A REGIONAL SCALE MANUAL FOR LOW IMPACT SITE DESIGN



Presentation To: Rapidan Regional Commission Land Use and Environmental Committee

July 29, 2008



LOW IMPACT SITE DESIGN

- Is a Comprehensive Design Approach
- Used to Mitigate Hydrology and Water Quality Impacts Caused by Development
- Mimic Predevelopment Site Hydrologic Response
- Incorporate Existing Site Conditions
- Utilize Distributed Small Landscape Features



LID GOALS

- Provide Improved Technology
- Provide Economic Incentives that Encourage Sound Development
- Build Communities Based on Stewardship
- Reduce Construction and Maintenance Costs
- Encourage Flexibility in Regulations that Promote "Smart Growth"



BIORETENTION







OTHER LID BMPs





Reduces stormwate runoff

Eliminates the need for detention pond and other costly stormwater manage ment practices

Replenishes water tables and aquifers

Allows for more efficient land development

Minimizes flash flooding and standing water

Prevents warm and polluted water from entering our streams

Mitigates surface pollutants



The best application for pervious concrete <u>is</u> parking lots.

When it Rains, it Drains.





The Northern Shenandoah Valley Regional Urban Manual for Low Impact Site Design (A Supplement to the Virginia Stormwater Management Handbook)

The NSVRC's Goals

Identify the Stakeholders and their needs
Create a Regional Manual that would meet the needs of the Stakeholders
Allow for a range of implementation mechanisms



PROJECT AREA NORTHERN SHENANDOAH VALLEY





PROJECT BACKGROUND

- Northern Shenandoah Valley Regional Commission
- Funded by National Fish and Wildlife Foundation – 2003 Chesapeake Bay Small Watershed Grants Program
- Promote Application of LID in the Region
 Identify Physical and Policy Limitations to LID Application



THE PROJECT TEAM

- Mr. Brian Henshaw Northern Shenandoah Valley Regional Commission
- C.J. Mitchem
- Terry Harrington MarshWitt Associates
- Dr. Shane Parson & Sara Hyland Va Tech Center for Geospatial Information Technology
- Steering Committee



PROJECT OVERVIEW

Three Main Project Tasks

- Ordinance Review
- LID Applicability and Restrictions Study
- Development of Regional LID Manual

The Fourth Task

Steering Committee Input and Oversight



ORDINANCE REVIEW

- Terry Harrington MarshWitt Associates
- Evaluation Criteria:
 - Maximum Lot Coverage Standards
 - Cluster Development Allowed/Required
 - Parking Lot Pavement Requirement
 - Parking Lot Landscaping Requirement
 - Parking Lot Landscaping Flexibility
 - Curb and Gutter Requirement
 - Private Streets Allowed
- Intended to be a temporary chapter in manual



ORDINANCE REVIEW

	Maximum Lot Coverage Standards	Allows Cluster Development	Requires Pavement of Parking Lots	Requires Parking Lot Landscaping	Flexibility in Landscape Placement	Requires Curb and Gutter	Allows Private Streets
Clark County	Y	Y	Y	Y	Y	Y –	Ν
Town of Berryville	N	Y	Y	Y	Y	Y	Ν
Town of Boyce	Y	Ν	Ν	Y	Y	Y	Ν
Warren County	Ν	Y	Y	Y	Y	Y	Y
Town of Front Royal	Y	Y	Y	Ν	Y	Y	Ν
Page County	Y	Ν	Ν	Ν	Y	N	Y
Town of Stanley	Ν	Ν	Ν	Ν	Y	Y	Ν
Town of Shenandoah	Ν	Ν	Υ	Ν	Y	N	Ν
Town of Luray	Ν	Ν	Y	N	Y	N	Ν
Shenandoah County	N	Y	Y	Y	Y	Y	Ν
Town of New Market	Y	Ν	Y	Y	Y	Y	Ν
Town of Edinburg	Ν	Ν	Υ	N	Y	Y	Ν
Town of Woodstock	Y	Ν	Υ	Y	Y	N	Ν
Town of Strasburg	Y	Ν	Y	Y	Y	Y	Ν
Frederick County	Y	Y	Y	Y	Y	Y 📕	Y
Town of Stephens City	Y	N	Y	Y	Y	Y 📕	N
Town of Middleton	Y	N	Y	Ν	Y	Y	N
City of Winchester	Y	Y	Y	Y	Y	Y	Y

Key

- 1 Curb and gutter can be waived
- 2 When average lot size is less than one acre
- 3 When all lots served are 10 acres or larger
- 4 Commercial and industrial uses
- 5 Private streets allow for some subdivisions
- 6 Building coverage only, except industrial zones
- 7 Shopping center frontage only
- 8 Commission can waive to allow more suitable surface

- 9 As part of approved PUD
- 10 Building coverage only; some districts
- 11 Allows use of stabilized pavers
- 12 In business districts
- 13 Currently being repealed
- 14 Varies by district
- 15 All-weather surface required
- 16 In industrial districts



ORDINANCE REVIEW

• As of 2005:

- Max. Lot Coverages Found in more than half (61%)
- 88% Require Paved Parking Lots
- 50% Allowed Cluster Development
- 60% Require Landscaping in Parking Lots
- 80% Require Curb and Gutter
- 20% Allow Private Streets (Limits Apply)
- Results Were Updated Following Steering Committee Review
- Added Phone Numbers for Local Staff (no names) to manual



LID APPLICABILITY AND RESTRICTIONS STUDY

- Shane Parson & Sara Hyland Va Tech Center for Geospatial Information Technology
- Used GIS Tools for Analyses
- Physical Factors Considered
 - Presence of Karst Topography
 - Zoning
 - Slope
 - Soils
 - Depth to Rock



LID APPLICABILITY AND RESTRICTIONS STUDY

LID Practices Considered:

Infiltration Based with NO Specific Slope Requirement

- Bio-retention
- Bio-filters
- Infiltration Trenches
- Seepage Pits
- Pervious Pavement

Non-Infiltration Based

Reduced road widths
Curb and Gutter Elimination
Curb Cuts
Rain Barrels, Cisterns, etc.
Downspout disconnections
Surface Roughness Technology
Green Roofs

Infiltration Based with Specific Slope Requirement

Vegetative SwalesBuffer Strips



LID APPLICABILITY AND RESTRICTIONS STUDY LID on KARST ISSUES:

- Urban development in areas over karst geology can impact groundwater quality and soil/geology matrix stability (sinkholes).
- We must avoid certain LID practices that promote infiltration when these conditions are present.
- If karst is present, unfiltered surface runoff can enter groundwater storage, thus increasing the potential for groundwater contamination.



LID APPLICABILITY AND RESTRICTIONS STUDY Suitability Weighting:

LID PRACTICE	SUITABILITY FACTORS					
CATEGORIES	Zoning	Soil	Slope	Karst		
Infiltration Based w/Specific Slope Required	1	1	1	1		
Infiltration Based w/No Specific Slope Required	1	1	1*	1		
Non-Infiltration Based	1	2	2	2		

Notes:

A value of 1 symbolizes primary importance

A value of 2 symbolizes secondary importance

* Slopes less than 15% are suitable for these practices.

LID APPLICABILITY AND RESTRICTIONS STUDY

Zoning Capability - Based on community zoning ordinances & VA Gap Analysis Land Use data

Zoning Flexibility - Based on Ordinance Review Results

Suitability rankings:

1. agriculture	.4
2. commercial	.4.5
3. residential	.5
4. industrial	.3.5
5. federal	.1
6. utility	.1
7. natural resource	.2.5
8. conservation	.2.5
9. non-vegetation	1
10. future development	5
11. town	0

The following criteria enables higher suitability:

- 1. Maximum Lot Coverage standard Yes
- 2. Curb and Gutter Required No
- 3. Landscape Placement Flexibility Yes
- 4. Pavement of Parking Lots Required No
- 5. Parking Lot Landscaping Required Yes
- 6. Cluster Development Yes
- 7. Private Streets Allowed Yes



LID APPLICABILITY AND RESTRICTIONS STUDY

Soil Infiltration

 Based on hydrologic soil groups included in the SSURGO data.

 Hydrologic soil group A is most suitable and group D is least suitable.

Based the Steering Committee feedback, the following factors were added to the analysis:

Depth to bedrock
Depth to water table
200 ft Limiting depth applied both

LID Site Suitability Map Suitability Based on Soil Characteristics



LID APPLICABILITY and RESTRICTIONS STUDY



Slope

- Slope layer was derived from 10 meter DEM
- Suitability increases as slope decreases



LID APPLICABILITY and RESTRICTIONS STUDY

LID Site Suitability Map Northern Shenandoah Valley Karst



KARST

Karst layer derived from 1:250,000 scale map produced by DMME

- Scanned hard-copy map
- Geo-referenced map image
- Digitized karst geology boundaries
- Coded karst with 0 and noncarbonate areas with a value

STEARNS & WHELER Environmental Engineers & Scientists

of 1

SUITABILITY MAPPING

LID Site Suitability Map Index Non-Infiltration Based LID







SUITABILITY MAPPING

LID Site Suitability Map Index Infiltration Based LID with Specific Slope Requirement







LID MANUAL DEVELOPMENT

TECHNICAL RESOURCES UTILIZED:

- Prince Georges County, MD LID Design Manual, Hydrologic Analysis
- Virginia Low Impact Development Workgroup Draft Technical Bulletin
- Huntersville, NC Water Quality Ordinance Design Manual
- Virginia Stormwater Management Handbook (VADCR-DSWC, 1999)
- Various Internet resources



REGIONAL LID MANUAL CONTENTS

Chapter 1 - Manual Purpose and Use

- 1-1 Stream Channel Erosion
- 1-2 Stormwater Runoff Quality

Chapter 2 - Local Ordinance Review

2-1 Introduction and Review Method2-2 Results of Ordinance Review2-3 Municipal Contacts

Chapter 3 - Regional LID Suitability

3-1 Introduction3-2 Suitability Assessment3-3 Map Use

Chapter 4 - LID Site Planning and Design

- 4-1 Introduction
- 4-2 The LID Site Planning Process
- 4-3 Determining Suitability
- 4-4 Conserving Resources
- 4-5 Minimizing Changes in Curve Number (CN)
- 4-6 Maintaining Site Time of Concentration (Tc)
- 4-7 Providing Retention
- 4-8 Providing Detention as Required
- 4-9 Facilitating Pollution Prevention
- 4-10 Analyzing Site Hydrology and
- Developing the Final LID Design



REGIONAL LID MANUAL CONTENTS

Chapter 5 - Hydrologic Analysis Methodology for LID

- 5-1 Introduction
- 5-2 Summary of Hydrologic Analysis Methods
- 5-3 Hydrologic Comparison Between
- Conventional and LID Approaches
- 5-4 LID Hydrologic Analysis Methodology (Prince George's County

Chapter 6 - LID BMP Minimum Standards

- 6-1 Bioretention Basins
- 6-2 Bioretention Filters
- 6-3 Infiltration Trenches
- 6-4 Vegetative Swales
- 6-5 Vegetated Filter Strips
- 6-6 Level Spreaders
- 6-7 Roof System BMPs

- 6-8 Roof Water Retention (Rain Barrels and Cisterns)
- 6-9 Roof Downspout Infiltration Systems
- 6-10 Roof Downspout Disconnections
- 6-11 Green Roofs6-12 Other Roadway and Parking Lot BMPs
- 6-13 Porous Pavement
- 6-14 Reduced Road Widths
- 6-15 Curb and Gutter Elimination
- 6-16 Curb Cuts
- 6-17 Surface Roughening
- 6-18 Manufactured BMP Systems

Chapter 7 - Incentives to Utilize LID for Stormwater Management

- 7-1 Environmental Incentives
- 7-2 Financial Incentives
- 7-3 Other Incentives



FUTURE CONSIDERATIONS

- New Stormwater Management regulations
 water quality
- Maintenance Chapter Model Maintenance Agreement Phasing
- Erosion & sediment control
- Retrofitting
- Long driveways with steep slopes
- Stream buffers as a BMP & other BMP's



Questions?

