

Remedial Options Program Work Group Activities

South River Science Team
Expert Panel Meeting
October 24, 2012



Topics

- SRST ROPs Scope
- Refining the Conceptual Site Model
- Remediation technology testing and deployment options
- Activities to develop an overall remediation approach
- SRST ROPs Task Teams



ROPs Work Group

- Identify, explore, evaluate, and test engineering solutions for the South River system. In so doing, we will
 - Use the conceptual pathway and exposure diagrams as a guide
 - Focus on the technical and scientific aspects of the possible solution
 - Explore and evaluate deployment methods of different technologies
 - Identify and define potential unintended consequences of a technology, and explore tradeoffs
- Evaluate effectiveness of pilot tests in achieving goals, and determine feasibility of implementation on a larger scale.
- Recommend promising technologies for consideration in the remedial alternatives and develop a remedial approach.
- Communicate activities and progress to greater South River Science Team



Mercury Management

- Remedial Action Vision (2008)
 - Reduce fish tissue Hg concentrations to levels that would allow consumption
 - Protect aquatic and terrestrial ecology with respect to Hg exposure

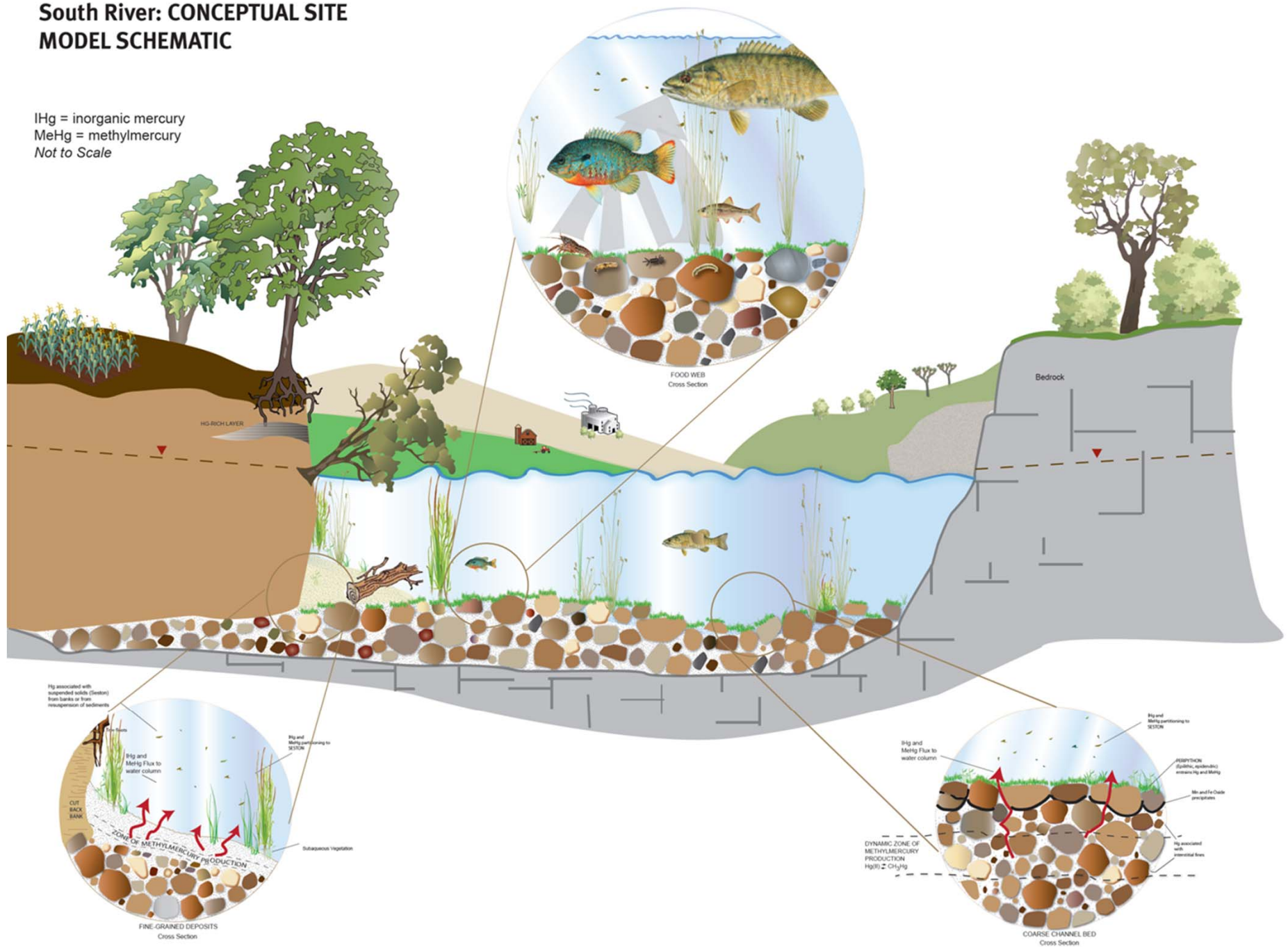


Refining the Conceptual Site Model

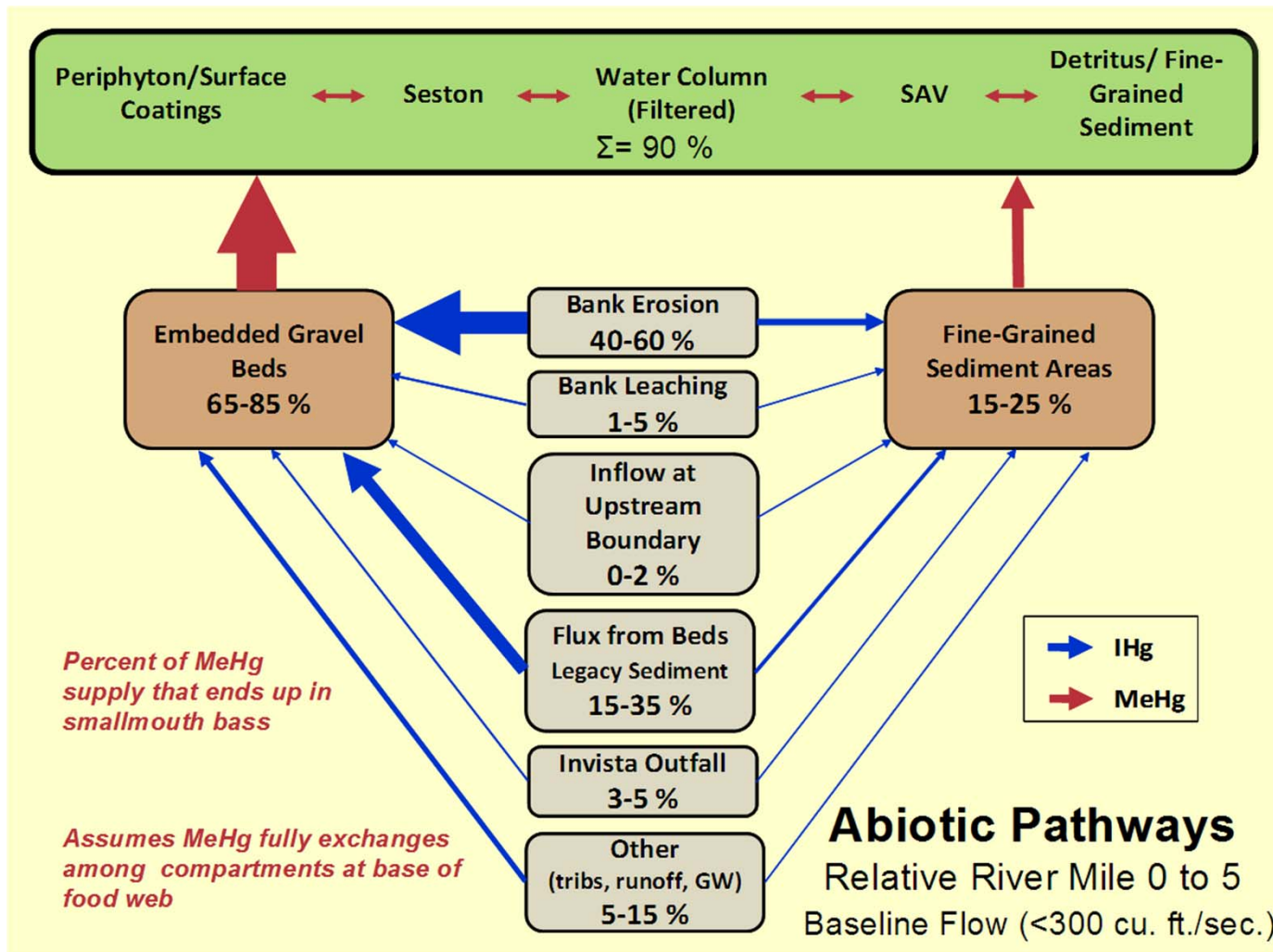


South River: CONCEPTUAL SITE MODEL SCHEMATIC

IHg = inorganic mercury
MeHg = methylmercury
Not to Scale

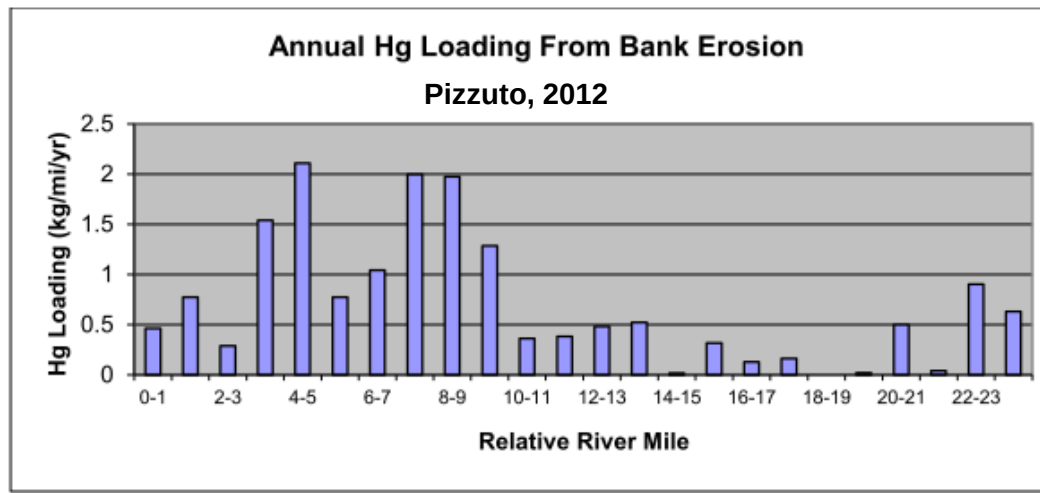


Conceptual Site Model for South River Aquatic System - Abiotic Pathways to Smallmouth Bass



Refining CSM for Remediation

- UT Austin DGT probe: vertical profile Mg and MeHg in pore water - potential identify zone of MeHg production
- Verify / refine UD bank loading model (ongoing)
 - Bank Hg concentration profiles (RRM 0 to 5)
 - BEHI survey for erosion potential (RRM 0 to 2)
- 2013: UD – Hg and MeHg geochemical dynamics in transition zones (bank-surface water-hyporheic)



Remediation technology testing and deployment options



Remediation technology testing and deployment options

- U Waterloo – ongoing laboratory studies
 - Characterize Hg speciation in soil and sediment
 - Test efficacy of potential treatment agents (Fe, carbon...) – Cowboy Charcoal
 - Subject systems to varying environmental conditions
- SERC biouptake studies
 - AC and biochar: both effective in reducing Hg/MeHg concentrations in lumbriculus
 - *BUT* – increase in MeHg in bulk amended sediment compared to control
- Toolbox of unscreened and screened remedial technologies (evergreen)
- 2013 W&M Effects of Biochar on Biota



Remediation technology testing and deployment options

- Bank Stabilization Pilot*
- Pond Biochar Amendment Pilot*
- Floodplain laboratory and field (2013)*
- 2013 JMU In River Mesocosm Studies
- Possible 2013 Particle tracking or shear evaluation for *in-river* technology deployment
- Possible 2013 UT Austin *InSitu Capping Simulator*



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Activities to develop an overall remediation approach

Mercury Management in the Aquatic Environment – Proposed Short-term Actions

- Control plant site Hg loading
- Refine Hg Bank Loading model estimates and validate with field program (RRM 0 to 10); prioritize reaches for bank stabilization
- Continue evaluation of other potential sources on a reach basis
- Develop a conceptual design for remediation on the first reach (e.g. RRM 0 to 2 or 3)
- Establish Stakeholder Group: review and refine designs
- Test proposed actions using Relative Risk Model for potential unintended consequences
- Implement on first reach, monitor and reevaluate (adaptive management)



Mercury Management in the Aquatic Environment

– Proposed On-going/Long-term Actions

- Continue to explore and test promising innovative approaches to reduce methyl mercury in the system
- Continue to explore potential natural attenuation processes in the different environmental compartments
- Continue remedial actions on a reach by reach basis
 - Incorporate information from remedial actions into CSM
 - Modify / improve remedial approach based on monitoring
- Integrate remedial actions with Overall Watershed Vision* when possible
- Test proposed actions using Relative Risk Model for potential unintended consequences

*Desired future conditions and clearly defined and achievable goals for the watershed are TBD



Activities to develop an overall remediation approach

- Enhanced Adaptive Management (EAM) Framework*
 - USACE – Develop a framework model that can be used for feedback of remedy monitoring in order to refine the CSM and improve / refine the remedy approach.
Ongoing
- 2013 Remediation Proposal (NRDC obligation)
 - Integrate “Strawman” approach, EAM and Pilot results
 - Monitoring Design – short term and long term
 - Draft timeline for implementation

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SRST ROPs Task Teams



**ROPs
Task
Teams**

**Laboratory and
Field Monitoring**

- Solicit/review/consult on proposals
- Vet new technologies
- Track remediation case studies
- Ensure communication with ROPs

**Remediation
Planning**

- Develop working approach and schedule for Phase 1
- Develop NRDC “Remediation Proposal”
- Adaptive Management Plan and Implementation
- CSM updates as needed
- Ensure communication with ROPs

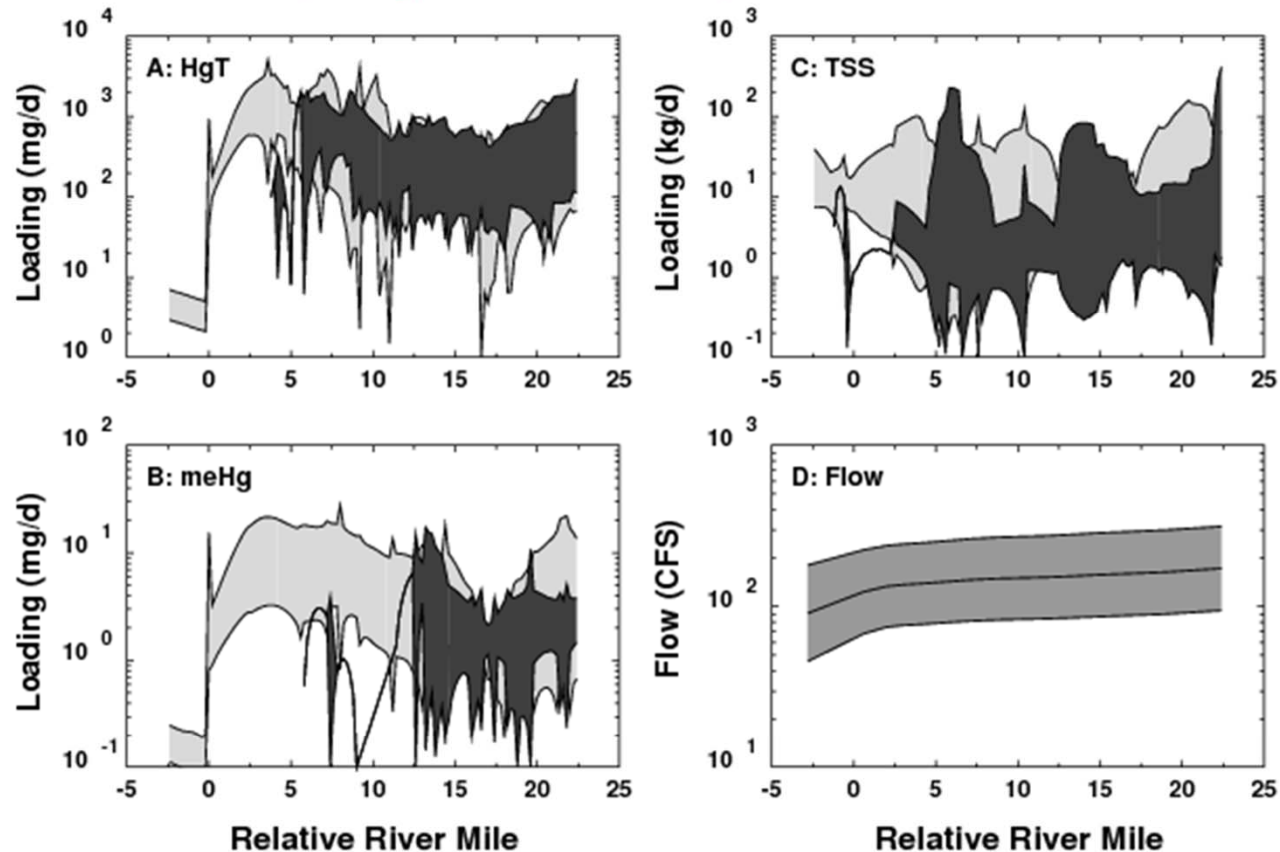
Field Scale / Pilots

- Track individual field pilot activities
- Track site remediation activities and effects in river
- Ensure pilot success criteria are “SMART”
- Identify engineering challenges and solutions
- Ensure communication with ROPs

Supplemental Slides



HydroQual (unpublished)



Spatial profiles of incremental loads of HgT (A), meHg (B), and TSS (C) at low flow. Light shaded polygons are positive incremental loads and dark shaded areas are negative loads. The range of the polygon represents one standard deviation across all months that were evaluated in this study. The flow (D) is plotted as the median and one standard deviation for all months included in this analysis.

2012 SRST ROP Activities

Laboratory Studies / Field Testing

- Treat South River soil and sediment to reduce bioavailability of Hg and MeHg
 - University of Waterloo (Ptacek)
- Assess effects of carbon amendments on bio-uptake of Hg
 - Smithsonian Environmental Research Center (Gilmour) and University of MD at Baltimore Co. (Ghosh)
- Develop and test probes for measuring *in situ* pore water concentrations of Hg and MeHg
 - University of Texas Austin (Reible)



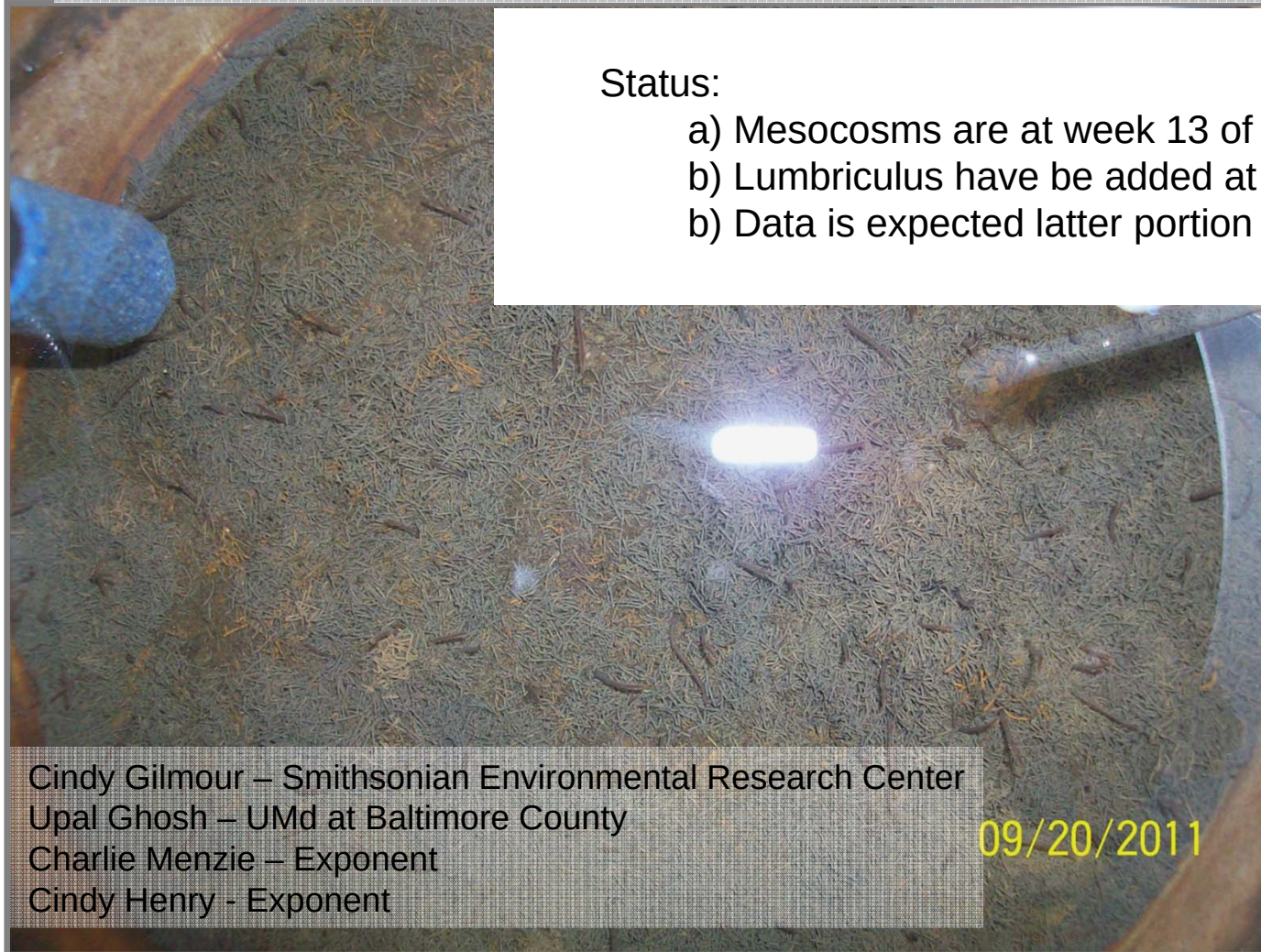
Phase 2 – Carbon Amendments (*SediMite*)

Primary Objective:

- Test carbon based amendment effectiveness in reducing biological uptake of Hg within the South River

Status:

- a) Mesocosms are at week 13 of a 14 week study
- b) Lumbriculus have be added at week 12 of study
- b) Data is expected latter portion of November



Cindy Gilmour – Smithsonian Environmental Research Center
Upal Ghosh – UMd at Baltimore County
Charlie Menzie – Exponent
Cindy Henry - Exponent

09/20/2011

south river
SCIENCE TEAM

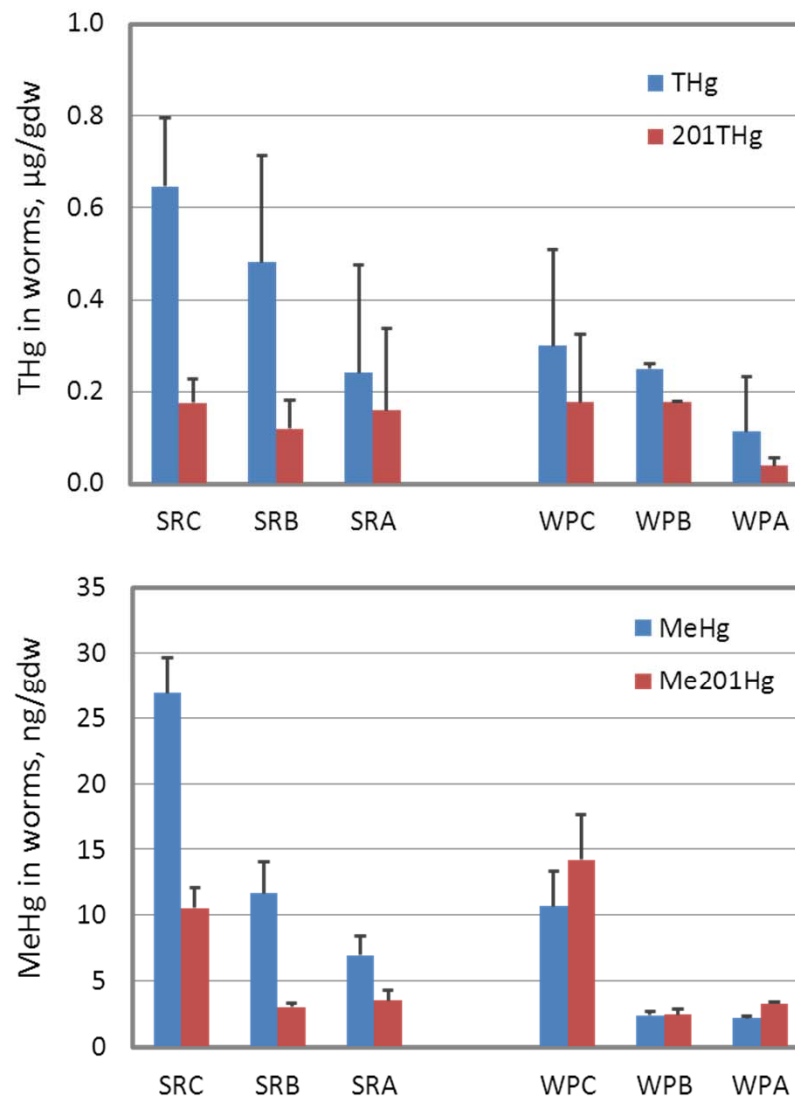
RESULTS – Bioaccumulation

Carbon amendments effectively decreased inorganic Hg and MeHg uptake by worms

Activated carbon was more effective in reducing worm Hg and MeHg concentrations than biochar

SRC – South River Control
SRB – South River Biochar
SRA – South River Activated Carbon
WPC – Wertman Pond Control
WPB – Wertman Pond Biochar
WPA – Wertman Pond Activated Carbon

Hg and MeHg in *Lumbriculus* 14-day exposure, microcosm day 72-86

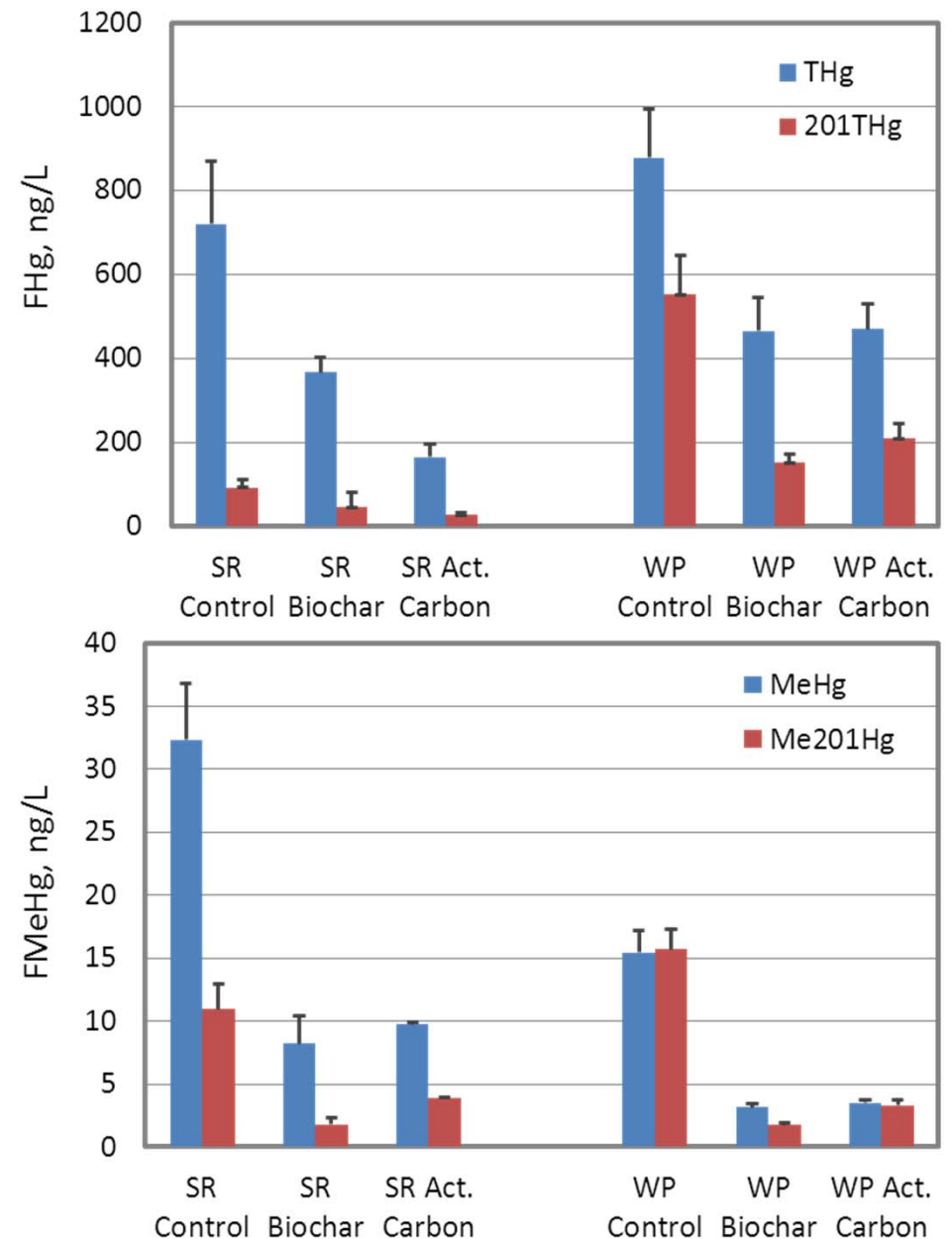


RESULTS – Porewater

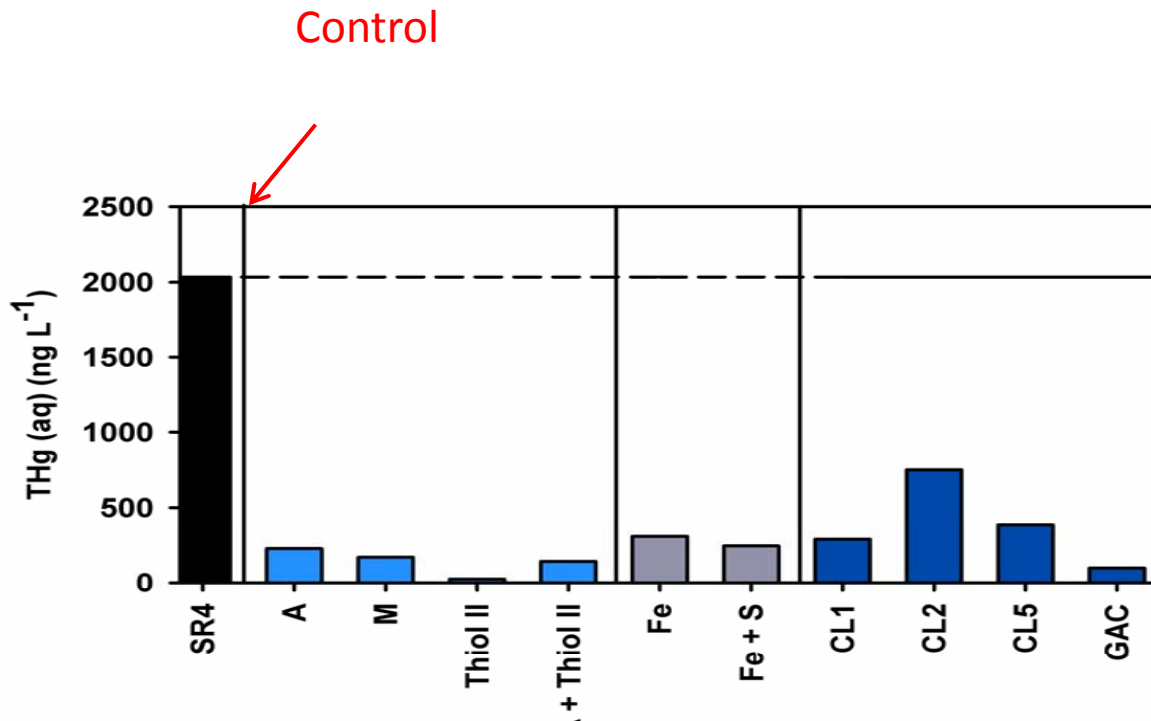
Carbon amendments effectively reduce porewater Hg and MeHg through 14 weeks, *despite increases in sediment Hg and MeHg*

Activated carbon was somewhat more effective than biochar only for THg in South River

Sediment porewater, day 86



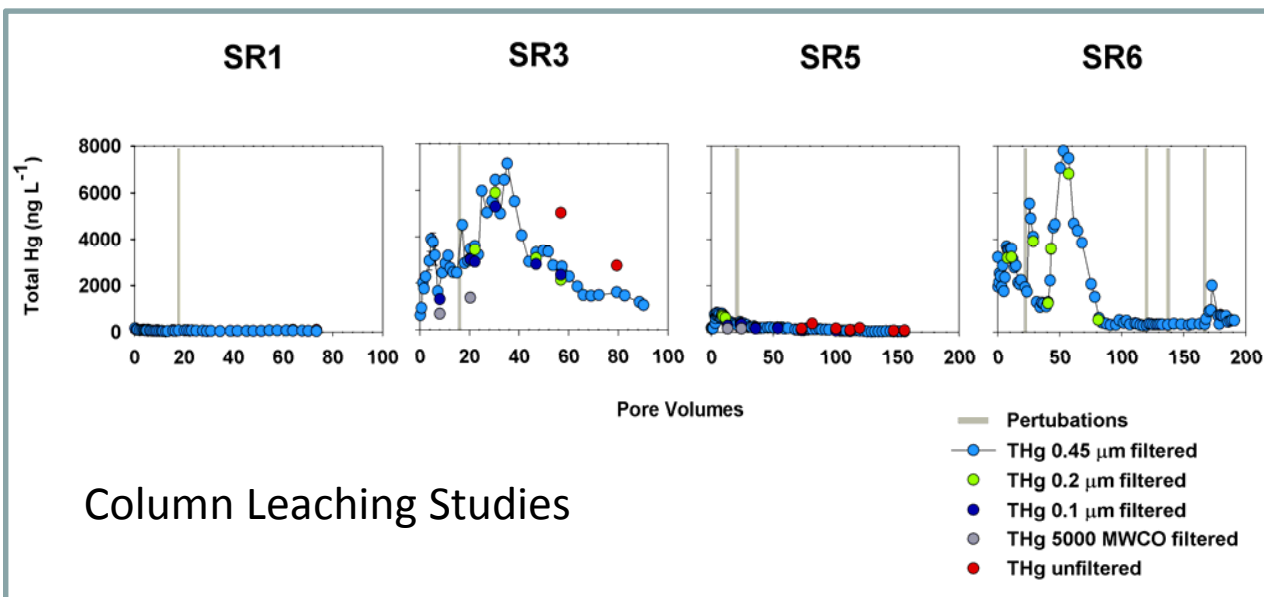
University of Waterloo South River Studies: Mercury Release from Sediments and Strategies for Remediation



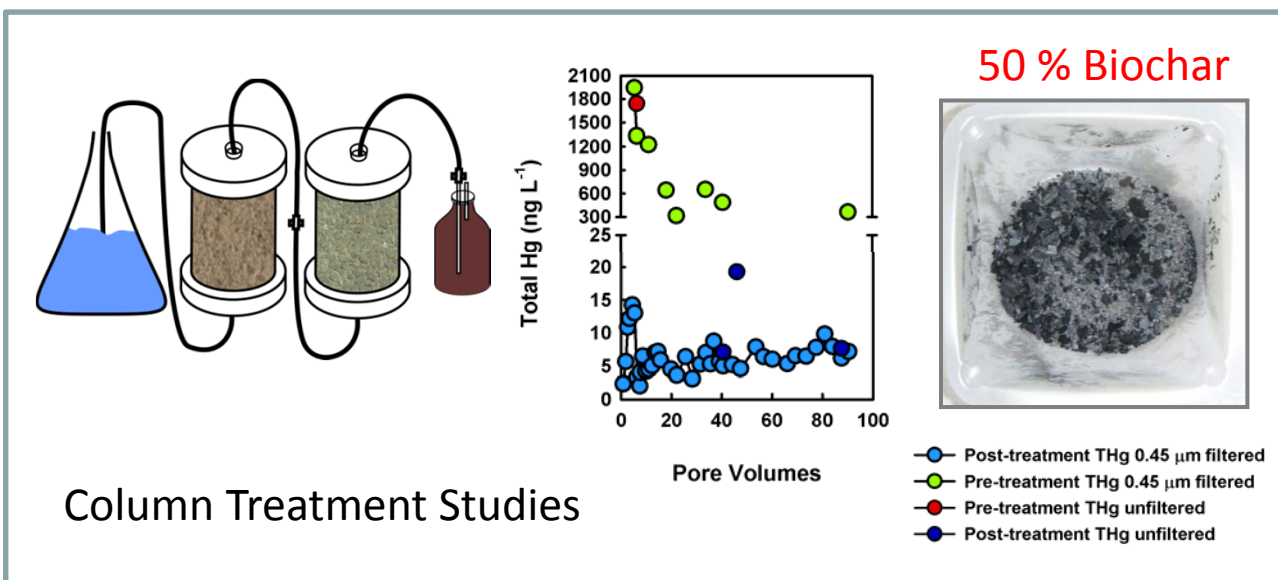
Sediment
Stabilization Studies



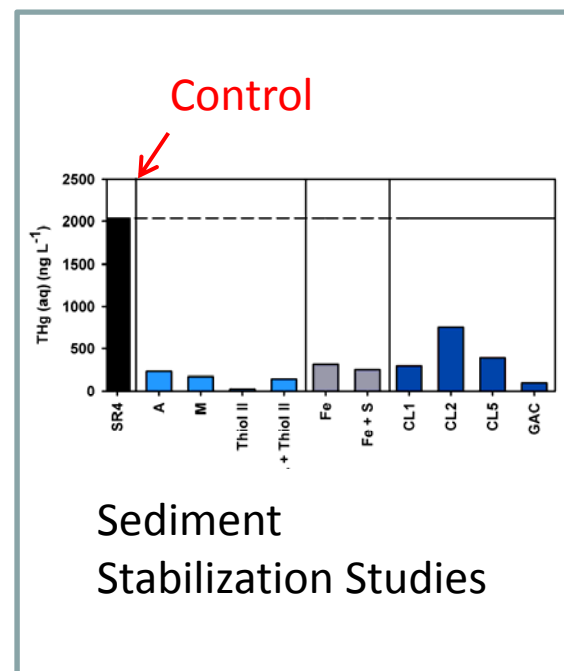
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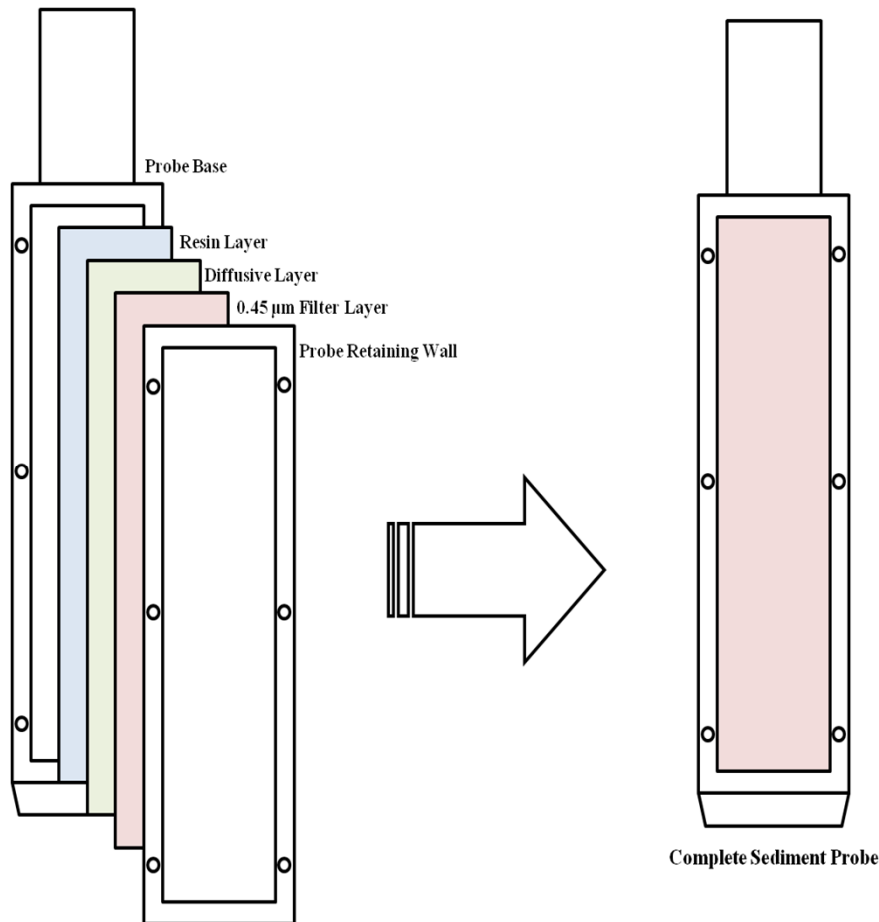
Column Leaching Studies



Column Treatment Studies



Sediment Stabilization Studies



Diffusive Gradient Probe University of TX Austin

Overall Objective:

Develop a tool to passively measure total Hg and MeHg gradient with depth in sediment porewater

2011 DGT deployment at Pond Amendment Pilot

Status:

Baseline and week 4 samples have been collected
DGT gels have been digested.

Technical issues with the analytical instrument
Next deployment in week 12

Tasks: Compare DGT PW data to:

Henry probe method
Benthic Hg burden data

Danny Reible - UT
Paul Bireta - UT
Rich Landis



2012 SRST ROP Activities

Characterization and Remedial Technology Pilots

- Refinement of UD Bank Loading Model
 - Verification of modeled Hg concentrations in the bank profile (RRM 0 to 5) and BEHI survey
- Bank Stabilization Pilot*
 - Assess engineering stability and local effectiveness in reducing Hg loading
- Pond Amendment Pilot*
 - Assess effectiveness of carbon amendment in contained aquatic system

* Presentations this meeting



2012 SRST ROP Activities

Remediation Planning and Implementation

- Toolbox of Remedial Technologies and Screened Technologies (evergreen)
 - Technologies ranked according to technical feasibility and implementability
- Enhanced Adaptive Management Framework*
 - USACE – Develop a framework model that can be used for feedback of remedy monitoring in order to refine the CSM and improve / refine the remedy approach. *Ongoing*



* Presentations this meeting

2013 SRST ROP Proposed Activities

Laboratory/ Desktop

- Soil and Sediment Treatment Testing (University of Waterloo cont.)
- Application of Carbon to Floodplain Soils – Part 1*
- Effects of Biochar on Biota (W&M)
- FAQ – carbon amendments and biochar

Field Characterization and Pilots

- Application of carbon to floodplain soils – Part 2*
- Refinement of UD Bank Loading Model (cont.)
- *In situ* mesocosm testing of carbon (JMU)
- Characterization of the near bank and hyporheic zone geochemistry (UD)
- Deployment of treatments in the river – exploring the engineering challenges of insitu treatment and reactive capping



* Presentation this meeting

2013 SRST ROP Proposed Activities

Remediation Planning and Implementation

- Plant Site Remediation efforts and monitoring (cont.)
- Enhanced Adaptive Management Framework (cont.)
- Overall Remediation Approach and Remediation Proposal
 - Technical Approach
 - Proposed Schedule
- Remediation Plan for first reach of the river



Current ROPs Projects

And Proposed for 2013

Laboratory Work / Small-scale Field

- U Waterloo
- SERC
- UT Austin (DGT)
- DuPont GRC (Biochar FP)
- Biochar FAQs
- Bank loading model verification (concentration /BEHI)
- W&M Biological effects of biochar
- UT Austin capping simulator
- UD biogeochemistry at the bank/water transition

Field Pilots / Deployment

- Bank Stabilization Pilot
- Pond Amendment Pilot
- Technologies Tool Box
- JMU mesocosms
- Floodplain Biochar Pilot
- Testing AquaGate™ deployment feasibility

Remediation Planning

- Design Alternatives Bank Stabilization
- Tentative Approach Phase 1
- Relative Risk Model
- Adaptive Management Framework
- Remediation Proposal (NRDC)



SRST ROPS Work Group – Task Teams

- Co-Leads
- Structure for advancing efforts at different levels of technology development
- Allows us to move forward on remediation pilots while continuing to seek and assess innovative approaches
- Co-leads will ensure appropriate progress on tasks/projects
- Individual tasks or projects will continue to be led by project individual
- Those interested can join project group in discussions on scope and progress (contact appropriate co-leads)
- ROPs will continue to be a fully integrated work group

