SETAC North America 39th Annual Meeting
4-8 November 2018 | Sacramento, CA, USA

A Case Study on Adaptive Management and the Optimization of a Pilot Bank Stabilization Remedy for a Mercury-Impacted River

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Background

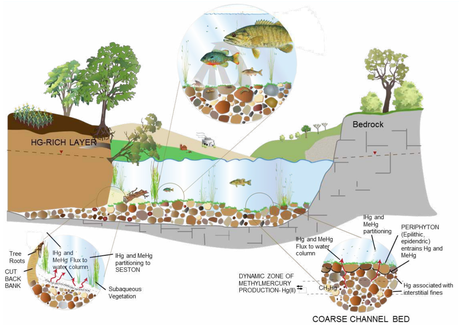

Figure 1. Conceptual Site Model for Hg loading to the South River

Historical mercury (Hg) releases from textile manufacturing facility on the South River, Virginia:

- Increased Hg concentrations in biotic and abiotic media have not declined in 30 years.
- Erosion of legacy Hg-impacted bank soils is highest loading source (see **Figure 1**).
- **Adaptive Management Framework** is optimal remedial strategy due to size, linear nature, complexity and spatial variability of the South River system.

Bank Stabilization Pilot

- Constructed along a 500-ft river reach
- Hypothesis: reducing Hg load; bank stabilization will result in reduced Hg concentrations in the aquatic environment (see **Figure 2**).
- Remedial approach confirmed by post-stabilization monitoring:

Significant reduction in near-bank sediment and pore water Hg concentrations within three to five years

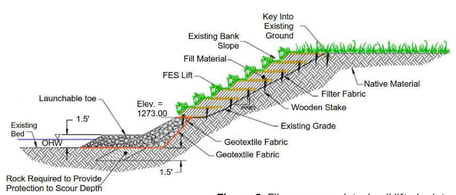

Figure 2. Fiber encapsulated soil lifts isolate Hg-impacted soils and stabilize bank

Figure 3. Bank Pilot following construction (left) and three years after completion (right)

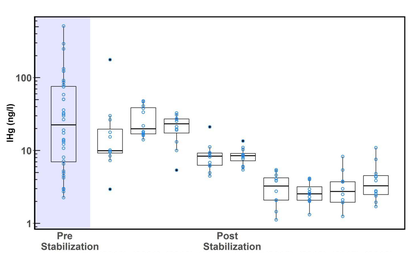

Figure 4. Inorganic Hg concentrations in filtered pore water

Adaptive Management Process

- Three Interim Measures implemented to date, based on Bank Pilot design (see **Figure 5**)
- Remedial design focuses on control of Hg loading to the aquatic system through bank stabilization (see **Figure 6** & **Figure 7**).
- Key learnings from each projects' design, construction and monitoring integrated into future remedial designs
- Ability to optimize design to integrate landowner preferences & site-specific challenges including:
  - Preservation of riparian habitats
  - South River Greenway Trail (see **Figure 7**)
  - Cultural resources

Figure 5. Phase 1- Interim Measures Locations

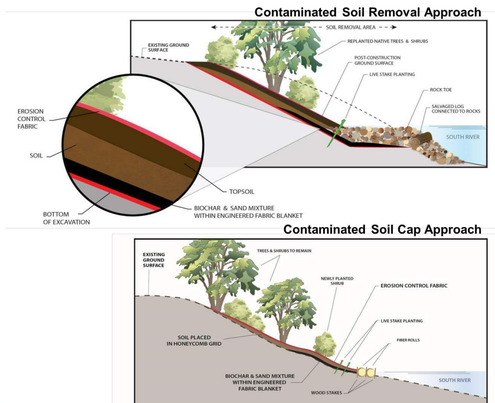

Figure 6. Remedial approach used for first interim measure at Constitution Park

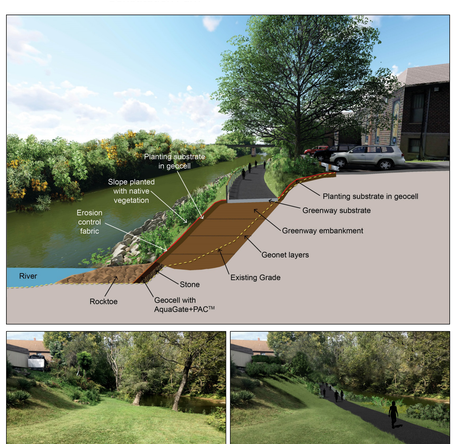

Figure 7. Integration of the South River Greenway Trail at Shiloh Baptist Church Bank Management Area (top), with before (left) and after renderings (right)

Remedy Effectiveness

Approximately 60% of Hg loading from eroding banks in first two river miles below site will be addressed upon completion of the 4th planned IM (see **Figure 8**).

Monitoring data show:

- Temporary increase in near-bank pore water Inorganic mercury (IHg) concentrations following construction (see **Figure 9**).
- Consistent decline in near-bank IHg sediment concentrations after first year of monitoring (see **Figure 9**)

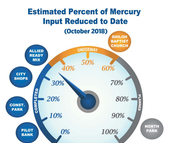

Figure 8. Estimated Percent Hg load reductions per BMA

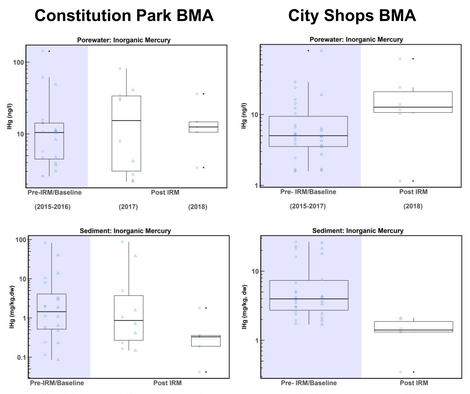

Figure 9. Filtered IHg concentrations in pore water (top) and IHg in sediment (bottom) following bank stabilization

Findings

Figure 10. Phase 1 Interim Measures

The Pilot Bank stabilization project demonstrates that bank stabilization is an effective remedial strategy for the South River that:

- Reduces Hg concentrations in near-bank media
- Is implementable, cost effective and sustainable
- Provides context for Post-IM monitoring data

Implementation is accelerated through an Adaptive Management Framework facilitating incorporation of stakeholder values and key learnings from previous projects into progressive remedial designs.

The work described in this poster has been performed in conjunction with the South River Science Team (SRST), a multi-stakeholder group including representatives from local, state and federal governments, academia, environmental groups and DuPont. The SRST is a collaborative team created to provide input into the watershed-level, risk-based assessment framework to address mercury in the system. For more information visit the South River Science Team website! ➔