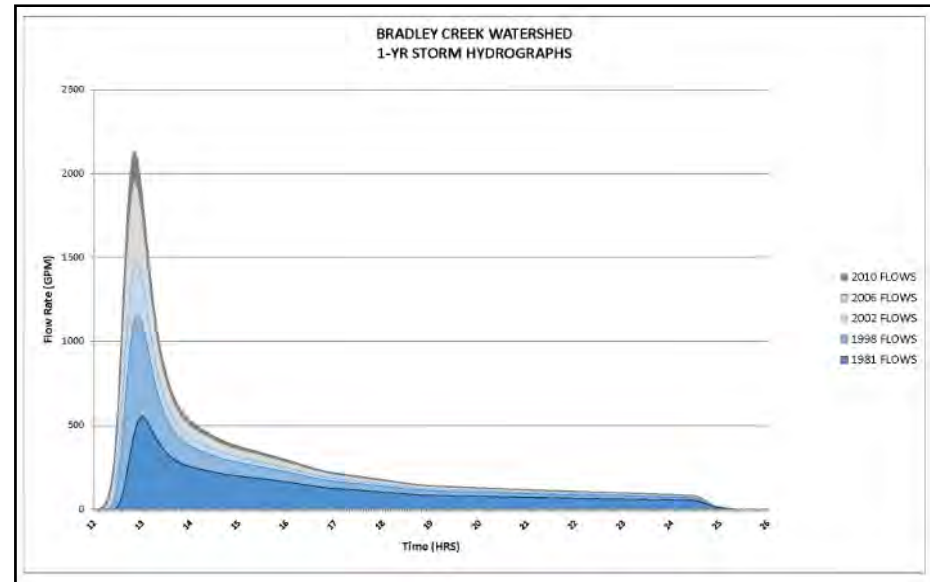


No. 3: LID Practices

minimize impacts on project schedules

Finish Ahead of Schedule!

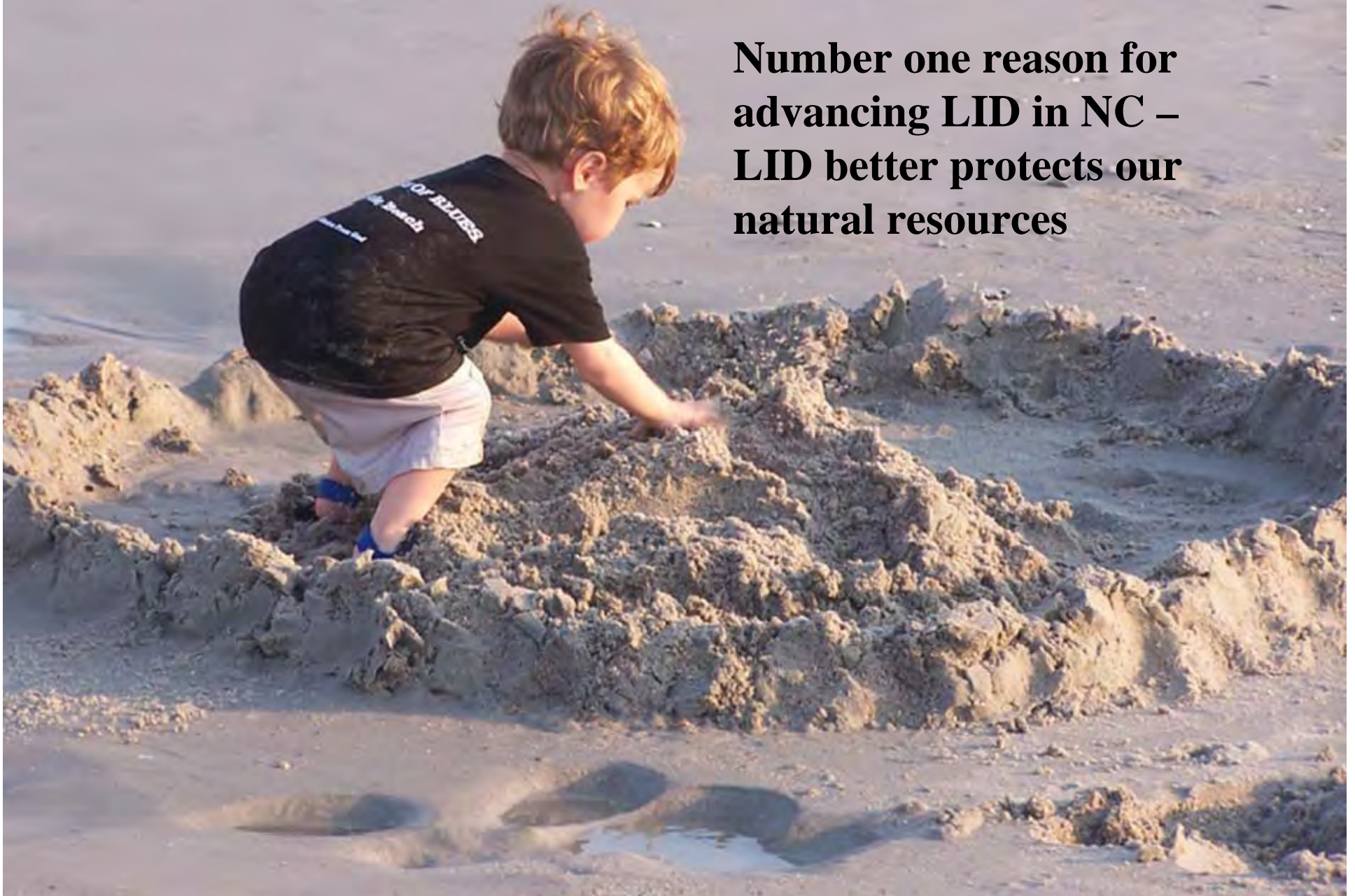




No. 2: Based on scientific research reflective of input from a variety of legitimate, diverse, and thoughtful perspectives - LID practices work

- Provided better stormwater treatment and control than end-of-pipe stormwater control measures
- Recharged drinking water sources
- Restored stream base flows, protecting vital habitats
- Restored the hydrology - restoring impaired waters

**Number one reason for
advancing LID in NC –
LID better protects our
natural resources**



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Advancing LID in NC

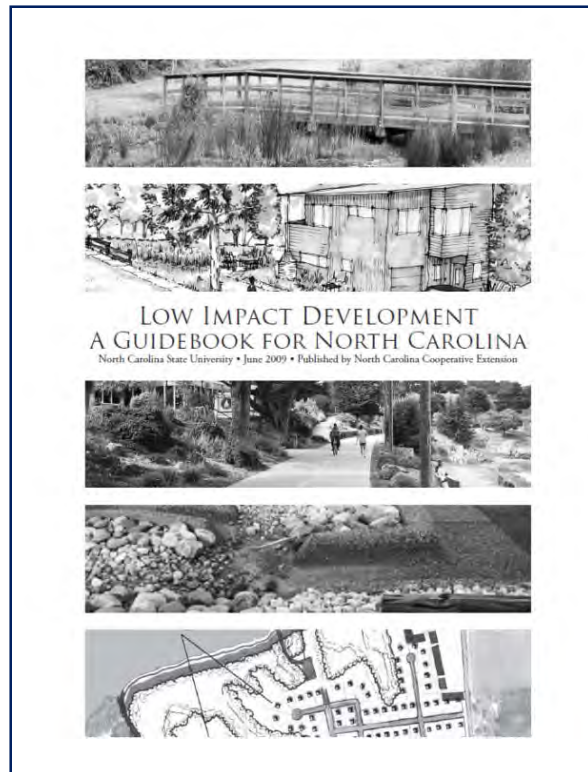
NC LID Certification Program

Topics: BMPs
 Policy Analysis
 Case Studies
 Economics
 Site Design Exercises



Certified Individuals: 112

Advancing LID in NC



LID Guidebook for NC

- Hydrology
- Site Assessment
- Planning
- BMPs
- Construction
- Case Studies

LID Guidebook is available online at:

<http://www.ces.ncsu.edu/depts/agecon/WECO/lidguidebook/>



Advancing LID in NC

Expanding the number of stormwater management controls that developers may choose to use on their sites



North Carolina
Division of Water Quality

Stormwater Best Management Practices Manual

July 2007*



*Individual chapters of the BMP Manual will be updated periodically. Individual chapters may be more recent than July 2007.

- Overland Flow
- Disconnected BUA
- Soil Amendments
- Rainwater Harvesting
- Blue and Green Roofs
- Bioretention
- Infiltration Swales



Disconnected BUA



Infiltration Swales

- Not just for conveyance anymore
- Design as infiltration, wetland or bioretention
- Credit based on design



Green Roofs



Bioretention

- Promote infiltration via soil prep
- Credits for bioretention and other stormwater infiltration practices will be based soil types

Inexpensive upturned under drains



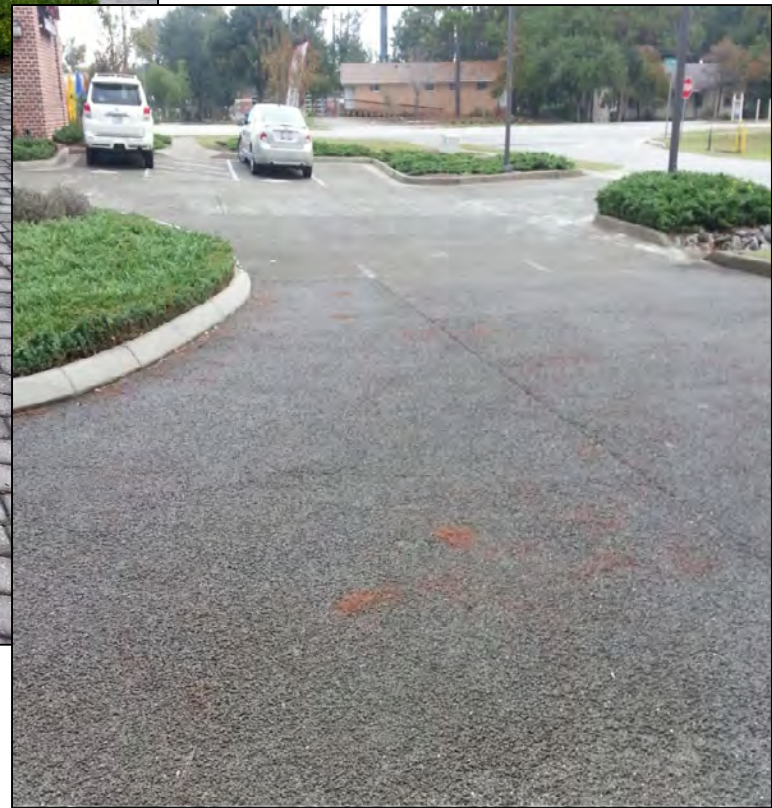
Photos: NCSU-BAE



Dual Purpose Landscape

2 acre park that provides recreation area and stormwater infiltration

Pervious Surface

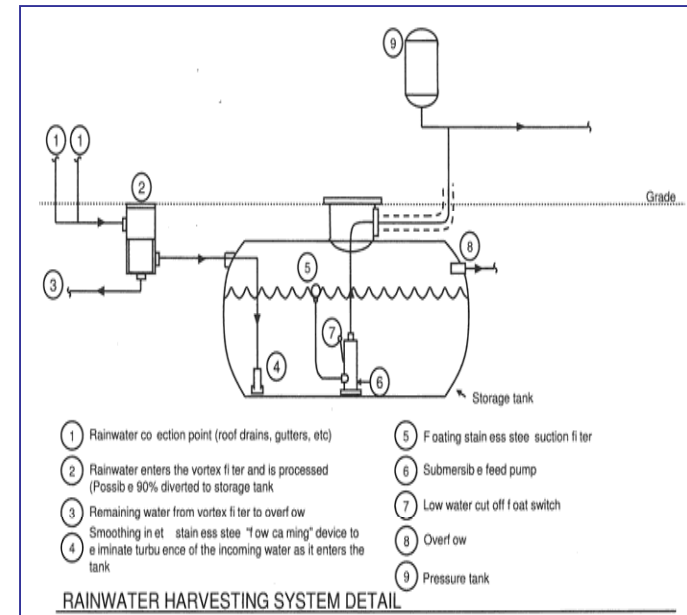
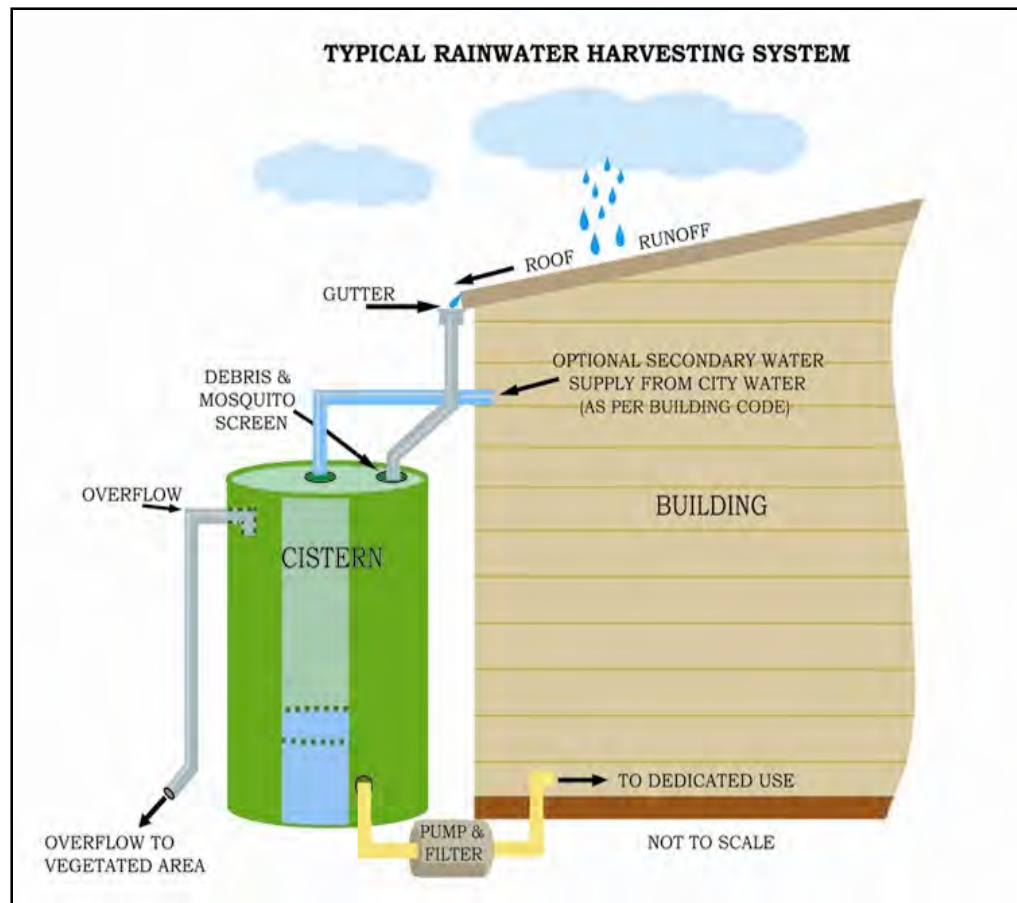




Infiltration Piping



Rainwater Harvesting



Advancing LID in NC

Step 1: Application Form
Project Name
Designer Name & Firm

Project Information

Project Name: _____ Date: _____
 Project address: _____ Lat: _____
 City, ZIP: _____ Long: _____
 Direction to project: _____ County: _____
 River basin: _____ Coastal / Noncoastal
 Receiving stream: _____
 Stream class: _____
 Surface water area (ac): _____ Coastal wetland area (ac): _____
 Total property area (ac): _____ Total project area (ac): _____

Project characteristics:
 (check all that apply) ☐ LID ☐ Low density ☐ High density ☐ Drain to an affluents stormwater system
☐ Within 575' of Saltwater ORW ☐ Within 5 miles of a public airport

Briefly summarize how the stormwater runoff will be treated: _____

Permit Information

Status of application: _____ Status of construction: _____

Other permits needed:
 (check all that apply) ☐ Sedimentation & erosion control ☐ 404 permit / 401 certification
☐ CMAA major permit ☐ Isolated wetlands permit
☐ Threatened & endangered species ☐ NPDES Industrial stormwater permit

If an application for this project has been previously returned, provide the original project number and previous name of the project: _____

Provide the permit type, number and issue date for any permits that have already been obtained for this project: _____

If claiming a vested right, then identify (and attach) the supporting documents and approval dates:
☐ Approval of site-specific development plan or PUD → Approval date: _____
☐ Valid building permit → Issue date: _____
☐ Other → Date: _____

Local jurisdiction for building permits: _____
 Point of contact: _____ Phone number: _____

Contact Information

Applicant and Title: _____ Status: _____

Storm EZ

- Excel Permitting Tool
- Developed by Hunter Freeman, PE, with Withers & Ravenel
- User inputs data about pre- and post-development land uses and Stormwater Control Measures

NCDENR

WATER MANAGEMENT PERMIT APPLICATION FORM

Bioinertion Operation and Maintenance Agreement

I will keep a maintenance record on the BMP. This maintenance record will be kept in a log at a known set location. Any defective BMP elements noted in the inspection will be corrected or replaced immediately. These deficiencies can affect the integrity of structures, safety of the public, and the general efficiency of the BMP.

Important operation and maintenance procedures:

- Immediately after the bioinertion cell is established, the plants will be watered twice weekly if needed until the plants become established (approximately two weeks).
- Trees, shrubs or any other material will NEVER be piled on the surface of the bioinertion cell.
- Heavy equipment will NEVER be driven over the bioinertion cell.
- Special care will be taken to prevent sediment from entering the bioinertion cell.
- Once a year, a soil test of the soil media will be conducted.

After the bioinertion cell is established, I will inspect it once a month and within 26 hours after every storm event greater than 1.0 inches of LS index at a Council County. Records of inspection and maintenance shall be kept in a known set location and will be available upon request.

Inspection activities shall be performed as follows. Any problems discovered shall be repaired immediately.

BMP element: SECTION 101	Potential problem: SECTION 102	Action I will undertake the problem: SECTION 103
The presence of the bioinertion cell	Partial problem: - Soil erosion or slump - Trees or lawn will die or - Severe gullies have formed	- I will reseed the problem area with seed. - Repairs the pit if necessary to remove the gully, and then plant a ground cover and water until it is established. Terminate time and a warning (various signs)
The inlet filter, pipe, stone cage or grate	- The pipe is clogged or collapsed. - The pipe is cracked or otherwise damaged (if applicable) - Erosion occurring in the made (if applicable)	- Remove the pipe, replace or clean the pipe. - Repair the pipe. - Replace the pipe if necessary to make it wet and provide constant drainage until it is replaced before possible wall erosion.
	- Stone cage is clogged or covered or weakened (if applicable)	- Remove weaknesses and collapse areas and replace with clean stone.

- **Storm EZ** works for High and Low Density Projects, Conventional Designs, LID, and everything in between
- **Storm EZ** documents compliance with **all existing** Federal and State stormwater programs including the Coastal County Rules, USMP, Phase II Rules, NSW, WS, HW, ORW, Jordan and Falls Lake, Goose Creek,

- **SW101 Application Form**
- One or more of 14 different Supplement Forms
- One or more of 11 different O&M Agreements

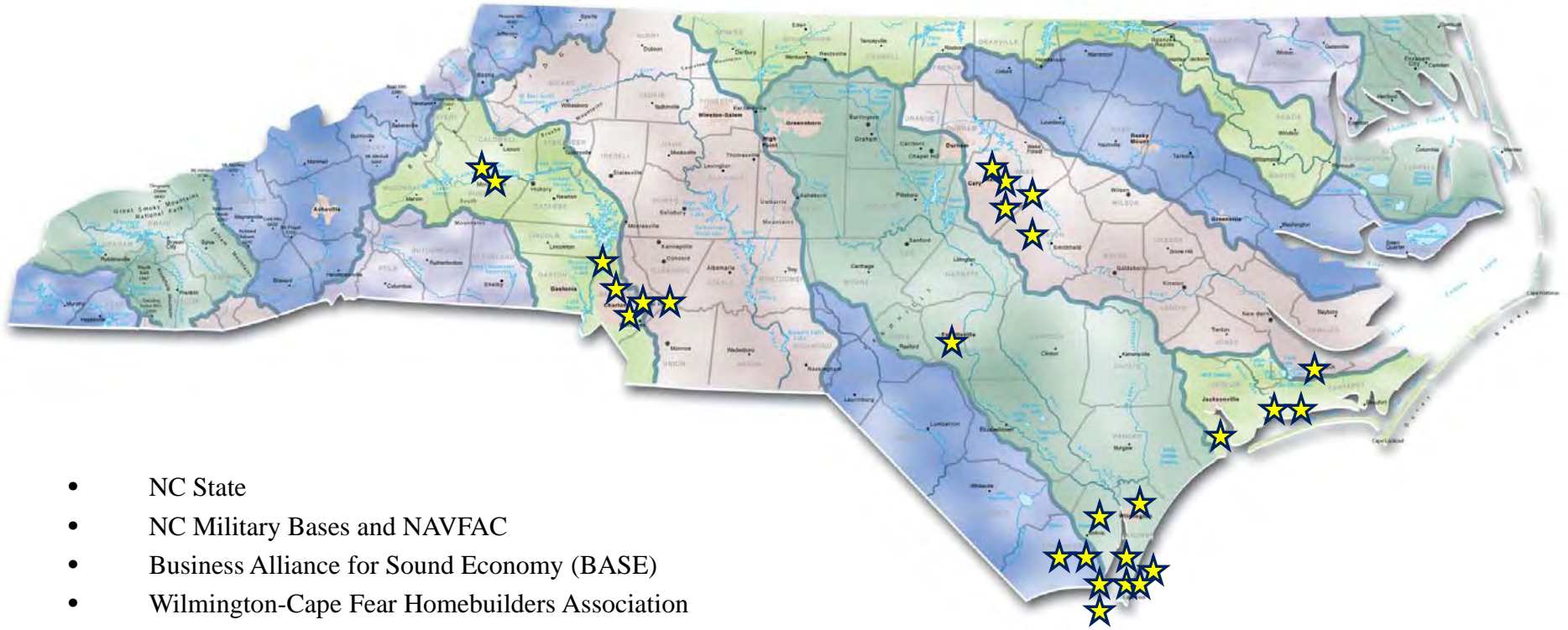
Advancing LID in NC

Outreach Efforts

- LID Summit
 - March 26 and 27, 2014
 - Raleigh Convention Center
- Launch the LID “Train the Trainers” Program in 2014
- Continue to assist local governments, developers, engineering firms, realtors, others
 - Workshops
 - Ordinance and code review
 - Develop fact sheets and guidance
 - Identify Impediments

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- NC State
- NC Military Bases and NAVFAC
- Business Alliance for Sound Economy (BASE)
- Wilmington-Cape Fear Homebuilders Association
- NC Coastal Federation (NCCF)
- NC Division of Coastal Management
- NC Soil and Water Conservation Districts
- Local Governments
- Realtors
- Landscapers
- Developers
- Engineering firms and consultants

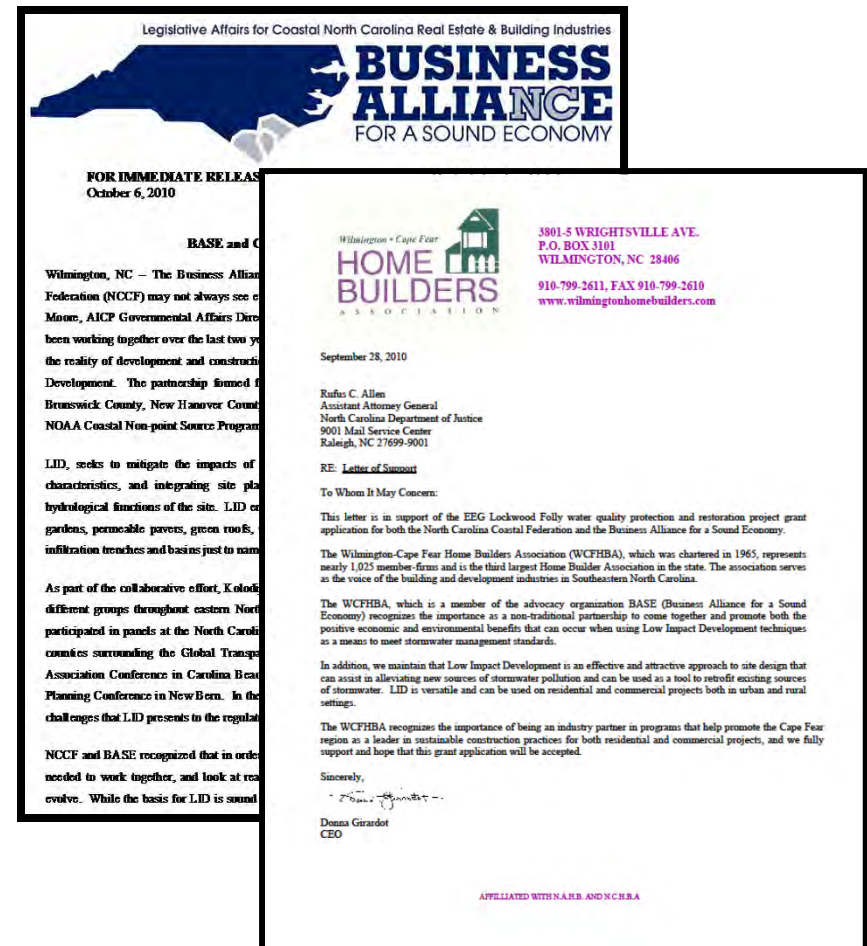
Partnerships

Endorsements

- **Business Alliance for Sound Economy (BASE)**
- **Wilmington-Cape Fear Homebuilders Association**

“...we maintain that Low Impact Development is an effective and attractive approach to site design that can assist in alleviating new sources of stormwater pollution and can be used as a tool to retrofit existing sources of stormwater. LID is versatile and can be used on residential and commercial projects both in urban and rural settings.”

– Wilmington-Cape Fear
Homebuilders Association



Joint Statement of Support

- Business Alliance for A Sound Economy
- N.C. Coastal Federation
- Wilmington-Cape Fear Homebuilders Association
- Bill Hunt, Professor & Extension Specialist, Bio & Ag Engineering, NC State University.
- Brunswick County Cooperative Extension Service
- Cape Fear Green Building Alliance
- New Hanover County Cooperative Extension Service
- Burrows Smith, River Bluffs Development Corporation
- David Newsome, Crystal Coast Engineering
- Gary J. McCabe, PE, Red Line Engineering, PC
- Jordan Building Co.
- Ward Shore Builders
- West Fourth Landscape Architecture, P.A.
- Tetra Tech

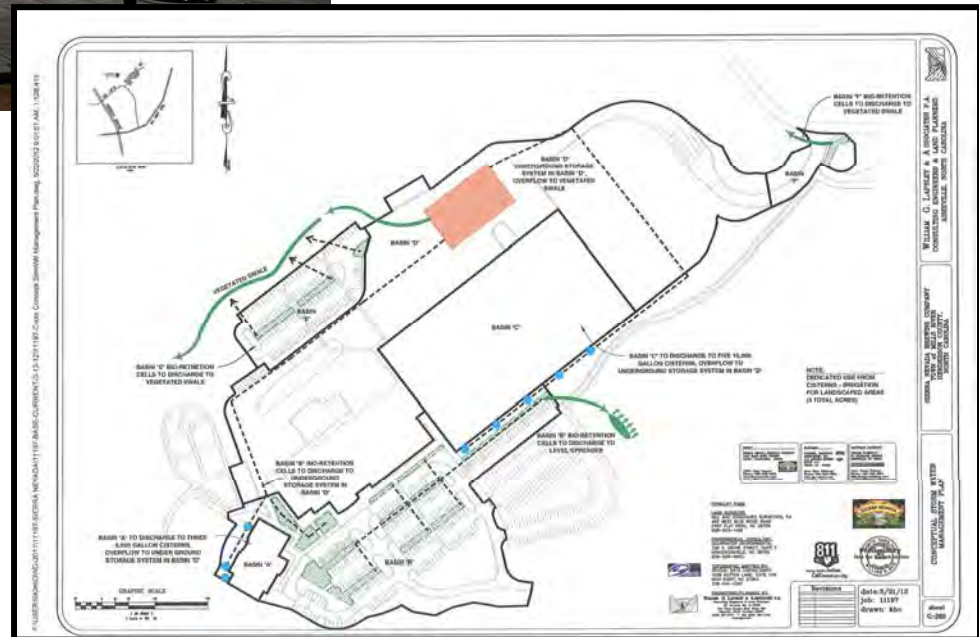
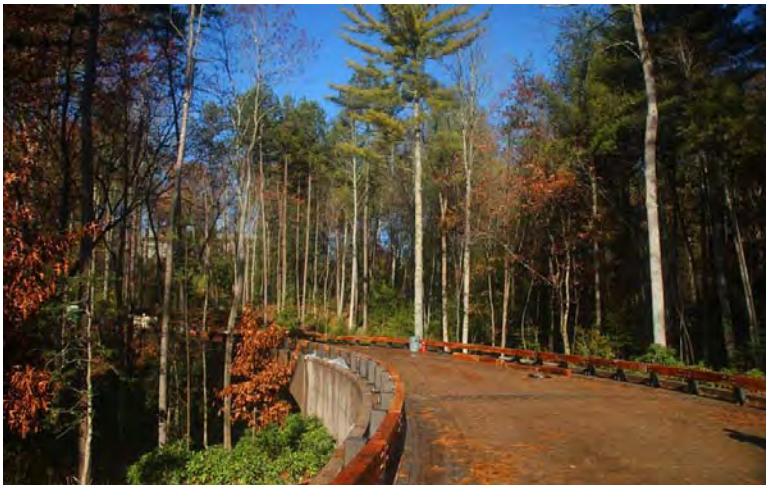
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Successful LID Projects



Sierra Nevada Brewing Co
Mills River NC



Successful LID Projects

Master Plan Town of Midland, NC



Successful LID Projects

Highclere Single-family Subdivision

Land Design, Charlotte



Six Mile Creek
(T&E Species)

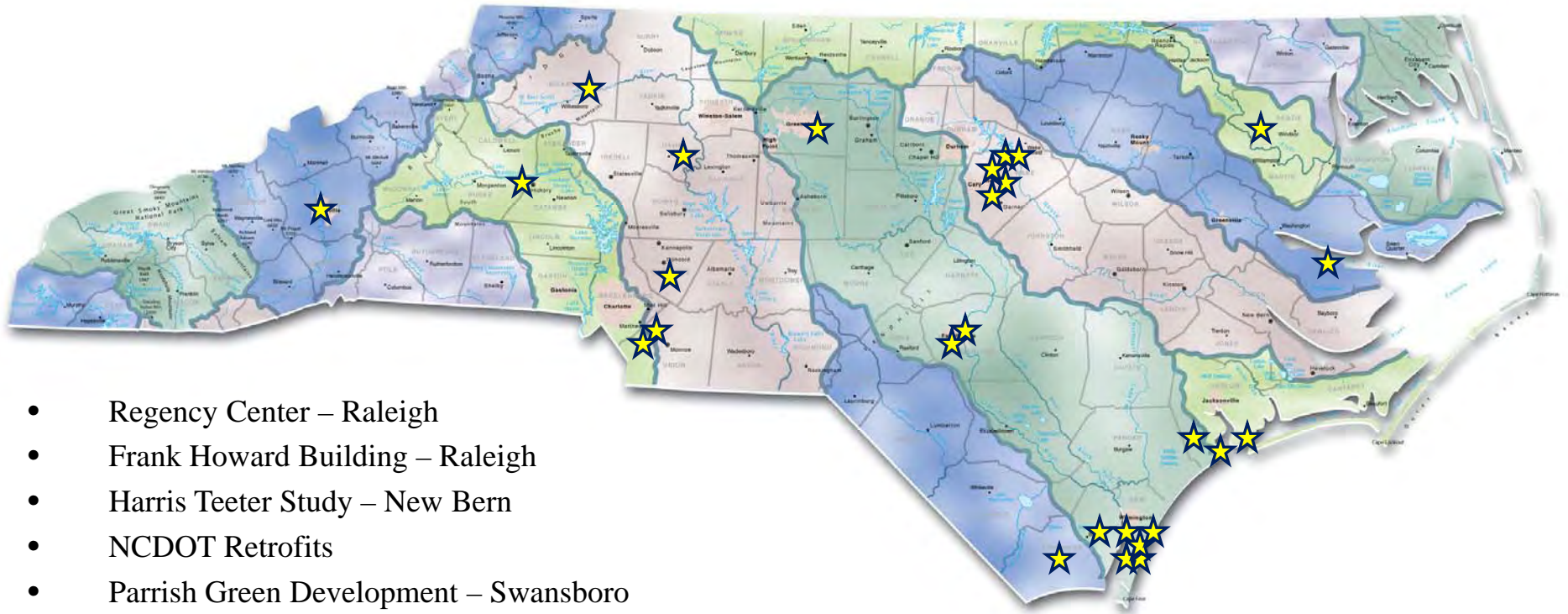
Successful LID Projects

Whole Foods, North Raleigh

Discharges LESS
after development
than before.



Successful Projects



- Regency Center – Raleigh
- Frank Howard Building – Raleigh
- Harris Teeter Study – New Bern
- NCDOT Retrofits
- Parrish Green Development – Swansboro
- Wade Wetland Project – Wilmington
- Capital Improvement Projects in Fayetteville, Greensboro, and Wilmington
- AIA NC Center for Architecture and Design – Raleigh
- Williamston High School Retrofit – Martin County
- River Bluff Development – New Hanover County
- Scott D. Stewart Developments - Wilmington

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Stormwater Program

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