



Subaqueous In-Lieu Fee Mitigation on the Elizabeth River

Portsmouth, VA

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York River

Chesapeake Bay

James River

Atlantic Ocean

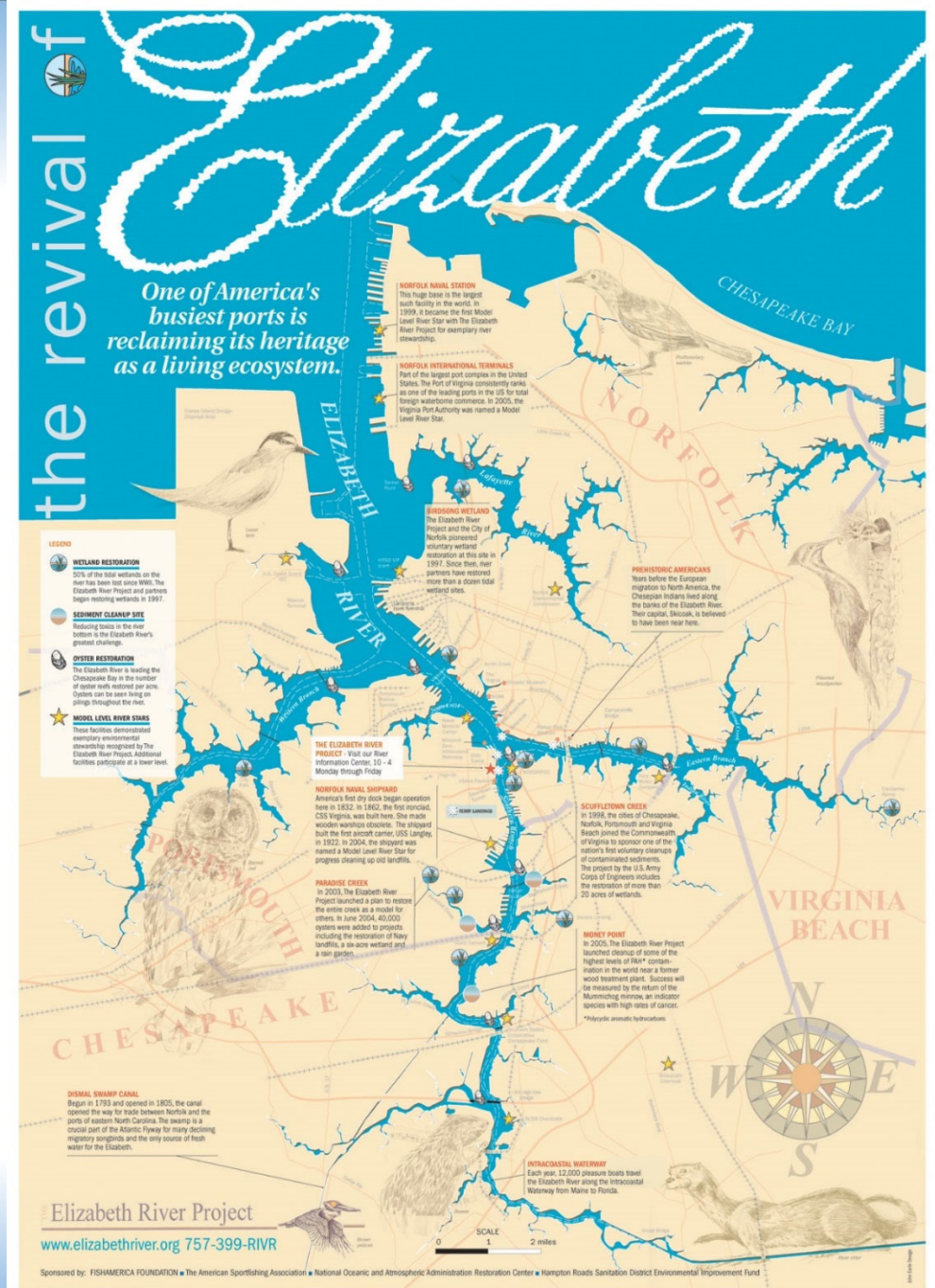
Elizabeth River

Living River Restoration Trust (LRRT)

Initially established in 2004 as a one-of-a-kind in-lieu fee program to provide subaqueous mitigation for a severely degraded urban river.

LRRT's program instrument was updated in 2018 providing the following advanced mitigation credits:

- 16 subaqueous credits
- 2 oyster reef credits
- 2 tidal wetland credits

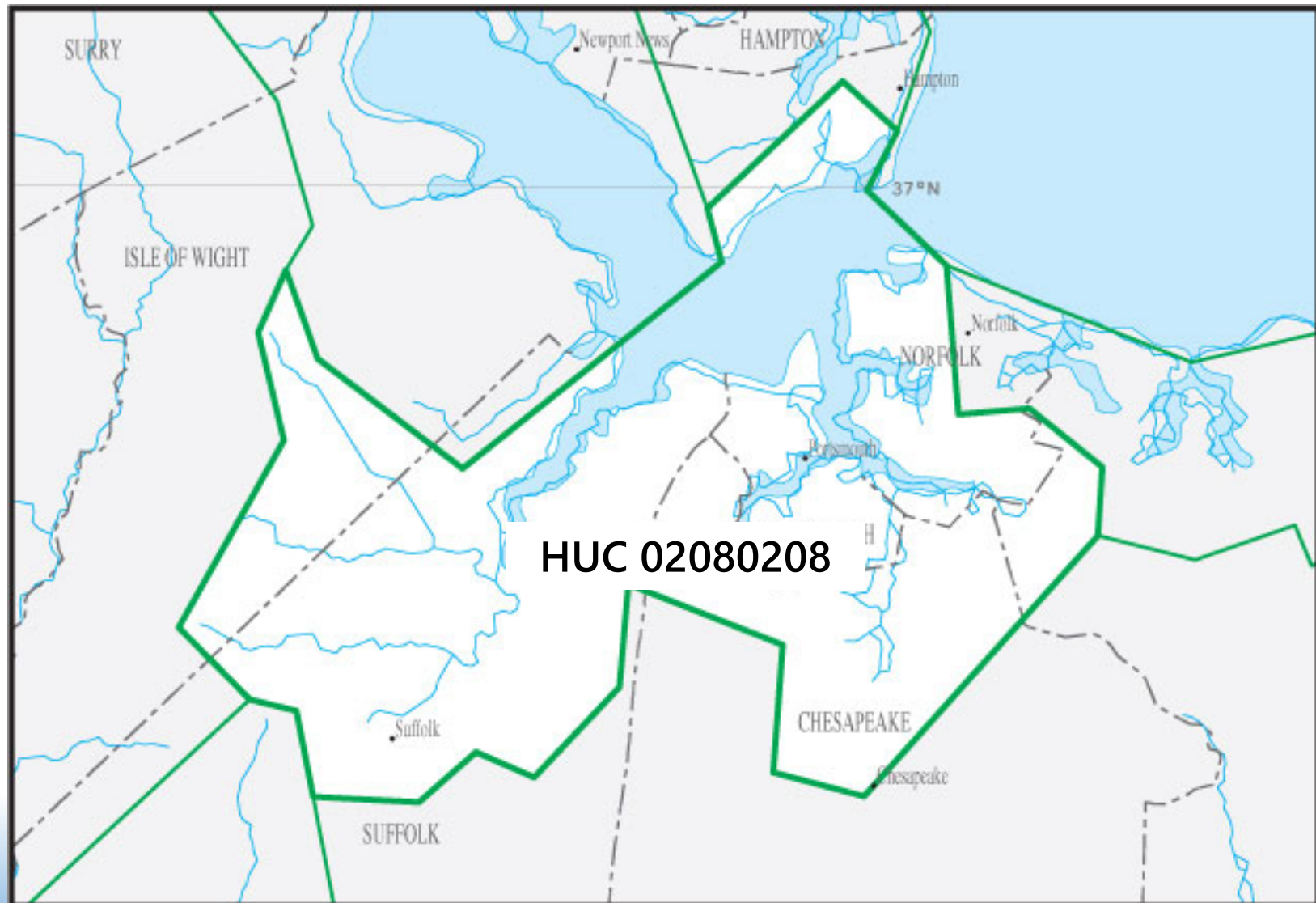




2018 Operating Agreement

- ✿ Provides a mitigation option for unavoidable permitted impacts to state owned river bottom.
- ✿ Mitigation is protected with a land use MOU, not a conservation easement.
- ✿ Success criteria is based on improved pore water quality.

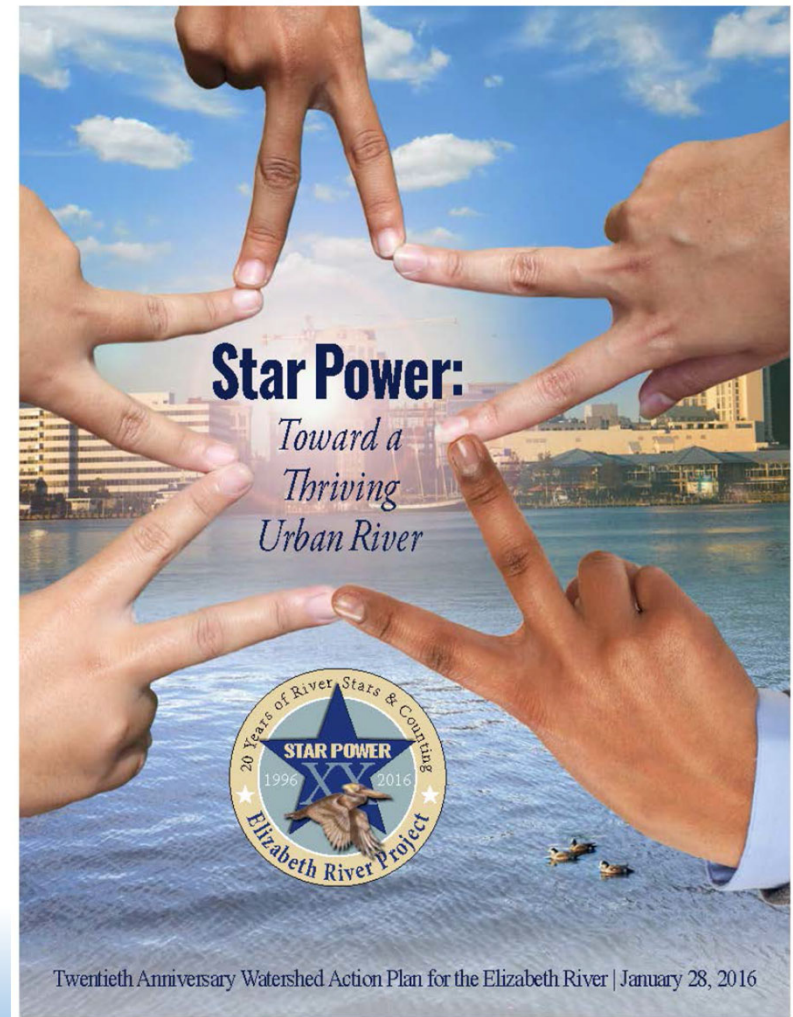
LRRT Service Area



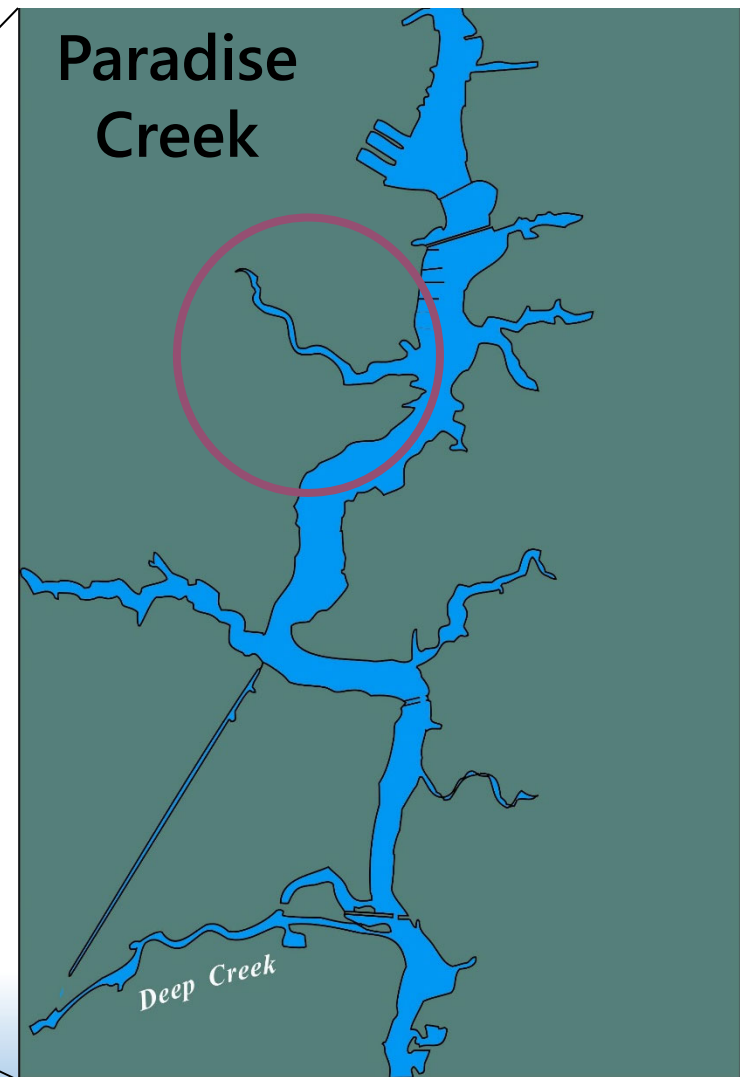
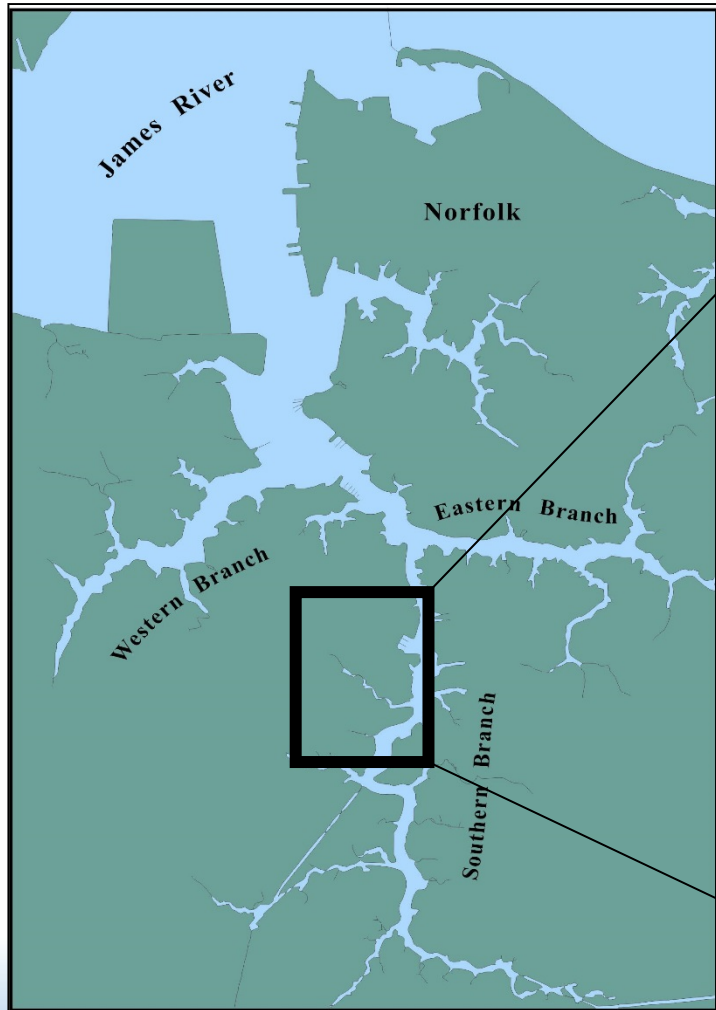
Mitigation Site Selection: A Watershed Approach

Paradise Creek will continue to “keep the goo going,” Action Item in the 2016 Elizabeth River Watershed Action Plan:

🐦 *Clean up contamination in the bottom of the Elizabeth River to non-toxic levels.*



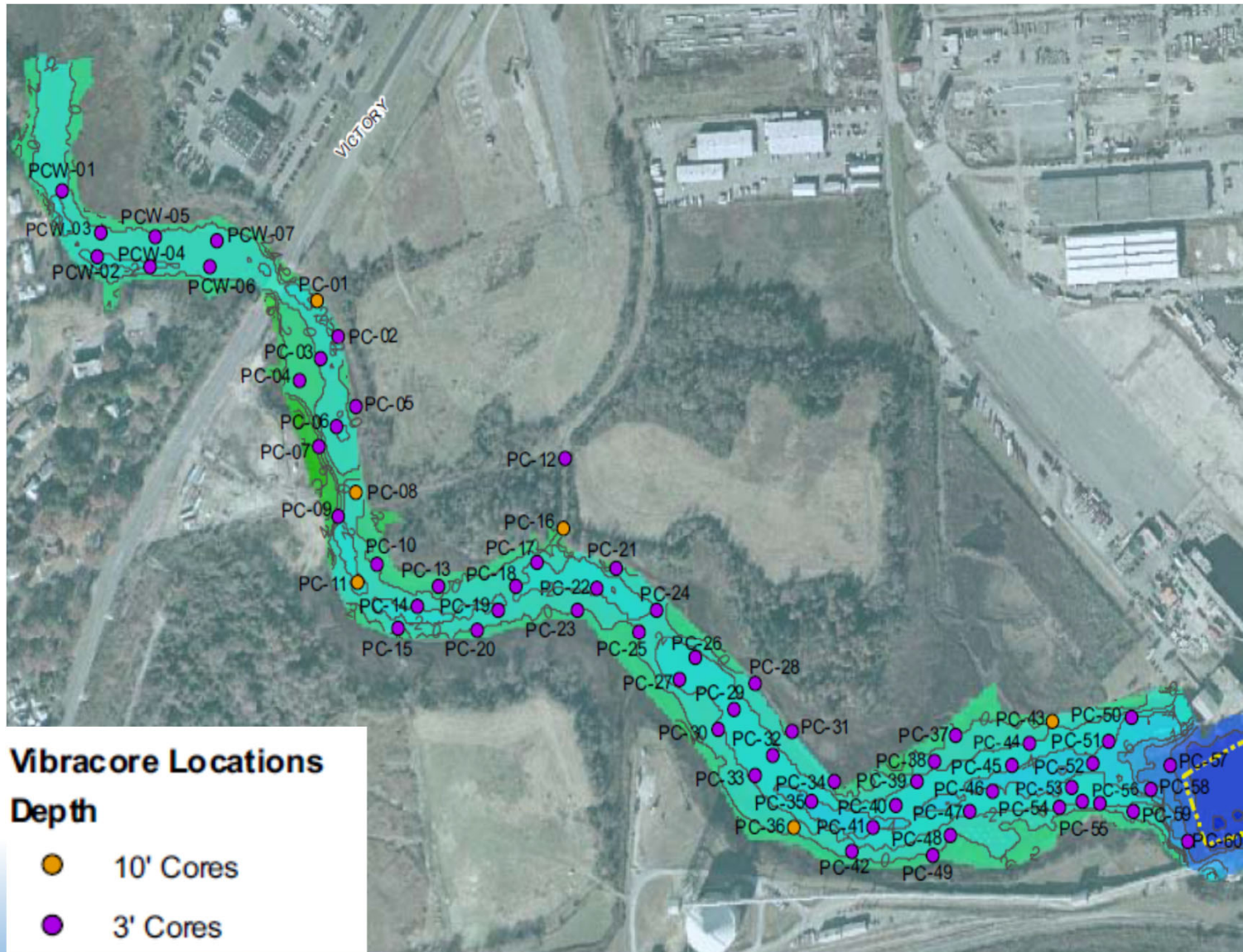
Paradise Creek



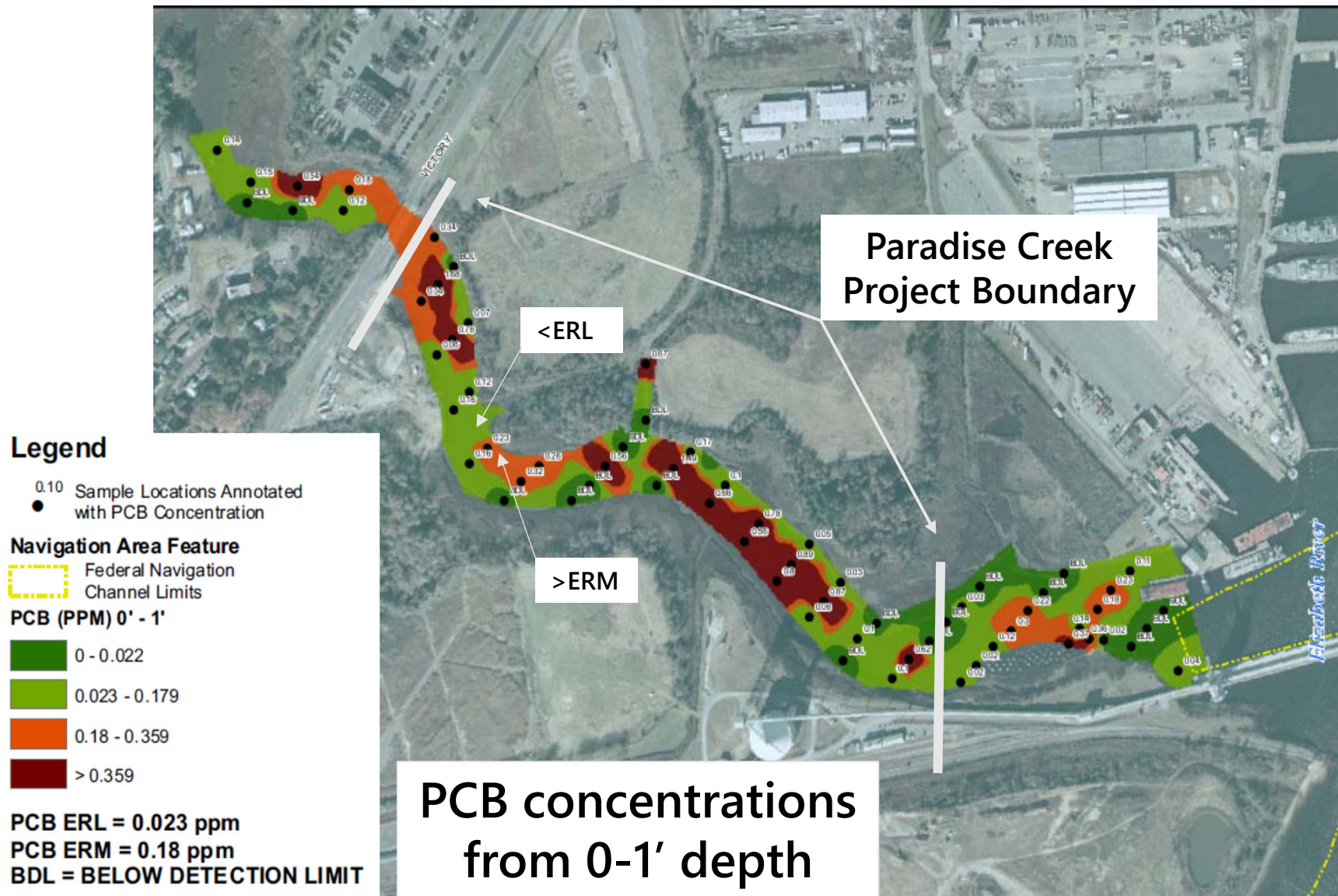
Paradise Creek Mitigation Area



Paradise Creek Core Locations



PCB is the Primary Chemical of Concern



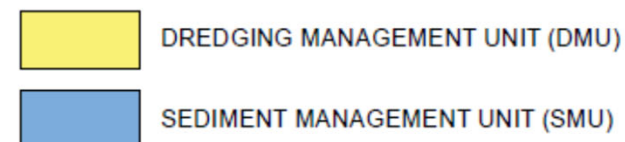


LEGEND

SURFICIAL TOTAL EFFECTS RANGE MEDIAN QUOTIENT (ERMQ)



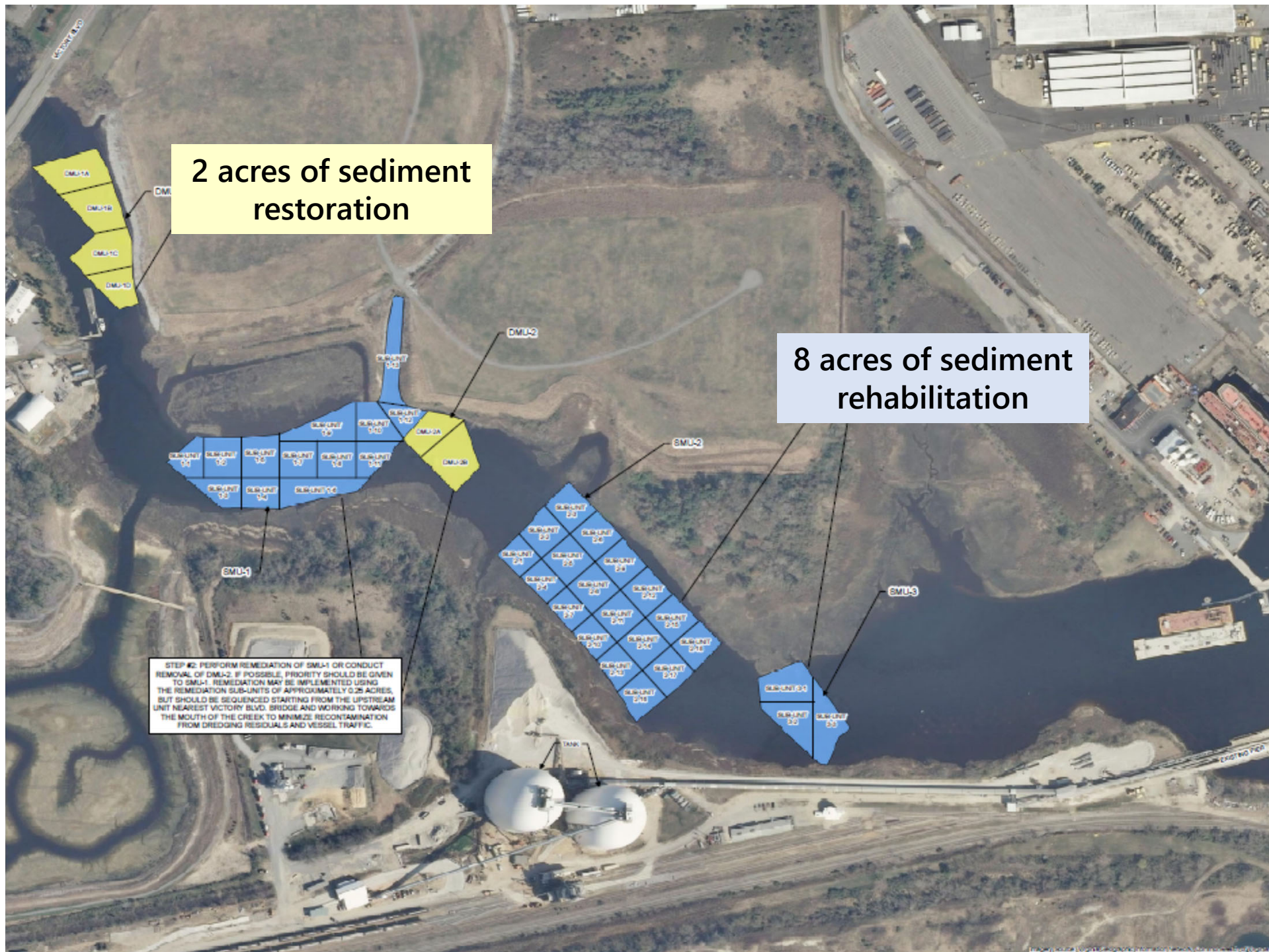
MITIGATION AREA



2 acres of sediment restoration

8 acres of sediment rehabilitation

STEP #2: PERFORM REMEDIATION OF SMU-1 OR CONDUCT REMOVAL OF DMU-2. IF POSSIBLE, PRIORITY SHOULD BE GIVEN TO SMU-1. REMEDIATION MAY BE IMPLEMENTED USING THE REMEDIATION SUB-UNITS OF APPROXIMATELY 0.25 ACRES, BUT SHOULD BE SEQUENCED STARTING FROM THE UPSTREAM UNIT NEAREST VICTORY BLVD. BRIDGE AND WORKING TOWARDS THE MOUTH OF THE CREEK TO MINIMIZE RECONTAMINATION FROM DREDGING RESIDUALS AND VESSEL TRAFFIC.



Two Mitigation Approaches

Sediment Restoration (2 acres):

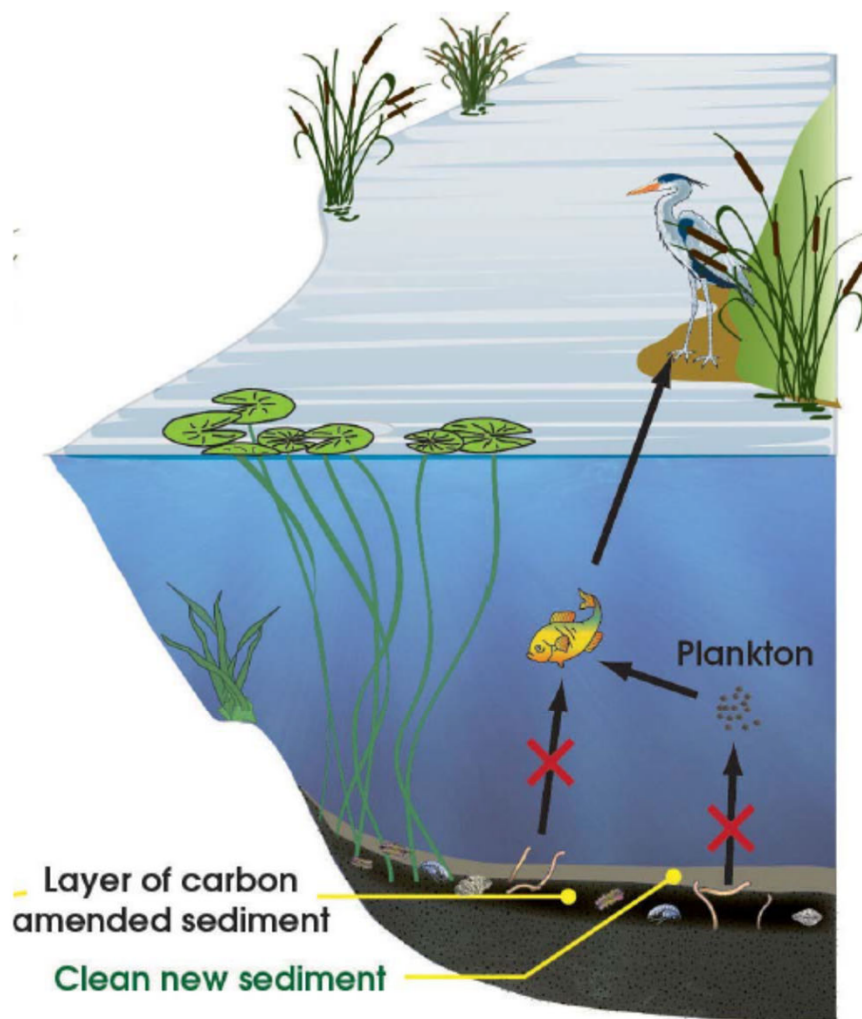
- ✈ Collect baseline pore water sample for analysis.
- ✈ Remove 1.0-1.5 feet of impacted sediment (mechanical dredging).
- ✈ Replace dredged material with a clean sand and (5%) activated carbon amendment mix.
- ✈ Five years of long term monitoring (years 1, 3, & 5).
- ✈ Success criteria will demonstrate improved pore water quality.

Two Mitigation Approaches

Sediment Rehabilitation (8 acres):

- ✿ Collect baseline pore water sample for analysis.
- ✿ No sediment dredging.
- ✿ Direct activated carbon amendment placement (estimated dose rate of 1 lb. /sf).
- ✿ Five years of long term monitoring (years 1, 3, & 5).
- ✿ Success criteria will demonstrate improved pore water quality.

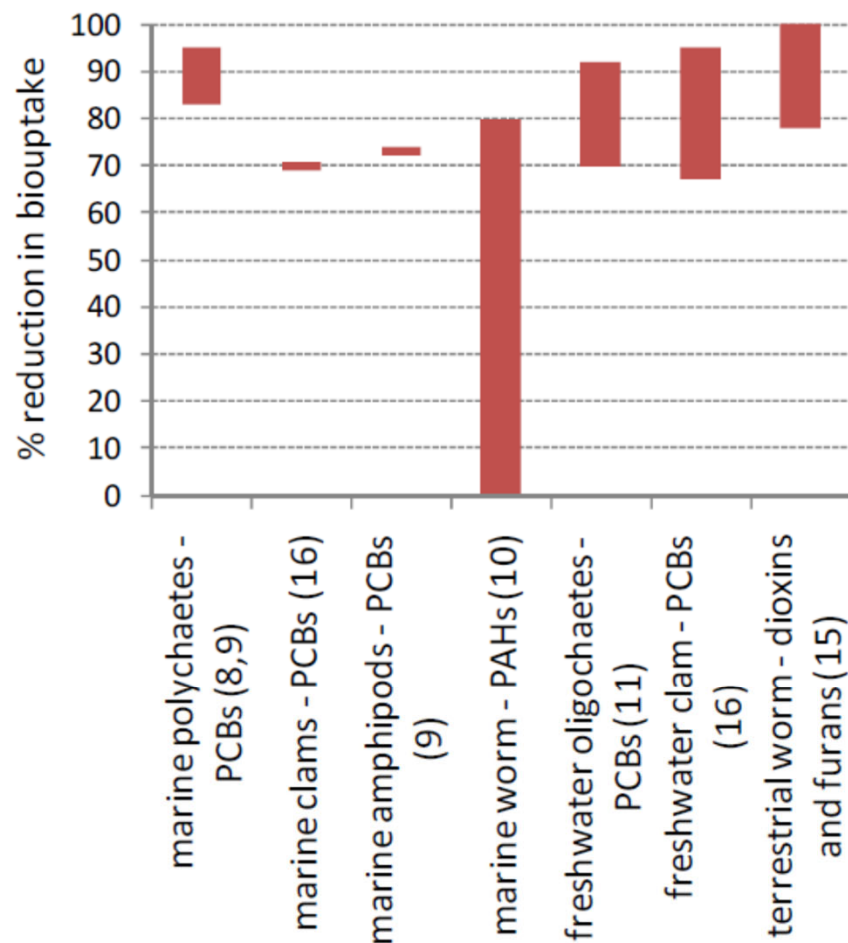
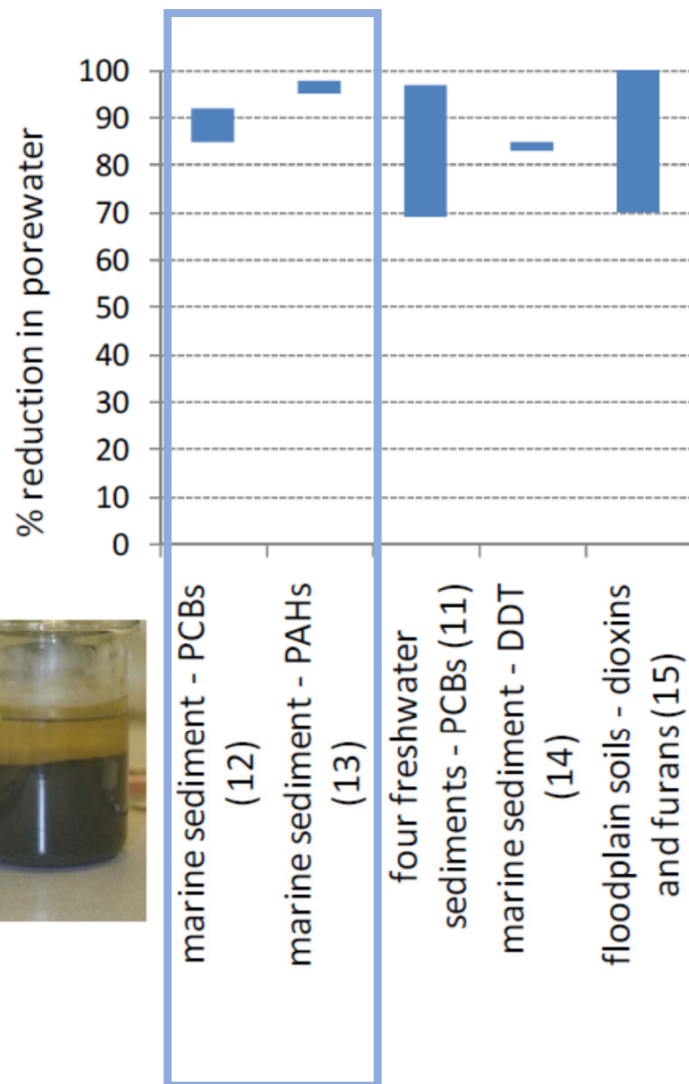
CONCEPTUAL MODEL OF IN-SITU TREATMENT WITH AC



AC amended reduces exposure to food chain through:

- 1) Reduced bioaccumulation in benthic organisms
- 2) Reduced flux into water column and uptake in the pelagic food web.
- 3) In the long-term, the carbon amended layer is covered with clean sediment.

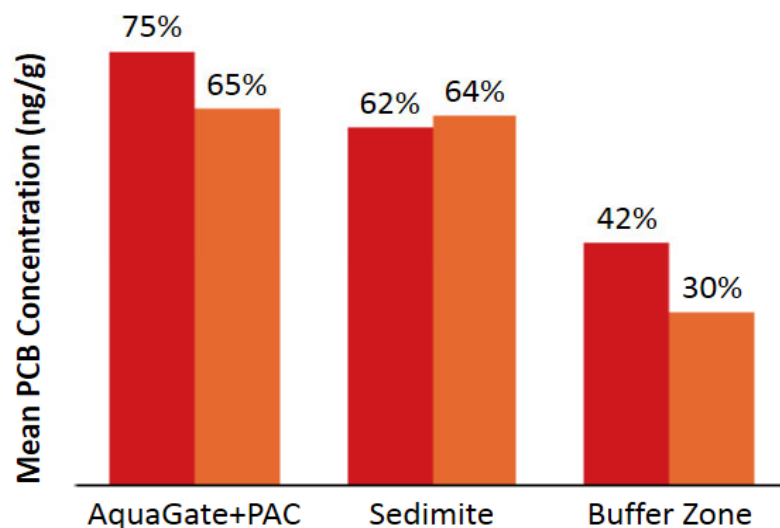
SUMMARY RESULTS FROM LABORATORY STUDIES



Activated carbon reduced pore water and tissue concentrations of target contaminants

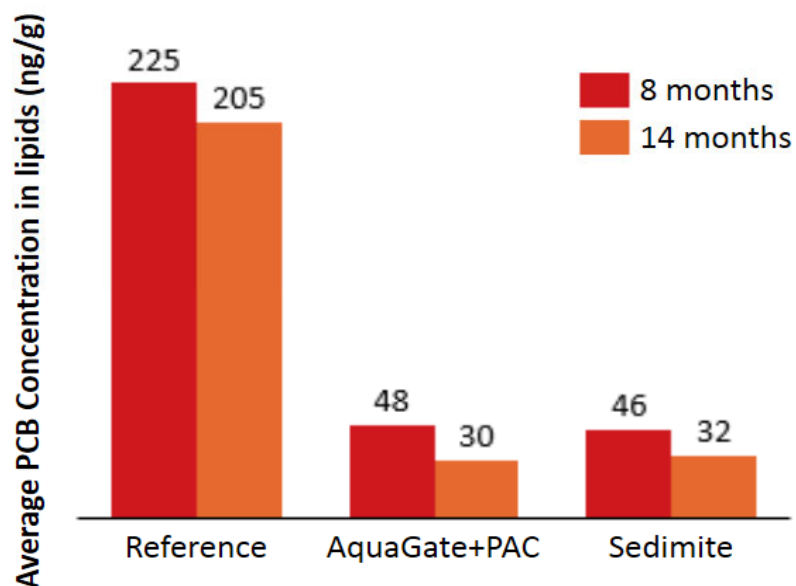
U.S. Navy Site
San Francisco, CA

Pore Water PCB Reduction %
relative to reference (top 16 cm)



Time	Total PCBs
Baseline	2.26 +/- 0.2 ng/l
8 months	0.30 – 0.42 ng/l
14 months	0.10 – 0.12 ng/l

PCB Concentrations in bent nose clams



Time	% PCB Reduction
AquaGate+PAC	82%
Sediment	85%

Estimated Surface Sediment PCB Porewater Concentrations

SMU	Sample	Baseline Dissolved Fraction			60% Reduction	
		Sum of Detects (ng/L)	Sum of all Aroclors* (ng/L)	DEQ Marine Aquatic Life Chronic Standard (ng/L)	Sum of Detects (ng/L)	Sum of all Aroclors* (ng/L)
SMU-1	PCMP08-13	0.5	27.8	30.0	0.2	11.1
SMU-1	PCMP08-14	0.6	27		0.2	10.8
SMU-1	PCMP08-17		32.8		0.0	13.1
SMU-1	PCMP08-18	2.4	33.9		1.0	13.6
SMU-1	PCMP08-19		62.9		0.0	25.2
SMU-1	PCMP08-20		81.3		0.0	32.5
SMU-2	PCMP08-26	5.3	46.8		2.1	18.7
SMU-2	PCMP08-27	3.2	40.7		1.3	16.3
SMU-2	PCMP08-29	7.0	50.6		2.8	20.2
SMU-2	PCMP08-30	5.2	41.8		2.1	16.7
SMU-2	PCMP08-32	5.2	46.7		2.1	18.7
SMU-2	PCMP08-33	0.7	42.0		0.3	16.8
SMU-3	PCMP08-40		42.3		0.0	16.9
SMU-3	PCMP08-41	3.9	43.3		1.6	17.3
Average		3.4	44.3		1.4	17.7

* includes all detected aroclors and non-detected aroclors at 1/2 the reporting limit

ng/L = nanograms per liter + parts per trillion

PCB = polychlorinated biphenyls

SMU = sediment management unit

Long Term Protection

Mitigation will occur on subtidal river bottom.

- ✿ A conservation easement for state owned submerged lands is not available in Virginia.
- ✿ A Conservation Land Use Memorandum of Understand (MOU) is an appropriate means of long-term protection (LRRT, VMRC, USACE).
- ✿ The MOU will not restrict the riparian rights of upland land owners, however.
- ✿ Unavoidable permitted impacts in mitigation areas will require "replacement mitigation".

Crediting and Debiting Procedure

- ✿ The USACE and DEQ will determine the appropriate mitigation required to compensate for unavoidable permitted loss (typically assessed as SF of mitigation).
- ✿ LRRT has 16 advanced credits available for river bottom mitigation.
- ✿ Paradise Creek offers 10 acres of mitigation area with a mitigation unit price of \$17/SF that is competitive with tidal wetland mitigation credits in the same service area.

Success Criteria

- ✈ Baseline pore water samples will be collected prior to mitigation activity.
- ✈ Follow up in-situ pore water sampling is proposed for years 1, 3, & 5 following mitigation activity.
- ✈ Mitigation success will be evaluated by documenting the reduction of dissolve PCBs in sediment pore water.

Long-Term Stewardship

- ✿ A portion of each advanced credit sale will be set aside for long-term stewardship and catastrophic event funds.
- ✿ The Long-Term Steward will be responsible for implementing the Long-Term Management and Maintenance Plan.
- ✿ LRRT currently intends to retain stewardship responsibilities.

Acknowledgments



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Craney Island Partners



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Thank you!
Questions and Comments?

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