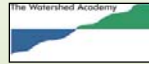


Designing LID to Work: Lessons Learned from North Carolina

Watershed Academy Webcast



Thursday, December 9, 2010
1:00–3:00 Eastern

Instructors:

Dwane Jones, North Carolina State University, Cooperative Extension
Heather Burkert, H. Burkert & Co.

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Dwane Jones
Extension Associate

dwane_jones@ncsu.edu
www.bae.ncsu.edu/topic/lid



Heather Burkert
RLA, LEED - AP, Principal, President

heather@hburkert.com
www.hburkert.com





LID & Sustainable Development

- LID is an integral component of sustainable development
- Workshops for design professionals, developers, and realtors
- Ultimate goal: achieve sustainable built form



LID & Current Research

- Water quality benefits
- Water quantity benefits
- Groundwater recharge
- Public perception



LID & NC's Geography

- Mountains
- *Piedmont*
- *Coastal Plain*



Implementation of LID in NC

- Mountains
- *Piedmont*
- *Coastal Plain*



Overcoming Barriers to Implementation in NC

- Public education
- Demonstration sites
- Applied research
- Division of Water Quality
- NC LID Certification Program

NC Piedmont

- Commercial
 - Harrisburg, NC Office - clay soils (Charlotte area)
 - Bio-cells with engineered soils

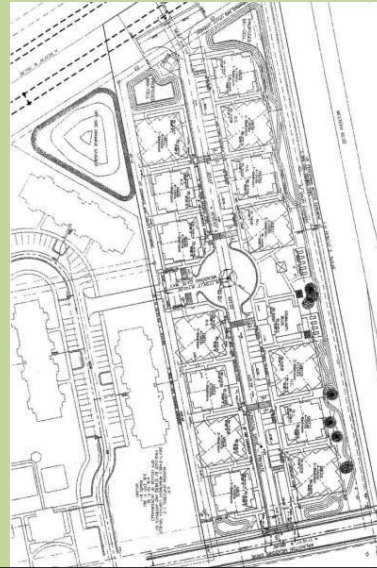


LID



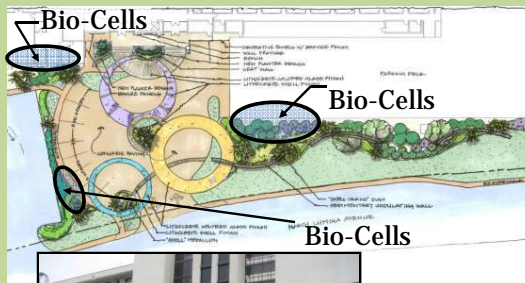
Hybrid LID

- May need to implement LID and Conventional Design
- Design accordingly
 - Do what you can



Hybrid LID

- Commercial
 - Shell Island Resort- sandy soils





NC STATE UNIVERSITY



LID: Past, Present, and Future

- Learning curve
- Decrease in construction costs
- Increased acceptance of LID
- LID simply becomes “development”; the norm



Holistic Implementation of LID

- Smart Growth
- Conservation Design
- New Urbanism
- LEED-ND
- Green Building
- Sustainable Development

Types of Development

- Rural and Agriculture
- Community
- Historical
- Residential
- Commercial Design
- Parks and Recreation
- Public Institutions

Holistic LID

- Commercial
 - Bolivia, NC Office - clay soils



Equestrian / Livestock

- Rural
 - Agriculture-tillage
 - Livestock- equestrian



Conventional



LID



Bio Swales / Cells



Equestrian / Livestock High Traffic Areas



High Traffic Cell



High Traffic Cell

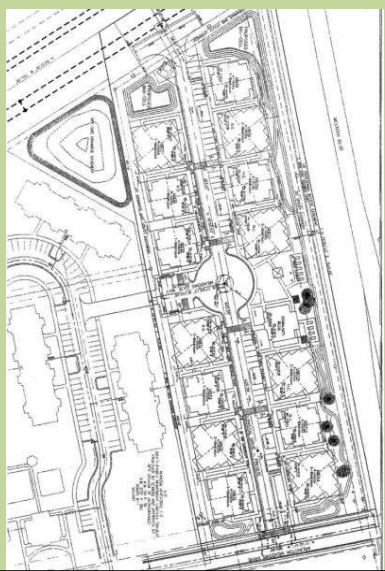


High Traffic Cell Sand / Fines Mix



Affordable Housing - LID

- Glenstal Apartments
Jacksonville, NC
- Caldwell Cove Community
Leland, NC
- Troy/Hayes Apartments
Leland, NC





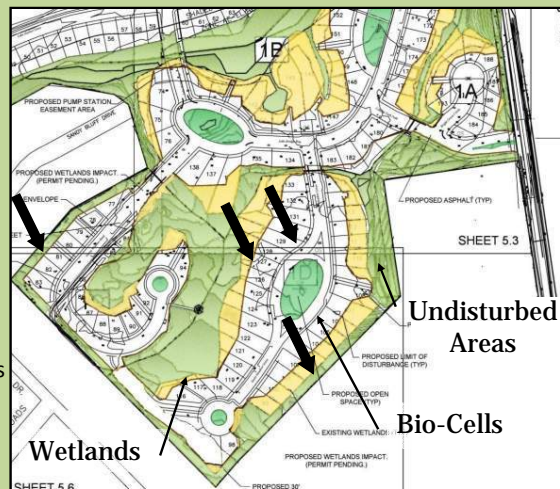
H. BURKERT & CO.
668 Midway Road Bolivia, NC
910.253.9515
www.hburkert.com



Western Blvd. Streetscape Glenstal Apartments

LID Implementation Lakeside

- Design Techniques
 - Limit area of disturbance
 - LID-less cut and fill
 - Add additional 30' vegetation conservation zone
 - 15' and 18' front yard setbacks
 - House design - small footprints (up, not out)
 - HOA covenants
 - Limits on construction impacts and sequence
 - Educational literature to residents and contractors
 - Management and preservation plan of all systems



LID Implementation

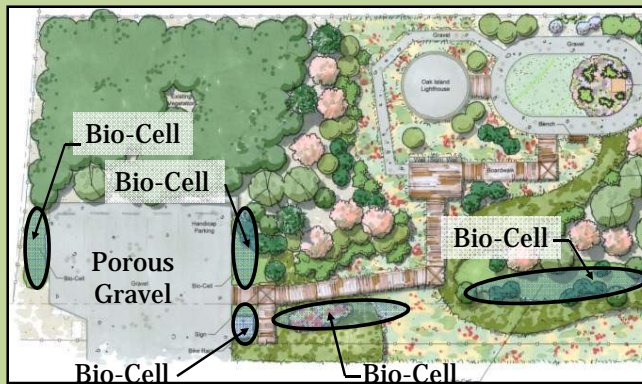


Latitude:
33°53'34.16"N
Longitude:
78° 2'5.73"W



LID Implementation

- Historical Sites
 - Oak Island Lighthouse



Before



After



LID Implementation

- Residential
 - Lovelace - Indian Beach, NC



LID Implementation

- Parks
 - Hugh Mac Rae Nature Trail



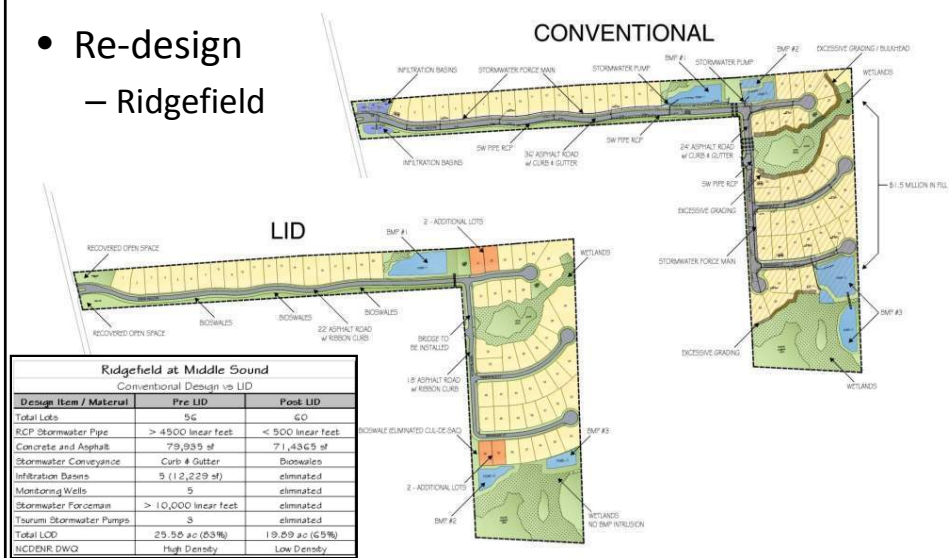
Ridgefield Re-Design New Hanover County, NC

- Conventional design under construction
 - Fully permitted
- Re-design with LID
 - Approval by New Hanover County



Conventional Versus LID

- Re-design
 - Ridgefield



Ridgefield Re-Design Summary

- Gained 4 additional lots
- Reduced stormwater pipe by 89%
- Decreased road widths 9%
- Eliminated 9,000 ft curb and gutter \$\$\$\$
- Eliminated 5 infiltration basins \$ in construction and maintenance
- Eliminated 5 monitoring wells \$ in construction and monitoring fees
- Eliminated 10,000 linear feet of stormwater force main



- Reduced LOD 18%, saved trees, and \$1 million in fill
- NCDENR DWQ - from high to low density
- Increased localized stormwater infiltration
- Eliminated 3 tsurumi stormwater pumps
- Increased functional and recreation open space
- Minimized wetlands intrusion and wildlife impacts
- Buyers prefer “green” real estate
- Promotes good neighbor
- Decreased construction traffic
 - Wear on roads
 - Noise and dust
 - Increased safety



Cost Comparisons

Conventional 01/08/08

LID 03/10/10

Estimated Costs to Complete		Estimated Costs to Complete	
Sewer System	\$200,488	Sewer System	\$179,000
Water System	177,340	Water System	177,340
Storm Drain	595,308	Storm Drain	30,000
Storm Water Ponds	100,000	Storm Water Ponds	40,000
Clear and Fill	750,000	Clear and Fill	35,000
Erosion control	50,000	Erosion Control	45,000
Roads:		Roads:	
Rough Grade	15,000	Rough Grade	20,000
Curb and Stone	150,000	Stone	75,000
Fine Grade / Asphalt	185,000	Fine Grade / Asphalt	100,800
Entrance/Sidewalks	75,000	Entrance/Sidewalks	30,000
Grade Shoulders/Seed	8,000	Grade Shoulders/Seed	10,000
Irr. Common Areas/Ponds	50,000	Irr. Common Areas/Ponds	35,000
NHC Tree Mitigation	35,000	NHC Tree Mitigation	20,000



Cost Comparisons

Conventional 01/08/08

LID 03/10/10

Survey & Civil Eng. Fees	\$30,000	Survey & Civil Eng. Fees	\$45,000
TOTAL	\$ 2,394,136	TOTAL	\$889,140
		ADD 4 HOMES & LOTS	500,000

LID SAVINGS
\$2,000,000 CASH

SAVE ON MAINTENANCE
FEEES



Quotes from Ridgefield Developer

“Your ideas and preliminary plans for incorporating LID for Ridgefield are proving invaluable. After having it approved for a conventional stormwater system, we were concerned with the extreme costs of the system and development’s financial feasibility. However, with the utilization of an LID stormwater system we can dramatically reduce the costs and make the project viable again.”



“In our estimates we are projecting a savings up to \$1.5 million in fill alone and adding 4 lots. In addition, we will be saving many of the natural features and topography resulting in a “greener,” more conservation oriented neighborhood.”

February 12, 2009



SE Low Impact Development (LID) Ordinance Project



SE LID Ordinance Project

- Bring in NC DWQ for input and buy-in.
- Determine appropriate techniques for coastal application.
- Ensure LID technologies compliant with local and state permitting requirements.
- Preparation of an LID manual and supporting resolution.
- Elected official unanimous adoption.
- Education, outreach, training.
- LID modeling tool to aid in LID design and permitting.



SE LID Ordinance Project Outcome and Status

Resulting Product:

- LID manual and resolution provide *optional* tool for developers to meet SW rules.
- Companion LID-EZ analytical tool assists with design and permitting.

Project Status:

- City of Wilmington, New Hanover County and Brunswick County unanimously approve in 2008.
- DWQ supports project, opening the door for LID.
- Project serves as model for other communities

(Cedar Point/Cape Carteret join in)



SE LID Ordinance Project Outcome and Status

L I D
LOW IMPACT
DEVELOPMENT
GUIDANCE
M A N U A L



CITY OF
WILMINGTON
NORTH CAROLINA



Future Research in LID

- Stormwater practices
- Planning and implementation processes
- Sustainable development
- GIS analyses
- Defining LID in 'pure form'



NC LID Certification Program

- Introduction to LID and LEED/Policy courses
- Exam
- NC LID Guidebook
- Continuing education requirements
- Designing stormwater practices
- Other certification courses

LID - EZ

Calculations - LID-EZ Features

- Excel based spreadsheet
- Customized error messages and data verification for NC permits
- Thresholds developed by regulators through stakeholder process
- Site scale
 - Predevelopment CN
 - Post development CN
- Land use
- Soil type
- Site composition
- Discrete CN method
- Disconnected / connected impervious area



LID - EZ

- Consistent methods between pre and post development
- Reflects soil conditions on site
- Can be used for volume and peak runoff
- Computations
- Disconnected impervious area / non structural devices



LID - EZ

Hybrid Sites – Additional Uses

- LID-EZ used to quantify impact of LID measures
- Presents results which are then used for input into routings
- Watershed analyses
- Retrofit analysis
- Land use planning



LID - EZ

Stormwater Management Plan

Project #: 0
Date: 01/00/00
Designer: 0

POST-DEVELOPMENT CALCULATIONS

CURVE NUMBER:

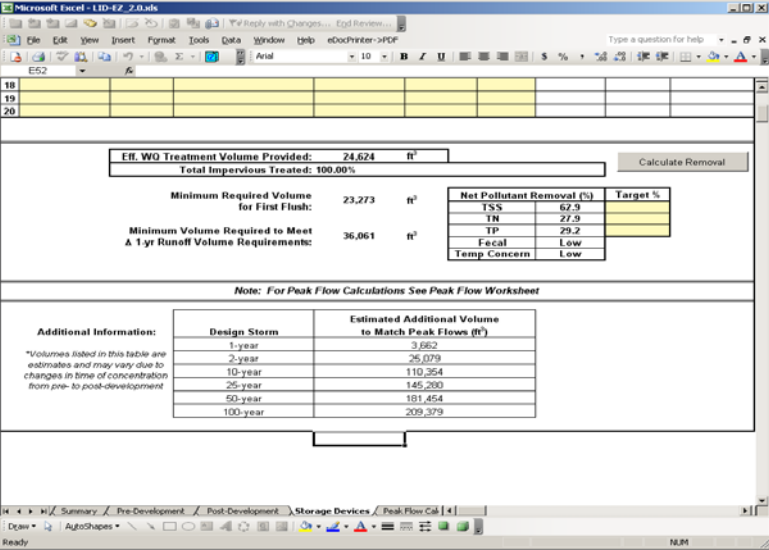
Residential Lot Data: (If Applicable)		
Total Area of Lots (Excluding RW and Open Space)	10.4	acres
Number of Lots:	36	
Allowable Impervious Area per Lot:	4500	sf
Percent of Impervious on Lots:	35.76	%
Preserved Woods per Lot:	2000	sf
Percent of Lot Impervious that is Disconnected:	46	%

Average Lot Size = 12584 sf

Pervious Pavement Data: (If Applicable)		
Type of Pavement:	Flexible pavement with +7" of gravel base	
HSG	A	
Soil Permeability	1	in/hr

CN=76, 60% Pervious

LID - EZ



Eff. WO Treatment Volume Provided: 24,624 ft³
Total Impervious Treated: 100.00%

Minimum Required Volume for First Flush: 23,273 ft³
Minimum Volume Required to Meet A 1 yr Runoff Volume Requirements: 36,061 ft³

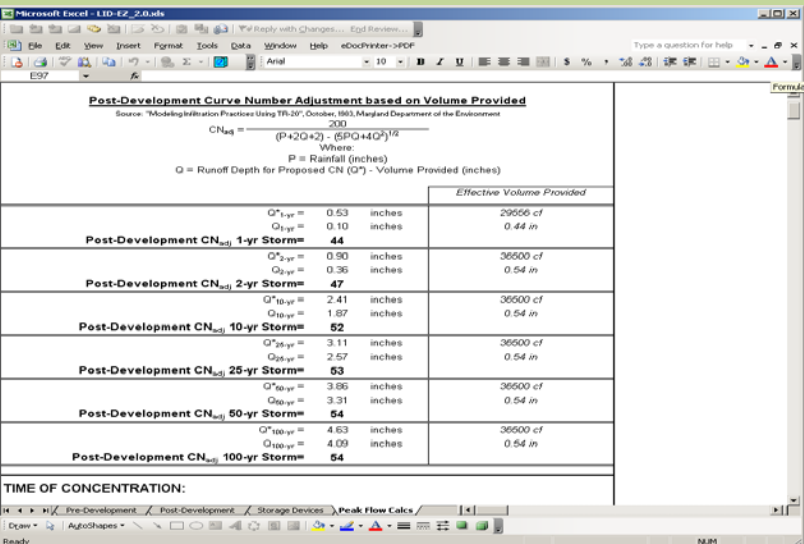
Net Pollutant Removal (%)		Target %
TSS	62.9	
TN	27.9	
TP	29.2	
Fecal	Low	
Temp Concern	Low	

Note: For Peak Flow Calculations See Peak Flow Worksheet

Design Storm	Estimated Additional Volume to Match Peak Flows (ft ³)
1-year	3,662
2-year	26,079
10-year	110,354
25-year	145,200
50-year	181,454
100-year	209,379

Additional Information:
 *Volumes listed in this table are estimates and may vary due to changes in time of concentration from pre- to post-development

LID - EZ



Post-Development Curve Number Adjustment based on Volume Provided
 Source: "Modeling Infiltration Practices Using TR-20", October, 1993, Maryland Department of the Environment

$$CN_{adj} = \frac{200}{(P+2Q+2) - (5PQ+4Q^2)^{1/2}}$$

Where:
 P = Rainfall (inches)
 Q = Runoff Depth for Proposed CN (Q_P) - Volume Provided (inches)

		Effective Volume Provided
Q _{1-yr} = 0.53 inches		29556 cf
O _{1-yr} = 0.10 inches		0.44 in
Post-Development CN_{adj} 1-yr Storm = 44		
Q _{2-yr} = 0.50 inches		36500 cf
O _{2-yr} = 0.36 inches		0.54 in
Post-Development CN_{adj} 2-yr Storm = 47		
Q _{10-yr} = 2.41 inches		36500 cf
O _{10-yr} = 1.87 inches		0.54 in
Post-Development CN_{adj} 10-yr Storm = 52		
Q _{25-yr} = 3.11 inches		36500 cf
O _{25-yr} = 2.57 inches		0.54 in
Post-Development CN_{adj} 25-yr Storm = 53		
Q _{50-yr} = 3.86 inches		36500 cf
O _{50-yr} = 3.31 inches		0.54 in
Post-Development CN_{adj} 50-yr Storm = 54		
Q _{100-yr} = 4.63 inches		36500 cf
O _{100-yr} = 4.09 inches		0.54 in
Post-Development CN_{adj} 100-yr Storm = 54		

TIME OF CONCENTRATION:

EZ Spreadsheet

Brunswick County website: www.brunsko.net

Click on: [departments/engineering/stormwater/](#)

Listed on bottom is LID:

LID Manual

LID EZ Spreadsheet

Speaker Contact Information



Dwane Jones

Extension Associate
North Carolina State University,
Cooperative Extension
dwane_jones@ncsu.edu

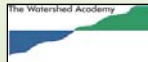


Heather Burkert

RLA, LEED – AP, Principal, President
H. Burkert & Co., Landscape Architect
heather@hburkert.com

Next Watershed Academy Webcast:

Nutrients and Harmful Algal Blooms Affecting Lakes



January 2011

1:00–3:00pm Eastern

<http://www.epa.gov/watershedwebcasts>

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http://water.epa.gov/learn/training/wacademy/upload/2010_12_9_certificate.pdf

You can type in each of the attendee's names and print the certificates.