Center for Watershed Protection

- Non-membership, nonprofit 501(c)3
- Work nationally with various organizations
- Provide technical information on protecting and restoring urban watersheds:
  - Watershed Planning
  - Stormwater Management
  - Better Site Design
  - Watershed Restoration and Research
- Publications & Techniques
I. Watershed Planning
1. Basic Concepts in Watershed Planning
2. Economics of Watershed Protection
3. The Tools of Watershed Protection
4. Watershed Protection Audit Form
5. Hartford Model Development Principles - Consensus Document

II. Stormwater Management
6. Center for Watershed Protection Model Stormwater Ordinance
7. Code and Ordinance Worksheet
8. Steps of Stormwater Retrofitting
9. Retrofit Field Form
10. Stormwater Reference List - Website Directory

III. Better Site Design
11. Introduction to Better Site Design

Part 1 of a 2-part series on stormwater management and watershed planning:

Stormwater Management in Context: Exploring the Technical Tools of Watershed Protection
Friday, November 7
Kimbel Lodge on Hobcaw Barony
Georgetown, SC

Center for Watershed Protection
• **Regulatory Drivers**
  - NPDES Phase II
  - 303(d) listings
  - 319 and 6217 CNPSP
  - SC Pollution Control Act
  - Drinking Water Act
  - Wetlands, CAFOs, OSDS, etc

• **Economic Drivers**
  - Recreation/tourism
  - Shellfish

• **Community Drivers**
  - Heritage
  - Habitat protection
  - Research
  - State and local entities

*Center for Watershed Protection*
Partner Gumbo

- EPA
- NOAA
- ACoE
- SC DHEC
- SC DNR
- NERRs
- Utilities

- COG
- CCU, USC, CU
- Sea Grant
- SCCL, TNC, Sierra Club
- NAHB & local Chapters
- Local Public Works, Planning

Center for Watershed Protection
Efficiency in Land Use

- Watershed Planning
  - One piece of local land use puzzle
  - Management scales
  - Comprehensive elements

- Better Site Design
  - Using Impervious Cover

- Stormwater Management
  - Water quality and control
  - New and old development

- Capitalizing on Phase II
What is a Watershed Plan?

- Customized road map
- Lays out a comprehensive, prioritized approach (8 tools)
- Achieve specific, local watershed protection/restoration goals
- Component of community comprehensive plan
- Tool for soliciting implementation $
- Tool for integrating existing programs
Watershed Plan Elements

• Local initiative at watershed scale
• Stakeholder Input
• Local Program Audits
• Mapping and Field Assessments
  – Current and future
• Baseline and Special Study Reports (tech memos)
• Final Management Plan
  – Goals and recommendations (who, what, when…)
  – 8 tools
  – Restoration and protection priorities
  – Implementation budget/schedule

Time and cost

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Pee Dee River Basin (7500 sq mi)

Waccamaw River/AIWW Basin (976 sq mi)

Kingston Lake Watershed (130 sq mi)

Brown Swamp Subwatershed (15 sq mi)

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The 8 Tools of Watershed Protection

1. Land Use Planning
2. Land Conservation
3. Aquatic Buffers
4. Better Site Design
5. Erosion & Sediment Control
6. Stormwater Management
7. Non-Stormwater Discharges
8. Watershed Stewardship
Planning Resources

- Rapid, 1998 [www.cwp.org](http://www.cwp.org)
- WURM, 2004
- Watershed Protection Audit
- Practice of Watershed Protection
- James City County, VA

- SAMP
- 319 funding
- Phase II
- Comp Plans

$\text{Center for Watershed Protection}$
What is BSD?

Approach to new residential & commercial site design that seeks to:

- Reduce the amount of impervious cover
- Increase the natural lands set aside for conservation
- Use pervious areas for more effective stormwater treatment
- Achieve a marketable, cost-effective product
BSD Principles Do Not Address Where Development Occurs

BSD Principles Address How Development Occurs
Conventional Subdivision

Open Space Subdivision

Center for Watershed Protection
# Redesign Analysis of Conventional & Open Space Subdivisions

<table>
<thead>
<tr>
<th>Residential Subdivision</th>
<th>Base Zoning (acre lots)</th>
<th>% Change in Site Impervious Cover</th>
<th>% Change in Stormwater Runoff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remlick Hall</td>
<td>5</td>
<td>- 31%</td>
<td>- 20%</td>
</tr>
<tr>
<td>Duck Crossing</td>
<td>3-5</td>
<td>- 35%</td>
<td>- 23%</td>
</tr>
<tr>
<td>Tharpe Knoll</td>
<td>1</td>
<td>- 46%</td>
<td>- 44%</td>
</tr>
<tr>
<td>Chapel Run</td>
<td>1/2</td>
<td>- 41%</td>
<td>- 31%</td>
</tr>
<tr>
<td>Pleasant Hill</td>
<td>1/2</td>
<td>- 58%</td>
<td>- 54%</td>
</tr>
<tr>
<td>Prairie Crossing</td>
<td>1/2 - 1/3</td>
<td>- 20%</td>
<td>- 66%</td>
</tr>
<tr>
<td>Rappahannock</td>
<td>1/3</td>
<td>- 24%</td>
<td>- 25%</td>
</tr>
<tr>
<td>Buckingham Greene</td>
<td>1/8</td>
<td>- 7%</td>
<td>- 8%</td>
</tr>
<tr>
<td>Belle-Hall</td>
<td>High Density</td>
<td>- 43%</td>
<td>- 31%</td>
</tr>
</tbody>
</table>

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## Projected Construction Cost Savings for Open Space Designs

<table>
<thead>
<tr>
<th>Residential Subdivision</th>
<th>% Construction Cost Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duck Crossing</td>
<td>12%</td>
</tr>
<tr>
<td>Rappahannock</td>
<td>20%</td>
</tr>
<tr>
<td>Pleasant Hill</td>
<td>43%</td>
</tr>
<tr>
<td>Remlik Hall</td>
<td>52%</td>
</tr>
<tr>
<td>Tharpe Knoll</td>
<td>56%</td>
</tr>
<tr>
<td>Buckingham Greene</td>
<td>63%</td>
</tr>
<tr>
<td>Chapel Run</td>
<td>64%</td>
</tr>
<tr>
<td>Canton, Ohio</td>
<td>66%</td>
</tr>
</tbody>
</table>

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Whittaker Island at Governor’s Land
A medium-density residential case study

• Pre-Development
  – 122.6 acres
  – bordered by James and Chickahominy Rivers
  – Tidal marsh, meadow, and mature forest

• Case Study Design
  – Designed and developed through the 1980s and early 1990s
  – 82 lots ranging in size from 1/3 to 1.75 acres
  – 49% of site is conserved forests and wetlands
BSD principles used:

- Native plants & tree conservation
- Minimized clearing and grading
- Open space design
- Smaller setbacks and frontages
- Common walkways
- Narrower streets
- Smaller cul-de-sacs

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Efficient Pedestrian Walkways
Notice tree retention at entrance
## Site Imperviousness

<table>
<thead>
<tr>
<th></th>
<th>Pre-Development</th>
<th>Status Quo</th>
<th>Case Study</th>
<th>% Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driveways (acres)</td>
<td>N/A</td>
<td>1.27</td>
<td>0.96</td>
<td>24.4%</td>
</tr>
<tr>
<td>Street (acres)</td>
<td>N/A</td>
<td>5.81</td>
<td>4.92</td>
<td>15.3%</td>
</tr>
<tr>
<td>Total Imp Area (acres)</td>
<td>1.3</td>
<td>15.34</td>
<td>11.99</td>
<td>21.7%</td>
</tr>
<tr>
<td>Total Imperviousness (%)</td>
<td>1.0</td>
<td>12.5</td>
<td>9.8</td>
<td>21.7%</td>
</tr>
</tbody>
</table>
Whittaker Island at Governor’s Land
A medium-density residential case study

## Stormwater Impacts

<table>
<thead>
<tr>
<th></th>
<th>Pre-Development</th>
<th>Status Quo</th>
<th>Case Study</th>
<th>% Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Runoff (inches/yr)</strong></td>
<td>2.3</td>
<td>6.3</td>
<td>5.4</td>
<td>14.3%</td>
</tr>
<tr>
<td><strong>Infiltration (inches/yr)</strong></td>
<td>6.0</td>
<td>4.7</td>
<td>5.0</td>
<td>6.4%</td>
</tr>
<tr>
<td><strong>Nitrogen (lbs/yr)</strong></td>
<td>84.3</td>
<td>389.3</td>
<td>321.3</td>
<td>17.5%</td>
</tr>
<tr>
<td><strong>Phosphorus (lbs/yr)</strong></td>
<td>10.6</td>
<td>43.9</td>
<td>36.6</td>
<td>17.3%</td>
</tr>
</tbody>
</table>
Whittaker Island at Governor’s Land
A medium-density residential case study

<table>
<thead>
<tr>
<th>Infrastructure Costs</th>
<th>Status Quo</th>
<th>Case Study</th>
<th>% Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrastructure Costs</td>
<td>$1,780,000</td>
<td>$1,524,000</td>
<td>14.4%</td>
</tr>
<tr>
<td>Landscaping / Reforestation</td>
<td>$7,500</td>
<td>$4,500</td>
<td>40.0%</td>
</tr>
<tr>
<td>Total Infrastructure Costs</td>
<td>$1,787,500</td>
<td>$1,528,500</td>
<td>14.5%</td>
</tr>
</tbody>
</table>
Resources for BSD

- COW
- Local Site Planning Roundtable
- Builders for the Bay
- VA BSD
- Harford County, MD
- Jordan Cove, CT

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Consensus across diverse interests

Deer Creek Watershed Association

Director of Planning

President of local homebuilders chapter

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Stormwater Management

- Stormwater is managed by practices that temporarily store runoff and remove pollutants

- Goals:
  - Maintain recharge & groundwater quality
  - Reduce stormwater pollutant loads
  - Protect stream channels
  - Prevent increased overbank flooding
  - Safely convey extreme floods

- New development versus existing development

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Stormwater Management for New Development

- Local ordinances set forth stormwater management criteria
  - Applicability / Waivers
  - Stormwater Sizing Criteria
  - Reference to a Technical Manual
  - Application Requirements
  - Plan Elements
  - Inspection/ Maintenance Requirements
  - Enforcement Procedures

- Constructed by developer as part of a development project by developer
Stormwater Sizing Criteria to set forth in Stormwater Ordinances

- Runoff Reduction *
- Groundwater Recharge Criteria *
- Water Quality Criteria
- Channel Protection Criteria
- Overbank Flood Protection Criteria
- Extreme Flood Control and Flood Plain Expansion Criteria *

* can be at least partially fulfilled by better site design practices
Motivation to Update Stormwater Ordinances…
NPDES MS4 Permit Program – Phase II

Who is Covered?

- Communities with pop. of more than 50K and a density greater than 1,000 people/sq mi. States assess whether communities from 10K to 50K should be covered, based on certain criteria.
NPDES MS4 Permit Program—What it Means

What is Required?

- Public education/outreach
- Public participation/ involvement
- Illicit discharge detection
- Construction site runoff control
- Post-construction runoff control
- Pollution prevention

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NPDES Requirements

“Your NPDES MS4 permit will require at a minimum that you develop, implement and enforce a stormwater management program designed to reduce the discharge of pollutants from your MS4 to the maximum extent practicable to protect water quality and to satisfy the appropriate water quality requirements of the Clean Water Act.”

Provides flexibility to create a stormwater management program that will address specific, local issues.
Key Stormwater Choices for the Watershed Manager

- Determine the most effective mix of structural and non-structural management practices that can meet the subwatershed goals
- Which hydrologic variables do we want to manage in the subwatershed?
- What are the primary stormwater pollutants of concern?
- Which management practices should be avoided because of their environmental impacts?
- What is the most economical way to provide stormwater management?
- Which stormwater management practices are the least burdensome to maintain with local budgets?

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Stormwater Management Considerations for Coastal Areas

- Attack human wastewater sources first
  - Illicit discharges, SSOs, CSOs
  - Failing septic systems
- Stormwater-friendly shoreline development
  - Better Site Design
- Design stormwater practices to maximize bacteria & nitrogen removal
  - Maximum on-site filtration with pretreatment
  - Utilize soil filtration and infiltration
  - Provide long residence time for coliform to die off
  - Design ponds for high light conditions and long retention
  - Do not use wet swales as primary STP - may be a source
- Source control for pets, geese, and Clemson Fans

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Stormwater Management for Developed Areas

- Retrofits are stormwater management measures inserted in an urban or ultra-urban landscape where little or no prior stormwater controls existed.
- Stormwater retrofit inventory completed as part of a watershed management plan.
What are Typical Goals of Stormwater Retrofitting?

- Enhance aquatic habitat &
- Minimize accelerated channel erosion
- Improve water quality
- Reduce flood peaks and volumes
- Provide groundwater recharge
- Educate the public
- Correct past mistakes

Goals Determined During the Watershed Planning Process
Offsite Storage
- Existing stormwater practices
- Upstream of existing road culverts
- Below storm drain outfalls
- Highway rights-of-way, cloverleaves

Onsite Nonresidential
- Within large parking lots
- Streets, courtyards and plazas
- Industrial or commercial rooftops

Onsite Residential
- Residential subdivisions – roofs, yards, and driveways
Subwatershed 207
Welcome to the Stormwater Manager's Resource Center!

The Stormwater Manager's Resource Center is designed specifically for stormwater practitioners, local government officials and others that need technical assistance on stormwater management issues. Created and maintained by the Center for Watershed Protection, the SMRC has everything you need to know about stormwater in a single site.

Watershed Protection Library
Stormwater Slideshows
Manual Builder
Ordinance Selector
Monitoring & Assessment
Pollution Prevention
Resource Protection Templates
Assorted Fact Sheets
By Category
Glossary

Do you need to start a stormwater or watershed protection program from scratch? Well, you'll probably need to write a local ordinance to make it happen. Make your life easier by adapting one of the 30 model ordinances we provide here for stormwater management, erosion and sediment control, stream buffers, and other important topics.