South River Science Team Presentation

October 2006

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Hydrologic and Hydraulic Analyses

- Hydrologic analyses
- Rating curve development
- Hydraulic analyses

Purpose: to aid in the computation of mercury loads and to determine flood inundation levels for a variety of storm events

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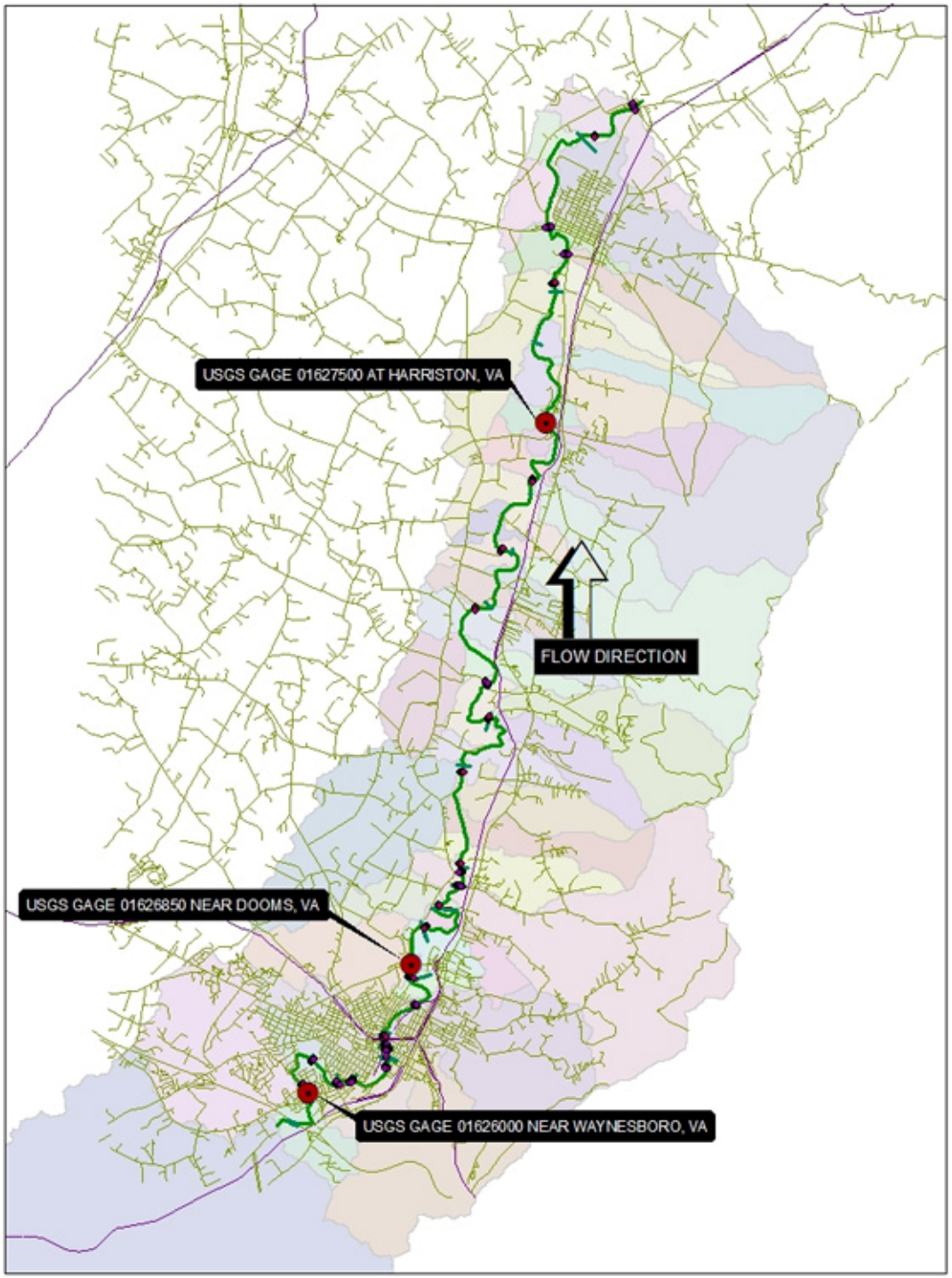

South River Hydrology

- Watershed is located in Central Virginia
- Three gages located within the study area
  - Waynesboro (54 years of record)
  - Dooms (17 years)
  - Harriston (63 years)

South River Hydrology - Methodology

- Drainage Area at Downstream Limit: 233 square miles
- Study Limits
  - Upstream: Interstate 64
  - Downstream: Port Republic Road

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South River Hydrology - Methodology

- Discharges were determined for the following recurrence intervals: 1, 2, 5, 10, 25, 50, 100, and 500
- National Flood Flow Frequency Methodology – weighted averages of:
  - Gage data
  - Rural regression equations

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South River Hydrology - Methodology

- Standardized USGS regional regression equations for rural areas
- At Gage locations - PEAKFQ software that utilizes Bulletin 17B guidelines to perform flood-frequency analysis.
- Weighting techniques improve the estimate of peak discharges

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Comparison of Discharges at Gage Locations

Gage Location	Regression Discharges (cfs)							
	1 year **	2 year	5 year **	10 year **	25 year	50 year	100 year	500 year
At Harriston, VA	3139.2	3258.2	6091.2	8539.0	12291.9	15473.5	19073.5	29006.0
Near Dooms, VA	3442.4	3569.1	6684.2	9378.2	13510.1	17011.2	20967.5	31850.2
Near Waynesboro, VA	4299.7	4452.3	8384.5	11800.2	17058.4	21518.5	26549.0	40317.3

Gage Location	Gage Discharges (cfs)							
	1 year **	2 year	5 year	10 year	25 year	50 year	100 year	500 year
At Harriston, VA	2336.7	2690.0	5997.0	9457.0	15810.0	22390.0	30940.0	61450.0
Near Dooms, VA	3181.8	3623.0	7766.0	11960.0	19450.0	27010.0	36650.0	69960.0
Near Waynesboro, VA	5119.0	5286.0	11110.0	16380.0	24770.0	32340.0	41110.0	66770.0

** Extrapolated

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Final Discharges Obtained by Weighting the Regression and Gage Discharges

Weighted Discharges (cfs)								
Gage Location	1 year**	2 year	5 year	10 year	25 year	50 year	100 year	500 year
At Harriston, VA	2513.0	2722.4	6008.3	9280.7	14826.5	20105.0	26615.5	48424.5
Near Dooms, VA	3459.0	3613.5	7420.6	10804.5	16085.9	20788.0	26371.5	43762.9
Near Waynesboro, VA	5147.0	5237.2	10786.1	15531.3	22759.1	29083.0	36385.8	57831.2

Weighted Discharges (cfs)								
Location	1 year**	2 year	5 year	10 year	25 year	50 year	100 year	500 year
At Downstream Study Limits	5198.0	5303.0	10774.2	15477.2	22666.8	28925.2	36115.8	56935.6

** Extrapolated

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Rating Curve Development

- Defines the relationship between the water stage (elevation) and flow at a cross-section in a channel.
- Convert flow depth measurements in a channel to flow rate
- Estimate water surface elevations for storms of specific return intervals.

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Rating Curves for the South River - Methodology

- Structures (i.e., bridges, culverts)
  - CulvertMaster software
  - Considers inlet and outlet control conditions
  - Uses gradually varied flow analysis for computing the upstream water surface elevation (WSEL)
  - Uses general broad-crested weir equation in case of roadway over topping

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Rating Curves for the South River- Methodology

- Natural (i.e., valley) cross sections
  - FlowMaster Software
  - Water surface elevations computed using the Normal Depth Method (Manning's equation)
  - Variables: manning's roughness, channel slope, wetted perimeter, channel area

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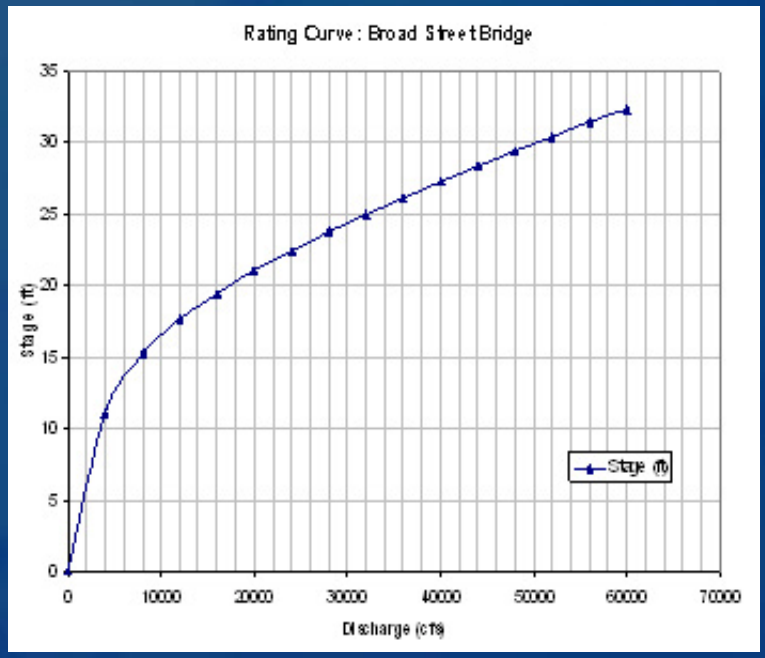
Rating Curve At Broad Street Bridge



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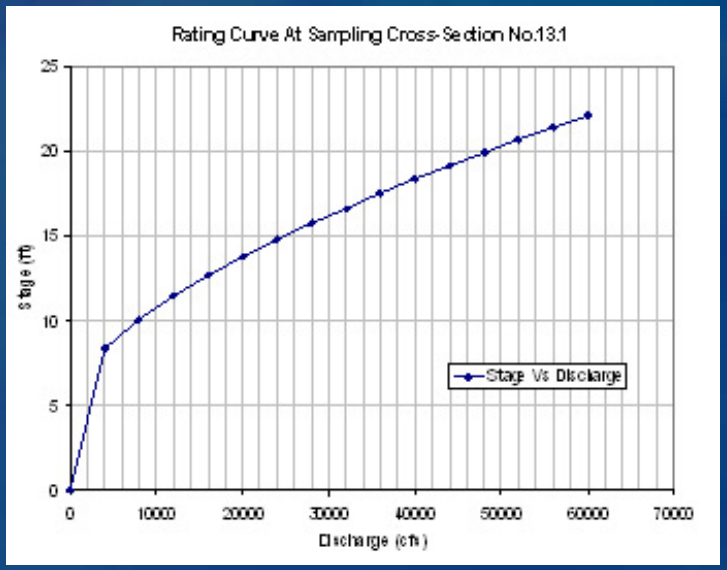
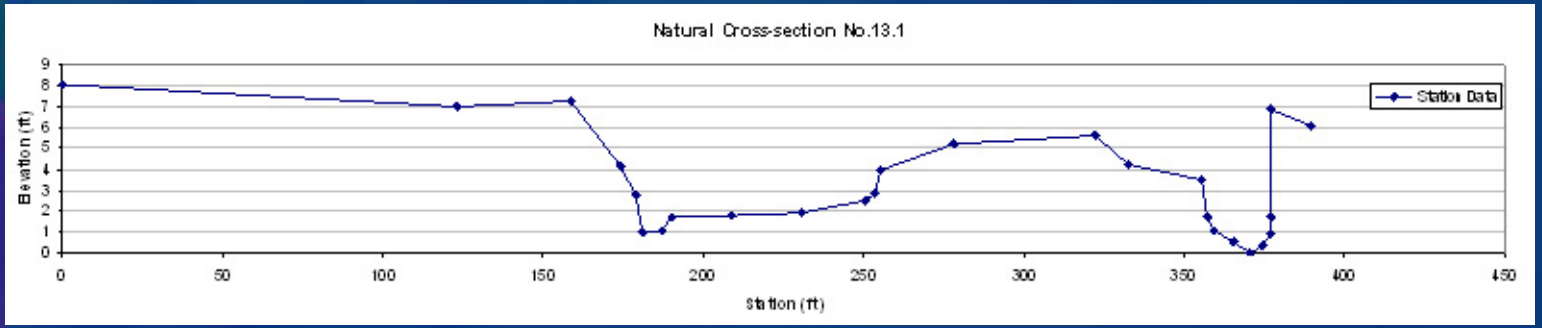
Rating Curve At Sampling Cross-Section No.13.1





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Hydraulic Analyses

- Purpose: to compute water surface elevations along the river for a wide variety of storm events (i.e., recurrence intervals)
- U.S. Army Corps of Engineers HEC-RAS Program
- GIS-based Watershed Information SystEm (WISE) platform

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Hydraulic Model – Input Data

- Topography - Cross sections
- Coefficients (manning's n values, expansion/contraction)
- Structure data
  - Bridges, Culverts
- Discharges

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Hydraulic Analyses - Method

- Sub critical, step-backwater analysis
- Calibration – using high-water mark data, gage height data, and sampling data

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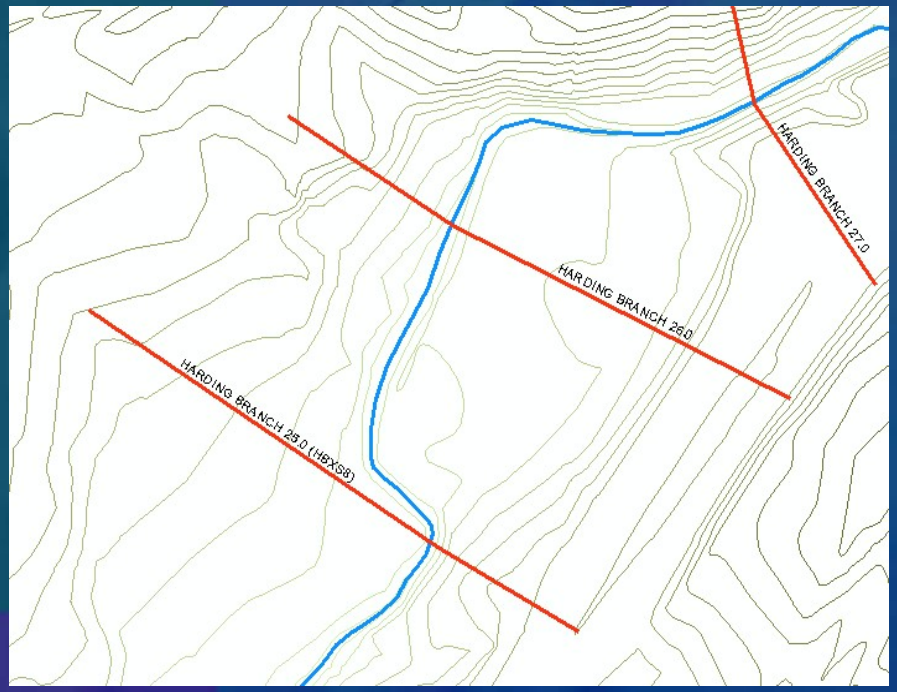
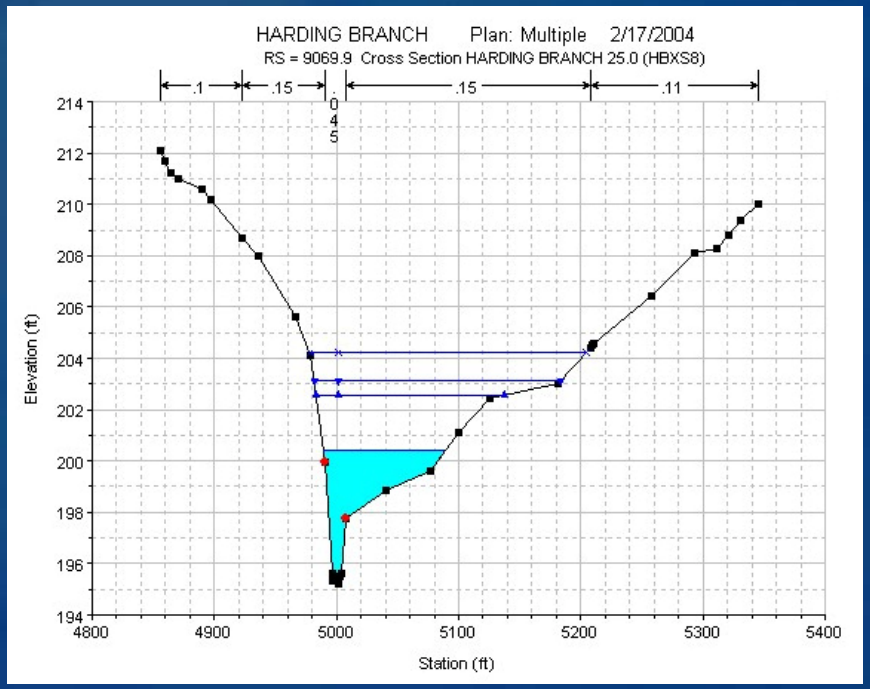
Hydraulic Model – Example





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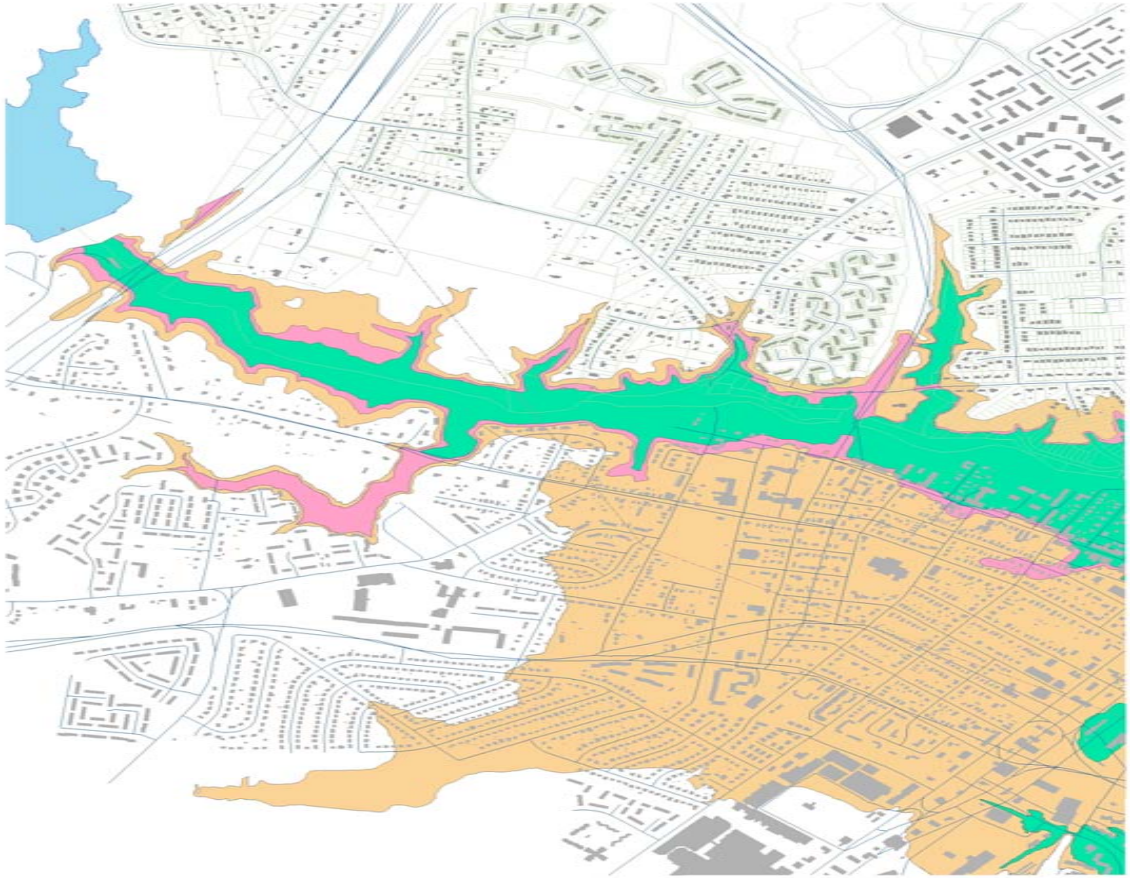
Floodplain Delineation



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Next Steps

- Finalize rating curve development
- Conduct hydraulic modeling
- Delineate floodplain boundaries

- Completion date: March 2007

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