

REMEDIAL OPTIONS PROGRAM

Year-2 Update



**South River Science Team Meeting
October 12, 2011**

Agenda

- Bank Stabilization Pilot Project
- Floodplain Pond Amendment Pilot Project
- Role of Submerged Aquatic Vegetation

Bank Stabilization Pilot Project

- **Objectives**

- Stabilize bank & reduce erosion
- Enhance existing aquatic and riparian ecosystems
- Reduce mercury (Hg) loads

- **Monitoring Plan**

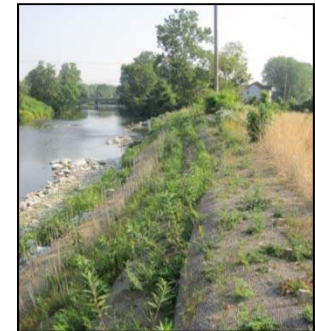
- Physical
- Biological
- Chemical



Bank Stabilization Pilot Project

Physical Monitoring

- Six transects monitored in 2011
- Bank is stable after two years
- Desired slumping of FES lifts



Biological Monitoring

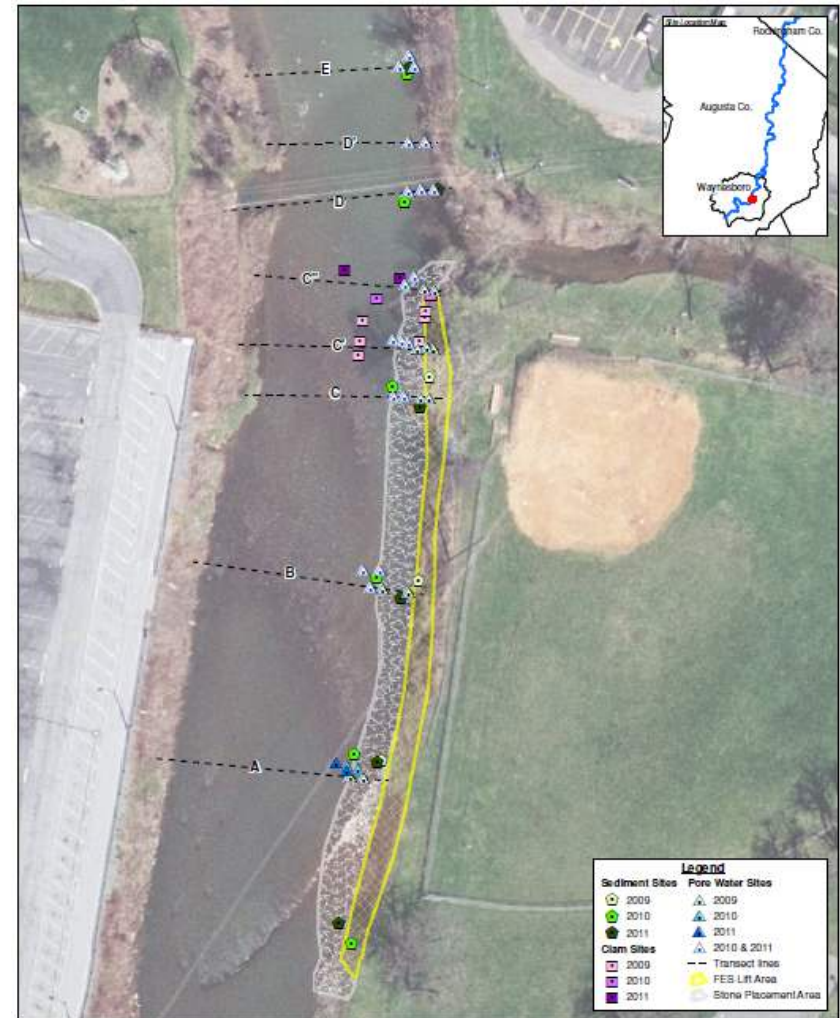
- Increased growth of planted stock
- Invasive species continue to impact community composition



Bank Stabilization Pilot Project

Chemical Monitoring

- Mercury concentrations in sediment and pore water continue to be less than pre-stabilization
- Maximum concentrations decreasing
- Lower variability observed for THg and IHg across media



Path Forward

- Findings of the Bank Stabilization Pilot Project will be used to inform remedial decision-making



Bank Soil Concentration Model

- University of Delaware modeled Hg concentration in bank soils
- RRM 0.0 – RRM 10.0
- Model groups banks into four bins based on THg:

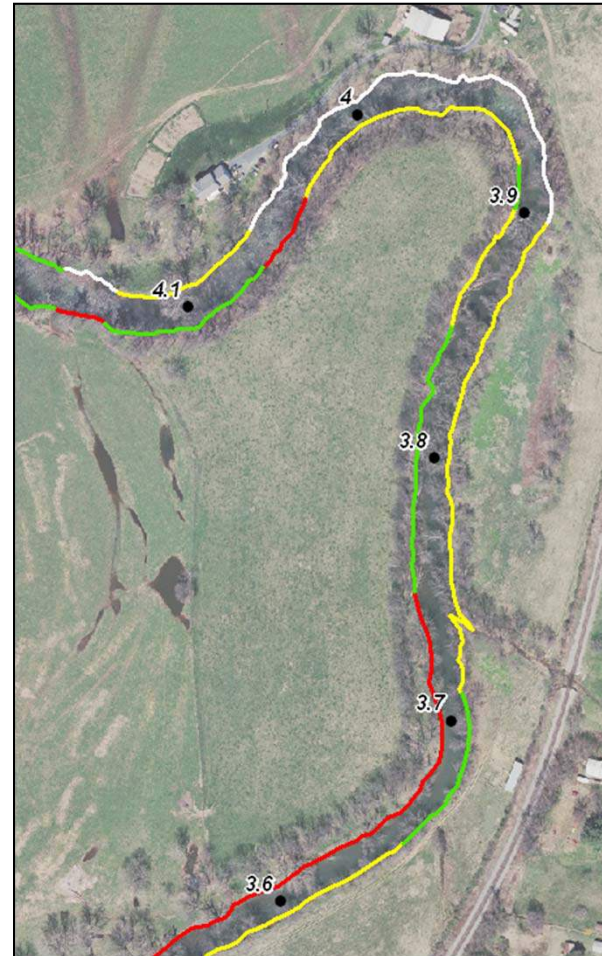
□ No estimate

■ < 7 ppm

■ 7-20 ppm

■ > 20 ppm

- Model uses predicted and empirical data



Model Confirmation Sampling

➤ Objectives

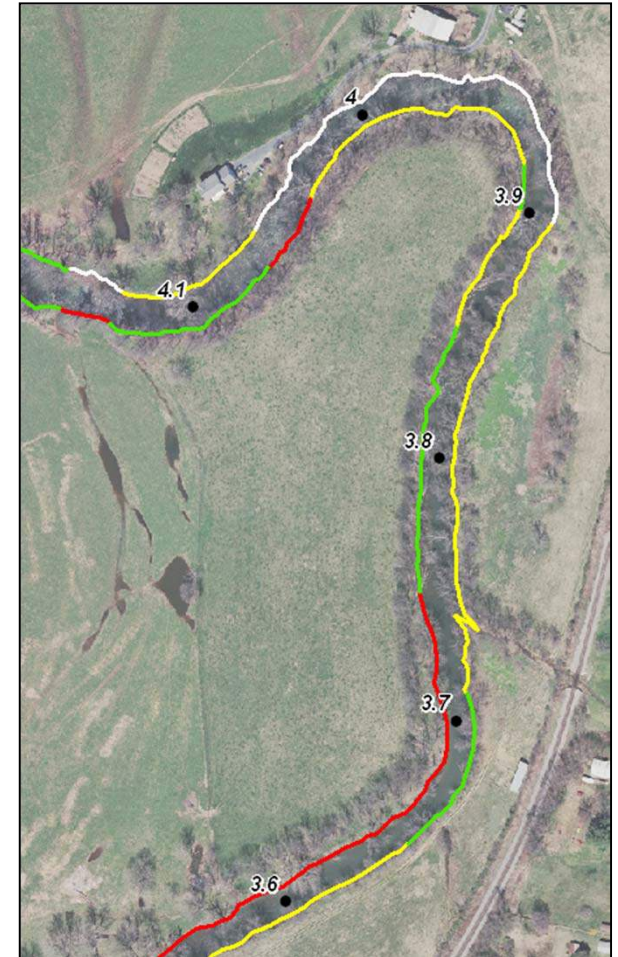
- Collect data to confirm model
- Fill data gaps
- Confirm key loading areas

➤ Approach

- Stratified – Random design
- Sample sized determined by power analysis
- Multiple samples/bank segment
- Analyze for THg only

➤ Schedule

- 4Q 2011/ 1Q 2012



Path Forward

- Continue to monitor chemistry in physical media at the Pilot Bank
- Confirm bank soil concentration model to inform optimal siting of stabilization remedies
- Apply lessons learned to future stabilization projects
- Continue evaluation of bank stabilization as a potential remedial option

Sediment Carbon Amendment Pilot Study



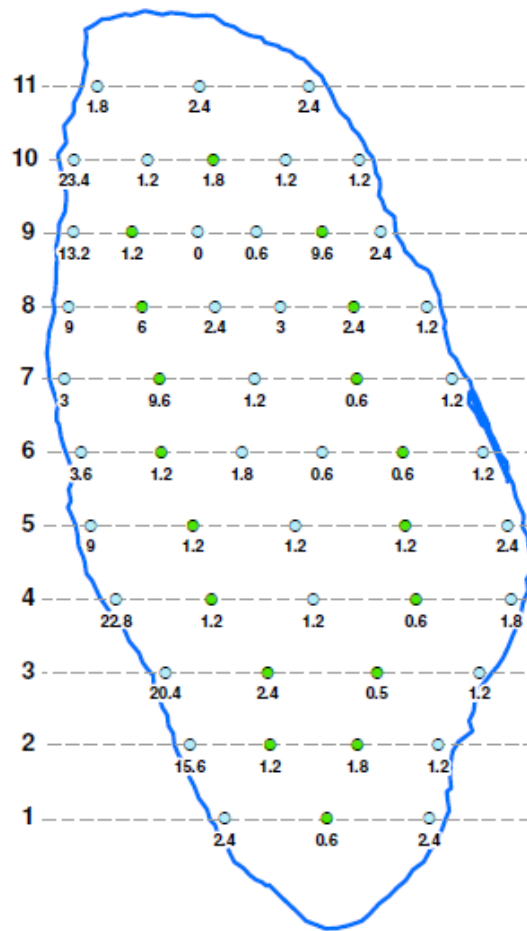
Objectives

- Design, implement and monitor use of a sediment carbon amendment as a remedial option to reduce the bioavailability of mercury in an aquatic environment
 - Specifically:
 - mercury in physical media
 - bioavailability of mercury to benthic macroinvertebrates
- Assess potential effects on
 - water quality
 - sediment characteristics
 - benthic macroinvertebrates

Phased Approach

- **Phase 1**
 - Site Selection
 - Characterization
- **Phase 2**
 - Engineering Design
 - Carbon Amendment
 - Monitoring

Pond Selection & Characterization



Legend

● Substrate Thickness & Surface Water Depth Sample Locations

● Surface Water Depth & THg Sediment Sample Locations

-- Sampling Transects

Pond Outline

All locations are approximate

Carbon Amendment

- Type of carbon amendment
- Amendment volume
- Method of dispersal



Non-Crushed



Crushed



Chicken
Manure

Hardwood

Corn Cobs

Pine Bark
Nuggets



Preliminary Findings

- No change in sediment THg or MeHg concentrations
- Decreases in:
 - Pore water IHg and MeHg
 - Surface water FIHg, MeHg_p, and FMeHg
 - MeHg in snail and *Caenis* tissues

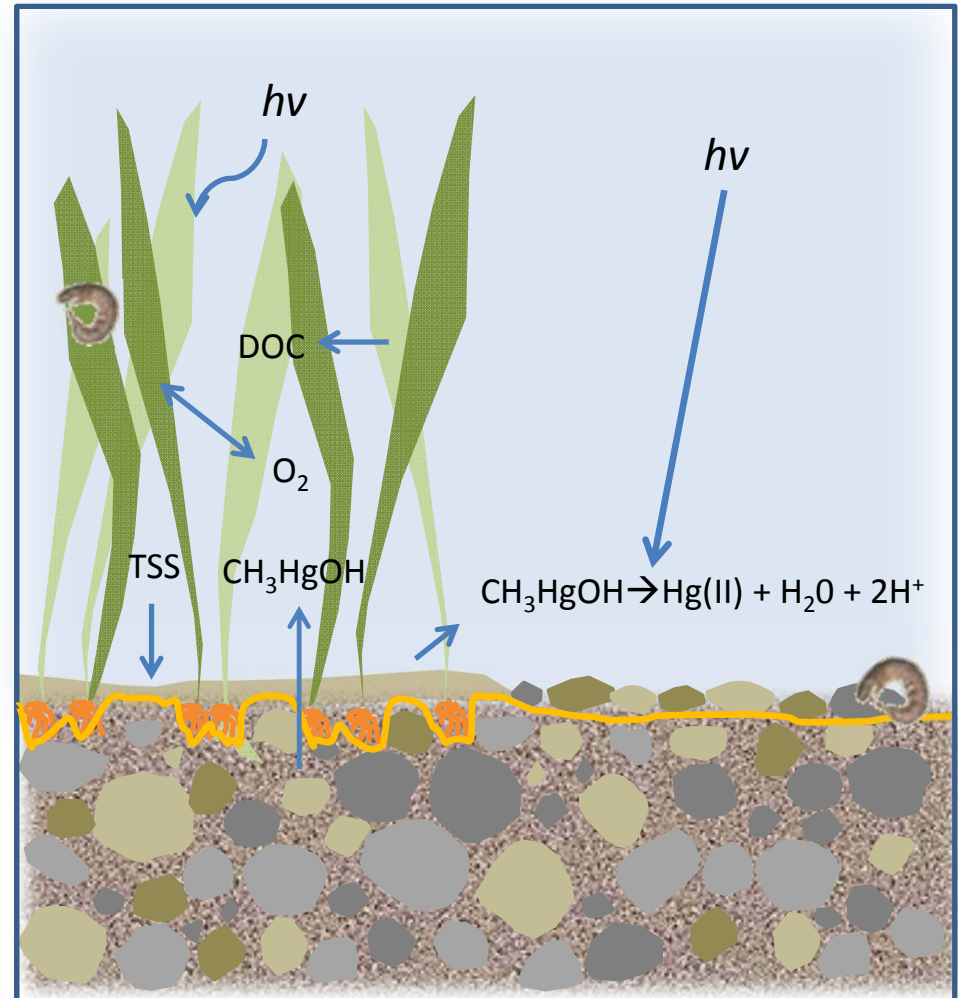


The Potential Role of Submerged Aquatic Vegetation in Mercury Methylation



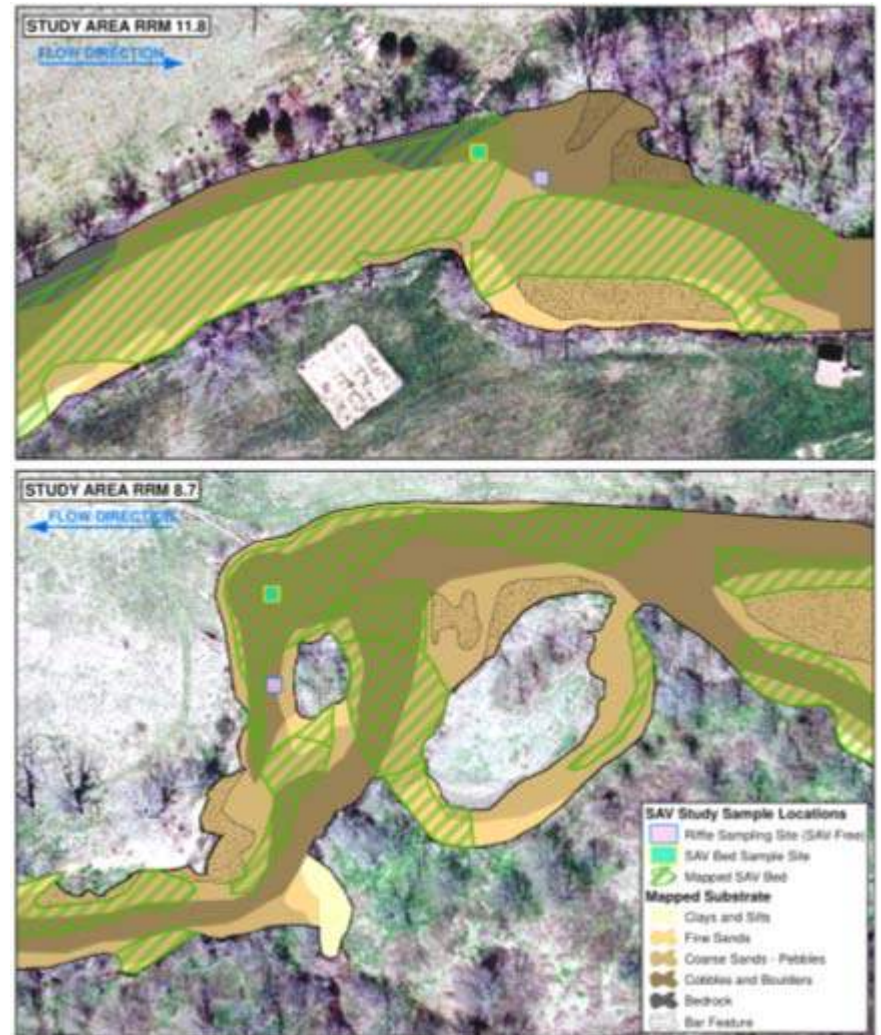
Objectives

- Understand the role of SAV as an environment for increased MeHg exposure to aquatic animals
 - MeHg sorption to SAV or associated fine-grained sediment
 - SAV a source of labile organic carbon for methylation
 - SAV as habitat for invertebrates



Study Design

- Collect samples from SAV beds & adjoining SAV-free areas & compare concentrations
- SAV identification and density estimate
- Study designed to coincide with detailed substrate mapping
- Sample sizes based on power analysis



Media, Analyte and Sample Size Summary



Media	Habitat	Family	Number of Study Areas	Number of Samples Per Habitat	Total Number of Samples
Surface Water	SAV	--	2	3	6
	Riffle	--	2	3	6
Sediment	SAV	--	2	5	10
	Riffle	--	2	5	10
Pore Water	SAV	--	2	3	6
	Riffle	--	2	3	6
Aquatic Insect	SAV	Chironomidae	2	8	16
		Baetidae	2	8	16
		Hydropsychidae	2	8	16
	Riffle	Chironomidae	2	8	16
		Baetidae	2	8	16
		Hydropsychidae	2	8	16

Note: One invertebrate type was selected based on availability and abundance at both study areas and SAV/riffles.

Preliminary Findings

- MeHg Concentrations in SAV vs Non-SAV samples:
 - Higher in sediment
 - Lower in surface water
 - No difference in pore water
 - Lower in invertebrates
- SAV may not drive MeHg production in South River



Progress

- Significant contribution to understanding of potential remedies and system dynamics
- Addressing challenges associated with working in South River environments
- Insight into behavior of carbon amendments in the environment
- Preliminary work underway in the assessment of biochar amendments to floodplain soils