Applied Research and Field Demonstration Testing of Contaminated Sediment Beneficial Use at Two Regional Sites

Presented by:

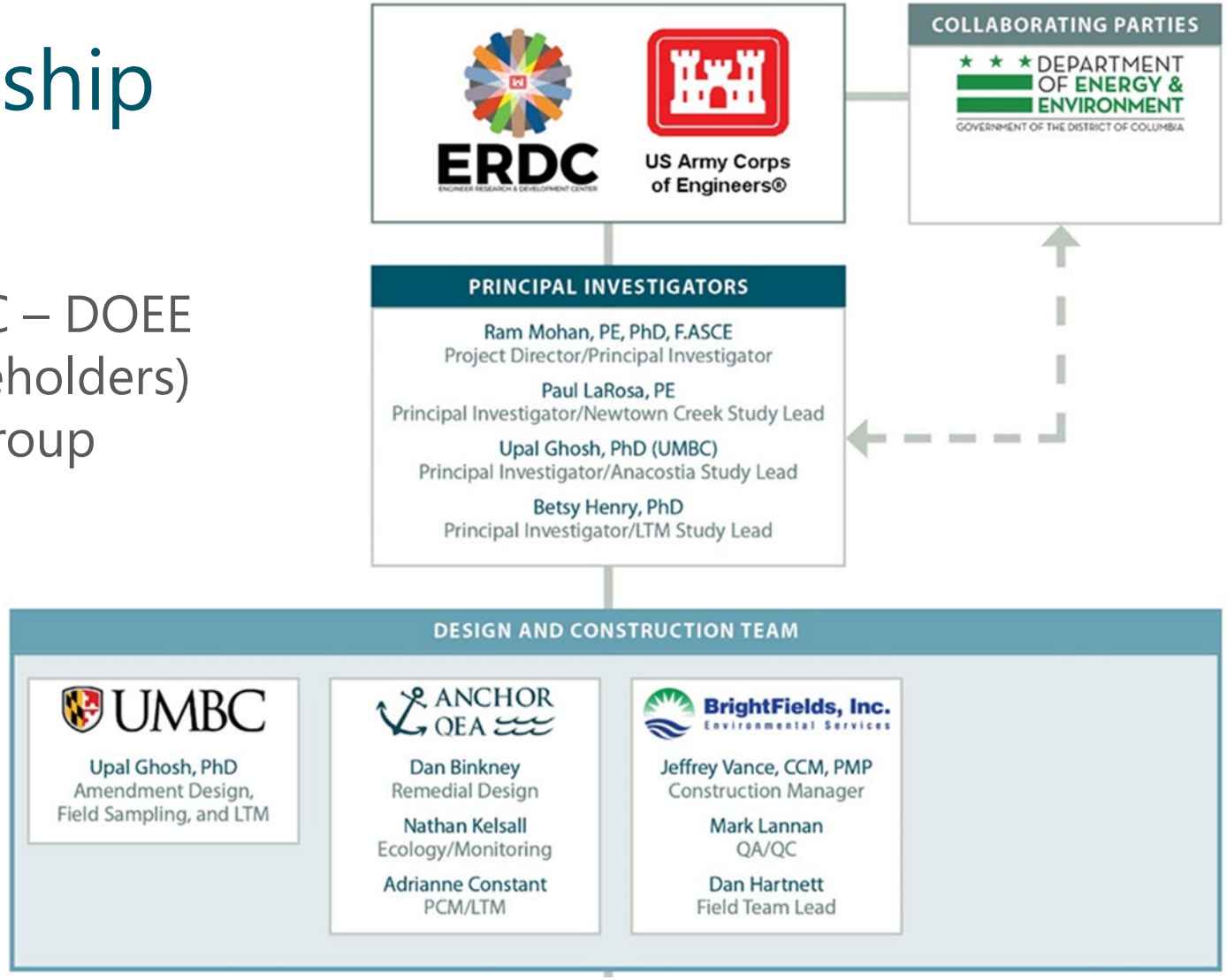
Ram Mohan, PhD, PE, and Upal Ghosh, PhD

Sediment Management Beneficial Use Workshop

March 26–27, 2024

Public-Private Partnership

- Project funding:
  - USACE ERDC, Washington DC – DOEE (in partnership with site stakeholders) and Newtown Creek Study Group
- ERDC Program Lead:
  - Dr. David Moore
- Principal Investigators:
  - Anchor QEA
  - University of Maryland, Baltimore County (UMBC)



Technical Objectives

Problem

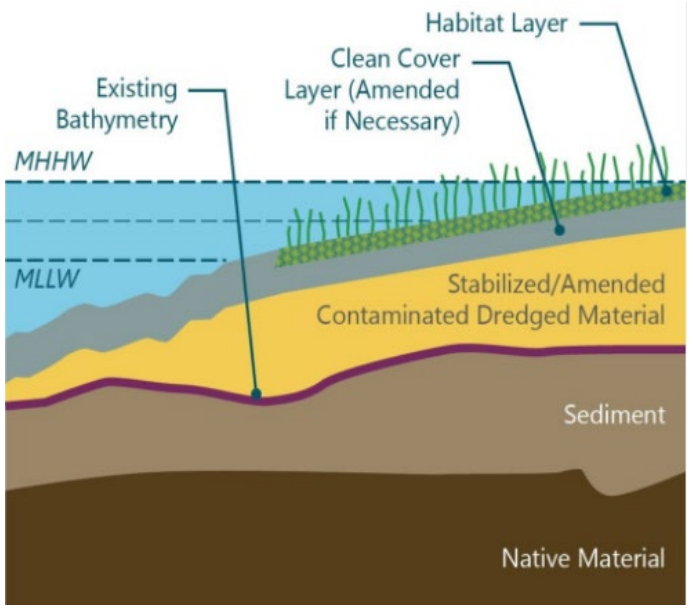
- Contaminated sediment remediation often involves expensive (unsustainable) end use of dredged material
- This PPP project investigates field technology deployment to evaluate how lower-to-mid-tier contaminated dredged material can be beneficially reused

ANCHOR QEA UMBC ERDC ENGINEER RESEARCH & DEVELOPMENT CENTER DEPARTMENT OF ENERGY & ENVIRONMENT GOVERNMENT OF THE DISTRICT OF COLUMBIA

Technical Objectives

Solution

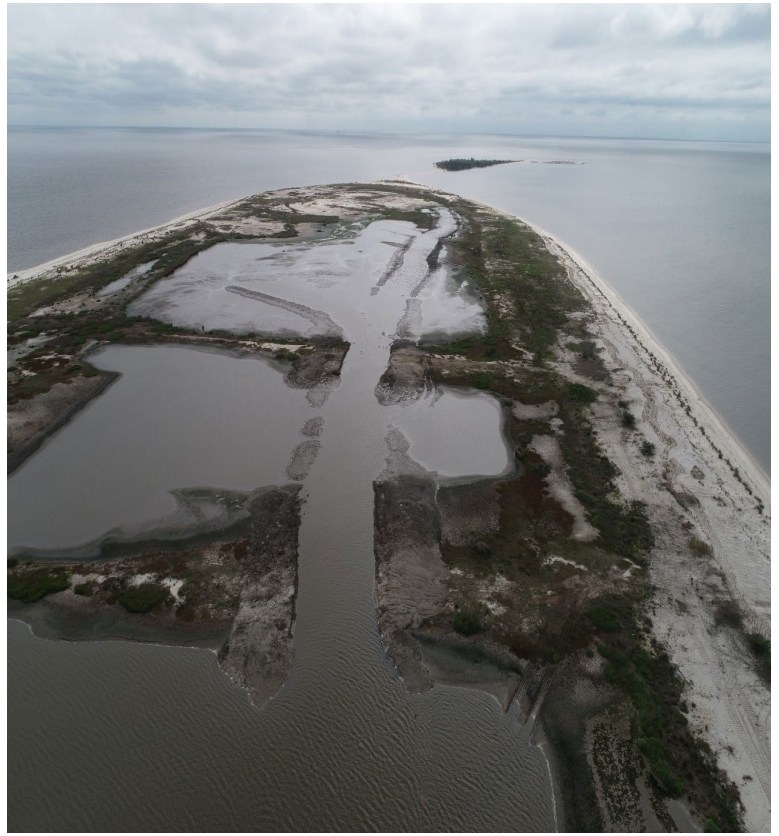
- Use amendments to physically stabilize contaminated sediments ex situ
- Use layers of clean sediment to provide further chemical isolation and promote habitat establishment
- Deploy various field technology concepts at two legacy contaminated sediment sites (pending Agency and stakeholder approval)



Technical Objectives

Applications

- Build scientific database and proof-of-concept for full-scale BU application of contaminated sediment
- Identify best practices, standard operating procedures for wider applications
- Develop regulatory acceptance and permitting guidance
- Publish papers, conduct knowledge-sharing workshops



ANCHOR QEA UMBC ERDC ENGINEER RESEARCH & DEVELOPMENT CENTER DEPARTMENT OF ENERGY & ENVIRONMENT GOVERNMENT OF THE DISTRICT OF COLUMBIA

Technical Objectives

Impact and Benefits

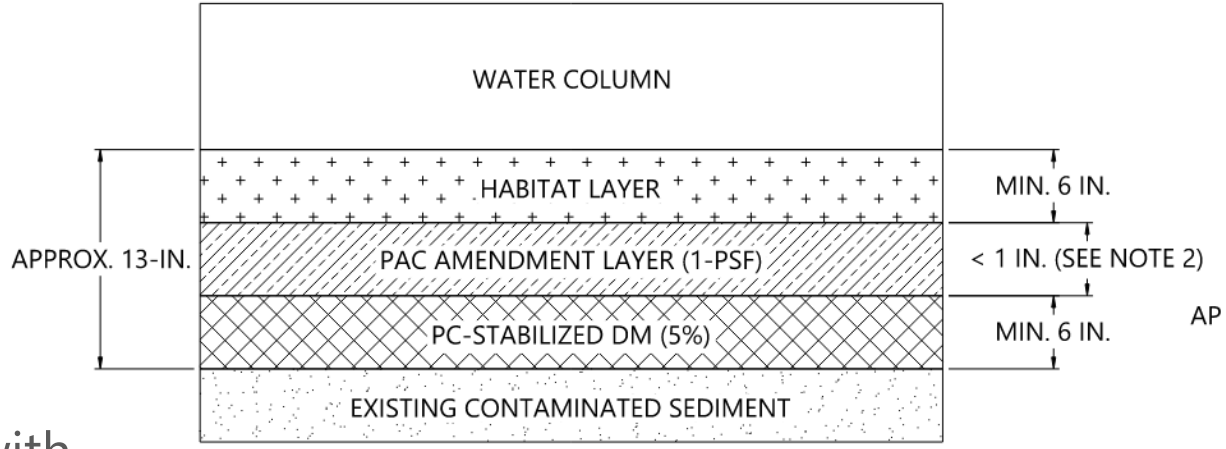
- Alternate and sustainable approach developed for legacy contaminated sediment site remediation
- Legacy contaminated lands converted into productive habitats
- Reduced carbon footprint of dredged material management
- Lowered costs for CERCLA sites

ANCHOR QEA UMBC ERDC ENGINEER RESEARCH & DEVELOPMENT CENTER DEPARTMENT OF ENERGY & ENVIRONMENT GOVERNMENT OF THE DISTRICT OF COLUMBIA

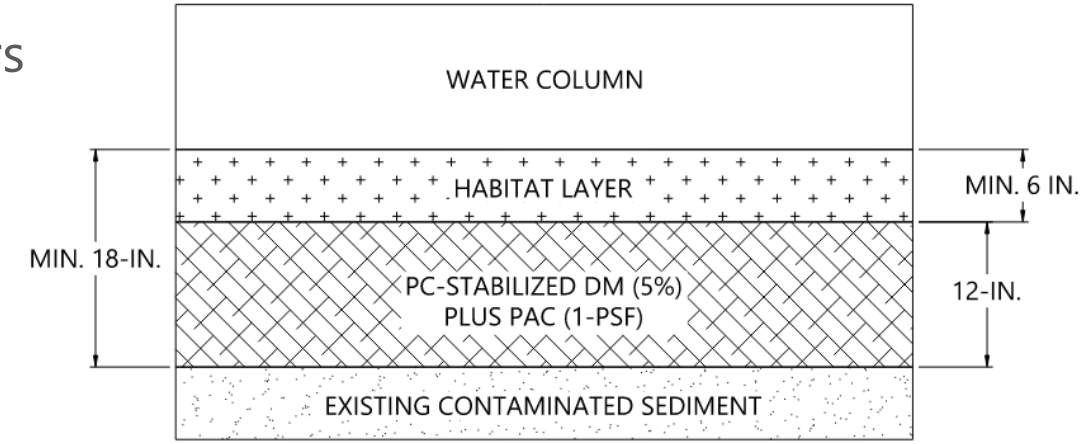
BU Concepts

BU Concepts

- 10 Test Plots
- 4 x 4-meter square
- Contaminated dredged material stabilized with Portland cement for structural strength
- Variations in activated carbon treatment layers
- Habitat layer on top
- Plots are paired with or without planted vegetation
- PAC amendment directly on top of existing sediment



TEST PLOT KL-4A



TEST PLOT KL-3

Variations in layer thickness and arrangement (as well as amendment type and dose) will be constructed to determine (via post-deployment monitoring) which are the most effective configurations for contaminant reduction

Demonstration Plot ID	Plot Layer	Layer Material / Amendment Type and Dose	Minimum Layer Thickness (inches)
KL-1 and KL-1V	Habitat Layer	25% sand and 75% topsoil	6
	PAC Amendment Layer	PAC (dosage to be determined)	<1
KL-2 and KL-2V	Habitat Layer	25% sand and 75% topsoil	6
	Stabilized DM Layer	Portland cement (dosage to be determined) and DM	12
KL-3 and KL-3V	Habitat Layer	25% sand and 75% topsoil	6
	Stabilized and Amended DM Layer	Portland cement and DM PAC	12
KL-4A and KL-4V	Habitat Layer	25% sand and 75% topsoil	6
	PAC Amendment Layer	PAC	<1
	Stabilized DM Layer	Portland cement and DM	6
KL-4B	Habitat Layer	25% sand and 75% topsoil	6
	GAC Amendment Layer	GAC	2
	Stabilized DM Layer	Portland cement and DM	6
KL-5	PAC Amendment Layer	PAC	2

Field Deployment Sites

Project Site: Newtown Creek, New York

- Site approval in progress, coordinating with Agencies and Project stakeholders
- Primary COCs
  - Total PAH (34)
  - Total PCB congeners
  - Copper

Project Site: Kingman Lake, Washington, DC

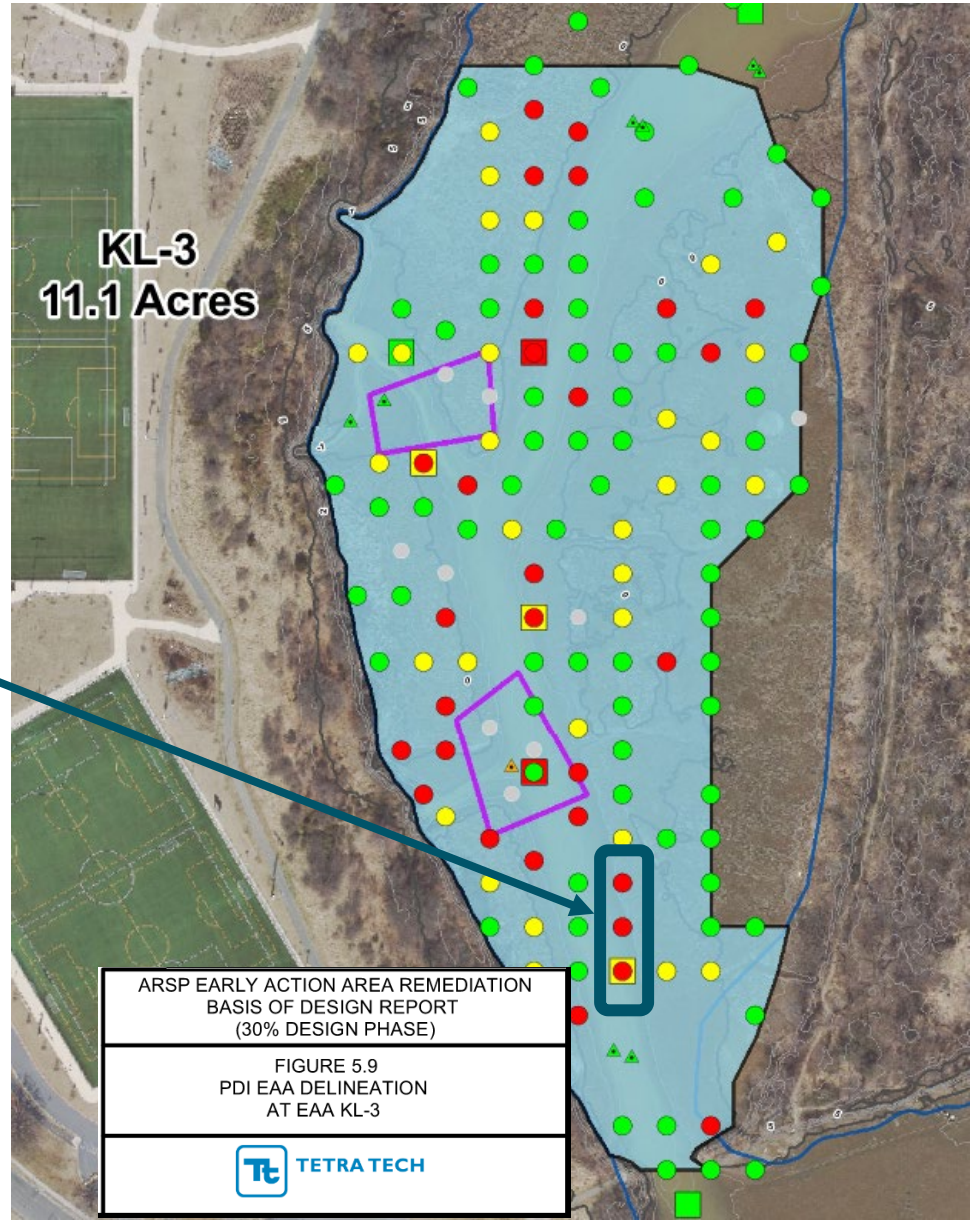
- Located in the Anacostia River system
- PCB congener-impacted sediment
- Included in Anacostia River Sediment Project (ARSP) as Early Action Area “EAA-KL3”
  - Design by Tetra Tech for DOEE

ANCHOR QEA UMBC ERDC ENGINEER RESEARCH & DEVELOPMENT CENTER DEPARTMENT OF ENERGY & ENVIRONMENT GOVERNMENT OF THE DISTRICT OF COLUMBIA

Kingman Lake Design

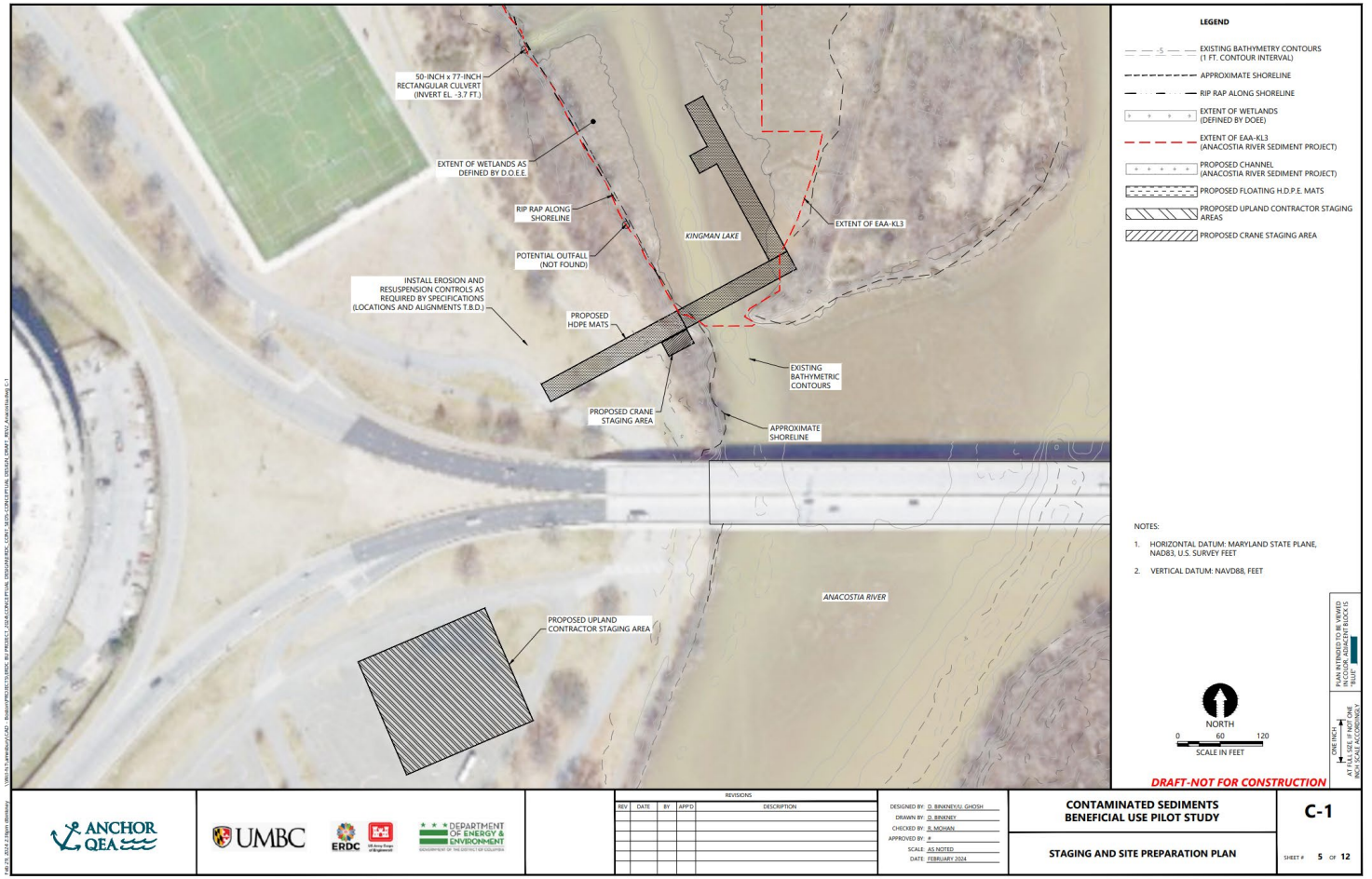
Project Site: Kingman Lake, Washington, DC

- BU project targeting dredging of low- to mid-tier contaminated sediment locations
- Plots adjacent to proposed ARSP direct amendment placement areas



Conceptual Design

- Conceptual staging and access areas
- Developed with input from BrightFields, Inc.
- Access to Lake via floating HDPE mats

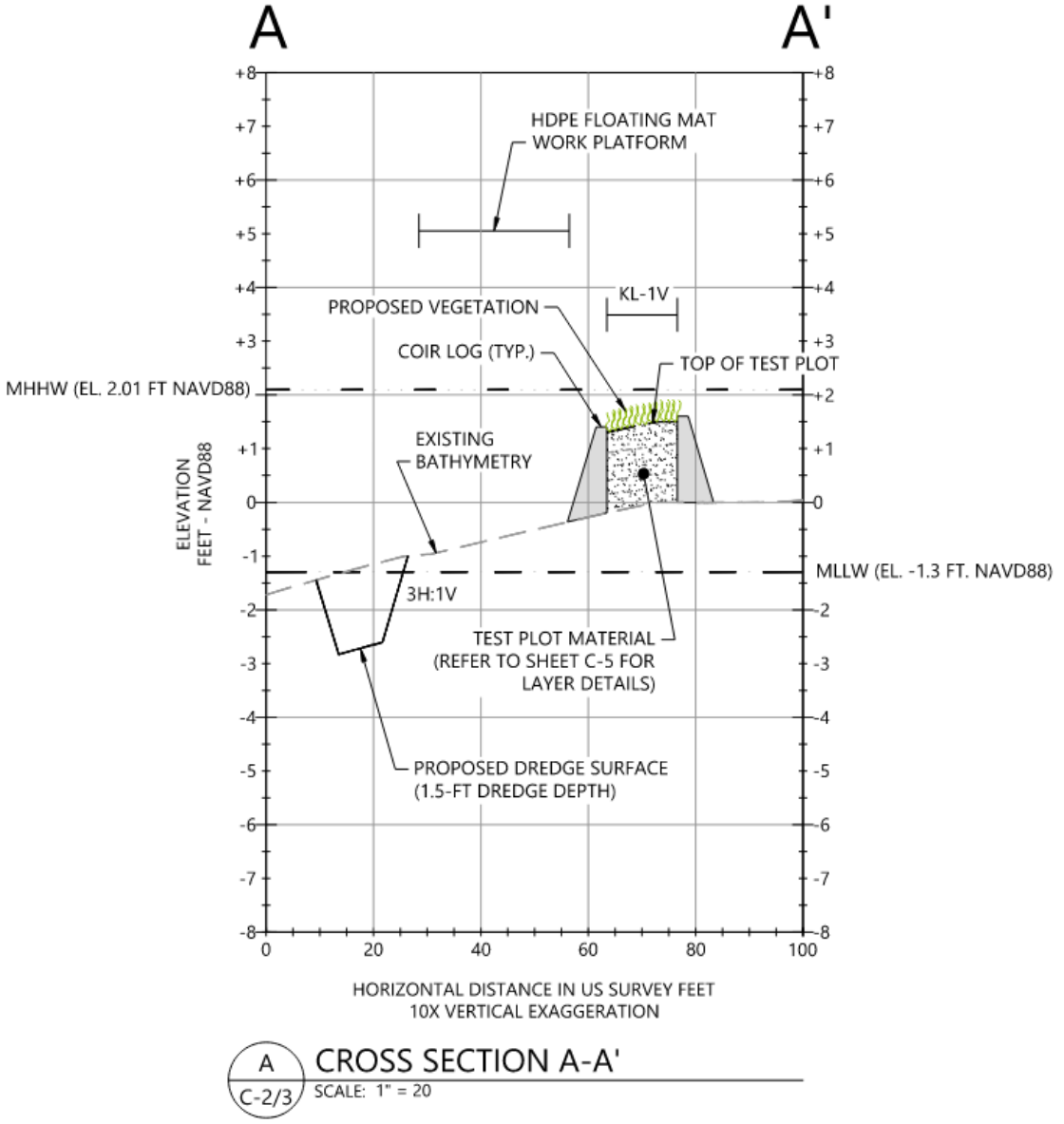


Conceptual Design

- Conceptual design developed in coordination with DOEE and Tetra Tech
- Targeted 1.5-foot dredge depth
  - Aligned with ARSP surface sediment concentrations > 800 µg/kg
- Proposed monitoring locations
  - Sediment chemistry, porewater, surface water, benthic community and bioaccumulation, and vegetation observations and tissue

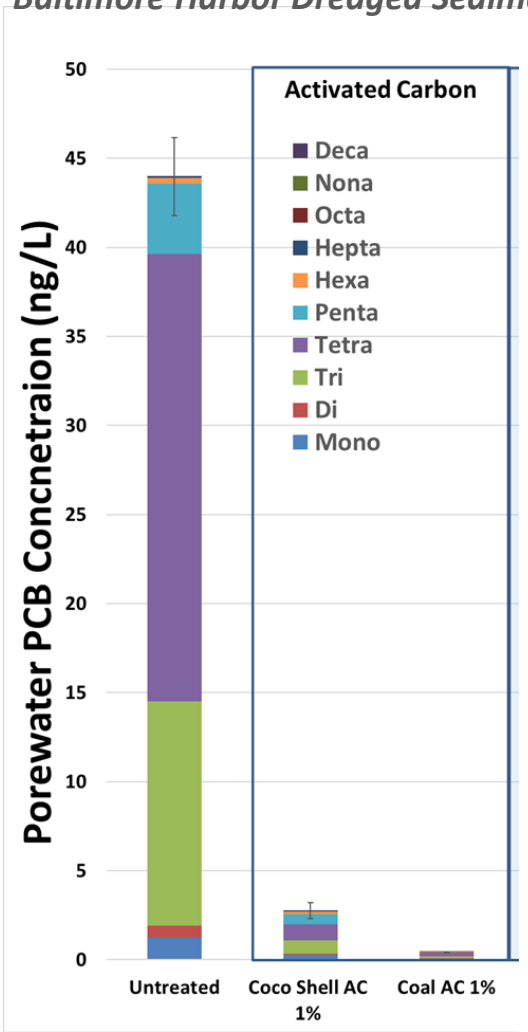
Conceptual Design

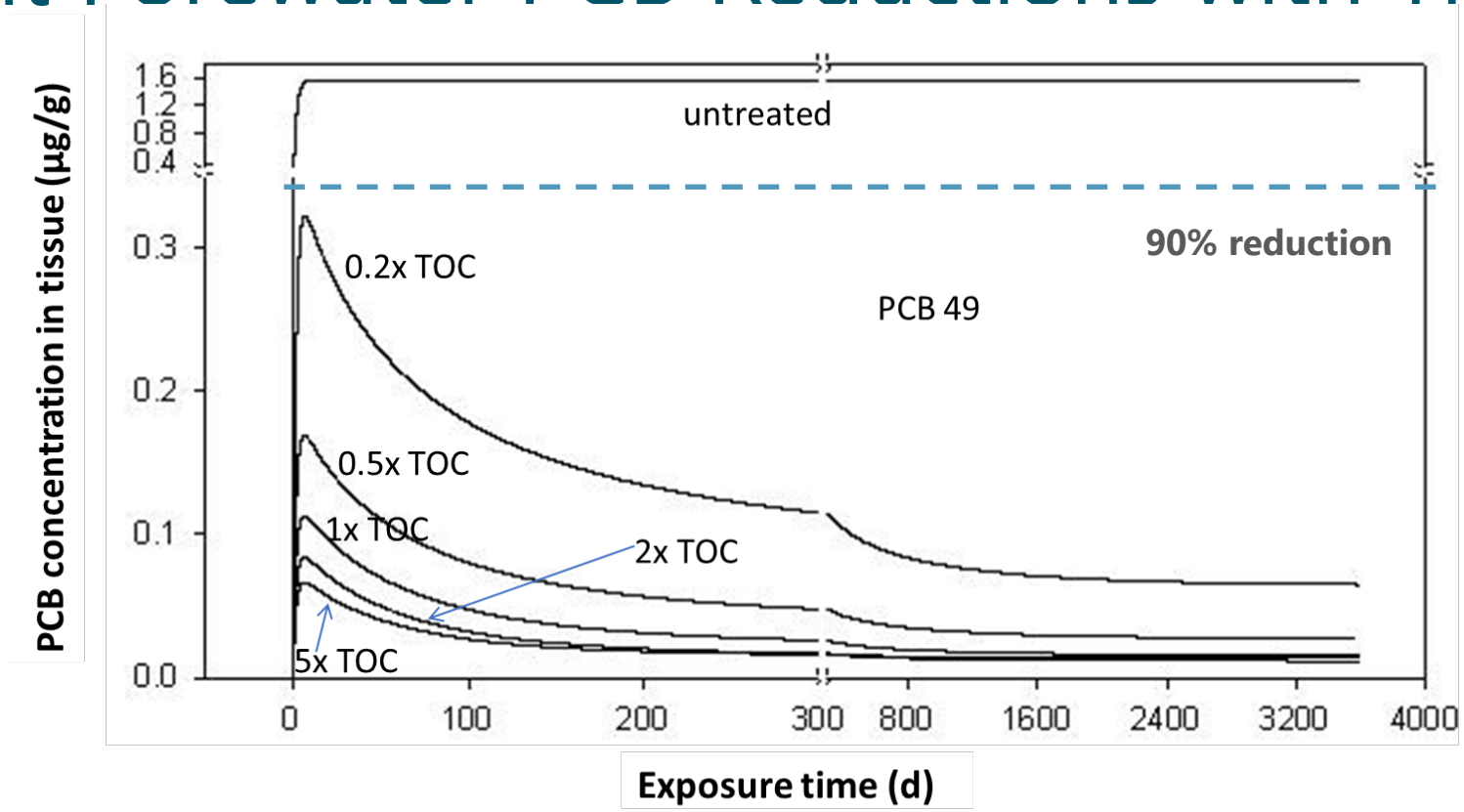
- Approximately 70 cy of sediment anticipated to be dredged
- Post-dredge backfill to be placed
- Plots to be stabilized with coir logs or equivalent
- Construction water management



Anticipated Sediment Porewater PCB Reductions with Time

Baltimore Harbor Dredged Sediments





> 90% reduction in PCB biouptake in 1 year with 1XTOC dose *Sun et al, ES&T 2009*

- AC amendment effectively reduces porewater PCBs in sediments by >90%
- Long-term modeling shows that slow mass transfer over time reduces bioavailability further
- Even low doses of AC very effective over time

Monitoring Activities

Matrix	Current Scope		Anticipated Future Scope			Measurements/Observations
	Baseline	6 Months (Post Deployment)	12 Months	24 Months	36 Months	
Sediment	Not Applicable	●	●	●	●	Visual determinants of consolidation, deposition, or other measures of disturbance
	●	●	●	●	●	PCB congeners; geotechnical parameters in baseline (grain size, Atterberg limits, water content)
Sediment Porewater	●	●	●	●	●	PCB Congeners
Surface Water	●	●	●	●	●	PCB Congeners
Vegetation	●	Not Applicable	●	●	●	Vegetative percent cover, species, species percent contribution to total cover, PCB congeners
Benthic Community	●	Not Applicable	●	●	●	Community Survey
Benthic Bioaccumulation	●	Not Applicable	●	●	●	Laboratory bioaccumulation tests with tissue analysis for PCBs

ANCHOR QEA UMBC ERDC DEPARTMENT OF ENERGY & ENVIRONMENT GOVERNMENT OF THE DISTRICT OF COLUMBIA

Project Progress and Schedule

- SQAPP for Baseline Monitoring at Kingman Lake reviewed by DOEE
- Conceptual Kingman Lake BODR submitted to ERDC and DOEE in early March
- Permit applications for Kingman Lake Baseline Monitoring submitted by DOEE and Tetra Tech in late February
  - Joint State/Federal application for alteration of tidal wetlands in MD
  - Request for USACE Nationwide Permit No. 6
  - Minimum 60-day review period
- Baseline Monitoring proposed for April/May 2024
- Proposed field deployment in Q4 2024

Questions?

Ram Mohan, Ph.D., P.E.
rmohan@anchorqea.com
(215) 756-5030

Upal Ghosh, Ph.D.
ughosh@umbc.edu
(443) 629-2136