

Assessing Alternative Fecal Coliform Bacteria
Direct Deposit Modeling Approaches

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November 3, 2006

Presentation Outline

- ◆ Key Concepts
- ◆ Model Limitations
- ◆ Implications
- ◆ Proposed research
 - ◆ Methods
 - ◆ Study watersheds

Key terms and concepts

- ◆ “Low Flow”
 - ◆ upland rural watersheds
 - ◆ low-order streams
 - ◆ no flow or discontinuous flow
 - ◆ dry weather
- ◆ Hydrological Simulation Program-FORTRAN (HSPF)
 - ◆ watershed-scale model

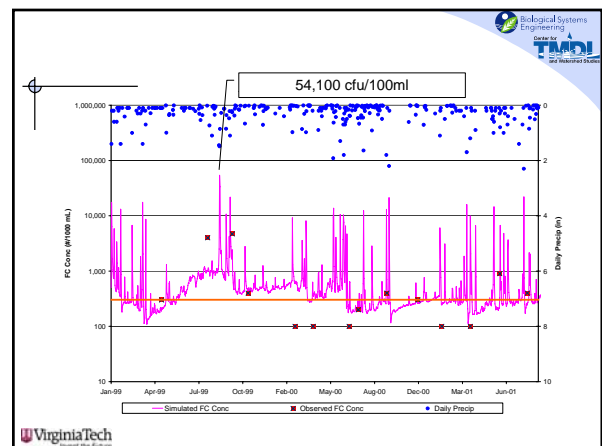
Direct Deposit (DD)

- ◆ Direct Deposit
 - ◆ bacteria enters the stream directly from the source (colony forming units CFU per hour)
- ◆ Livestock
- ◆ Wildlife
- ◆ Permitted discharges
- ◆ Straight pipes

Limitations in HSPF application

- ◆ Discharge continues at extreme low flows
 - ◆ Channel is continuous, flat slope
 - ◆ Flow is simulated as a thin “sheet” of water
 - ◆ Discontinuous flow is not simulated
- ◆ Bacteria continue to be transported with stream flow

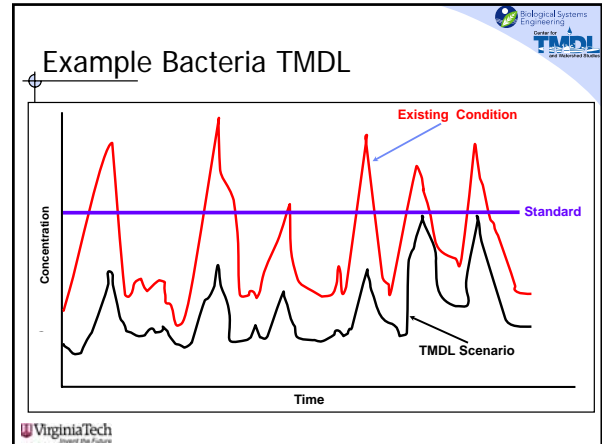
vs.



TMDL development

- ♦ Erroneously high bacteria concentrations **increase simulated violations** of the freshwater bacteria standard
- ♦ TMDLs require **zero violations** during simulation
- ♦ Low Flow DD simulation methods are used to calibrate the model based on observed values

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Proposed Research

- ♦ Evaluate the impact of three low flow DD simulation methods on bacteria source reductions
 - ♦ Flow Stagnation
 - ♦ Direct Deposit Stage Cut-off
 - ♦ Stream Reach Surface Area
- ♦ This research will **quantify the differences** between each method.
 - ♦ water quality criteria violation rates
 - ♦ reductions in violation rate for increasing magnitude of DD reductions

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Hydraulic Function Tables (FTABLES)

- ♦ Calculated from channel geometry
- ♦ Volume based
 - ♦ HSPF calculates a volume to obtain discharge, stage

Stage	Surface Area	Volume	Discharge
ft	ft ²	ft ³	ft ³ /s
0.000	359,981	0	0
0.12	362,773	9,892	0.0792
0.25	384,951	91,580	3.08
20	21,810,173	187,424,208	69,318

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Flow Stagnation

- ♦ Low flow conditions results in **zero discharge** from the reach
- ♦ DD is still input, but not transported

Stage	Surface Area	Volume	Discharge
ft	ft ²	ft ³	ft ³ /s
0.000	359,981	0	0
0.12	362,773	9,892	0
0.25	384,951	91,580	3.08
20	21,810,173	187,424,208	69,318

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Direct Deposit Stage Cut-off

- ♦ Low flow conditions results in **zero DD** from livestock

1. Output simulated hourly stage (depth).
2. Filter stage based on predetermined depth.
3. Use "filtered output" to remove direct deposit inputs.

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Stream Reach Surface Area

- DD is converted from a constant load/time into a constant load/area
 - Analogous to “dry deposition” on the surface area of the reach
- A decrease in stream surface area results in a proportional decrease in DD
- Hydrology Based

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Study Watersheds

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Long Glade

- Anecdotal evidence of the creek running dry
 - Watershed residents
- DD Stage Cut-off method
- Predominantly pasture land use
 - Compare methods on livestock sources of DD

Percent contribution from BST results			
Livestock (Min; Max)	Wildlife (Min; Max)	Human & Pet (Min; Max)	
43 (0;83)	30 (2;83)	27 (0; 65)	

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Old Woman's Creek

- Simulated low flow issues
 - Previous TMDL development
- DD Stage cut-off method
- Predominantly forested land use
 - Compare methods on wildlife sources of DD

Percent contributions from BST results			
Livestock (Min; Max)	Wildlife (Min; Max)	Human (Min; Max)	Pet (Min; Max)
36 (8;83)	38 (0;90)	1 (0; 50)	25 (0; 59)

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Questions?

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