

Mercury TMDL Update SRST, February, 2006

Cooperating Agency



Jack Eggleston

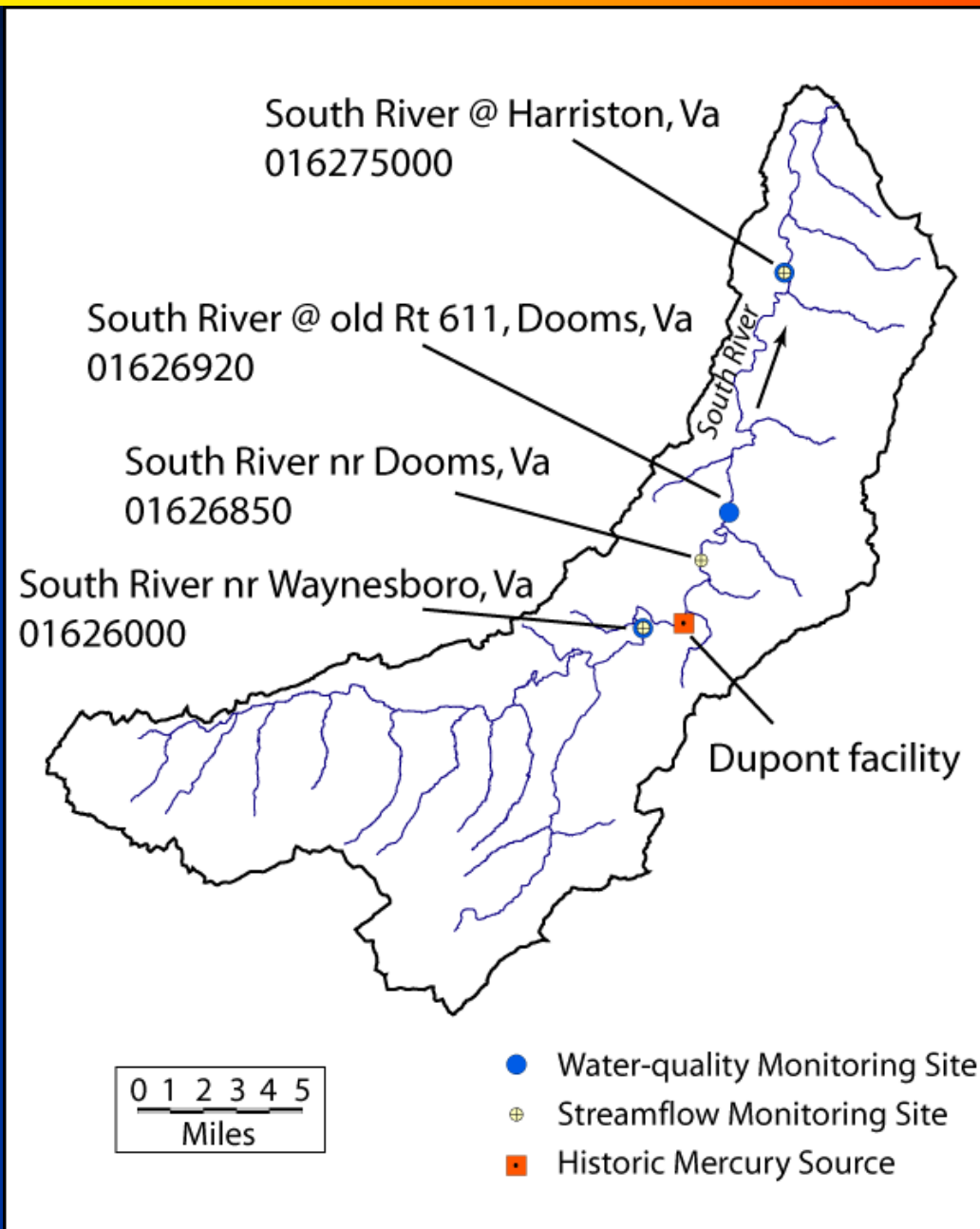


Goals of the Project

- Collect data characterizing methyl-mercury (MeHg) fluxes and production rates in the South River watershed.
- Develop numerical models for simulating surface water flows and MeHg production and transport.
- Using the surface water and contaminant transport models, calculate maximum allowable mercury loads (TMDL) from all point and non-point sources.



South River Monitoring Stations



Stream Monitoring

Continuous Monitoring

Discharge
pH
Temperature
Turbidity
Sp. Conductivity

Periodic Monitoring

Total Hg (filtered and Total)
MeHg (filtered and Total)
DOC
Sulfate
Chloride
Suspended Sediment

South River at Harriston, VA



Periodic Monitoring/Sampling

Periodic Monitoring

Total Hg (filtered and Total)

MeHg (filtered and Total)

DOC

Sulfate

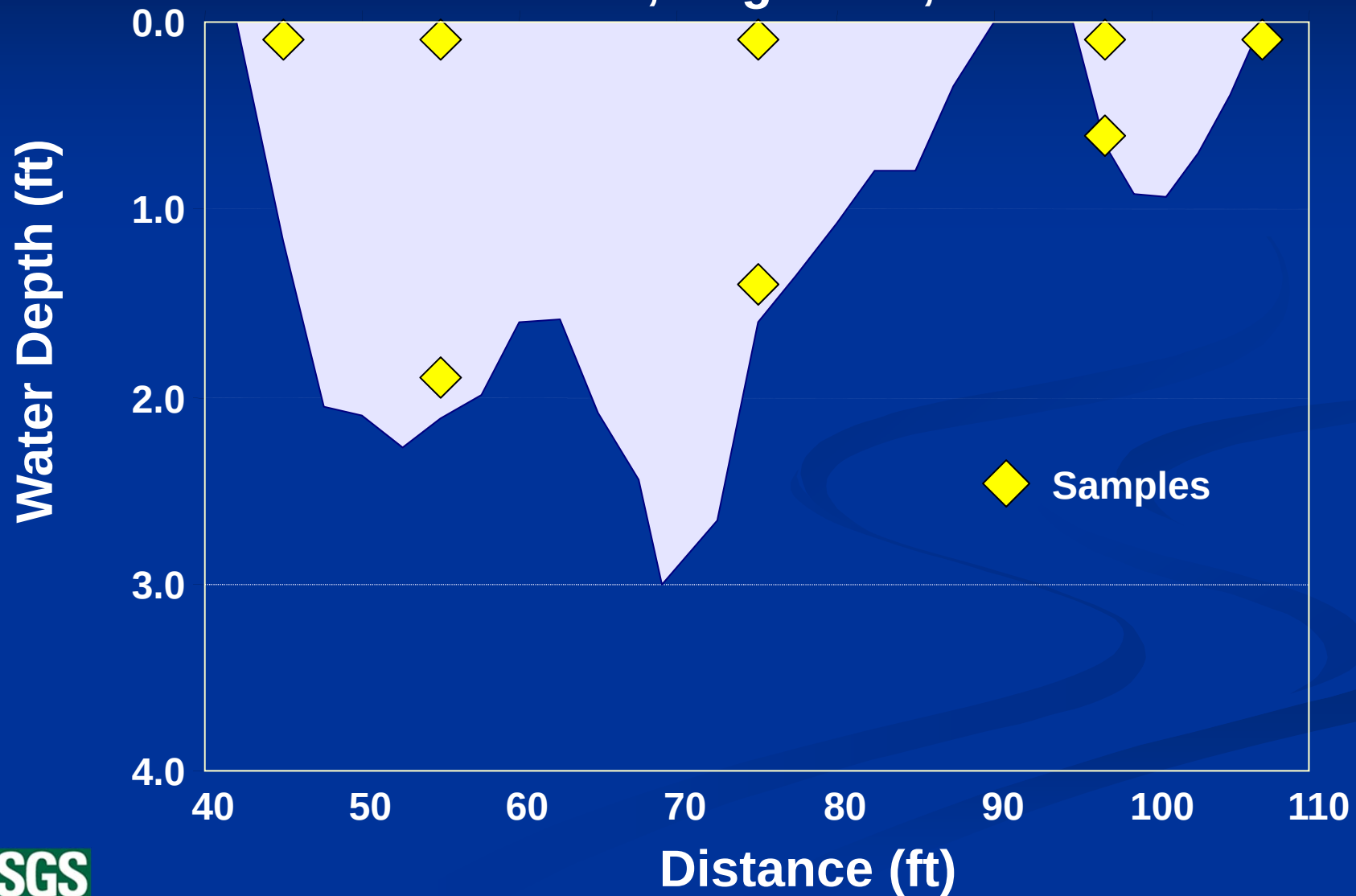
Chloride

Suspended Sediment

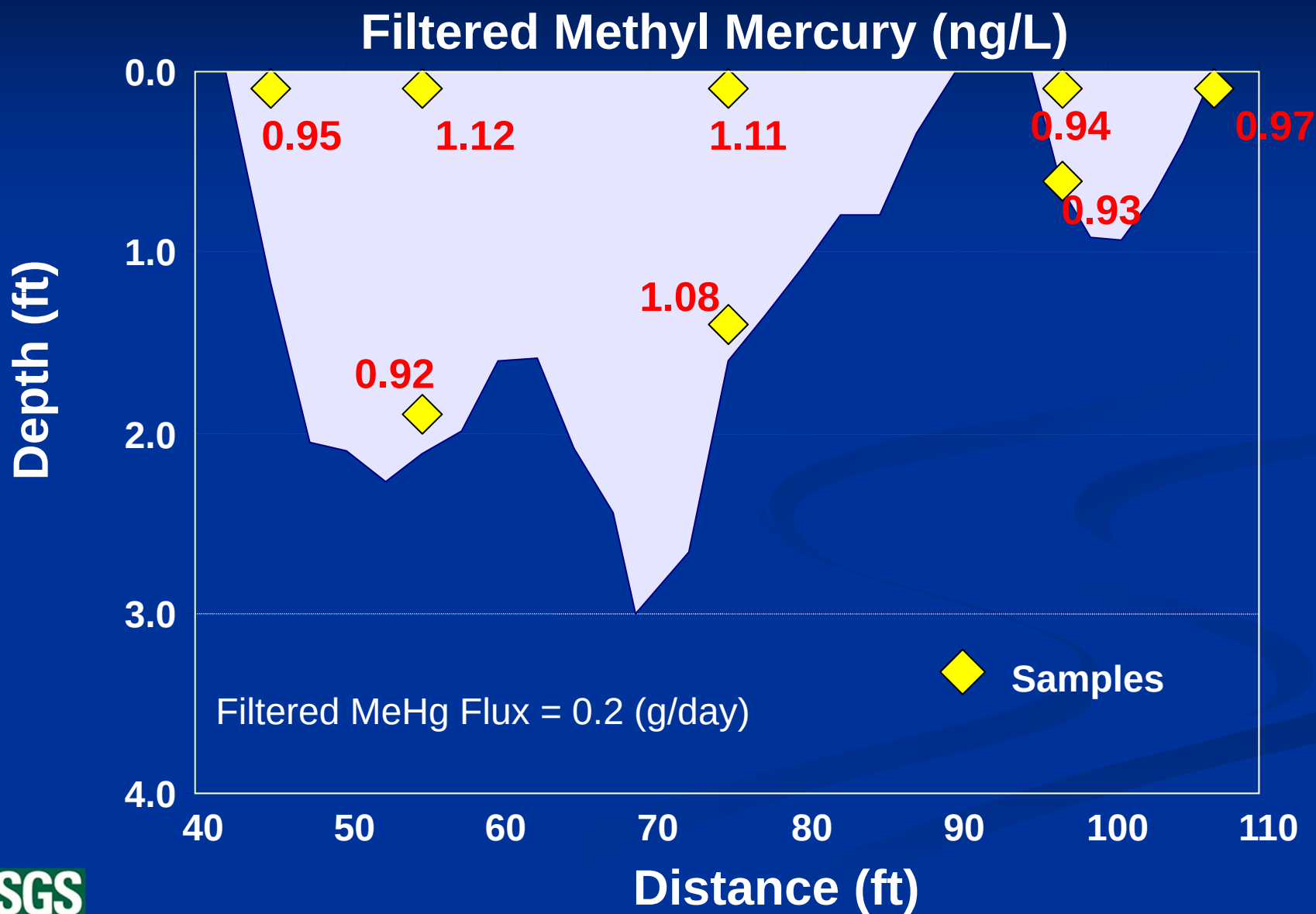


Cross-Stream Sampling

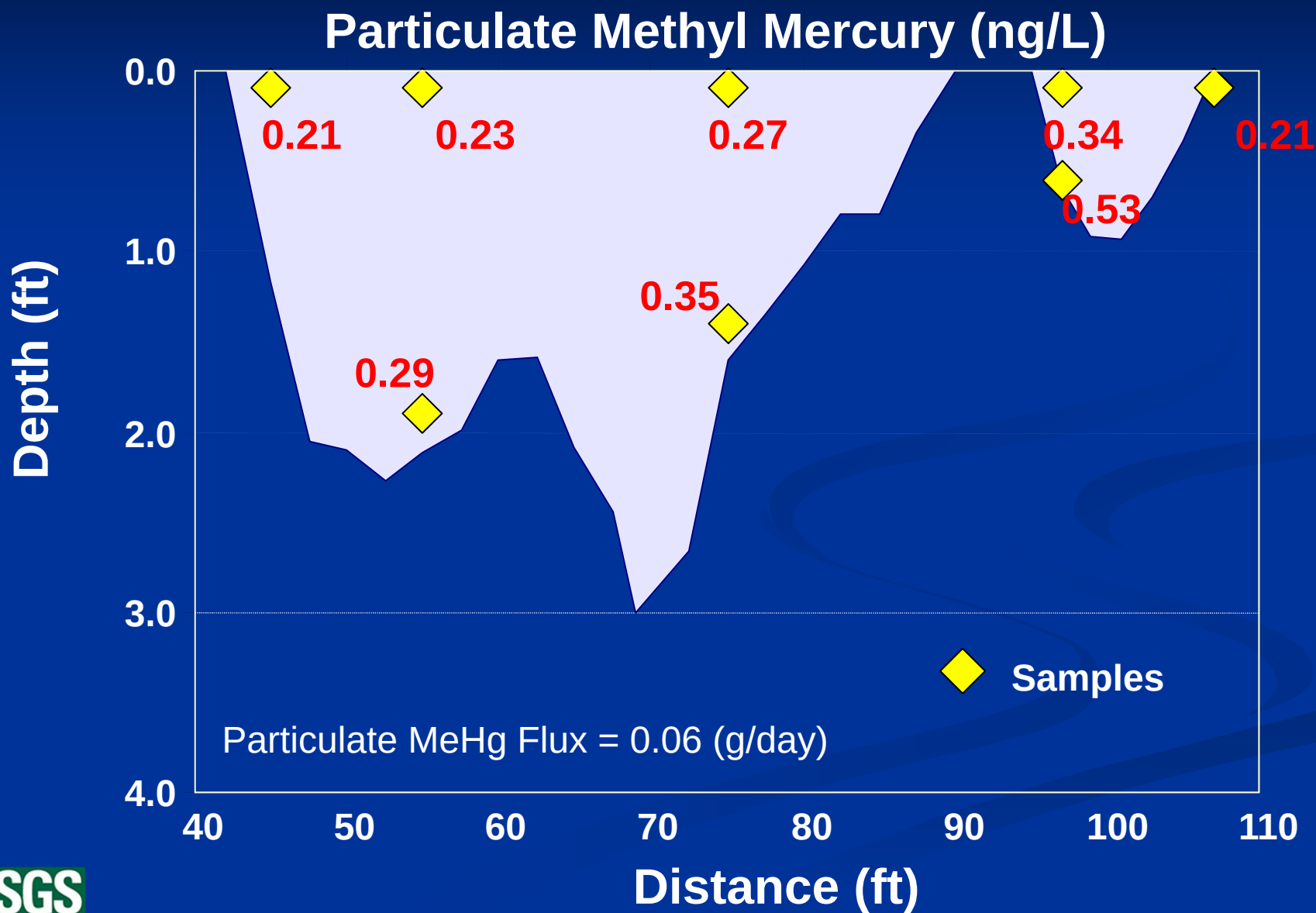
Harriston, August 30, 2005



Cross-Stream Sampling



Cross-Stream Sampling



Mercury Statistics, Feb. '06

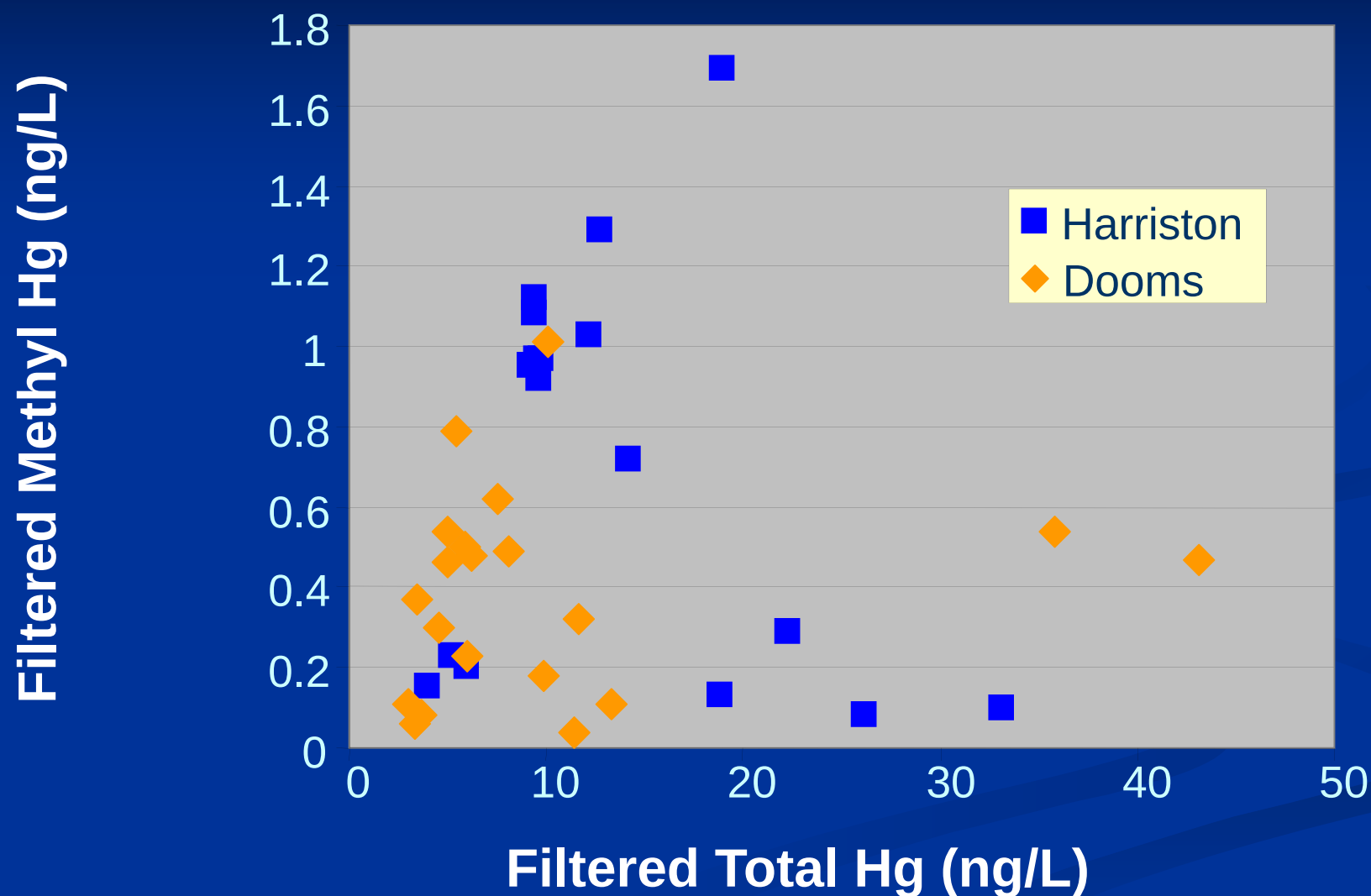
(ng/Liter)	Waynesboro 01626000	Dooms 01626920	Harriston 01627500
Filtered Total Mercury			
Count	15	23	18
Mean	1.2	9.8	13.7
Particulate Total Mercury			
Count	12	14	20
Mean	5.7	390.8	413.8
Filtered Methyl Mercury			
Count	17	26	21
Mean	0.0	0.4	0.7
Particulate Methyl Mercury			
Count	12	13	19
Mean	0.0	1.2	1.3

Notable Findings

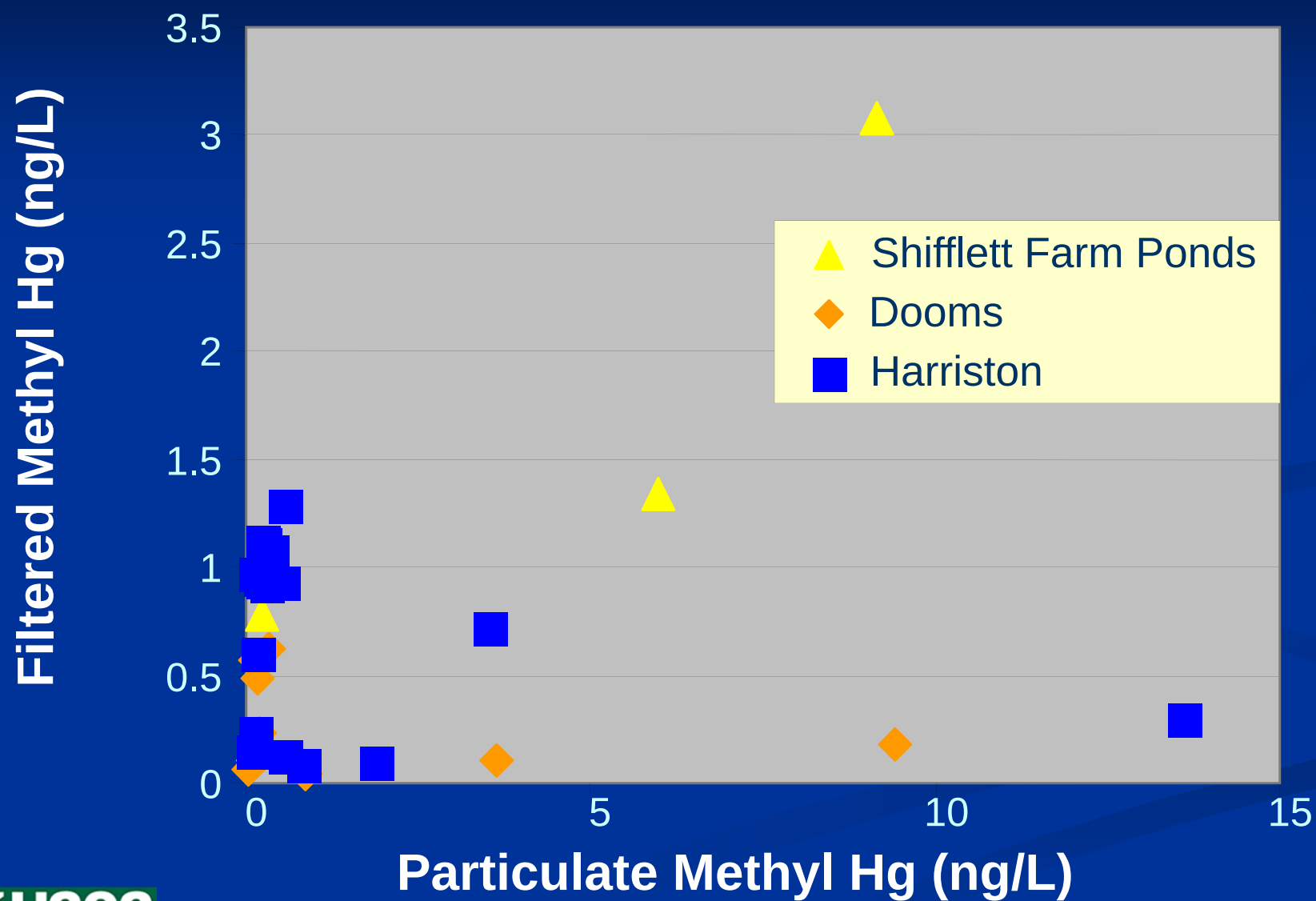
- All species/phases show an increase from Wboro downstream to Harriston
- Filtered THg at Wboro is much less than Hg in precip 1.4 vs. 13 (ng/L)
- Suspended MeHg load may be higher than dissolved (filtered) MeHg load
- Of all species/phases, methylmercury shows the greatest increase from

Dooms to Harriston

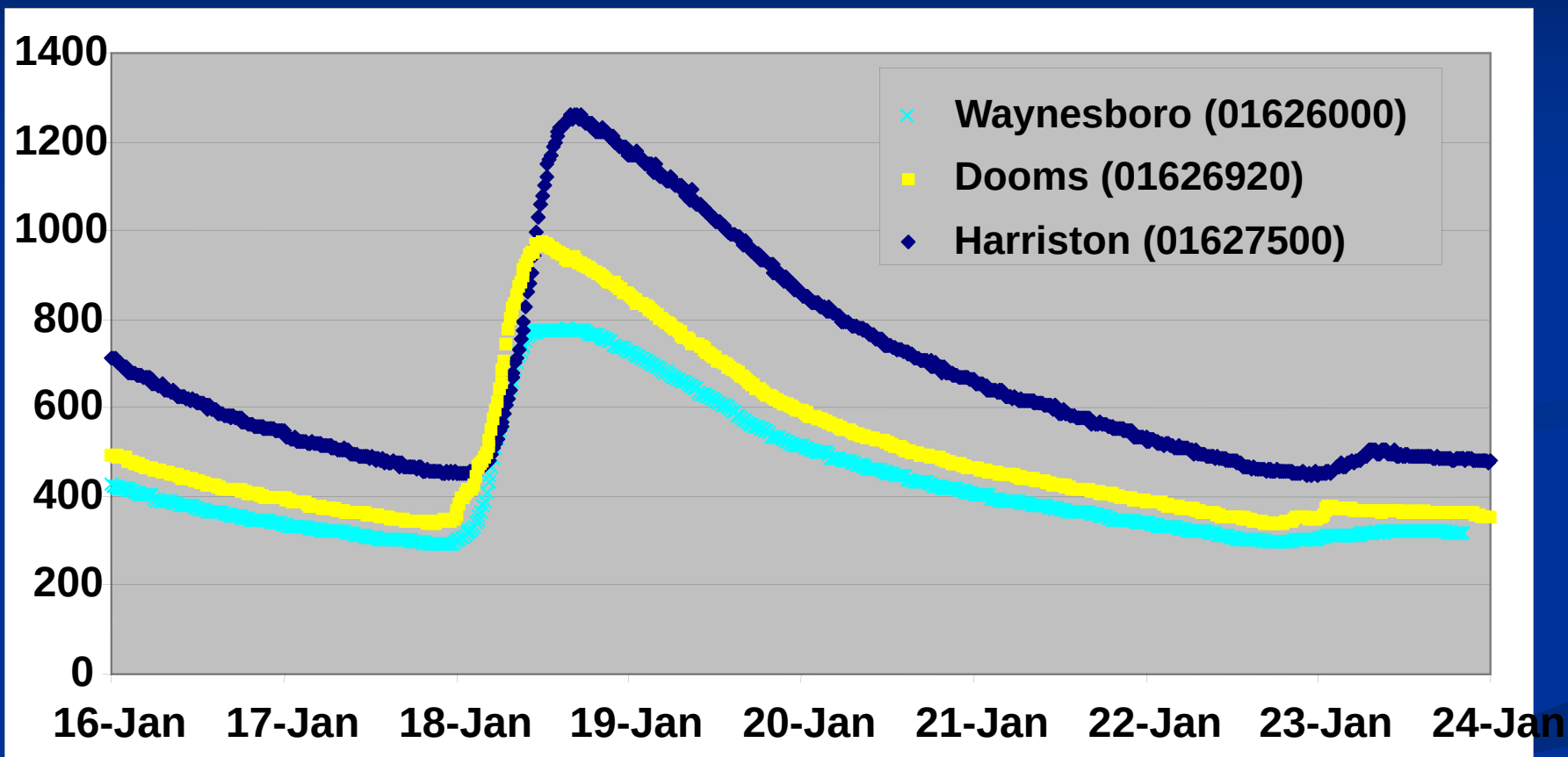
Methyl Hg : Total Hg (Filtered)



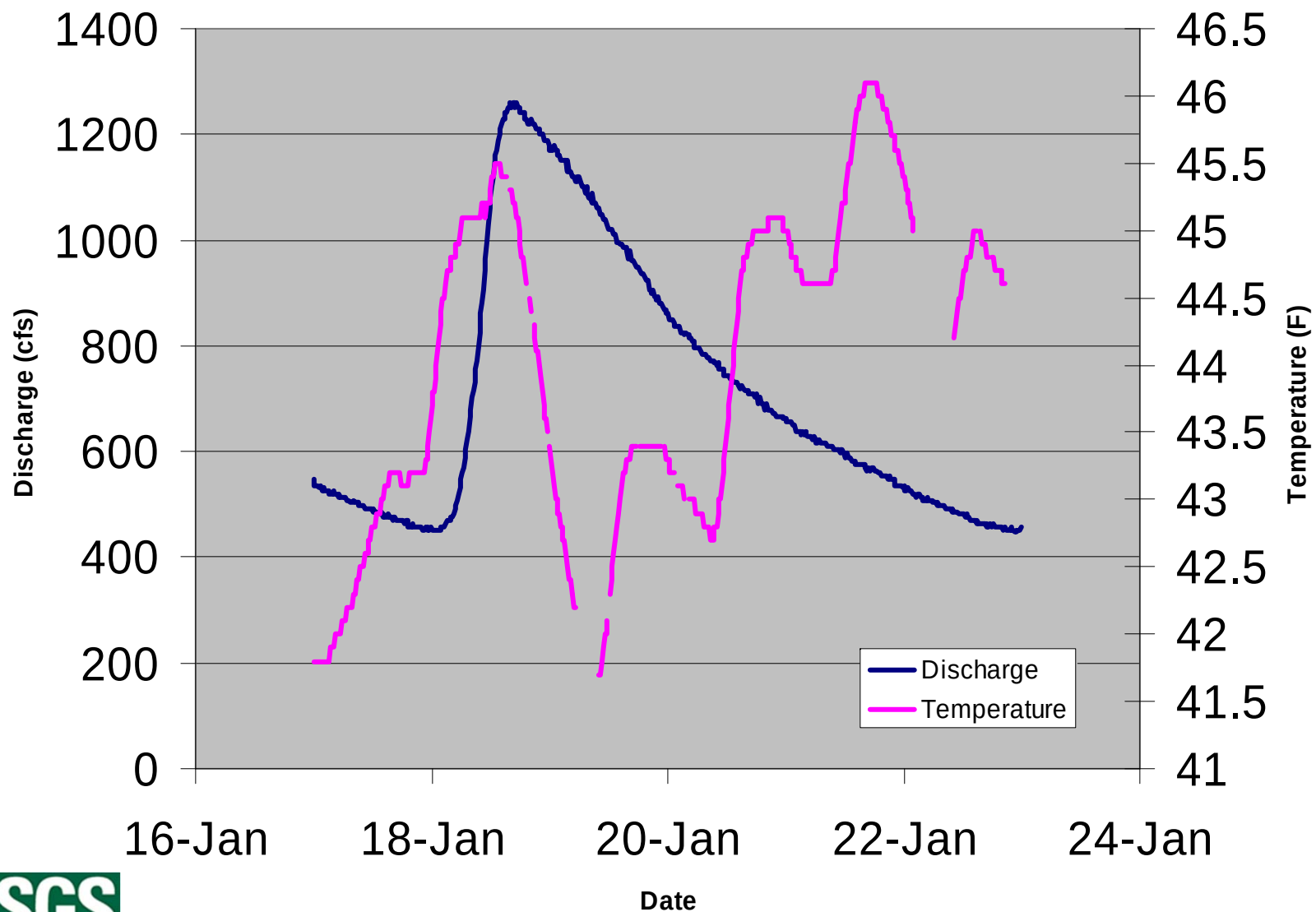
Methyl Hg - Filtered vs. Particulate



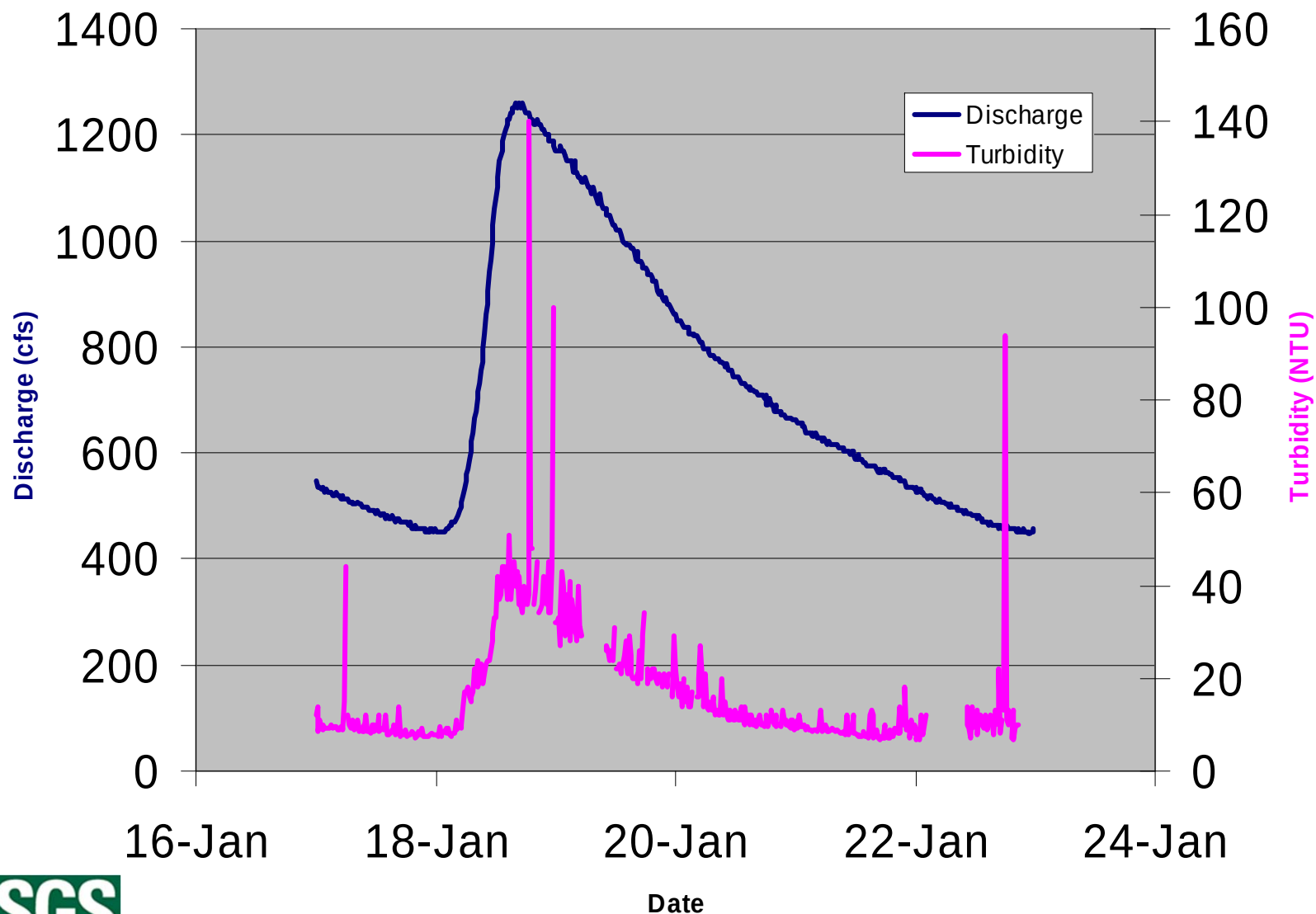
South River Discharge



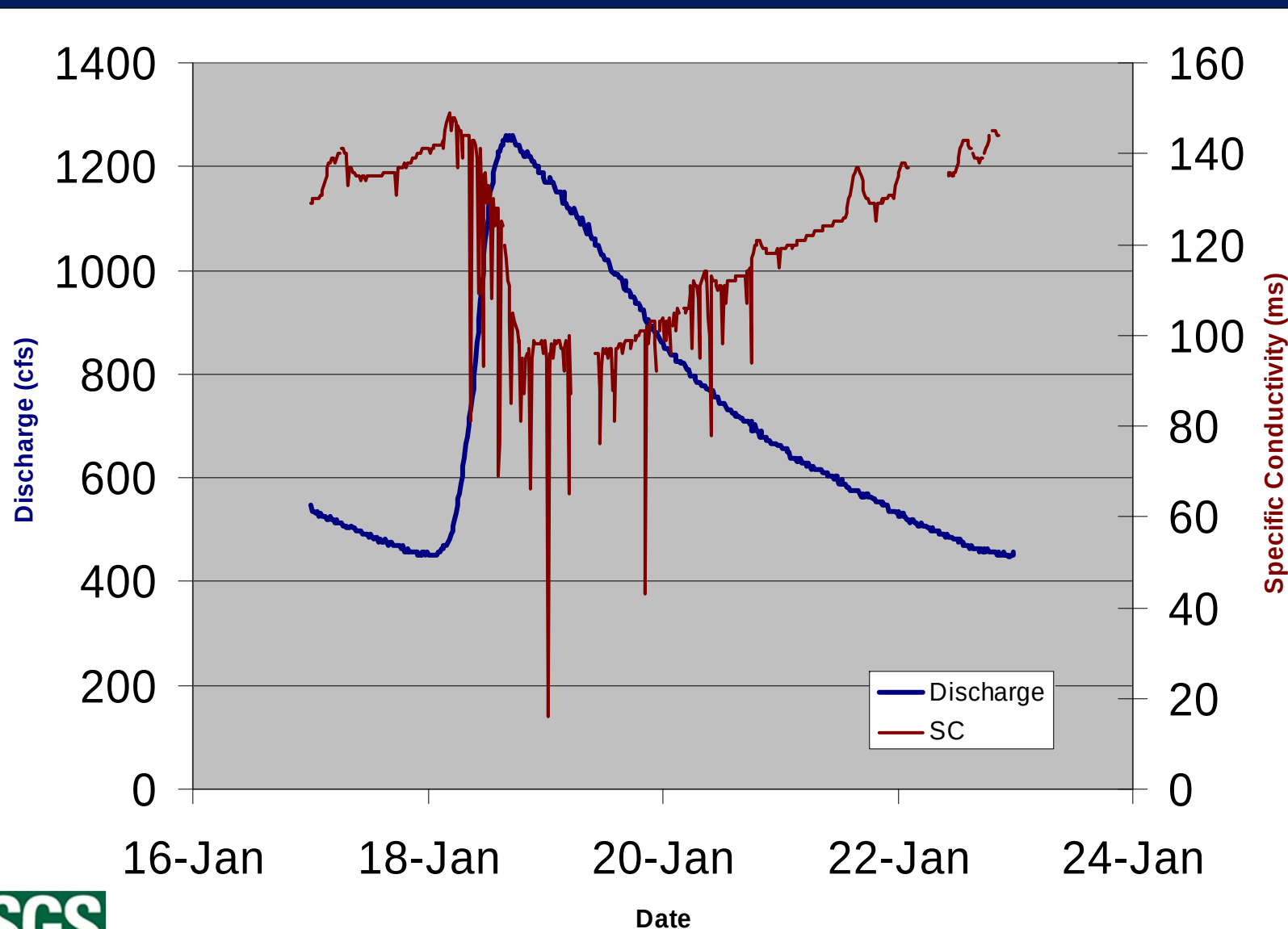
Discharge vs. Temp



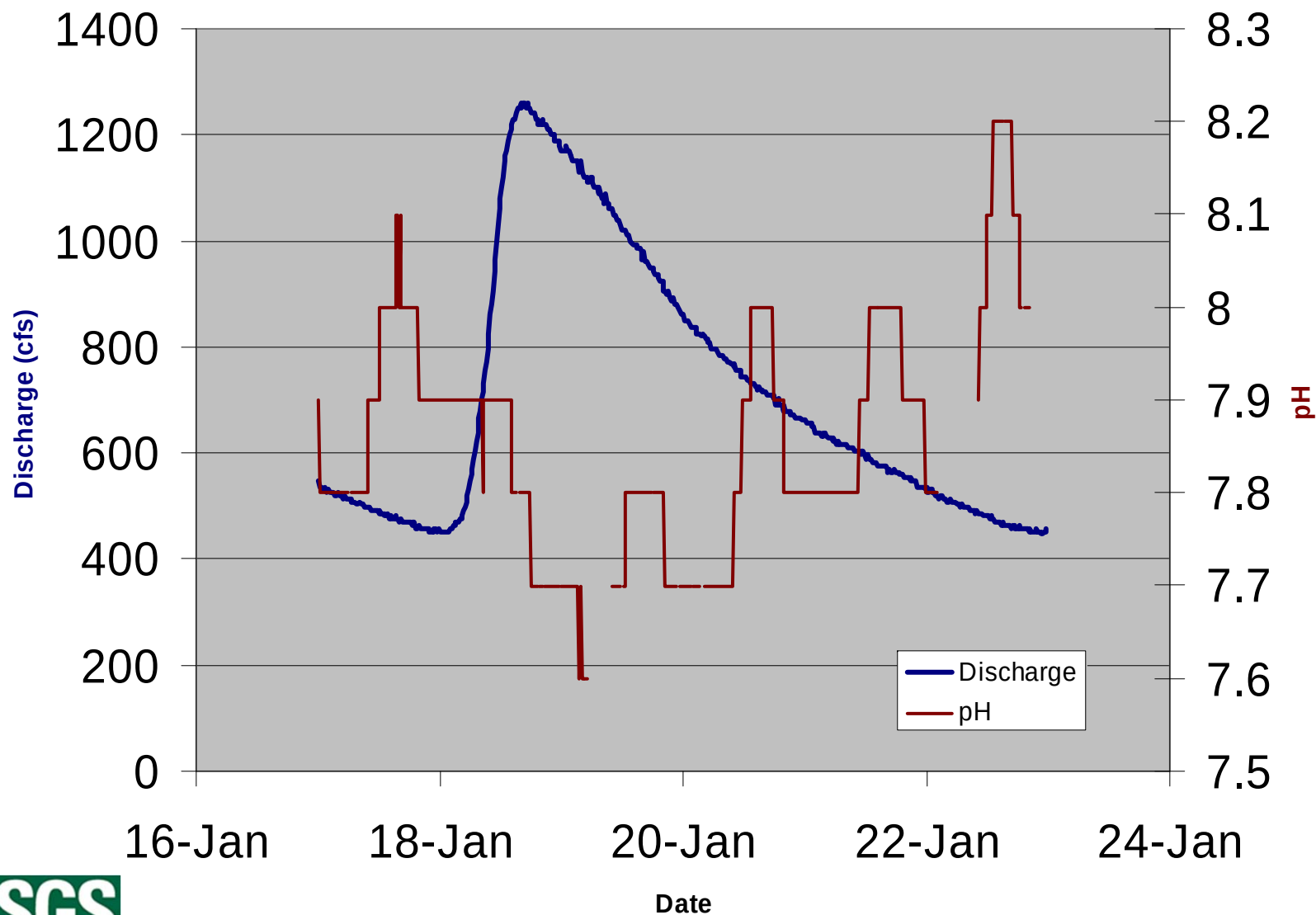
Discharge vs. Turbidity



Discharge vs. Sp Conductivity

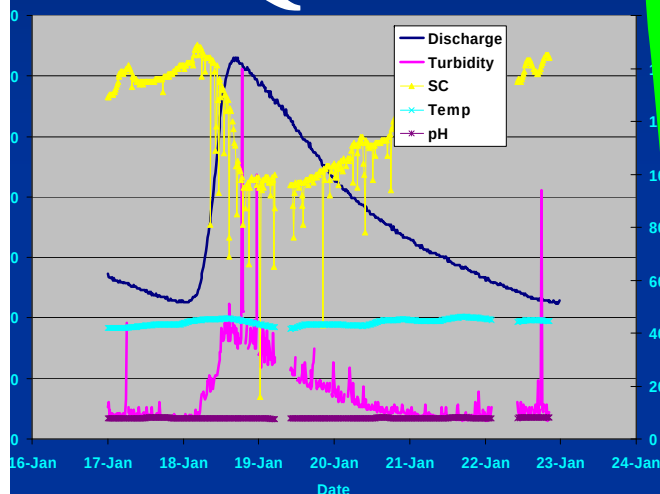


Discharge vs. pH



Estimating Fluxes

Continuous
WQ Data

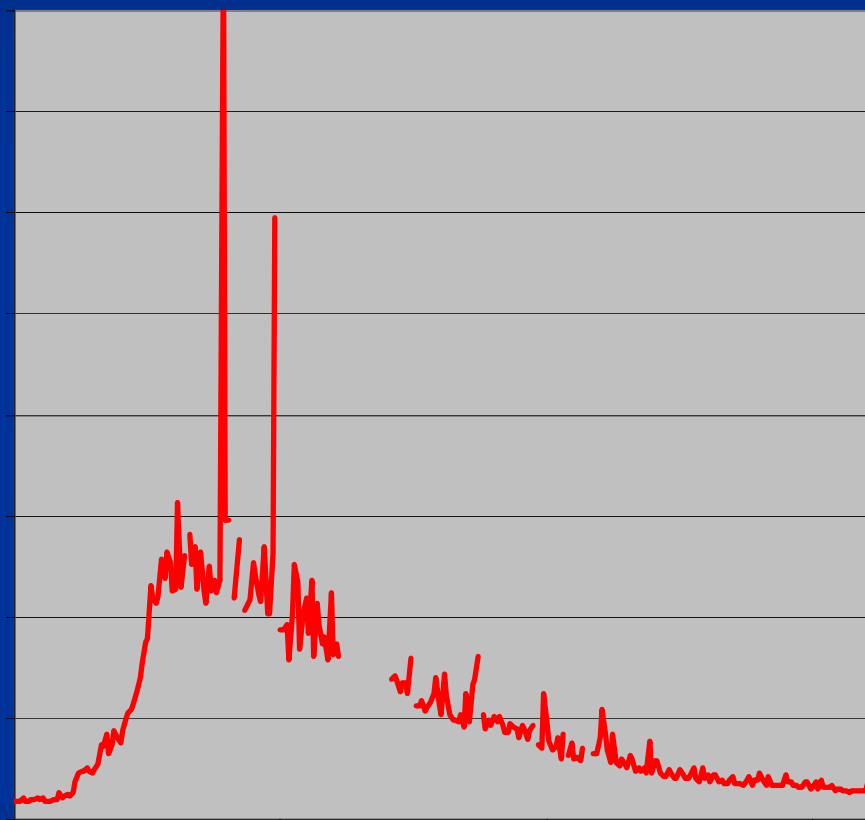


+

Periodic
WQ Data

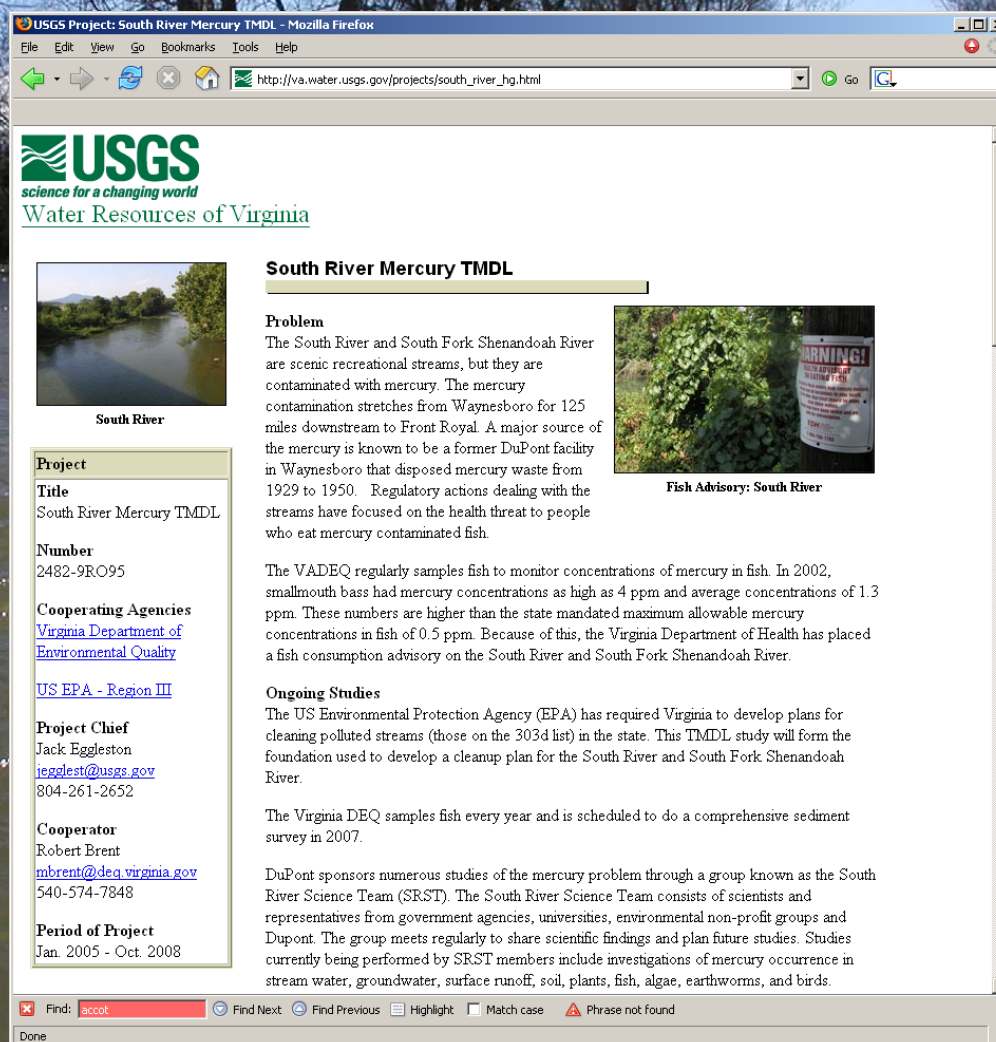
Statistical
Correlation

Hg Flux Estimate



South River Mercury Webpage

http://va.water.usgs.gov/projects/south_river_hg.html



The screenshot shows a web browser window titled "USGS Project: South River Mercury TMDL - Mozilla Firefox". The address bar displays the URL http://va.water.usgs.gov/projects/south_river_hg.html. The webpage content includes the USGS logo with the tagline "science for a changing world" and "Water Resources of Virginia". A photograph of the South River is shown with the caption "South River". To the right, the "South River Mercury TMDL" section is titled, followed by a "Problem" paragraph and a "Fish Advisory: South River" image. Below the problem section, there are sections for "Project" details, "Cooperating Agencies", "Project Chief", "Cooperator", and "Period of Project". The "Project" section lists the title "South River Mercury TMDL", number "2482-9RO95", and cooperating agencies "Virginia Department of Environmental Quality" and "US EPA - Region III". The "Project Chief" is Jack Eggleston, and the "Cooperator" is Robert Brent. The "Period of Project" is from Jan. 2005 to Oct. 2008. The "Ongoing Studies" section mentions the VADEQ fish sampling and the DuPont mercury problem studies. The bottom of the browser window shows a search bar with the word "scott" and a status bar with "Done".

USGS
science for a changing world
Water Resources of Virginia

South River

South River Mercury TMDL

Problem
The South River and South Fork Shenandoah River are scenic recreational streams, but they are contaminated with mercury. The mercury contamination stretches from Waynesboro for 125 miles downstream to Front Royal. A major source of the mercury is known to be a former DuPont facility in Waynesboro that disposed mercury waste from 1929 to 1950. Regulatory actions dealing with the streams have focused on the health threat to people who eat mercury contaminated fish.

Fish Advisory: South River

Project
Title
South River Mercury TMDL
Number
2482-9RO95
Cooperating Agencies
[Virginia Department of Environmental Quality](#)
[US EPA - Region III](#)
Project Chief
Jack Eggleston
jegelest@usgs.gov
804-261-2652
Cooperator
Robert Brent
mbrent@deq.virginia.gov
540-574-7848
Period of Project
Jan. 2005 - Oct. 2008

Ongoing Studies
The US Environmental Protection Agency (EPA) has required Virginia to develop plans for cleaning polluted streams (those on the 303d list) in the state. This TMDL study will form the foundation used to develop a cleanup plan for the South River and South Fork Shenandoah River.
The Virginia DEQ samples fish every year and is scheduled to do a comprehensive sediment survey in 2007.
DuPont sponsors numerous studies of the mercury problem through a group known as the South River Science Team (SRST). The South River Science Team consists of scientists and representatives from government agencies, universities, environmental non-profit groups and Dupont. The group meets regularly to share scientific findings and plan future studies. Studies currently being performed by SRST members include investigations of mercury occurrence in stream water, groundwater, surface runoff, soil, plants, fish, algae, earthworms, and birds.

Find: Find Next Find Previous Highlight Match case Phrase not found
Done

Mercury Flux During Storm, Nov. 29-30, 2006

Total Mercury Flux

Current Guesses for Watershed

Inputs (kg/year)

Net Atmospheric Deposition Wet+Dry	+11
assume watershed storage	-6
Dupont Plant continuing source	+~1

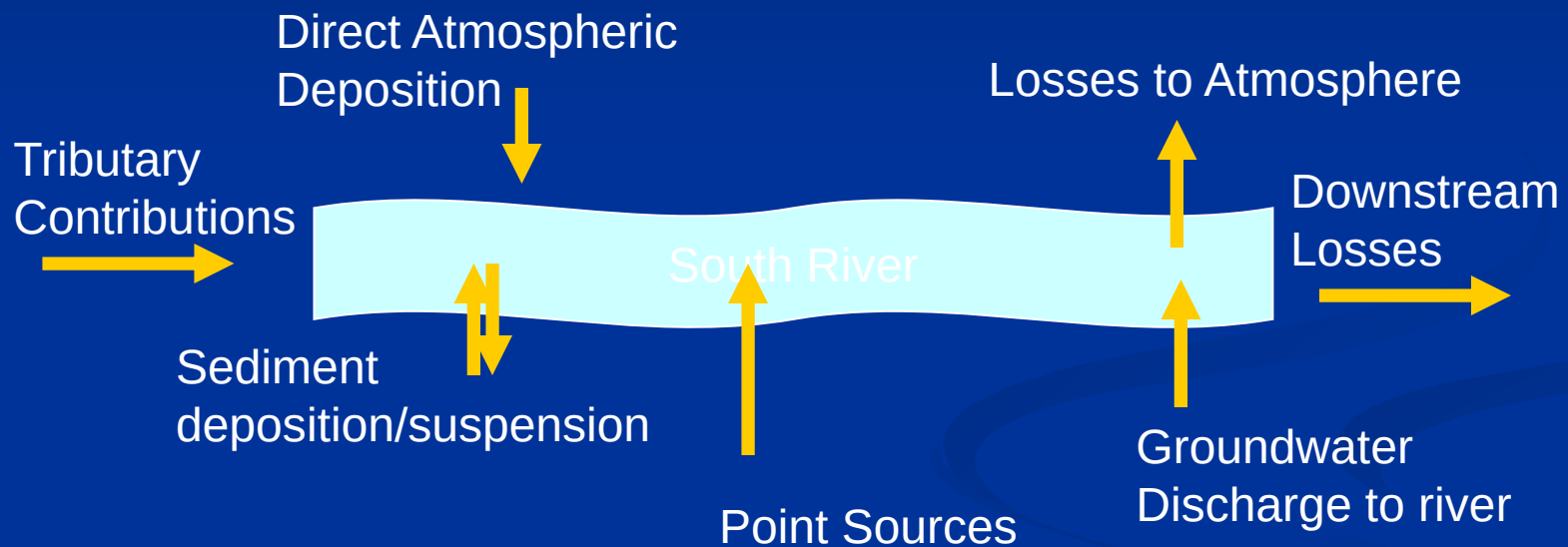
Outputs (kg/year)

River Discharge	-100
Volatilization & Evasion	-1
Total	-95

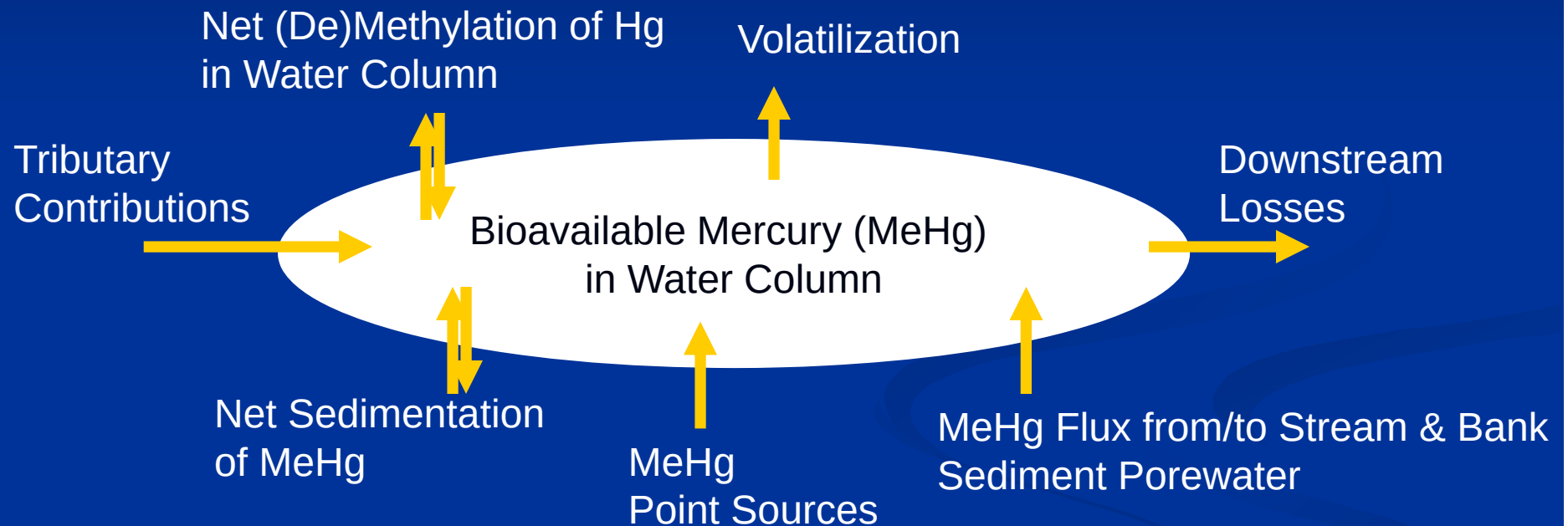
TMDL Study Design

- Focus on *methylmercury* (MeHg). (MeHg makes up ~90% of total mercury in fish.)
- Collect data needed to understand methylmercury cycling in the South River basin
- Build a defensible conceptual model before building a numerical model
- Focus efforts on the South River, then extrapolate to downstream Shenandoah river reaches

Mass Balance of Total Mercury

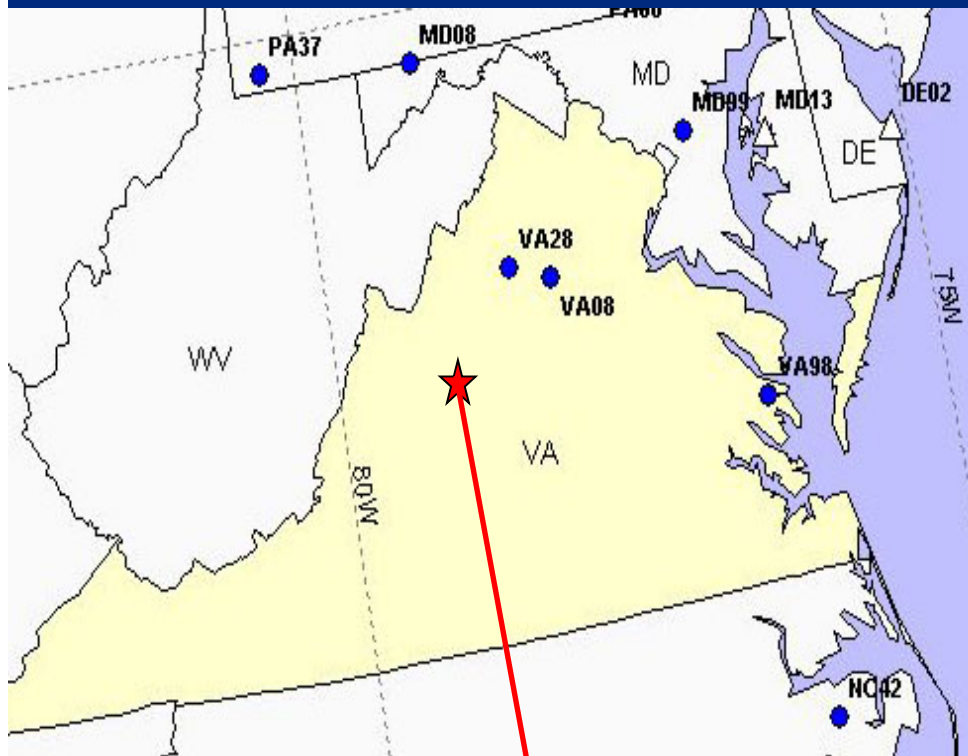


Mass Balance of Methyl Mercury

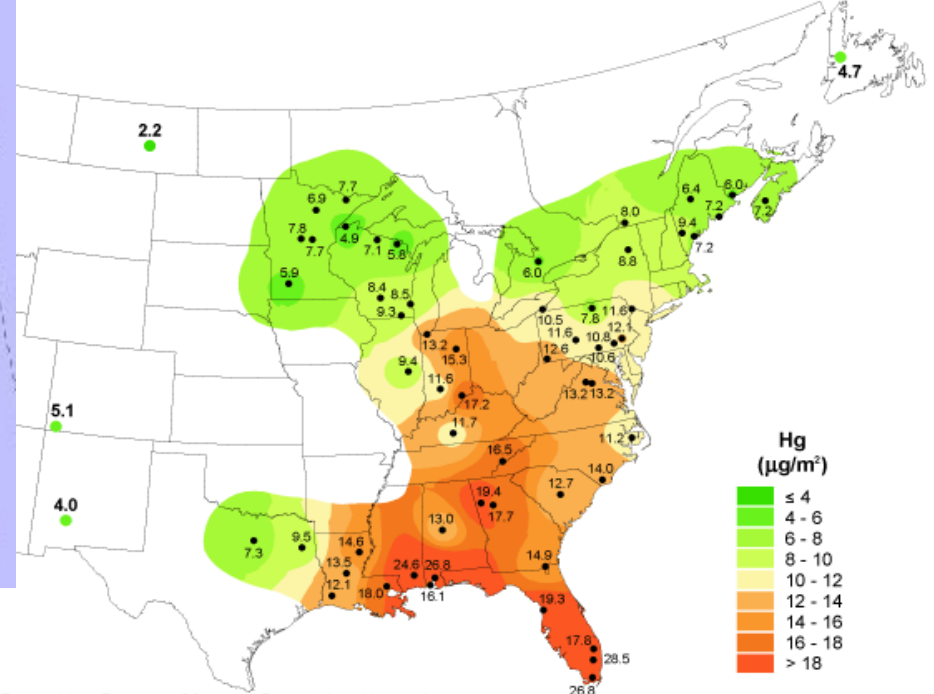


Atmospheric Deposition of Hg

Estimates from EPA's Mercury Dep. Ntwork



Total Mercury Wet Deposition, 2003



National Atmospheric Deposition Program/Mercury Deposition Network

Wet deposition rate = $13.2 \mu\text{g}/\text{m}^2/\text{yr}$

Atmospheric Deposition of Hg

$$\begin{array}{rcl} \text{Wet deposition rate} & & 13.2 \text{ mg/m}^2/\text{yr} \\ \text{Watershed Area (Harriston shed)} & \times & 212 \text{ sq miles} \\ \hline \text{Watershed Wet Deposition of Hg} & = & 7.2 \text{ kg/yr} \end{array}$$

Dry Deposition?

no good numbers currently in hand

$$\begin{array}{rcl} \text{1997 Mercury Report to Congress suggests} & \sim & 6.8 \text{ mg/m}^2/\text{yr} \\ \hline \text{Watershed Dry Deposition of Hg} & = & 3.7 \text{ kg/yr} \end{array}$$

$$\begin{array}{rcl} \text{Total Atmospheric Deposition} & & \\ \hline & = & \sim 11.0 \text{ kg/yr} \end{array}$$

How much of this gets into the stream system?

10%

50%

90%

Clean Sampling Techniques

- “Clean Hands / Dirty Hands”
- No field filtering or treatment
- Gloves
- Ultra-clean sampling equipment



Other Data Collection

- Shallow porewater sampling in stream banks (Hg, MeHg, pH, DOC)
- Stream bank sediment sampling (Hg, MeHg)
- Shallow groundwater sampling (Hg, MeHg)