Agenda: Module 4

REVIEW

EXAMPLE 1
Presentation Goals

Goals

- Review site plans and stormwater management report
- Identify any errors with the design

Determining Applicable Design & Performance Standards

Does the Development

- Trigger the municipality’s SCO?
- Disturb one acre or more?
- Increase impervious coverage by ¼ acre or more?

Determining Applicable Design & Performance Standards

Municipal Stormwater Control Ordinance:

- Major Development:

   Any development that provides for ultimately disturbing one or more acres of land or more than 10,000 square feet of new impervious surface.
Familiarize Yourself with the Site

Where are the pre-construction conditions?
- Important in determining the requirements
- Existing land cover
- Has the existing land cover existed for the past 5 years?

Pre-Development Site

Stormwater Management Report

<table>
<thead>
<tr>
<th>Existing Coverage</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Coverage Type</td>
<td>Area</td>
</tr>
<tr>
<td>Woods</td>
<td>19.71 acres</td>
</tr>
<tr>
<td>Open space</td>
<td>0.95 acres</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Proposed Coverage</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Coverage Type</td>
<td>Area</td>
</tr>
<tr>
<td>Road, Roof, Driveway</td>
<td>5.50 acres</td>
</tr>
<tr>
<td>Open space</td>
<td>8.25 acres</td>
</tr>
<tr>
<td>Woods</td>
<td>6.91 acres</td>
</tr>
</tbody>
</table>
Post-Development Site

Disturbance & Increase in Impervious Area

- Total Disturbance: 13.5 acres
- Increase in impervious area: 5.5 acres
- Is the site a major development? Yes

Determining Applicable Design & Performance Standards

Which standards are required?

- Water Quantity
  - Required
- Water Quality
  - Increase in impervious coverage > 0.25 acre
  - Required
- Groundwater Recharge
  - Planning Area 1 – Not "previously developed"
  - Required
- Nonstructural
  - Required for all major developments
Nonstructural Strategies Used

What nonstructural measures were provided?

- Maximize the protection of natural drainage features and vegetation (#3)
- Minimize land disturbance including clearing and grading (#5)
- Minimize soil compaction (#6)

Nonstructural Strategies Used

What nonstructural measures were provided?

- Minimize impervious surface or disconnect the flow of runoff over impervious surfaces (#2)
- Provide low maintenance landscaping that encourages retention and planting of native vegetation that minimizes the use of lawns, fertilizers, and pesticides (#7)
Proposed Structural BMPs

Infiltration Basin
- Lower area of BMP is infiltration area
  - 6,000 square feet
- Upper area of BMP to remain as woods

Soil Testing

Infiltration basin
- 6,000 square foot infiltration area
  - Required – 2 soil profile pits in infiltration area
  - Provided – 1 soil profile pit in infiltration area
    - 4 soil profile pits nearby
  - Also need determination of permeability
    - Used undisturbed tube permeameter tests - Acceptable

Basin Detail
Test Pit #4

Test Pit #5

Test Pit Summary

<table>
<thead>
<tr>
<th>Test Pit</th>
<th>SHWT Elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP #1</td>
<td>9.5 ft</td>
</tr>
<tr>
<td>TP #2</td>
<td>9.0 ft</td>
</tr>
<tr>
<td>TP #3</td>
<td>9.5 ft</td>
</tr>
<tr>
<td>TP #4</td>
<td>9.4 ft</td>
</tr>
<tr>
<td>TP #5</td>
<td>9.5 ft</td>
</tr>
</tbody>
</table>
Basin Detail

Permeability Test

Infiltration Rate Summary

<table>
<thead>
<tr>
<th>Test Pit</th>
<th>Permeability Results (in/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP #1</td>
<td>2.67 (A)</td>
</tr>
<tr>
<td>TP #2</td>
<td>0.28 (A)</td>
</tr>
<tr>
<td>TP #3</td>
<td>6.54 (A)</td>
</tr>
<tr>
<td>TP #4</td>
<td>2.45 (A)</td>
</tr>
<tr>
<td>TP #5</td>
<td>12.73 (A)</td>
</tr>
</tbody>
</table>
Test Pit #2

Soil Replacement

Drain Time

- 6 inch orifice @ 13.2 ft
- Bottom of basin @ 12.0 ft
- Ponding depth 1.2 ft
- Infiltration rate = 1in/hr
- Drain Time = 14.4 hr
For example purposes only; use published default values from the guidance document.

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For example purposes only; use published default values from the guidance document.
Infiltration Basin Requirements

- Distance from SHWT > 2 ft
  - Distance = 2 ft
- Infiltration rate > 1 in/hr
  - Soil Replacement
- Max. standing water depth < 2 ft
  - 6 in orifice @ 13.2 ft, basin bottom 12.0 ft
- Infiltrate water quality storm
  - WQDS elevation = 12.5 ft
  - Recharge design storm elevation = 13.2 ft
- Drain Time (with mounding analysis) < 72 hr
  - BMP merits 80% TSS removal rate

Water Quantity

<table>
<thead>
<tr>
<th>Design Storm</th>
<th>Pre-developed Onsite Peak Runoff (cfs)</th>
<th>Pre-developed Offsite Peak Runoff (cfs)</th>
<th>Allowable Onsite Peak Runoff (cfs)</th>
<th>Allowable Total Peak Runoff (cfs)</th>
<th>Proposed Total Peak Runoff (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-year</td>
<td>2.3</td>
<td>1.5</td>
<td>1.15</td>
<td>2.65</td>
<td>2.5</td>
</tr>
<tr>
<td>10-year</td>
<td>12.9</td>
<td>3.7</td>
<td>9.675</td>
<td>13.375</td>
<td>5.1</td>
</tr>
<tr>
<td>100-year</td>
<td>48.5</td>
<td>9.6</td>
<td>38.8</td>
<td>48.4</td>
<td>34.7</td>
</tr>
</tbody>
</table>

What to check? (NRCS Method Used)

- Do the numbers in the table match calculation results?
- Were pervious and impervious calculated separately?
- Is the rainfall depth/distribution correct?
- Are the Times of Concentration correct?
- Do the land covers/HSGs match the field?
- Was the appropriate unit hydrograph used?
- Does the basin model match the plans (volume, outlets, etc.)?
- Was infiltration included in routings?
Water Quantity

Do the numbers in the table match results?

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<td>9.6</td>
<td>38.8</td>
<td>48.4</td>
<td>34.7</td>
</tr>
</tbody>
</table>

Water Quantity

Were pervious and impervious surfaces calculated separately?

- Easiest way to see this is usually the subcatchment diagram (ask for this if they haven’t provided it)

- Note that some programs may allow pervious and impervious on the same subcatchment but still calculate separately
Water Quantity

40

Water Quantity

41

Water Quantity

42

Were the correct rainfall depths/distribution used?

Calculations used:
Type III
2-year = 3.3 in
10-year = 5.2 in
100-year = 8.9 in
Water Quantity

Are the Tc calculations correct?

- Existing – 23.5 minutes
  
<table>
<thead>
<tr>
<th>Tc (min)</th>
<th>Width</th>
<th>Slopes</th>
<th>Velocity</th>
<th>Capacity (cfs)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>18.3</td>
<td>100</td>
<td>0.0500</td>
<td>0.69</td>
<td>5.2</td>
<td>Sheet Flow,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Woods, Light understory n= 0.400</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Shallow Concentrated flow,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Unpaved X= 15.19'</td>
</tr>
<tr>
<td>23.5</td>
<td>975</td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Proposed – 6 minutes for all impervious surfaces

Water Quantity

Do the land covers/HSGs match the field?

- What is the HSG?
  - They should have provided soil map
  - If not, visit the web soil survey

- Remember if web soil survey shows no HSG or defines the material on-site as fill, testing is required in accordance with appendix E to determine HSG

Water Quantity

Pink = HSG B
Green = HSG A/D
Gray = unknown HSG
Water Quantity

<table>
<thead>
<tr>
<th>Existing Coverage</th>
<th>Coverage Type</th>
<th>Area</th>
<th>Curve Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woods</td>
<td>19.71 acres</td>
<td>30/55</td>
<td></td>
</tr>
<tr>
<td>Open space</td>
<td>0.95 acres</td>
<td>39/61</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Proposed Coverage</th>
<th>Coverage Type</th>
<th>Area</th>
<th>Curve Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road, Roof, Driveway</td>
<td>5.5 acres</td>
<td>98/98</td>
<td></td>
</tr>
<tr>
<td>Open space</td>
<td>8.25 acres</td>
<td>39/61</td>
<td></td>
</tr>
<tr>
<td>Woods</td>
<td>6.91 acres</td>
<td>30/55</td>
<td></td>
</tr>
</tbody>
</table>

Water Quantity

Was the appropriate unit hydrograph used?
- Application used DelMarVa unit hydrograph
  - Site is in coastal plain
  - Site is largely undisturbed
  - No steep slopes

- Can DelMarVa be used in proposed conditions too?
  - Yes, just not when sizing MTDs

Water Quantity

Does the basin model match the plans?
- Outlet structure

<table>
<thead>
<tr>
<th>Design</th>
<th>Routing</th>
<th>Invert</th>
<th>Outlet Device</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>Primary</td>
<td>0.05</td>
<td>8.16&quot; x 31.7&quot; long 36&quot; Culvert</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>GPF square edge headwall, H=0.500</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Outlet Knee 3.75&quot; S=0.0025 T</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Curved 0.003</td>
</tr>
<tr>
<td>#2</td>
<td>Divver 1</td>
<td>13.00</td>
<td>4.87&quot; x 4.07&quot; Horiz.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Type E Grate X 4.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Limited to weir flow</td>
</tr>
<tr>
<td>#3</td>
<td>Divver 1</td>
<td>14.00</td>
<td>4.00&quot; x 4.00&quot; Horiz.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Type E Grate X 4.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Limited to weir flow</td>
</tr>
<tr>
<td>#4</td>
<td>Primary</td>
<td>14.00</td>
<td>3/4&quot; Lanced Valve, Or 3.10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Head (ft) 0.00 0.00 1.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Valve (ft) 20.00 21.00 27.20</td>
</tr>
</tbody>
</table>
Water Quantity

- Outlet structure

Does the basin model match the plans?

- Volume

<table>
<thead>
<tr>
<th>Volume</th>
<th>Invert</th>
<th>Axial Storage</th>
<th>Storage Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>12.00</td>
<td>270,250 cf</td>
<td>Custom Stage Data</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Elevation</th>
<th>Surf Area</th>
<th>Inc Store</th>
<th>Cum Store</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.00</td>
<td>36,439</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>13.00</td>
<td>40,250</td>
<td>41,383</td>
<td>41,383</td>
</tr>
<tr>
<td>14.00</td>
<td>72,800</td>
<td>56,498</td>
<td>100,986</td>
</tr>
<tr>
<td>15.00</td>
<td>84,940</td>
<td>78,465</td>
<td>173,476</td>
</tr>
<tr>
<td>16.00</td>
<td>97,505</td>
<td>90,063</td>
<td>270,250</td>
</tr>
</tbody>
</table>

Water Quantity

180 x 200 = 36,000 sq ft
Water Quantity

Does the basin model match the plans?

- Volume

<table>
<thead>
<tr>
<th>Elevation (ft)</th>
<th>Surf Area (sq ft)</th>
<th>Inc Store (cubic ft)</th>
<th>Cum Store (cubic ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.00</td>
<td>36,430</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>13.00</td>
<td>46,305</td>
<td>41,385</td>
<td>41,385</td>
</tr>
<tr>
<td>14.00</td>
<td>72,900</td>
<td>84,495</td>
<td>126,895</td>
</tr>
<tr>
<td>15.00</td>
<td>84,340</td>
<td>78,466</td>
<td>159,370</td>
</tr>
<tr>
<td>16.00</td>
<td>87,265</td>
<td>90,923</td>
<td>270,288</td>
</tr>
</tbody>
</table>

Water Quantity

200 x 480 = 96,000 sq ft
Water Quantity

Was infiltration used in the routings?

- Check outlet structure for infiltration, exfiltration, custom outlets, or discarded flow

<table>
<thead>
<tr>
<th>Device</th>
<th>Routing</th>
<th>Insert</th>
<th>Outlet Devices</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>Primary</td>
<td>9.932</td>
<td>34&quot; x 61.97 long 34&quot; Culvert</td>
</tr>
<tr>
<td>#2</td>
<td>Device 1</td>
<td>15.52</td>
<td>34&quot; x 9.74 Culvert headwall, Kern 0.50</td>
</tr>
<tr>
<td>#3</td>
<td>Device 1</td>
<td>15.52</td>
<td>34&quot; x 9.74 Culvert headwall, Kern 0.50</td>
</tr>
<tr>
<td>#4</td>
<td>Primary</td>
<td>14.82</td>
<td>34&quot; Broadmoor Valve, D=2.30</td>
</tr>
</tbody>
</table>

Water Quantity

Summary

- Need to fix detail of outlet structure on plan
- Otherwise everything looks OK

The water quantity requirement is met

Water Quality

- 5.5 acres of new impervious coverage
  - Only roadways, parking areas, etc. require treatment

Simplest thing to do is look back at the plans and determine if the entire roadway/parking network is directed to the basin
Post-Development Site

Water Quality

Summary
• Since BMP is granted 80% TSS removal rate
  \textbf{AND}
• All of the new roadway/parking/driveways drain to the BMP

\textbf{The water quality requirement is met}

Groundwater Recharge

Engineer has opted to infiltrate the difference in the 2-year storm
• Existing 2-year runoff volume = 40,825 cf
• Proposed 2-year runoff volume = 100,218 cf
• Difference = 59,393 cf
• Volume below lowest outlet = 59,400 cf
Maintenance Plan

- Responsible party – Developer
  - Will probably need updating after construction
- Preventative maintenance tasks and schedules – OK
- Cost estimates – OK
- Blank maintenance logs – OK
- Needs to be recorded on deed

Stormwater Management Report

Total Summary
- Nonstructural – OK, need to require restriction
- BMP Design – OK
- Water Quantity – OK, with change to outlet detail
- Water Quality – OK
- Groundwater Recharge – OK
- Maintenance Manual – OK

Meets the stormwater control ordinance and can be approved

Contact Information

Bureau of Nonpoint Pollution Control
Division of Water Quality
401 East State Street
PO Box 420, Mail Code 401-2B
Trenton, NJ 08625-420
Tel: 609-633-7021
www.njstormwater.org

Brian Salvo
Brian.Salvo@dep.nj.gov