




STORMWATER MANAGEMENT PRINCIPLES AND MODEL ORDINANCE

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Stormwater Management Principles

- Reduce Site Runoff
- Maximize Use of Natural Drainage
- Provide Pre-Treatment of Runoff
- Treat Water Quality Storm

Reduce Site Runoff & Maximize Natural Drainage

- Minimize Impervious Areas
- Maximize Vegetated Areas
- Maximize Open Space
- Avoid Storm Sewers
- Infiltrate Stormwater Runoff
- Maintain Natural Features



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Source: MDE



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Objectives

- No Net Increase in Nonpoint Source Pollution
- No Net Increase in Runoff Rates
- No Net Increase in Runoff Volume

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Key Elements

- **Integrate Into Regional Plan**
- **Use Nonstructural Practices First**
- **Infiltrate the Water Quality Storm**
- **Control Runoff at Source**
- **Use Stormwater Treatment Trains**
- **Minimize Concentrating Stormwater**

Stormwater Management Ordinance

Infiltration Options

- Infiltrate Water Quality Storm
- Buy Private Land-Keep As Open Space
- Mitigate on Other Developed Land
- Fund Stormwater Controls Elsewhere

Stormwater Management Ordinance

Stormwater Management Manual

- Separate Manual - Linked to Ordinance
- Goals & Objectives & Procedures
- Description of BMPs
- Design Criteria
- References

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Percentage Change in Various Quantities from a Conventional Site Design with BMPs to an Innovative Site Design with BMPs

<i>Development Scenarios</i>	<i>Medium Density Residential</i>	Rural Subdivision	Shopping Center	Office Park
<i>Percentage Change from a Conventional Design</i>				
Impervious Cover	-24%	-35%	-18%	-22%
Stormwater Runoff	-25%	-23%	-17%	-21%
Stormwater Infiltration	+55%	+12%	-2%	+42%
Phosphorus Output	-60%	-50%	-46%	-47%
Nitrogen Output	-45%	-46%	-43%	-45%
Development Cost	-20%	-12%	-5%	-17%



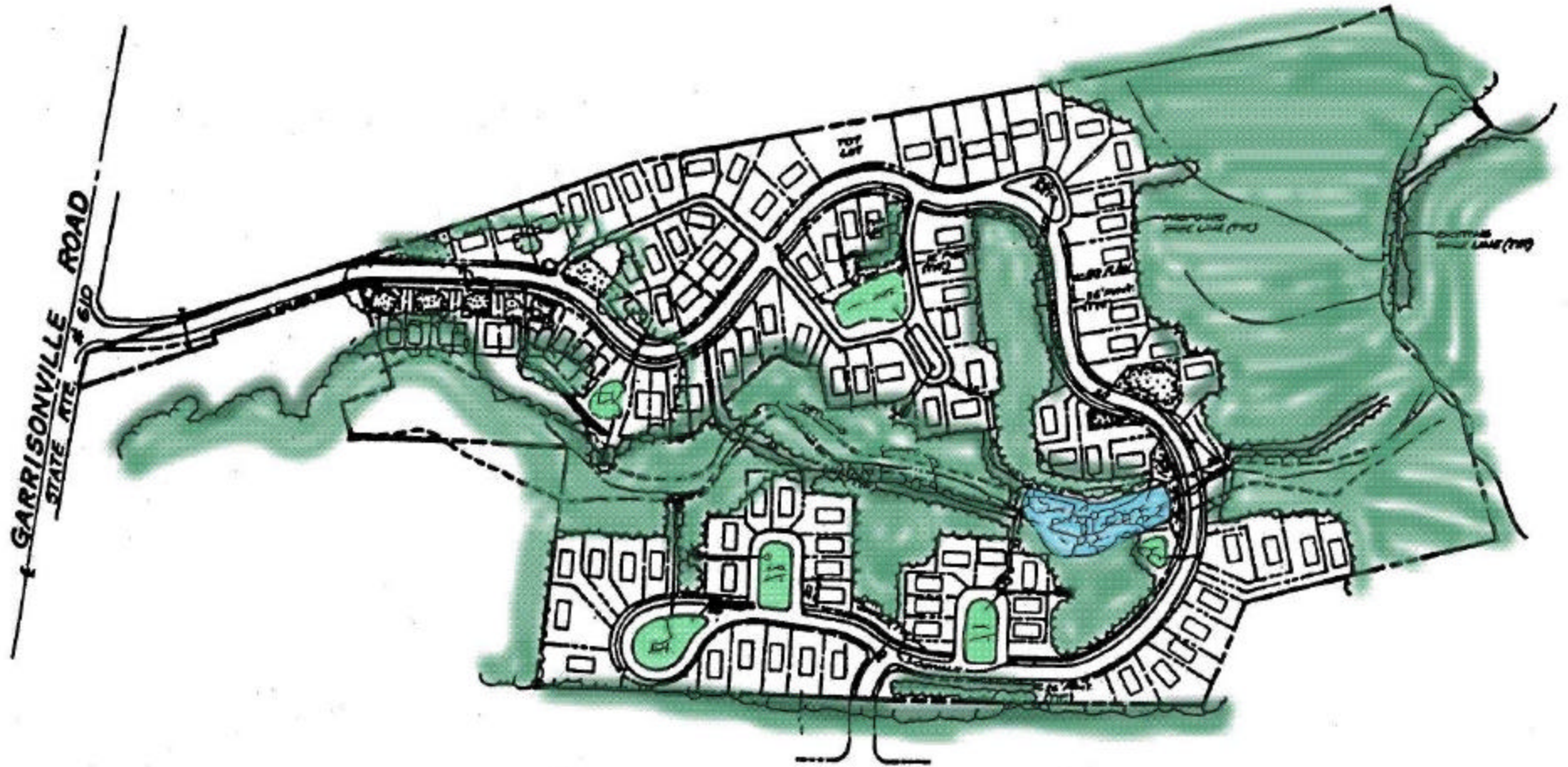
Medium Density Residential Site: Conventional Design

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Source: Center for Watershed Protection

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Medium Density Residential Site: Innovative Design

MEDIUM DENSITY RESIDENTIAL SITE

Site Features

	<u>Conventional</u>	<u>Innovative</u>
Open Space	11 Acres	20 Acres
Impervious Cover	12 Acres	9 Acres
Paving	7 Acres	4 Acres
Road Widths	34' 26'	26'
Stormwater Management	Dry Basin	Wet Pond Bioretention

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MEDIUM DENSITY RESIDENTIAL SITE



Natural Features

Conventional

Innovative

Forest Area

5 Acres

19 Acres

Wetlands Impacted

0.88 Acres

0.23 Acres

Stream Impacted

1150 Feet

300 Feet

MEDIUM DENSITY RESIDENTIAL SITE

Nonpoint Source Features

	<u>Conventional</u>	<u>Innovative</u>
Stormwater Runoff	11 in/yr	9 in/yr
Infiltration	3 in/yr	5 in/yr
Phosphorus Load	24 lb/yr	10 lb/yr
Nitrogen Load	191 lb/yr	188 lb/yr

MEDIUM DENSITY RESIDENTIAL SITE

Development Costs

	<u>Conventional</u>	<u>Innovative</u>
Infrastructure	\$1,390,000	\$993,000
BMPs	\$149,000	\$245,000
Landscaping	0	950
Total	\$1,539,000	\$1,239,000

SUMMARY

Stormwater Management Principles

- * Less Impervious Cover
- * Little or No Storm Sewers
- * More Open Space

Stormwater Management Ordinance

- * Control Runoff Quantity, Quality, Volume
- * Incorporate Stormwater Principles

Better Environment

- * Lake & Stream Water Quality
- * Natural Open Space
- * Recreation
- * Aesthetics
- * “A Better Place to Live”

Stormwater Management Ordinance References

- Great Swamp Watershed Management Plan, F. X. Browne, Inc., 1998
- Nutrient Loading from Conventional and Innovative Site Development, Center for Watershed Protection, 1999

Stormwater Information

For More Information on Stormwater
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