Introduction to Stormwater Pollution Modeling: Terminology and Why Model?

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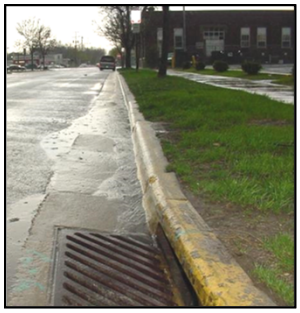
Topics to Cover:

- How is stormwater pollution quantified?
- Different Models for Different Rains
- Why use a model?
- Terminology



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How is stormwater pollution quantified?

Two components of stormwater pollution measurement:

- Volume (how much water)
- Concentration (pollution)

Reported as a "Pollution Load" over a time period

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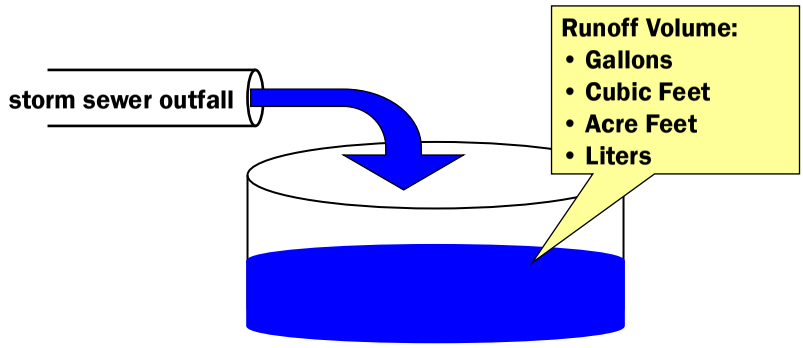
Volume

- A Single Rain Event or Multiple Events



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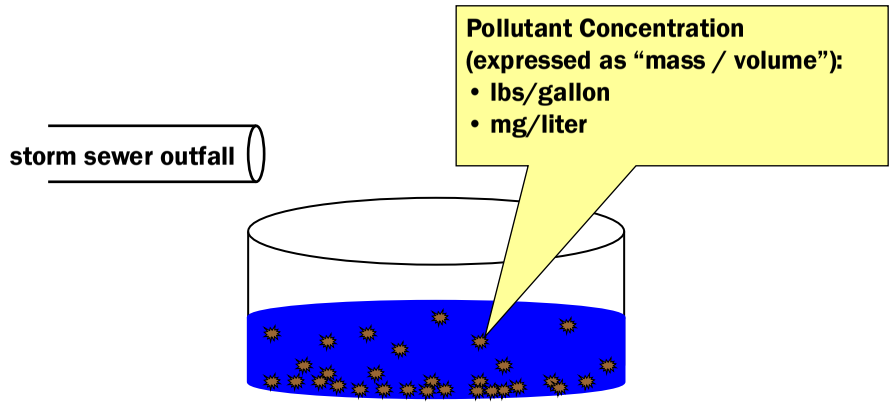
Pollutant Concentration



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How is stormwater pollution quantified?

Volume x Concentration = Pollutant Load

Example Calculation:

1. Say: runoff from a 1" rain over 1 ac. = 1,800 ft^3 (1/2" runoff)
2. Say: average sediment concentration = 50 mg/l (EMC)
3. Then: Event Sediment Load = 1,800 ft^3 x 50 mg/l

= 2.55 kg or 5.6 lbs. of sediment

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How is stormwater pollution quantified?

Volume x Concentration = Pollutant Load

How WinSLAMM Works:

1. Determine runoff volume from each source area for each rain event
2. Determine EMC for each source area and each rain event
3. Then do the math for each source area and rain event and sum
4. Results in Annual Pollutant Load (mass / area / year)

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Urban Stormwater Hydrology

- Annual / Continuous Rain – Not "Design" Events
- Urban Pollution and Runoff Volume Generated from Smaller - Medium, More Frequent Storms

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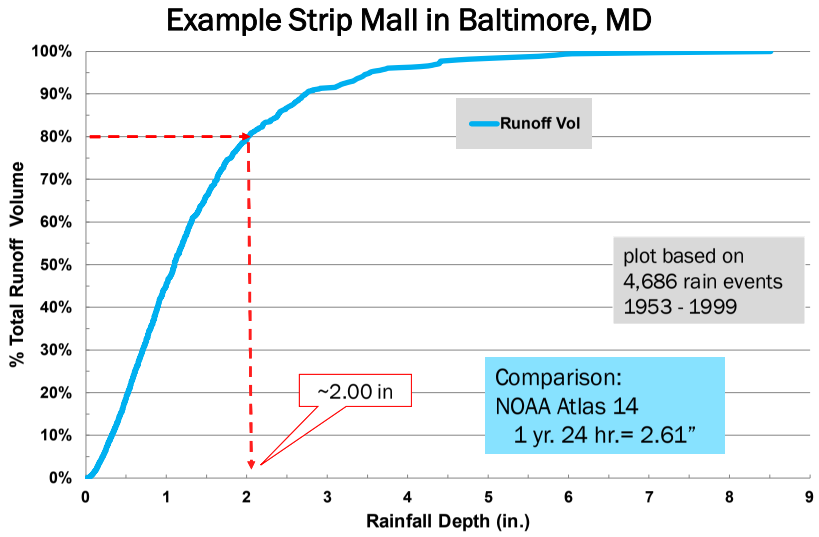
Rainfall vs Runoff Volume



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For Urban Stormwater Management – Different Rains Create Different Problems & Need Different Analytical Tools

Conveyance System Sizing

Bigger Rains:

- Infrequent
- Public Safety / Property Damage
- Design Storm
- Peak Flow
- Conveyance Size & Storage Needs
- Hydrology / Hydraulics Model (SWMM, etc.)

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For Urban Stormwater Management – Different Rains Create Different Problems & Need Different Analytical Tools

Urban Pollution Loading & Management

Medium and Small Rains:

- Frequent
- Pollution Loads, Channel forming
- Longer Term / Continuous Rain Input
- Source Area Controls & Outfall Controls
- Volume
- Peak Flow and Conveyance Less Important
- Runoff, & Pollutant Mass / Concentrations Model (WinSLAMM)

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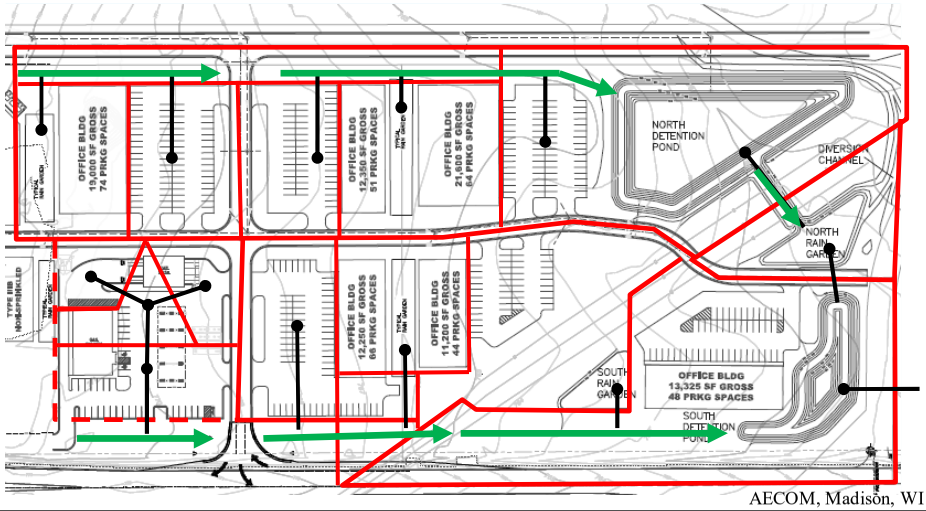
Select Drainage Basins to Size Pipes and Swale Conveyance System

Site Development Drainage Modelling



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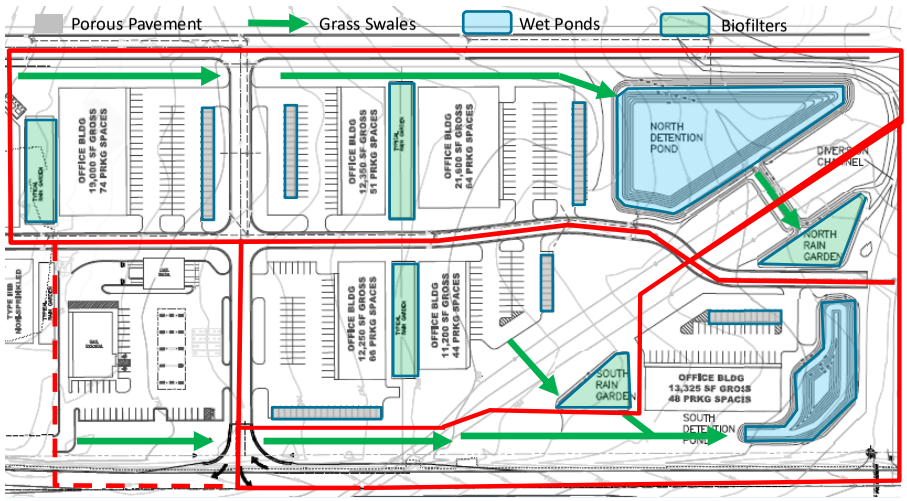
Enter all the practices for a site and link them to determine the overall runoff and pollutant reductions

Site Development Water Quality Modelling



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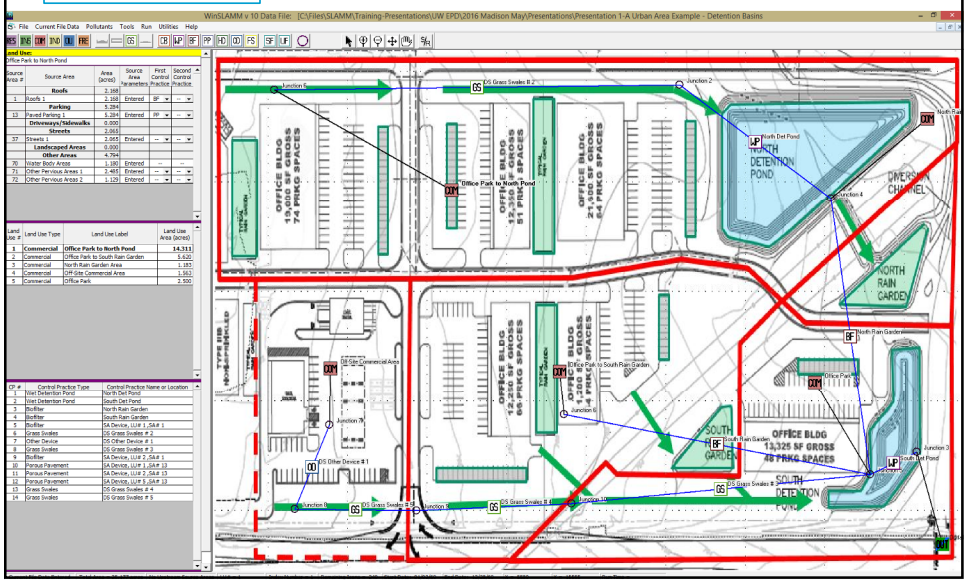
Prepare Model Layout in WinSLAMM

Site Development Water Quality Modelling



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Why Use a Model – Why Not Just Monitor?

1. Variability

Monitoring Results:

Milwaukee Highway

Date	Rain (in)	Runoff Volume (cu.ft)	Sediment EMC (mg/l)
6/21/2002	0.52	420	71
7/8/2002	1.5	1610	51
4/19/2003	0.55	340	780
5/4/2003	0.9	540	73
5/30/2003	0.54	320	110
6/8/2003	0.62	450	60
6/27/2003	0.57	460	77
7/4/2003	0.53	550	29
7/8/2003	0.33	260	57
9/12/2003	0.22	150	700
9/14/2003	0.47	340	50
9/22/2003	0.27	270	37
10/14/2003	0.25	220	35
10/24/2003	0.71	410	67
11/4/2003	0.60	560	55

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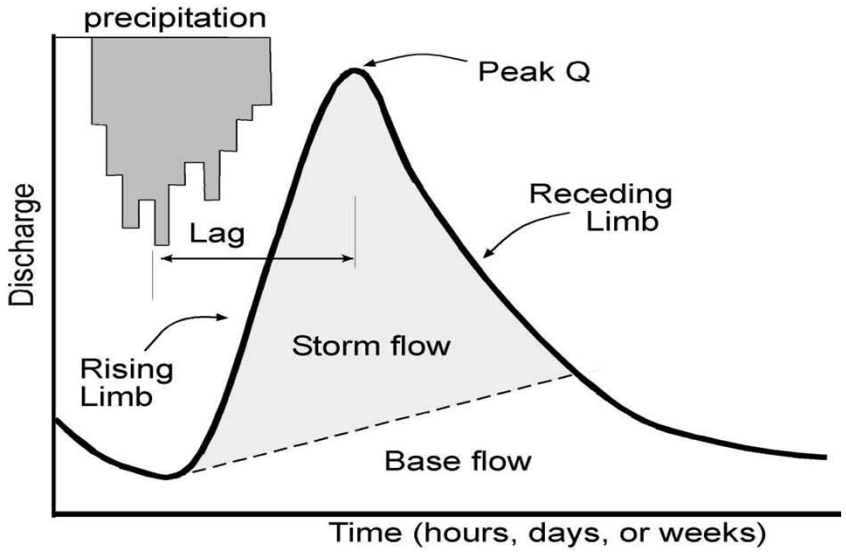
1. Variability



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Why Not Just Monitor?

2. Cost
- Equipment
- Labor
- Lab

One station can cost $100,000 – or more – each year.

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Why Not Just Monitor?

3. Time Line and "What Ifs"
- Monitoring Shows "What Happened" – Not "What If's?"
  - Management Changes
  - Land Use Changes
  - Etc.
- Models Try Capturing Variables:
  - Seasonal
  - Different Rain events
  - Year to Year Changes
  - "What If" Questions

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Terminology

- "TSS" = Total Suspended Solids
- "DS" = Dissolved Solids (also "Filterable")
- "TS" = Total Solids = "TSS" + "DS"
- "SSC" = Suspended Sediment Concentration

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Background – Pollutants

Stormwater Pollutants Particle Size

Particle Size				
mm	micrometers (or microns)	Soil Class Name *	Suspended Sediment Concentration (SSC)	Total Suspended Solids (TSS)
> 2.0	> 2,000	Gravel **		
1.0 - 2.0	1,000 - 2,000	V. Coarse Sand		
0.5 - 1.0	500 - 1,000	Coarse Sand		
0.25 - 0.5	250 - 500	Medium Sand		
0.125 - 0.25	125 - 250	Fine Sand		
0.05 - 0.125	50 - 125	V. Fine Sand		
0.02 - 0.05	20 - 50	Coarse Silt		
0.002 - 0.02	2 - 20	Med & Fine Silt		
< 0.002	< 2	Clay		

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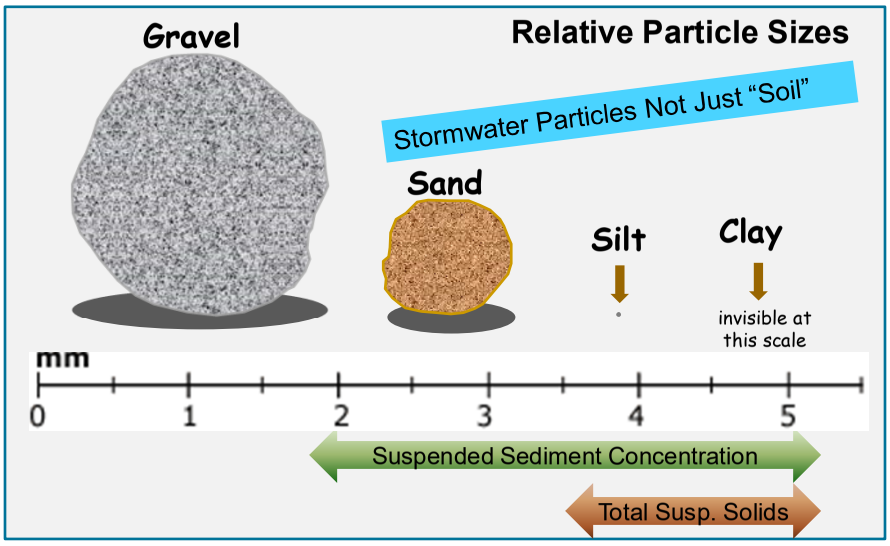
Stormwater Pollutants Particle Size



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Terminology

- Pollutant "Yield" = Pollutant "Load"
- "Solids" = "Sediment" (for this class only)
- "Connected" verses "Disconnected"

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Questions?

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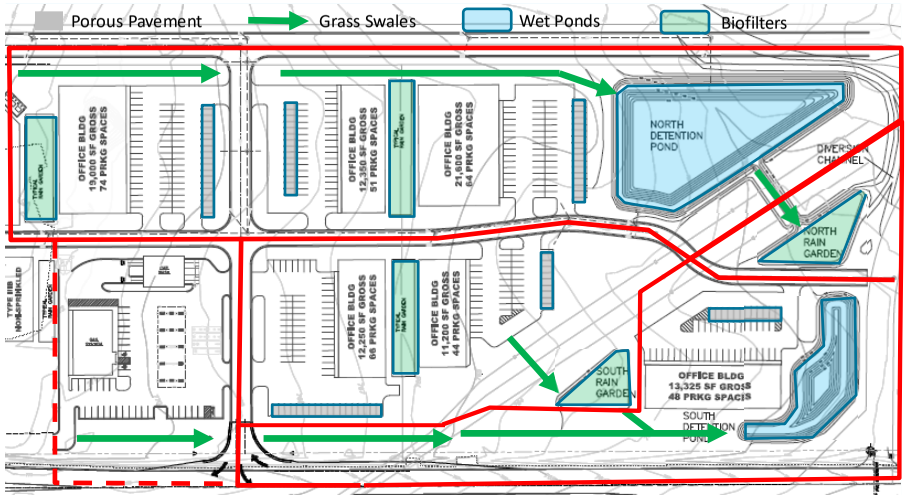
Site Development Water Quality Modelling

Also includes Source Area Controls:

1. Paved Parking Porous Pavement
2. Biofilters for Rooftop



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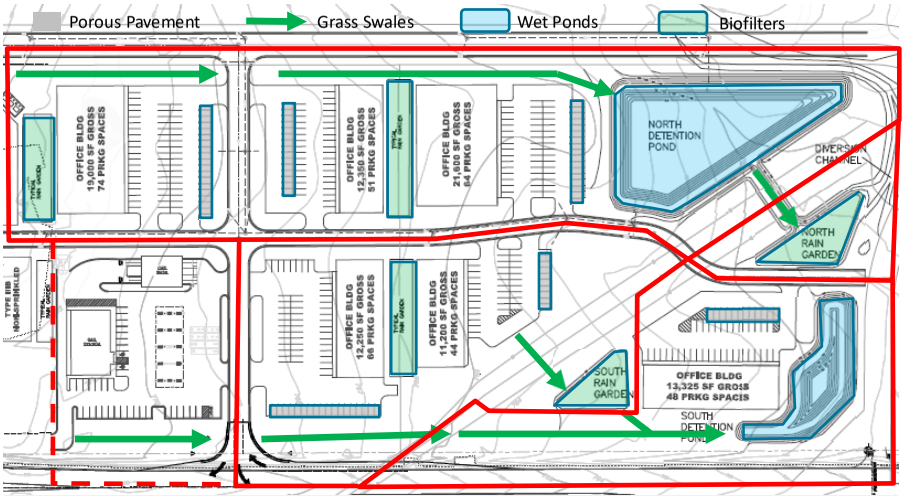

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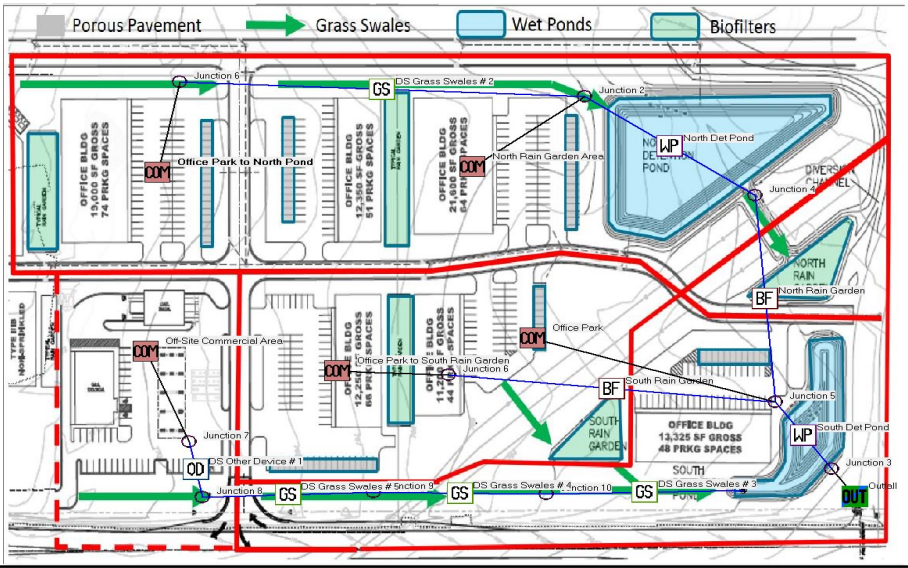

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