



South River Conceptual System Model Update

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South River Factoids

From Former DuPont Site

River Length: ~25 miles

Watershed: 104 sq. mi.

Floodplain: 5.5 sq.mi.

Land Use:

Forested 67%

Agriculture 24%

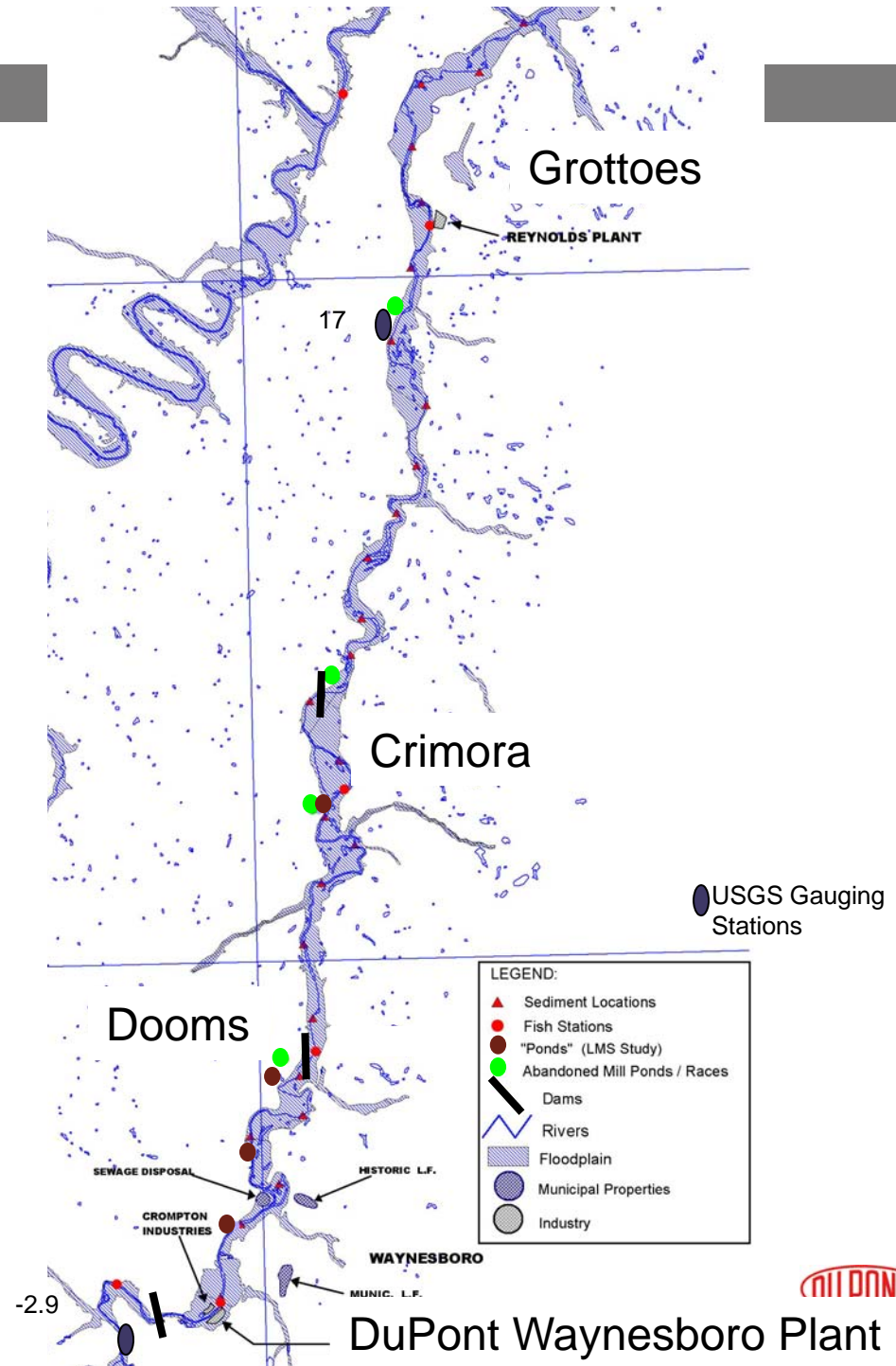
Urban 9%

Average Annualized River Flow:

Waynesboro USGS 147 cfs

Harriston USGS 262 cfs

Port Republic (est.) 282 cfs



South River Conceptual System Model

Sources

- External to the aquatic system
- Internal to the aquatic system

Migration Pathways

- During low and high river flow
- Spatial and temporal scale variations

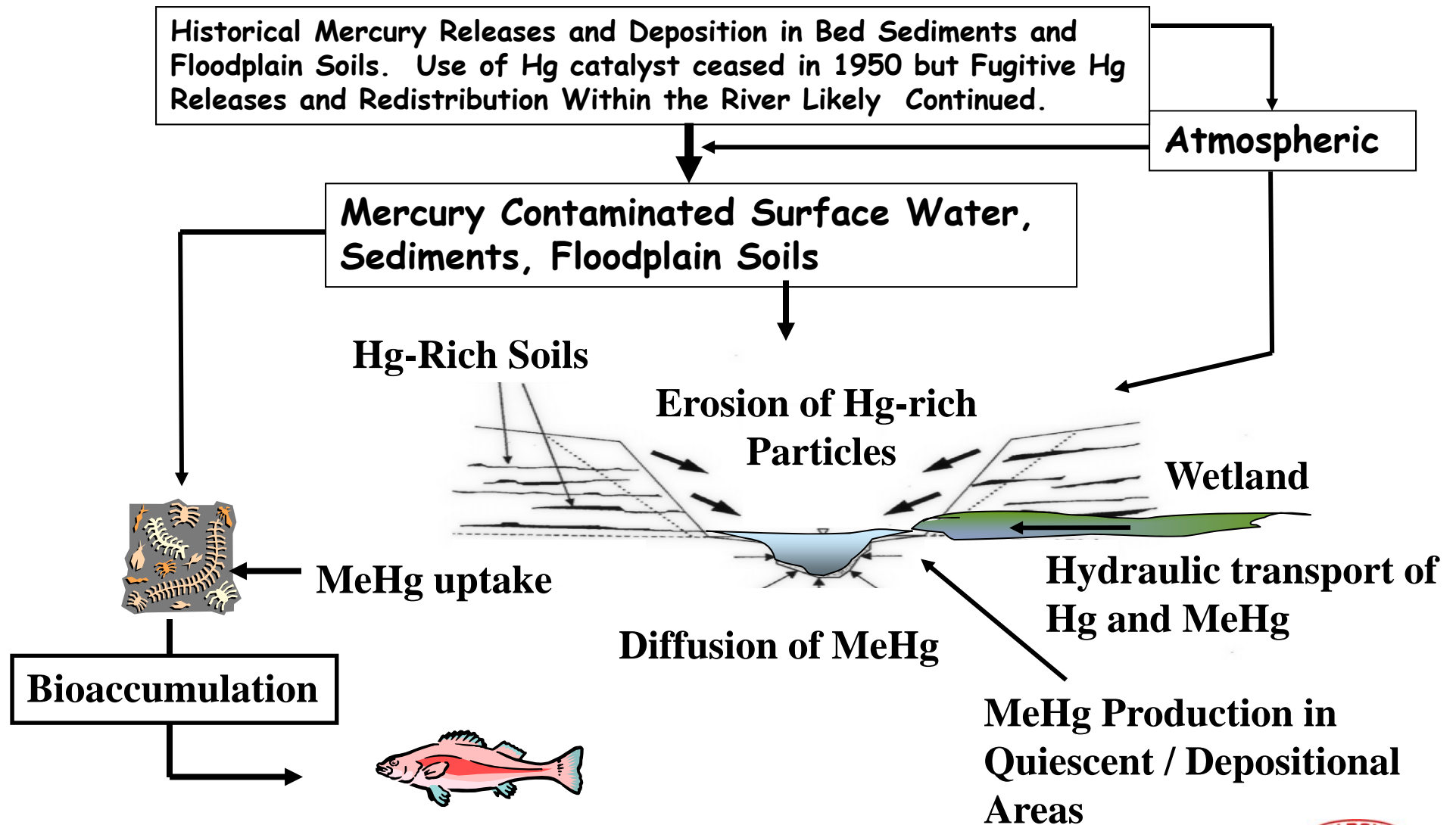
Exposure Pathways

- Ingestion
- Inhalation

Receptors

- Human
- Ecological

Conceptual System Model of Historical Mercury Contamination and Current Exposure Pathway To Fish in the South River



Potential Present Day Sources based on Current Working Hypotheses

Potential Sources External to the aquatic system

- Input of Hg/MeHg to the aquatic system from erosion of historical floodplain deposits at the banks
- Dissolved Hg/MeHg from alluvial groundwater
- Dissolved Hg from unidentified sources (outfalls and or bedrock springs)
- Episodic contribution from isolated backwaters (oxbows and mill ponds)

Potential Sources Internal to the aquatic system (subsequent to loading to the system)

- Fine-grained in channel sediment accumulation areas as reservoirs of Hg and as Hg methylation areas
- Mercury from in-channel sediments behind or beneath natural sediment armour
- Aquatic vegetation and periphyton areas that enhance Hg methylation
- Increased (or decreased) bioavailability due to other chemical or physiochemical conditions/changes

Mercury is Usually Associated with Fine-grained Sediment

In-channel natural pools (<10 ft deep)

Pools behind dams (some dams are partially breached)

Wetlands

Floodplain deposits

Abandoned mill races

Accumulation of fine sediments (clays and silts) in eddies behind leaning and downed trees and wood debris

Fine-grained sediment accumulations below the in-channel natural armour layer

Veneer of fine-grained sediments along banks

High organic, low density fluff layers in more quiescent areas of the river (usually near-bank)

Recent Results that Refine CSM

The first twelve miles of the river have a gentler gradient than the next 13 miles

- Higher probability of encountering fine-grained sediments
- Inventory of mercury in the floodplain is likely to be higher
- More likely to encounter quiescent waters where methylation may occur
- Fish tissue concentrations appear to crest at Crimora and then decrease to Port Republic

Close interval water sampling chemistry in the river channel does not show discrete significant inputs of Hg to the system at different locations

Water chemistry near the banks shows higher concentrations of Hg and MeHg than in the channel center

- Close interval sampling may identify discrete inputs or significant MeHg production areas

Near Term Work Needed for the CSM

Continue to explore tools and methods for locating significant sources

- Different tools in different environmental compartments may be more effective in some areas than others

Continue to track seasonal changes in biota tissue and compare to patterns in other media

Evaluate patterns in the environmental compartments on longer term cycles when possible

Evaluate significant inputs to the system in light of potential remedial actions

- Sources of mercury (external and internal) may be different for different reaches

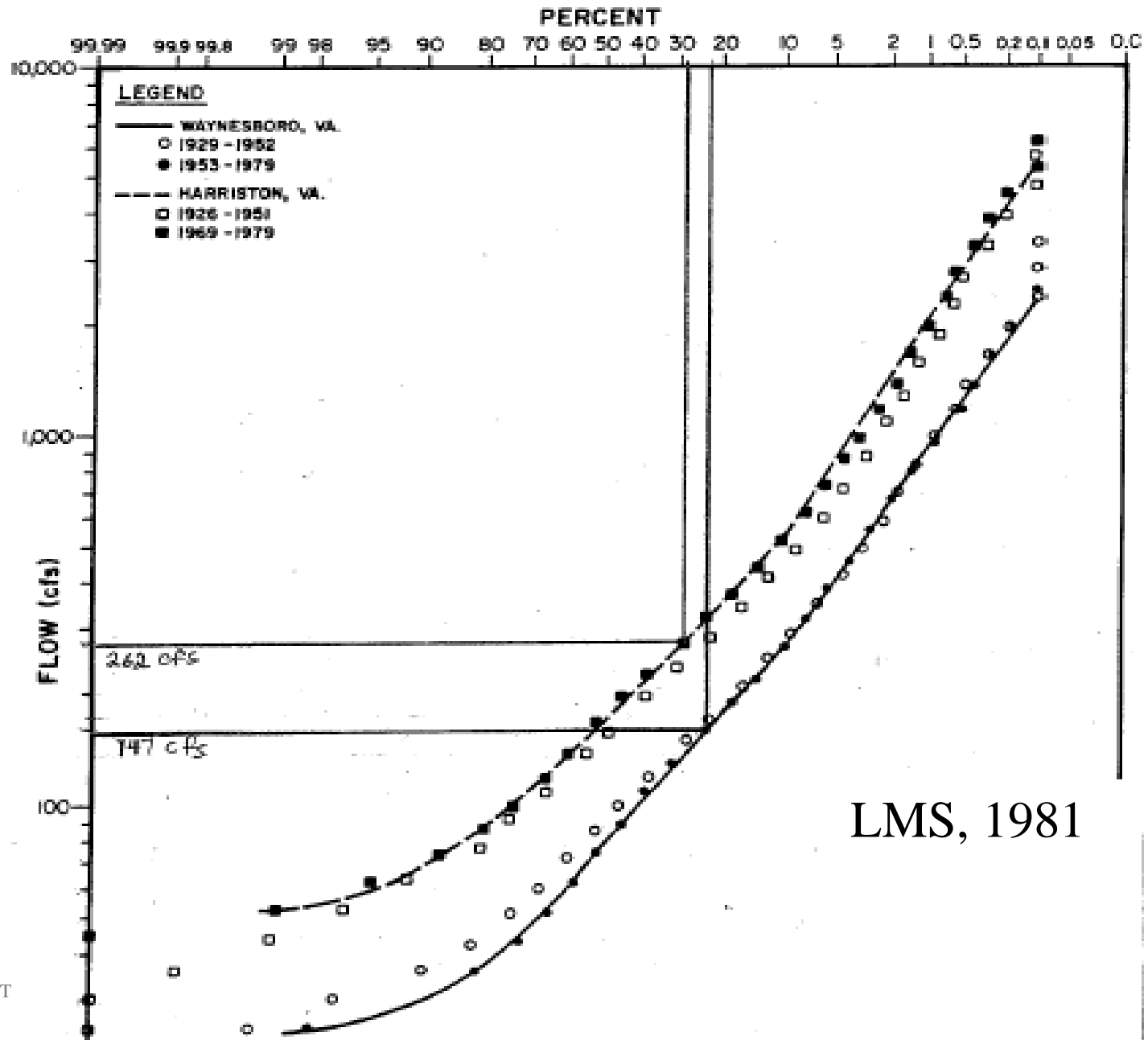
Identification of Significant Sources

- Approach identification of sources from the river side
- Trace clues on sources back to origin
- Identify the processes that are important for to remedy alternatives analysis and selection
- Balance riverside characterization with characterization of floodplain for long term ongoing sources

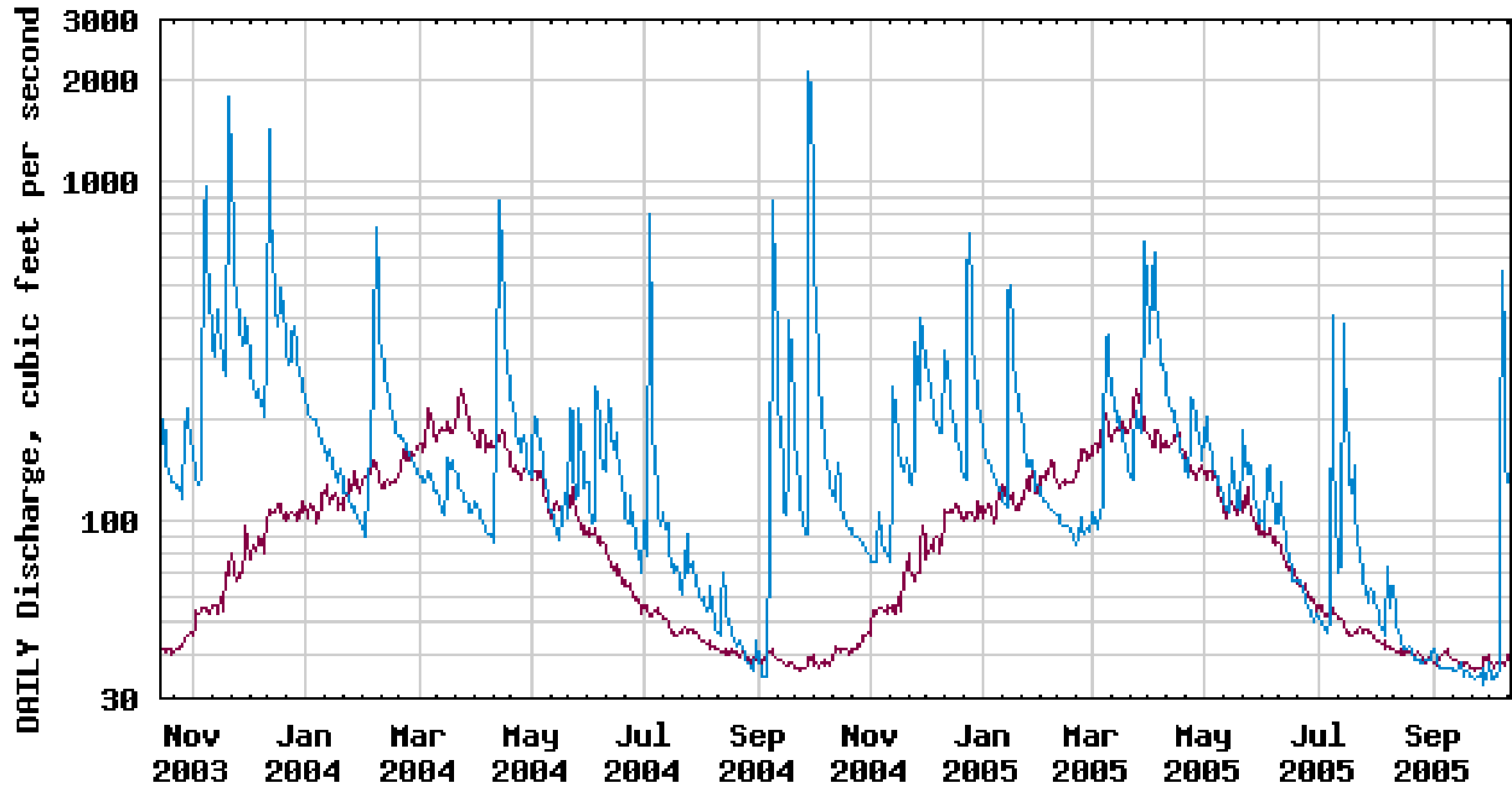
Others...

Backup Slides

**SOUTH RIVER
AT WAYNESBORO AND HARRISTON, VIRGINIA**



USGS 01626000 SOUTH RIVER NEAR WAYNESBORO, VA



CSM for the River includes Elements such as:

- The environmental setting, sediment type, organics and hydrology/hydraulics
- Potential receptors of concern and assessment endpoints
- Potential pathways of Hg migration and potential routes of exposure
- Potential Hg sources and sinks
- Nature and spatial extent of Hg in media
- Nature and spatial extent of other confounding constituents in the system
- Sediment erosion and deposition areas and rates
- Chemical, physical and biological processes relevant to Hg transformation and transport including episodic events such as flooding
- Relevant mechanisms for Hg and MeHg flux (diffusion, advection, resuspension and desorption)
- Bioavailability and Bioaccessibility of Hg and MeHg
- Temporal variations of the physical, chemical and biological system with consideration of temporal scale
- Bioaccumulation in the food chain
- Degree of interaction with the broader surface water setting and watershed