

# Remedial Options (ROPs) Program Update

May 14, 2015

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# Review From Yesterday's ROPs Meeting



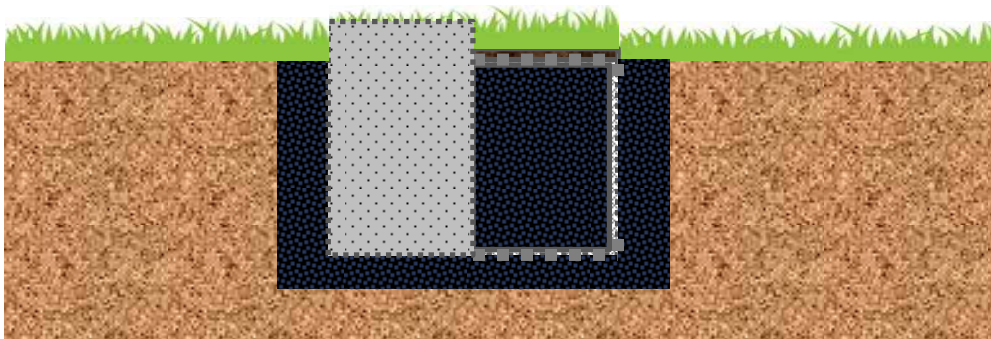
|    | Initiative                                  | Primary Investigator | Research Objective                                                                                                                                 | Status                                               |
|----|---------------------------------------------|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
| 1. | Floodplain Soil Amendment Pilot             | AECOM                | Investigate effects of floodplain biochar amendments on soil invertebrates, plants, and mercury uptake.                                            | Laboratory studies complete; field studies beginning |
| 2. | GW and SW Interaction Modeling              | Aquanty              | Use HydroGeoSphere modeling software to simulate groundwater and surface water interaction within the bank area during and following storm events. | Ongoing                                              |
| 3. | Biochar Effects on Invertebrate Communities | Will Clements        | Field and microcosm study of biochar effects on invertebrate communities.                                                                          | Completed                                            |

## Phase I – Laboratory Pilot (Completed)

- Found no adverse effects on earthworms and plants
- Found potential reduction in MeHg bioaccumulation

## Phase II- Field Pilot

- Validate the effectiveness and potential unintended consequences of using carbon amendments *in situ*
- Treatments: Control, 5% Biochar (unsaturated and saturated), 10% Biochar (unsaturated)
- Reps: 3



## Phase II- Study Metrics



## Analysis at 4&8 Weeks

–Adult and juvenile earthworm tissue: THg, MeHg, lipids

–Survival and growth

- Number, length and mass of adults

–Reproduction:

- Number and length of juveniles or cocoons produced

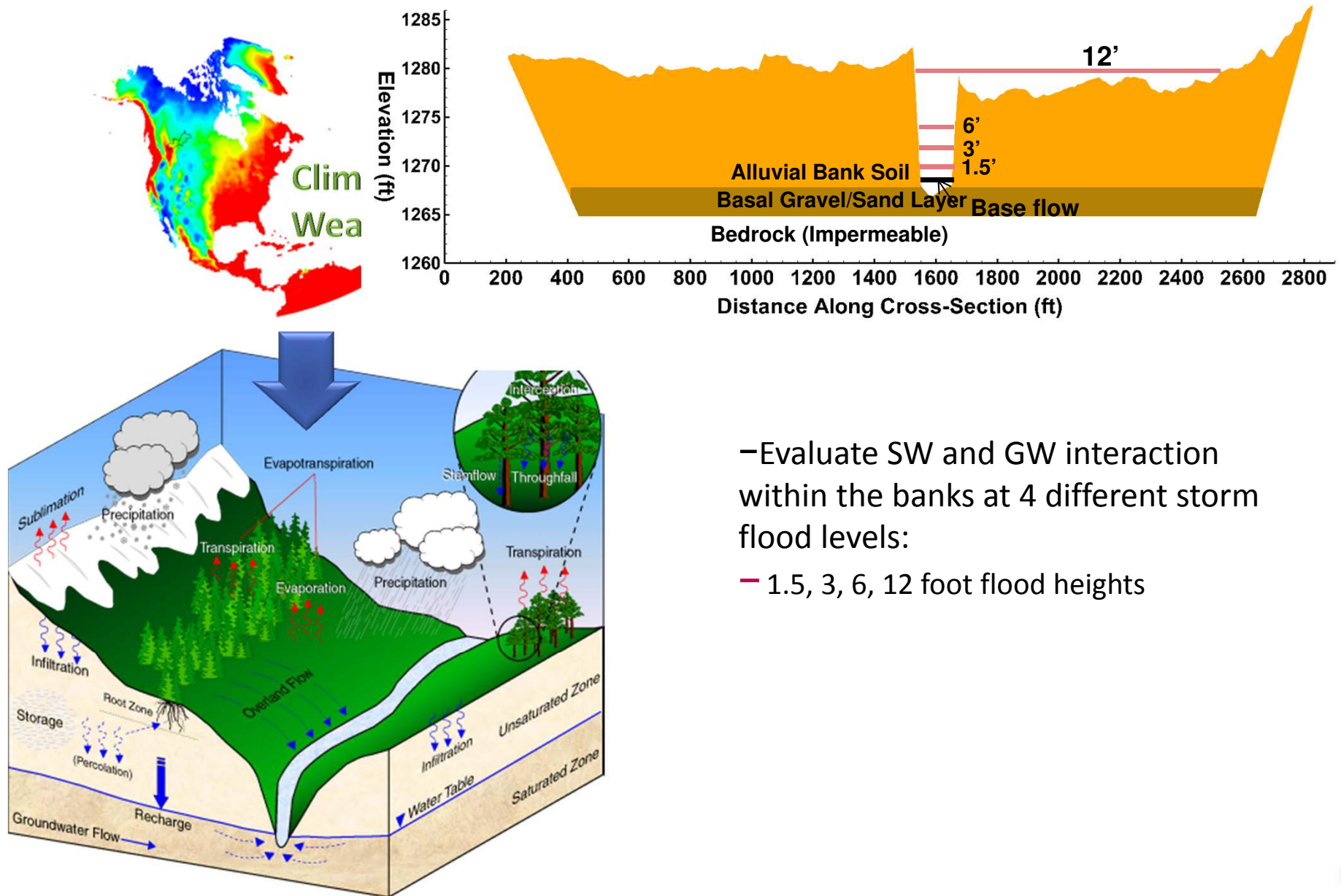
–Soil: THg, MeHg, organic carbon; Continuous redox and moisture monitoring

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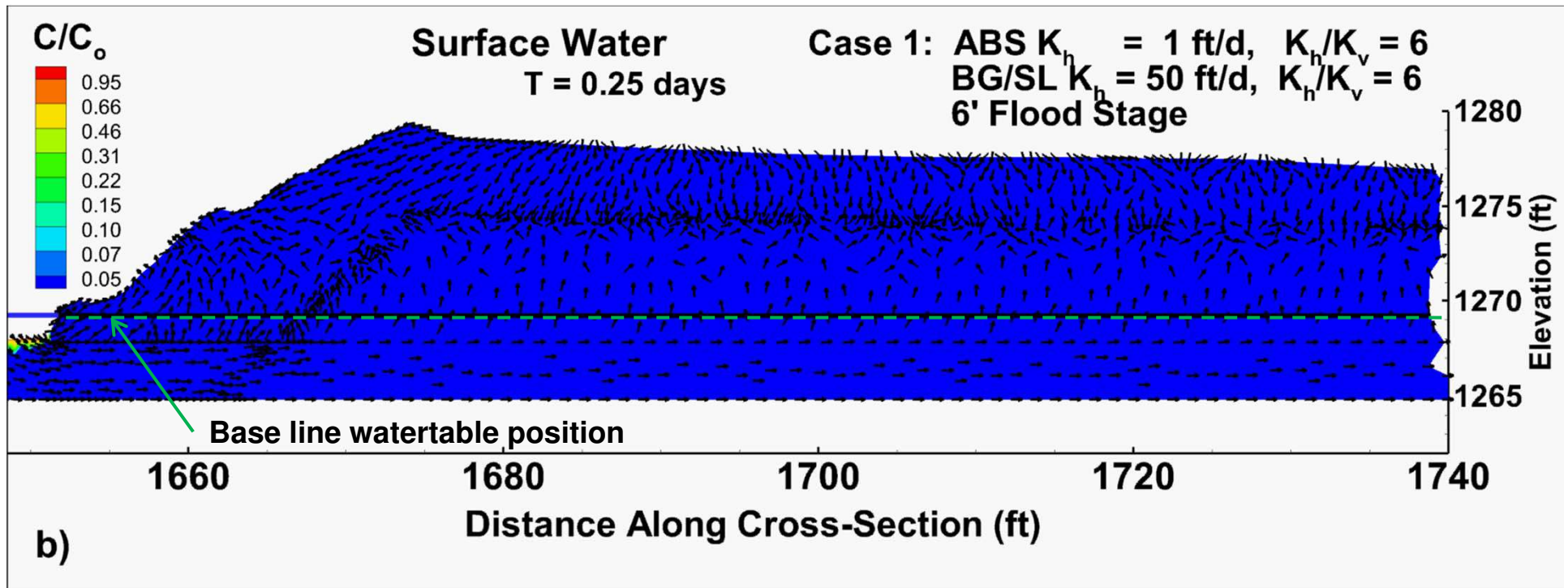
# Simulation Platform - HydroGeoSphere



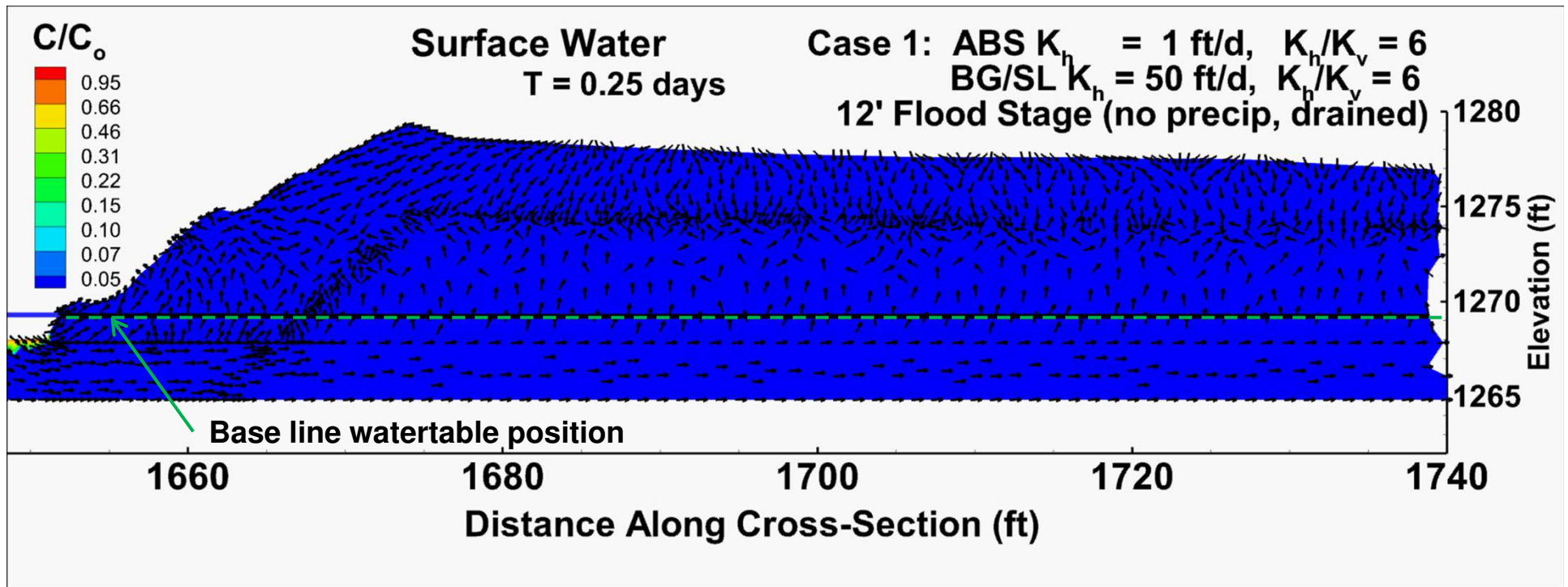
–Evaluate SW and GW interaction within the banks at 4 different storm flood levels:

– 1.5, 3, 6, 12 foot flood heights

## Inundation of Surface Water - 6' Flood Stage



## Inundation of Surface Water - 12' Flood Stage

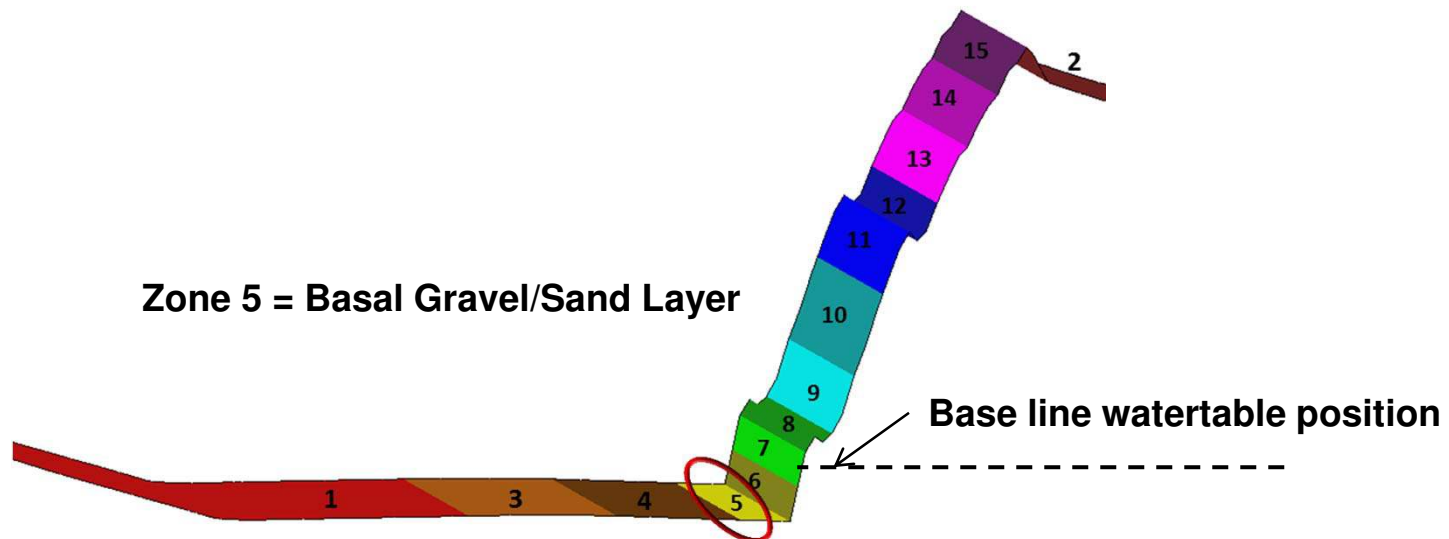


## Conclusions and General Observations

**Depends on hydraulic conductivity of bank material** - The degree of bank infiltration is highly dependent on the material properties of the bank, as well as the magnitude of the flood event

**In-channel and floodplain events behave very differently** and may activate different portions of the bank

**Most water enters and leaves channel through Zone 5** - During an in-channel event most of the water enters the system through the high-permeability layer at the base of the river (Zone 5)



## Conclusions and General Observations

**Infiltration rate > Exfiltration rate** - The rate of infiltration during a flood event is approximately an order of magnitude greater than the exfiltration rates during the receding limb

**Infiltration lasts days, exfiltration lasts weeks** - Infiltration into the bank may persist for several days following the peak of the flood event, and the timing of the reversal is related to the soil properties of the system

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# 1. Macroinvertebrate Colonization Experiment

Mesh bags filled with either Biochar or small gravel substrate



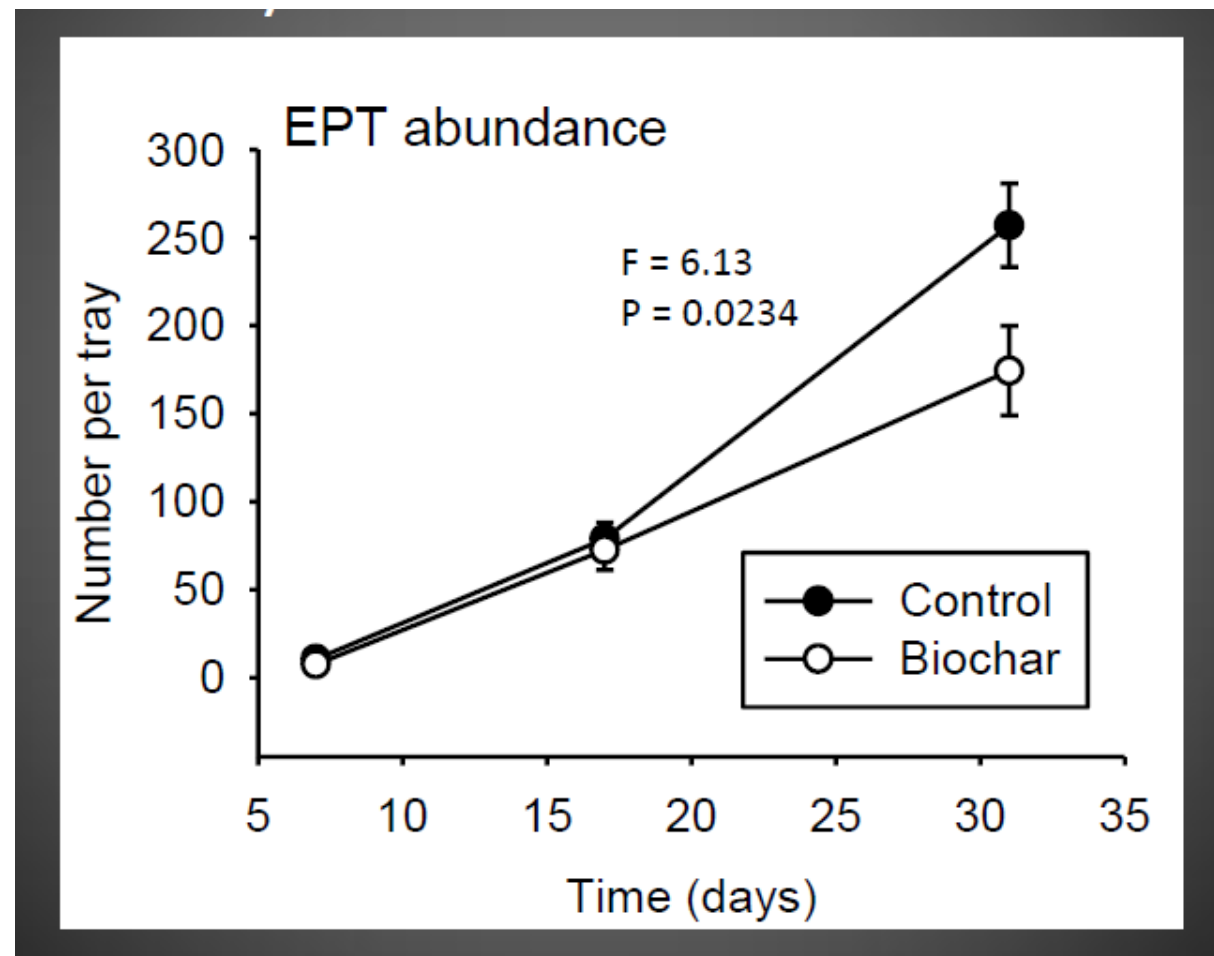
Covered with small cobble



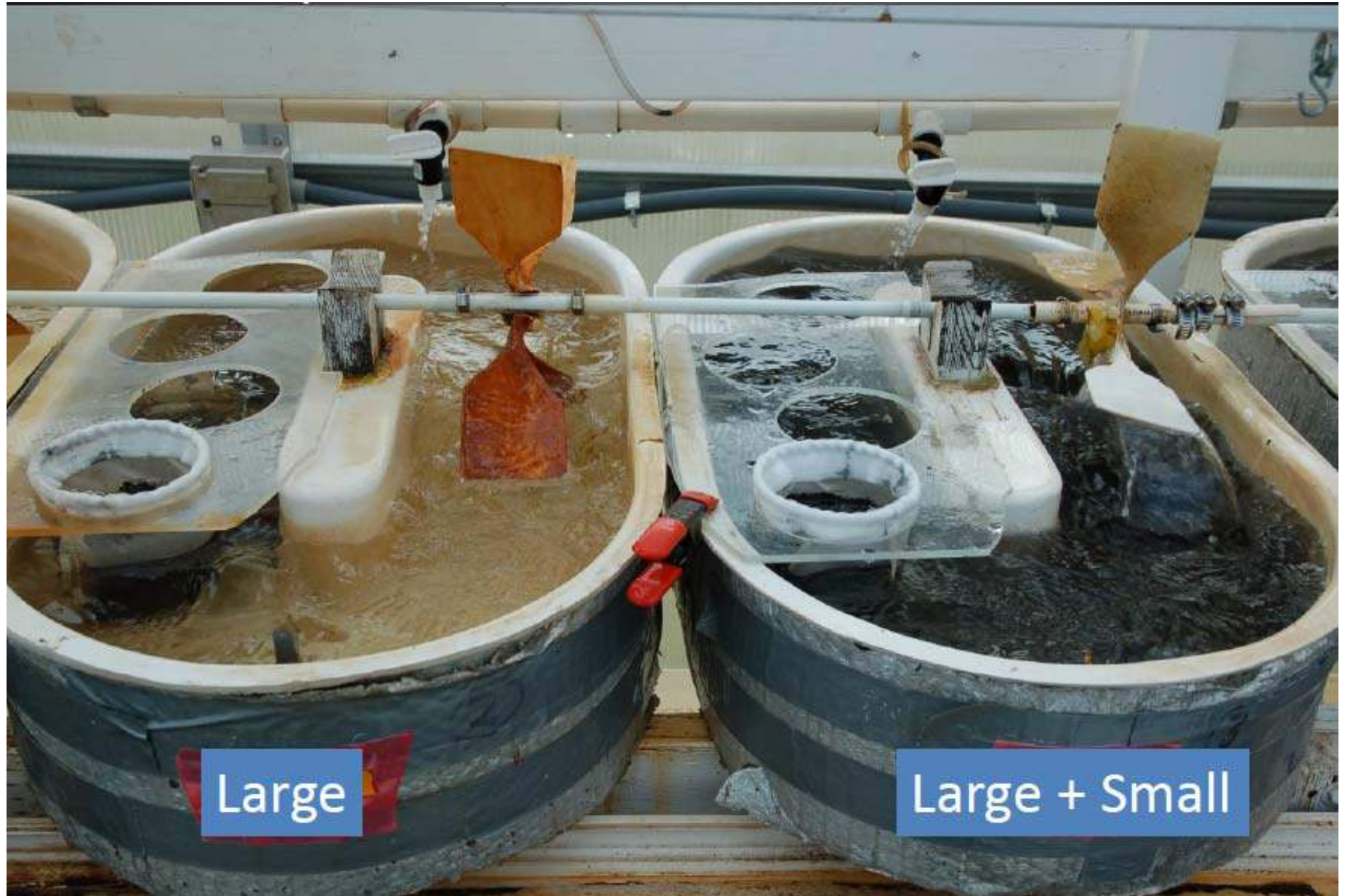
- Deployed in the field
- Collected after 7, 17 & 31 d

## Field Results

- Colonization of stoneflies was significantly lower in trays containing biochar; mechanism unclear

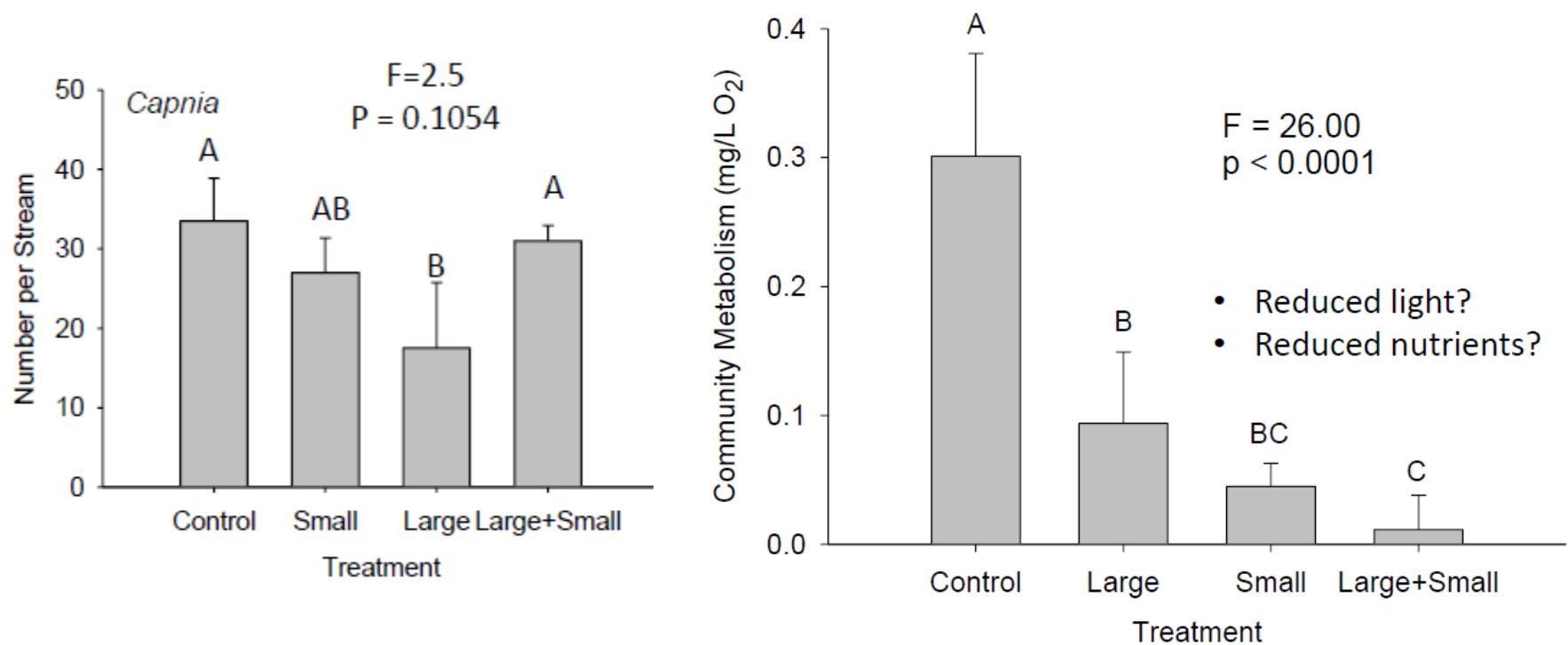


## 2. Effects of Biochar in Stream Microcosms



## Microcosm Results

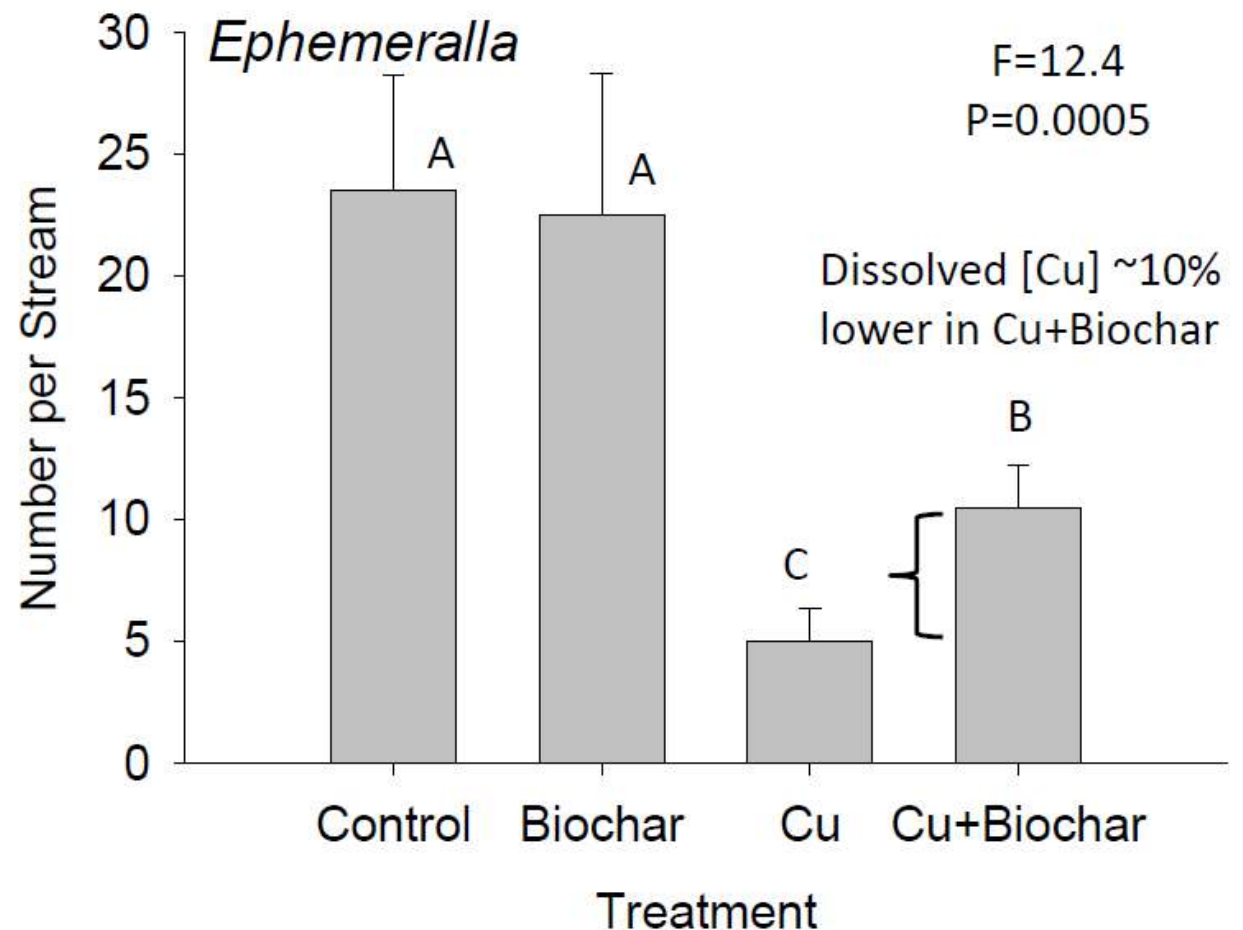
- Biochar increased macroinvertebrate drift and reduced community metabolism in stream microcosms



- Effects of Biochar in stream microcosms were generally limited to stoneflies (especially early instars)

## Microcosm Results

- Negative effects of Biochar should be evaluated within the context of benefits associated with reduced contaminant bioavailability



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|----|-----------------------|----------------------|-----------------------------------------------------------------------------------------|-------------------------------------------------|
| 4. | Phase I Remediation   | Clay Patmont         | Design and implement Phase I Interim Measures for remediation of South River (SR AOC4). | Design phase                                    |
| 5. | Relative Risk Model   | Wayne Landis         | Develop relative risk model for human and ecological risks in the South River.          | Completed; beginning integration with EAM model |
| 6. | Mercury Cycling Model | Reed Harris          | Develop Mercury Cycling Model for application to the South River.                       | Ongoing                                         |

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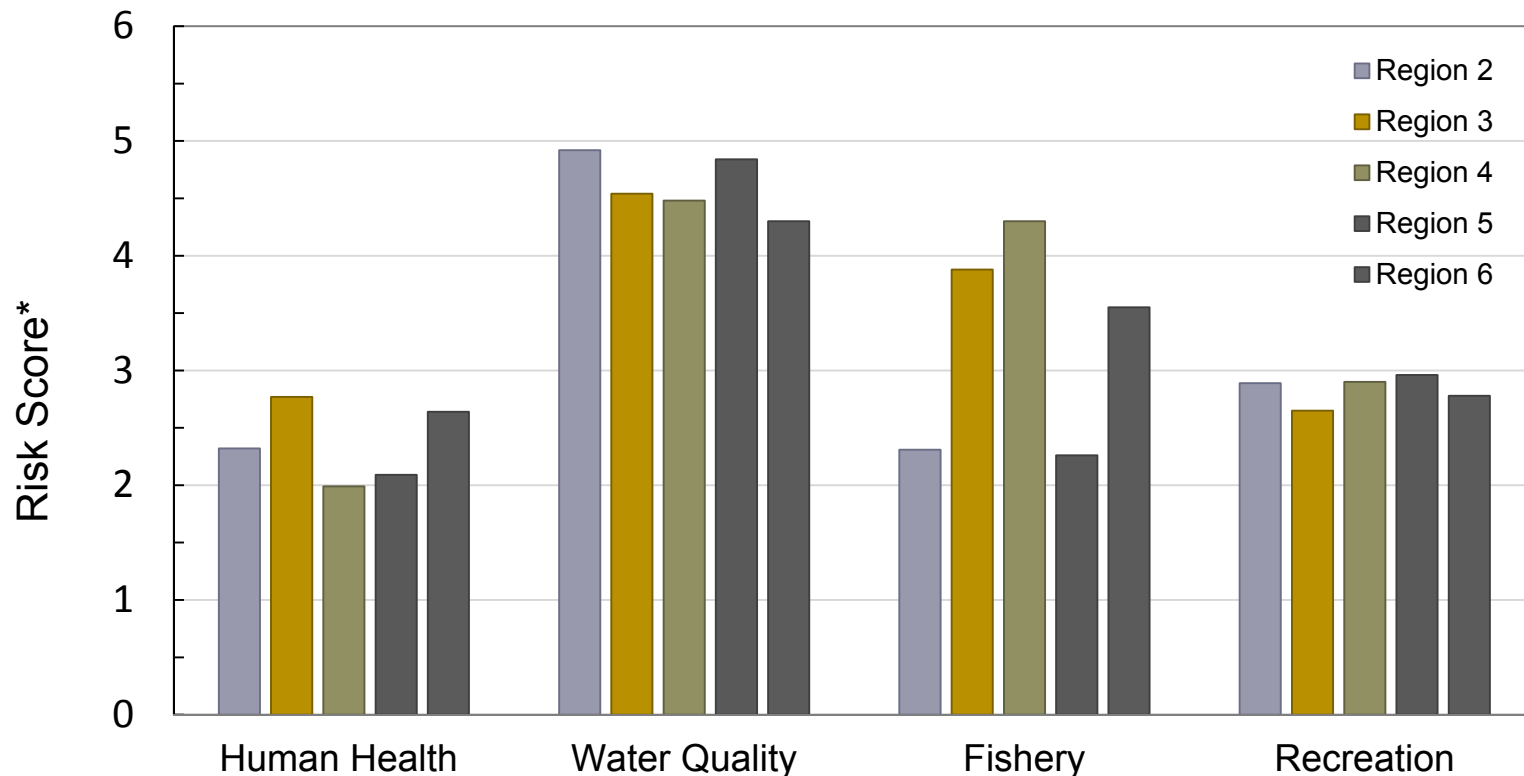
# Update

1. Completed the human health risk assessment (HHRA) using the Relative Risk Model.
2. Have integrated the HHRA and the ERA (biota and water quality).
3. Currently working on including bank stabilization and Ag BMPs in the HH and recreation models



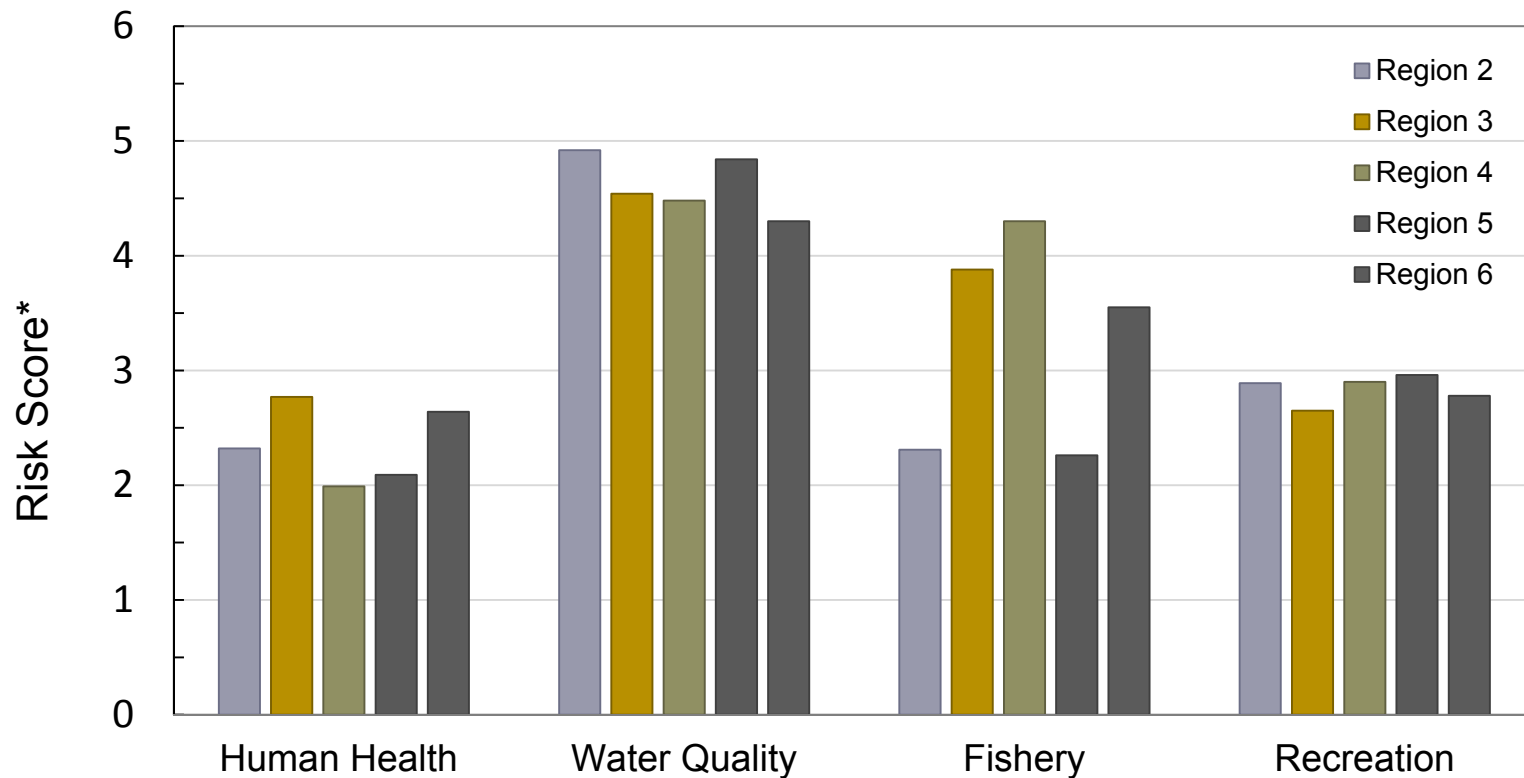
# Key findings

1. Human health risk for the South River is low and less spatially variable than risk to biotic and water quality endpoints.



# Key findings

2. Risk to recreation is moderate with low spatial variability.



# Key findings

3. Mercury is not the only stressor of importance; river temperature, discharge, *E. coli* bacteria, and phosphorus also drive risk to human health, water quality, and biota.

| Activity | Top Input Parameters            |
|----------|---------------------------------|
| Fishing  | Dissolved oxygen (5 regions)    |
|          | Fish tissue Hg (5 regions)      |
|          | River temperature (5 regions)   |
| Swimming | River Temperature (5 regions)   |
|          | River discharge (5 regions)     |
|          | Bacteria indicators (4 regions) |
| Boating  | River Temperature (5 regions)   |
|          | River discharge (5 regions)     |
|          | Bacteria indicators (4 regions) |

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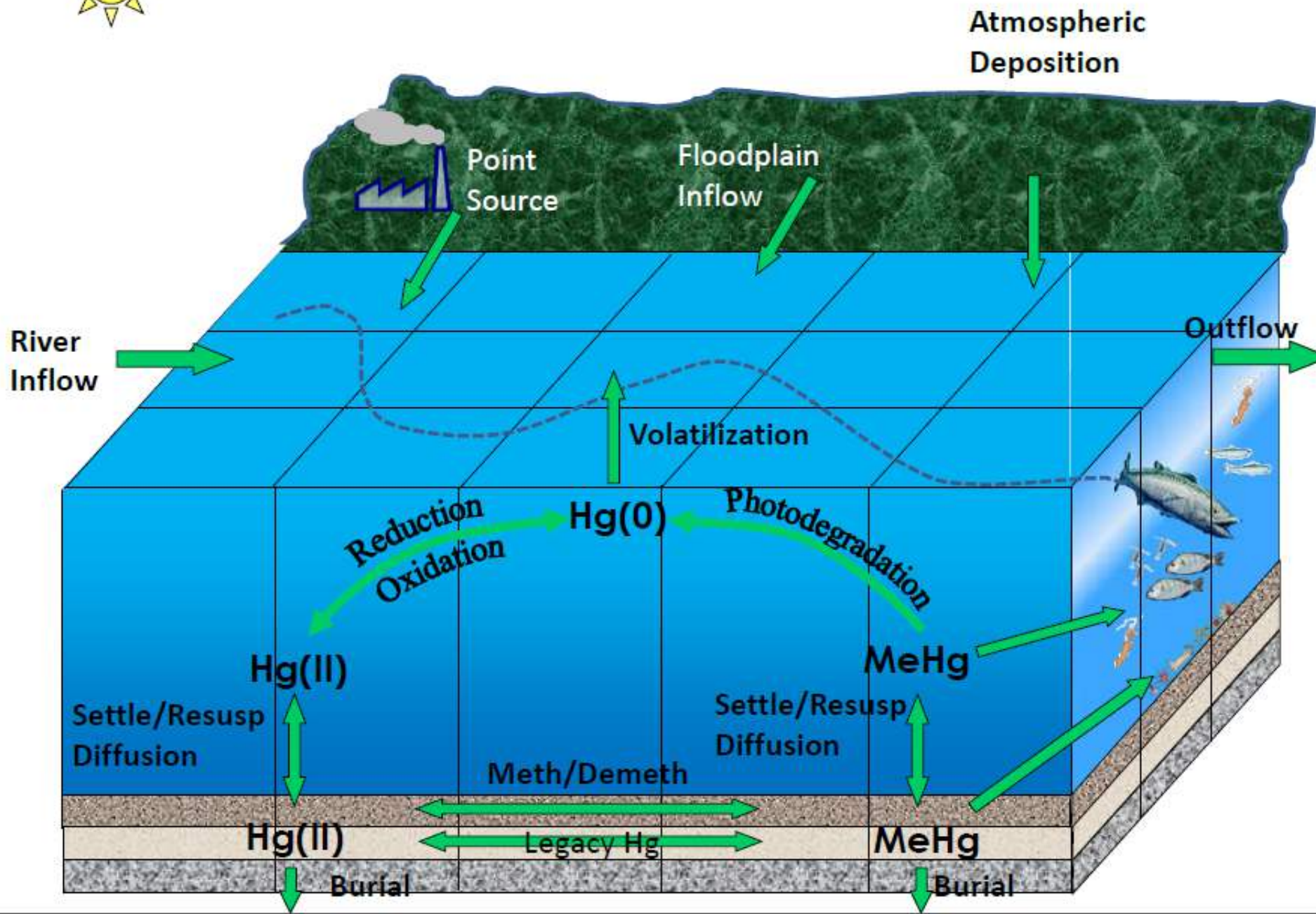


## Objectives

- Help predict and assess the benefits of bank stabilization.
- Help interpret monitoring data.
- Help integrate multi-disciplinary studies carried out on the South River. Do the pieces fit together?
- Help address uncertainty
- Provide another line of support for decisions.



## D-MCM setup for South River



## Schedule

- Modeling completed Fall 2015
- Report completed end of 2015

| Task                                                                                          | 2015                                                                                  |                                                                                       |                                                                                       |                                                                                                                                                                                |
|-----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                               | Q1                                                                                    | Q2                                                                                    | Q3                                                                                    | Q4                                                                                                                                                                             |
| Task 5.1 Data assembly                                                                        |    |                                                                                       |                                                                                       |                                                                                                                                                                                |
| Task 5.2 Model grid development                                                               |                                                                                       |    |                                                                                       |                                                                                                                                                                                |
| Task 5.3 Model calibration                                                                    |                                                                                       |                                                                                       |    |                                                                                                                                                                                |
| Task 5.4 Uncertainty and sensitivity analysis                                                 |                                                                                       |                                                                                       |    |                                                                                                                                                                                |
| Task 5.5 Scenario simulations                                                                 |                                                                                       |                                                                                       |                                                                                       |                                                                                             |
| Task 5.6 Meetings:<br>- SRST Spring 2015 meeting<br>- SRST Fall 2015 meeting                  |                                                                                       |  |                                                                                       |                                                                                           |
| Task 5.7 Reporting:<br>- Quarterly progress updates<br>- Draft final report<br>- Final report |  |  |  | <br> |

**Figure 8. South River Dynamic Mercury Cycling Model study schedule**

# Other Ongoing ROPs Projects Not Discussed Yesterday



|    | Initiative                                          | Primary Investigator | Research Objective                                                                                                                                                | Status             |
|----|-----------------------------------------------------|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| 1. | Enhanced Adaptive Management Framework              | Christy Foran        | Prepare an enhanced adaptive management framework based on the conceptual model that can direct remediation steps and gather information in an iterative fashion. | Ongoing            |
| 2. | Reactive Capping                                    | Danny Reible         | Investigate the potential of reactive capping in the South River using mesocosm experiments.                                                                      | Ongoing            |
| 3. | Characterization and Treatment of Sediment and Soil | Carol Ptacek         | Laboratory batch and column studies to characterize South River soil and sediment and investigate potential treatment approaches to reduce mercury leaching.      | Nearing completion |
| 4. | Stable Isotope Analysis                             | Joel Blume           | Explore forensic monitoring potential of stable Hg isotopes in South River.                                                                                       | Ongoing            |