Introduction to Better Site Design

www.cwp.org
www.stormwatercenter.net

2.5.2002
The 8 Tools of Watershed Protection

1. Watershed 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
What is BSD?

Approach to 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
Why Better Site Design?

WATER BALANCE

PRE-DEVELOPMENT
- Evapotranspiration
- Canopy Interception
- Surface Runoff
- Baseflow

POST-DEVELOPMENT
- Transpiration
- Surface Runoff
- Interflow
- Baseflow
BSD Principles Do Not Address Where Development Occurs

BSD Principles Address How Development Occurs

Site Plan

Zoning Map
22 Development Principles

- Residential streets & parking lots
- Lot design
- Natural Areas
Residential Streets & Parking Lots

1. Street Width
2. Street Length
3. ROW Width
4. Cul-de-Sacs
5. Vegetated Open Channels
6. Parking Ratios

7. Parking Codes
8. Parking Lot Design
9. Structured Parking
10. Parking Lot Runoff
PRINCIPLE NO. 1
Reduce Residential Street Width

◊ Design residential streets for minimum pavement width needed to support
  – travel lanes
  – on-street parking
  – emergency, maintenance, and service vehicle access.

◊ Street widths should be based on traffic volume.
PRINCIPLE NO. 4
Minimize Cul-de-Sacs

- Minimize # of cul-de-sacs and incorporate landscaped areas to reduce their impervious cover.
- The radius should be minimum needed for emergency and maintenance vehicles.
- Considered alternative turnarounds.
PRINCIPLE NO. 5 Use Vegetated Open Channels
PRINCIPLE NO. 6
Lower Parking Ratios

- The required parking ratio for a land use should be enforced as both a maximum and a minimum in order to curb excess parking.
- Existing parking ratios should conform to local and/or national rates.
PRINCIPLE NO. 8
Reduce Parking Lot Imperviousness

- Reduce the IC of parking lots by providing
  - compact car spaces,
  - minimizing stall dimensions,
  - incorporating efficient parking lanes
  - using pervious materials in spillover areas.
Reality Check
Lot Development

11. Open Space Developments
12. Setbacks and Frontages
13. Sidewalks
14. Driveways
15. Open Space Management
16. Rooftop Runoff
PRINCIPLE NO. 11
Open Space Design Options

- Advocate open space development that incorporates smaller lot sizes to
  - minimize total impervious area,
  - conserve natural areas,
  - provide community space,
  - and promote watershed protection.
Relax Front Setbacks

Relax Frontages & Side Setbacks
Utilize pervious materials ...
Conservation of Natural Areas

17. Aquatic Buffers
18. Buffer Maintenance
19. Clearing and Grading
20. Tree Conservation
21. Conservation Incentives
22. Stormwater Outfalls
Conservation Incentives and Flexibility

- By-right open space development
- Density compensation
- Stormwater credits
- Buffer averaging
- Property tax credit
- Density bonus
- Transferable development rights
- Off-site mitigation
Reality Check
## 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>
# 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>
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
Efficient Pedestrian Walkways
Notice tree retention at entrance
Note tree retention; use of curb and gutter
One-way loop de lane (12 ft width)
### 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

## Infrastructure Costs

<table>
<thead>
<tr>
<th></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><strong>Total Infrastructure Costs</strong></td>
<td><strong>$1,787,500</strong></td>
<td><strong>$1,528,500</strong></td>
<td><strong>14.5%</strong></td>
</tr>
</tbody>
</table>
Belle Hall, SC

http://www.doverkohl.com/project_graphic_pages_pfds/Belle%20Hall%20project%20page.pdf

http://www.scdhec.net/ocrm/HTML/belle.html#Development%20Cost
$599,000

$213,000

$424,900

30% Less Runoff
73% Less Sediment
69% Less Nitrogen
66% Less Phosphorus
Somerset
An early LID site in PG County, MD
www.lowimpactdevelopment.org
Somerset Model Development Principles Used

- Vegetated open channels
- Rooftop runoff to pervious areas
- Flexible use of sidewalks
Somerset

- Small reduction in sediment and TN
- Reduction in runoff from smaller events
- Increase in TP

- developer saved $300,000 in storm pond construction costs, gained 6 additional lots, and reduced finished lot cost by $4K.

- Compared to a site without traditional BMPs
Jordan Cove, CT
A paired watershed innovative residential site design and a traditionally developed

http://www.canr.uconn.edu/jordancove/
Model Development

Principles Used

- Vegetated open channels
- Rooftop runoff to pervious areas
- Flexible use of sidewalks
- Street width/ setbacks
- Street length
- Cul-du-sac island
- Open space
- Buffer systems
- Clearing and grading
- Tree conservation
Jordan Cove

- Paired watershed study
- Low impact development can reduce stormflow – however it can increase pollutant concentrations during early phases of the project if not installed properly
- Traditional development tends to increase flow and pollutant transport (even if concentrations do not increase)
- Reduced runoff by 90%
SEA Streets
Runoff attenuation Seattle, WA

Model Development
Principles Used

- Vegetated open channels
- Rooftop runoff to pervious areas
- Flexible use of sidewalks
- Street width
- Tree conservation

http://www.cityofseattle.net/util/SEAstreets/tour.htm
SEA Streets

- Retrofit – Before and After Study
- Reduced total runoff by 98% over the project period
- Treated 2.3 acres
- Cost $244,000+
How Can We Implement Better Site Design in Our Community?

Conduct a Local Site Planning Roundtable
TAKE THE COW!

Codes and

Ordinances

Worksheet

Evaluates:

• General ability to support BSD
• How flexible your current codes are
• What specific rules are in need of change
Codes and Ordinances Worksheet

1. Street Width
   a. What is the minimum pavement width allowed for streets in low density residential developments that have less than 500 average daily trips (ADT)?

   If the answer is between 18-22 feet, award 4 points

   4

   b. At higher densities are parking lanes allowed to also serve as traffic lanes (i.e., queuing streets)?

   If the answer is YES, award 3 points

   3

2. Street Length
   a. Do street standards promote the most efficient street layouts that reduce overall street length?

   If the answer is YES, award 1 point

   0

3. Right of Way Width
Harford County Final COW Score:

**SCORING** (A total of 100 points are available):

See Page 10 to determine where your community’s score places in respect to the site planning roundtable Model Development Principles:

**Final Score 62 / 100 points**

<table>
<thead>
<tr>
<th>Your Community’s Score</th>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>90-100</td>
<td>Congratulations! Your community is a real leader in protecting streams, lakes, and estuaries. Keep up the good work.</td>
</tr>
<tr>
<td>80-89</td>
<td>Your local development rules are pretty good, but could use some tweaking in some areas.</td>
</tr>
<tr>
<td>79-70</td>
<td>Significant opportunities exist to improve your development rules. Consider creating a site planning roundtable.</td>
</tr>
<tr>
<td>60-69</td>
<td>Development rules are inadequate to protect your local aquatic resources. A site planning roundtable would be very useful.</td>
</tr>
<tr>
<td>less than 60</td>
<td>Your development rules definitely are not environmentally friendly. Serious reform of the development rules is needed.</td>
</tr>
</tbody>
</table>
How Well Does Your Community Stack Up?

- **Blue**: 80-89
- **Green**: 70-79
- **Yellow**: 60-69
- **Red**: 60 and below
Consensus across diverse interests

Deer Creek Watershed Association

Director of Planning

President of local homebuilders chapter
Generate specific code change recommendations

# 4. Reduce total length of residential streets by examining alternative street layouts to determine the best option for increasing the number of homes per unit length.

The Roundtable members endorse this principle with the following recommendation:

1. Encourage designers to routinely examine alternative layouts by modifying Roadway Design Standards, Part III(C), pg R-12, as follows:

   These modifications may be appropriate for roadway alignments that preserve existing natural areas, buffers for width and section adjustments that complement rural character and/or flexible design criteria, or for the use of traffic calming measures to increase pedestrian activity through reduced speed. The goal is to provide, in limited situations at the discretion upon approval of the Director of Public Works, alternatives to the regulations of the Road Code if the plan meets the following objectives:

   1) The proposed street layout provides a circulation network for reduced traffic congestion or improved neighborhood connectivity.
   2) Road sections and streetscapes are designed to reduce traffic speeds, reduce visual impact of parking areas, and promote pedestrian safety.
   3) Vehicular and pedestrian connections are provided to existing, or proposed, community retail, civic and recreation facilities.
   4) The proposed street layout reduces total street length and impervious cover, and maximizes the number of homes per unit length.

2. Review existing roadway, sidewalk, and pedestrian walkway standards for opportunities to promote or provide incentives for greater neighborhood connectivity.