Development of a Custom Carbon Amendment Strategy using Biochar for a Mercury-contaminated River

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Outline

- Background
- Conceptual Site Model
- What is Biochar
- Why Biochar
- Implementation
- Challenges
- Results
Background - Timeline

1929-1950: Operation of Fibers Plant
1977-1980: Fish Consumption Ban-Advisory
2001: South River Science Team
2005-2013: NRDC Consent Decree
2014: RCRA Permit Modification
2016 - Present: Remedy Implementation Begins
Conceptual Site Model

South River: CONCEPTUAL SITE MODEL SCHEMATIC

- Hg-Rich Layer
- Bank Erosion 40-60%
- Factory Outfalls 3-5%
- Overland Flow & Groundwater 5-20%
- Sediment 15-35%
- Bedrock
Conceptual Site Model – Storm Event with Cap
Conceptual Site Model – Storm Event with Amended Cap
Evaluation of BioChar as Remedial Option

- BioChar
- Activated Carbon
- Thiol SAMMS
- Polymeric Adsorption Resins

Laboratory Evaluation
- Column Studies
- Leachability Testing
- Ecological Impact

Field Pilots
- Ecological
- Pond
- Floodplain
- Surface Water

Remedy Implementation

Laboratory Testing

Dr. Robert Brent
Biochar Treatment and Bioaccumulation

Dr. William Clements
Biochar impacts on Benthic Macroinvertebrates

Dr. Danny Reible
Mercury Leaching from Banks

Dr. Carol Ptacek
Biochar Treatment Efficacy

Dr. Cynthia Gilmour
Partitioning to pore water and bioaccumulation in aquatic oligochaete

Dr. Michael Newman
Efficiency of Sediment Amendments

Biochar affect on Bio-accumulation in aquatic invertebrate and in earthworms
Implementation Timeline

2009: Pilot Bank
No Biochar
Implementation Timeline

2016: Constitution Park
6” 50% Biochar Layer

1' GeoCell
6” 50%/50% Biochar / Planting Substrate
6” Planting Substrate
RipRap Toe
Existing Bank Soils
Implementation Timeline

2017: City Shops
6" 15% Biochar Layer

- 1' GeoCell
- 6" 15%/85% Biochar / Planting Substrate
- 6" Planting Substrate
- RipRap Toe

Existing Bank Soils
Implementation Timeline

2018: Allied Ready Mix
3” 30% Biochar layer w/ AC RCM

- 8" GeoCell
- 3" 30%/70% Biochar / Planting Substrate
- 5" Planting Substrate
- Activated Carbon
- Reactive Core Mat
- Existing Bank Soils
- RipRap Toe
Implementation Timeline

2019: Shiloh Baptist Church
3” 30% Biochar layer to base of slope

8" GeoCell
3” 30%/70% Biochar / Planting Substrate
5" Planting Substrate
2" Diameter Stone
RipRap Toe
Existing Bank Soils
2020: North Park
3” 30% Biochar layer to base of slope
Or Biochar Bonded to Aggregate
Mixing
Placement
Cover and Restoration
Challenges

Supply

Mixing

Placement
Post Remediation Results

- Decreasing IHg and MeHg concentrations in near bank sediment
- Bulk sediment IHg concentrations similar to water column particulates
- No reduction in concentrations at non-remediated banks
- Pore water IHg concentrations decreasing after initial post remediation 'bump' at Constitution Park

Constitution Park

City Shops
Thank You!

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