PCB Symposium

Cross Program Contaminant Working Group

January 24-25, 2023

Meeting Day 1 - January 24, 2023

Time (PST)	Time (EST)	Topic	Presenter
09:00	12:00	Introduction Purpose Scope Introduce Zoom polls and whiteboard	Marielle Larson (UW Tacoma) Andy James (UW Tacoma) Greg Allen (US EPA Chesapeake Bay Office) Katrina Radach (Puget Sound Partnership)
09:30	12:30	**Puget Sound** 50 min presentation. 10 min Q&A.	Louisa Harding (Washington Dept of Fish and Wildlife) Rachel McCrea (Washington State Dept of Ecology)
10:30	13:30	**Spokane River** 50 min presentation. 10 min Q&A.	David Dilks (LimnoTech) Adriane Borgias (Washington State Dept of Ecology)
11:30	14:30	BREAK	
11:45	14:45	**Great Lakes** 50 min presentation. 10 min Q&A.	Brian Lenell (US EPA Great Lakes Office) Mark Loomis (US EPA Great Lakes Office)
12:45	15:45	Closing Discussion Request for feedback, value of symposium, future topics and venues, etc.	Joel Baker (UW Tacoma)
13:00	16:00	End of Day	

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- We are extremely interested in getting feedback on specific topics and/or focus areas that support management of contaminants.
- A Mural board will be open during the entire meeting to collect feedback (link will be posted to chat)
- We will use a Zoom poll near the end of each day to get focused feedback
- Speaker Q&A will be through the chat. Please put questions into chat as they arise and the moderator will facilitate following each presentation.

Meeting Day 2 - January 25, 2023

Time (PST)	Time (EST)	Topic	Presenter
09:00	12:00	Day 2 - introduction	Marielle Larson (UW Tacoma) Will Hobbs (Washington State Dept of Ecology) Doug Austin (US EPA Chesapeake Bay Office)
09:15	12:15	Chesapeake Bay 50 min presentation. 10 min Q&A.	Greg Allen (US EPA Chesapeake Bay Office)
10:15	13:15	Delaware River 50 min presentation. 10 min Q&A	John Cargill (Delaware Dept of Natural Resources)
11:15	14:15	BREAK	
11:30	14:30	New Bedford Harbor 50 min presentation. 10 min Q&A	Natalie Burgo (US EPA Region 1) Dave Dickerson (US EPA Region 1)
12:30	15:30	Closing Request for feedback, next steps, value of symposium, future topics and venues, etc.	Joel Baker (UW Tacoma) Andy James (UW Tacoma) Greg Allen (US EPA Chesapeake Bay Office)
13:00	16:00	End of Day	

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LOGISTICS NOTES:

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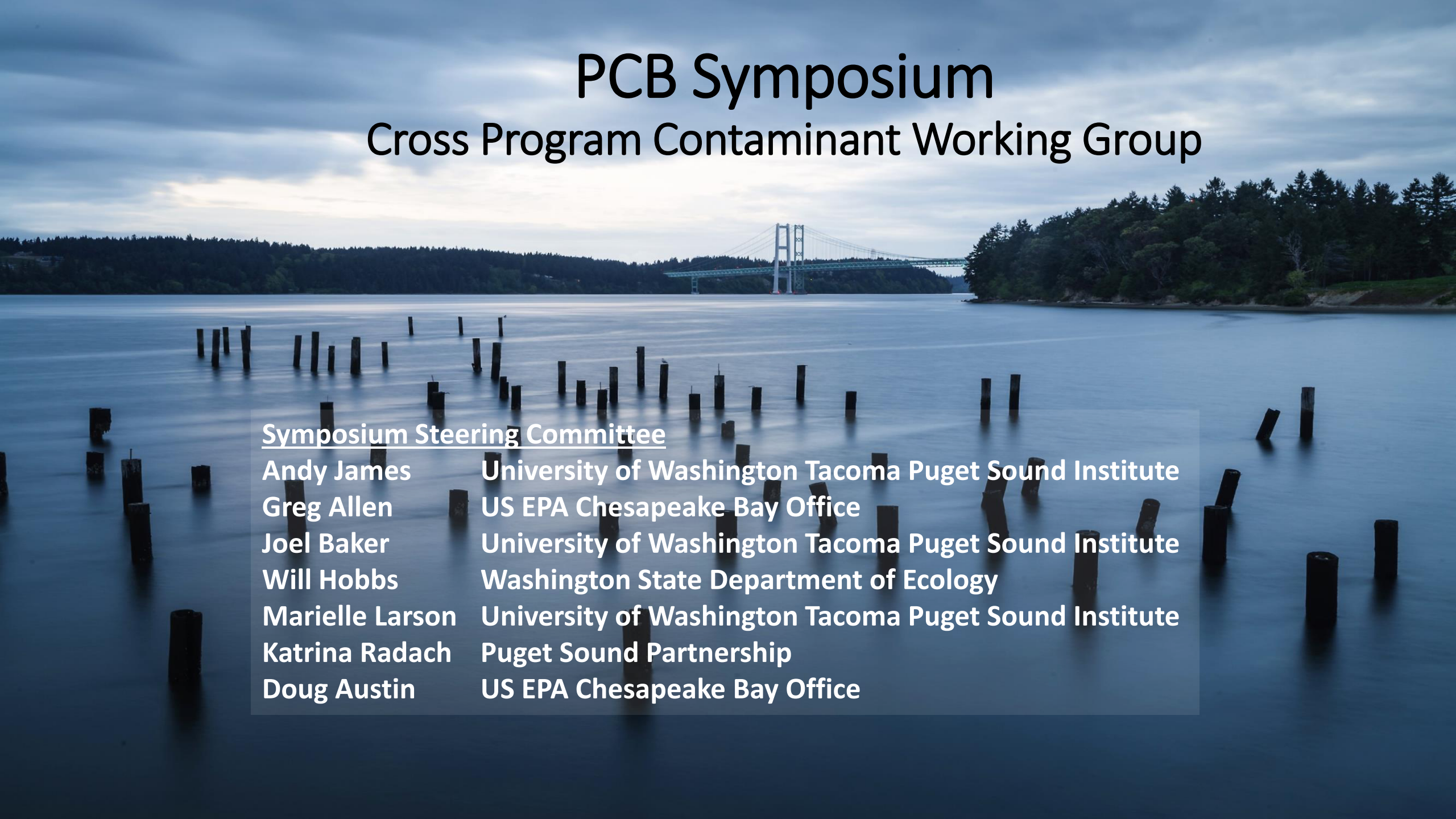

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Cross Program Contaminant Working Group

Symposium Steering Committee

Andy James	University of Washington Tacoma Puget Sound Institute
Greg Allen	US EPA Chesapeake Bay Office
Joel Baker	University of Washington Tacoma Puget Sound Institute
Will Hobbs	Washington State Department of Ecology
Marielle Larson	University of Washington Tacoma Puget Sound Institute
Katrina Radach	Puget Sound Partnership
Doug Austin	US EPA Chesapeake Bay Office

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Cross Program Contaminant Working Group

BACKGROUND and OBJECTIVES:

- We all have a contaminant problem

- Premise:
  Perhaps we share information on programs, projects, and best practices across regions to improve the effectiveness by which toxics contaminants are managed, controlled, and cleaned up.

- We are focused on sharing practical advice.

- Start with background and context across geographies

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THIS SYMPOSIUM:

1. Share background and context across geographies

2. Seek input and feedback on:
   a. The utility of carrying forward with this exercise – is there value on organizing specific and focused discussion groups, venues, symposium?
   b. If there is value – what do we want to focus on?

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Subsequent meetings could cover:

- How do we use tools and authorities available to reduce impacts? How is science and monitoring used to inform actions under those tools and authorities?
- Source identification.
- Mitigation and management technologies – what worked and what did not?
- What are characteristics of successful programs and projects (i.e., those that have led to a measurable reduction of PCBs in the environment). Hearing about unsuccessful ones (perhaps those defined by a lot of investment without change) would also be useful.
- Monitoring
- How can the lessons learned from PCBs be applied to other harmful and persistent compounds such as PFAS?

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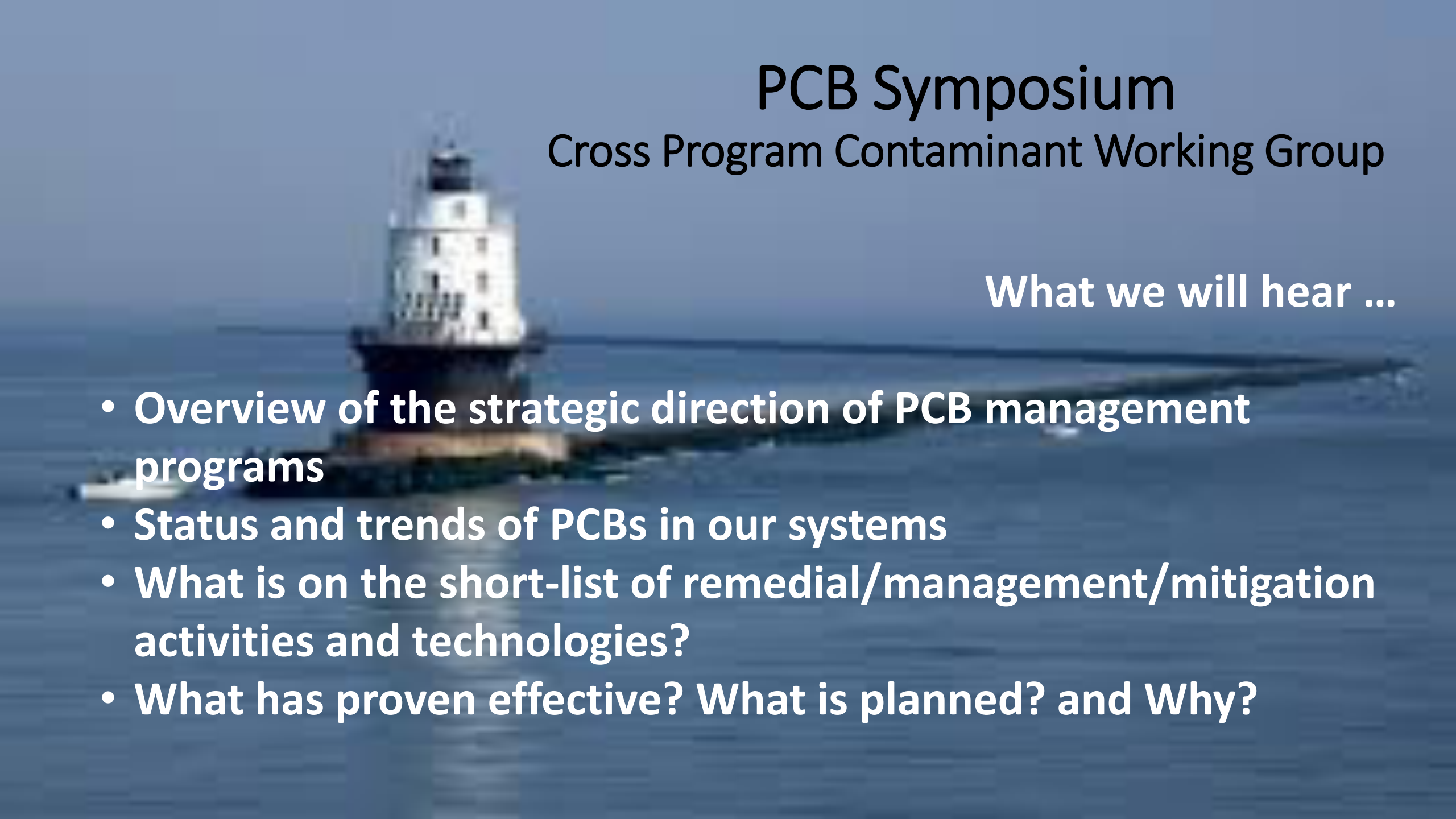
An initial focus on PCBs …

- **PCBs are an active and dynamic issue in many coastal management areas**
- **PCBs dominate fish consumption risk in estuarine waters**
- **Understanding of fate, transport, occurrence, and impacts, and clean up and management strategies**
- **Provides a good base of knowledge and experience that we can share with one another**



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What we will hear …

- **Overview of the strategic direction of PCB management programs**
- **Status and trends of PCBs in our systems**
- **What is on the short-list of remedial/management/mitigation activities and technologies?**
- **What has proven effective? What is planned? and Why?**

Thirty years of PCB monitoring in Puget Sound biota

Toxics Biological Observation System (TBiOS)
Washington Dept. of Fish and Wildlife

James West, Sandra O'Neill, Louisa Harding, Andrea Carey, Molly Shuman-Goodier, Mariko Langness, Rob Fisk, Danielle Nordstrom, and Andrew Beckman

Cross Program Contaminant Symposium,
24 January 2023

Washington Department of FISH and WILDLIFE

WDFW's Toxics Biological Observation System (TBiOS)

We evaluate the ***effects of toxic contaminants*** on marine and anadromous species in Puget Sound to:

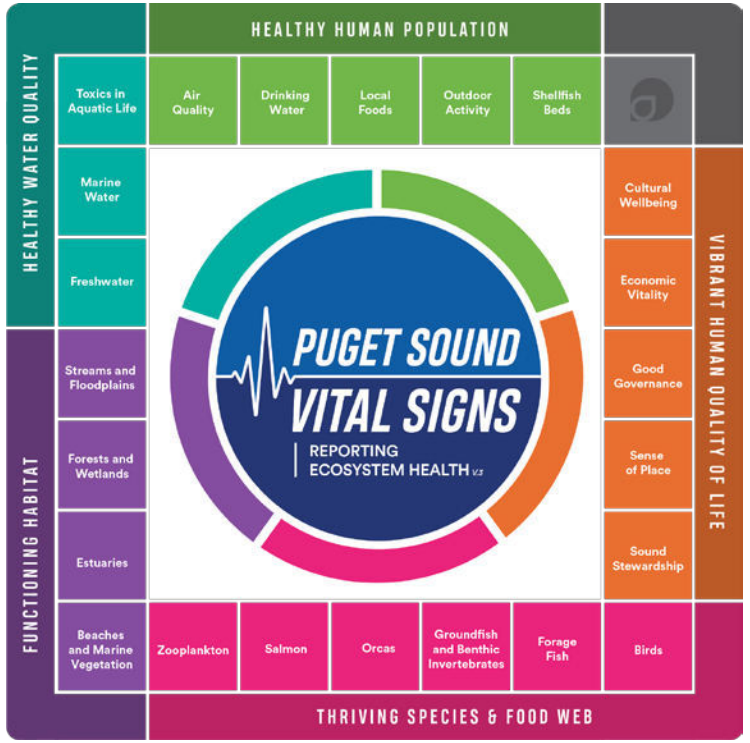
- guide efforts to ***protect fish and shellfish health***,
- ***ensure seafood safety***, and
- ***promote ecosystem recovery***.

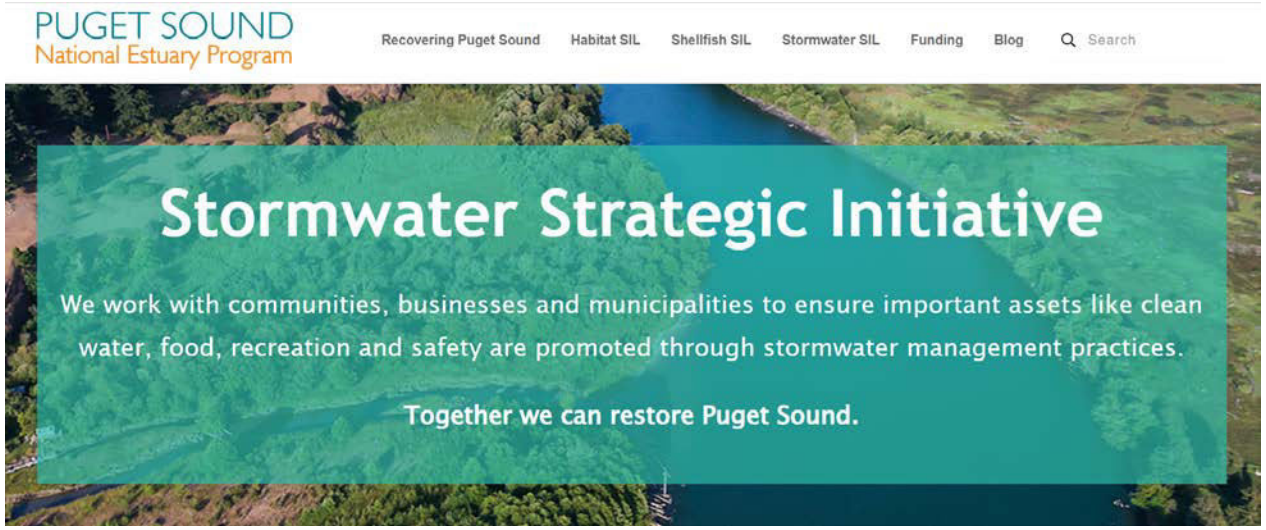
https://wdfw.wa.gov/species-habitats/science/marine-toxics/tbios

25 Vital Signs for Puget Sound Ecosystem Health & Progress Towards Recovery Goals

A tool designed to distill complex information to ***guide ecosystem recovery managers – to Inspire Action!***

https://vitalsigns.pugetsoundinfo.wa.gov/VitalSign/Detail/28

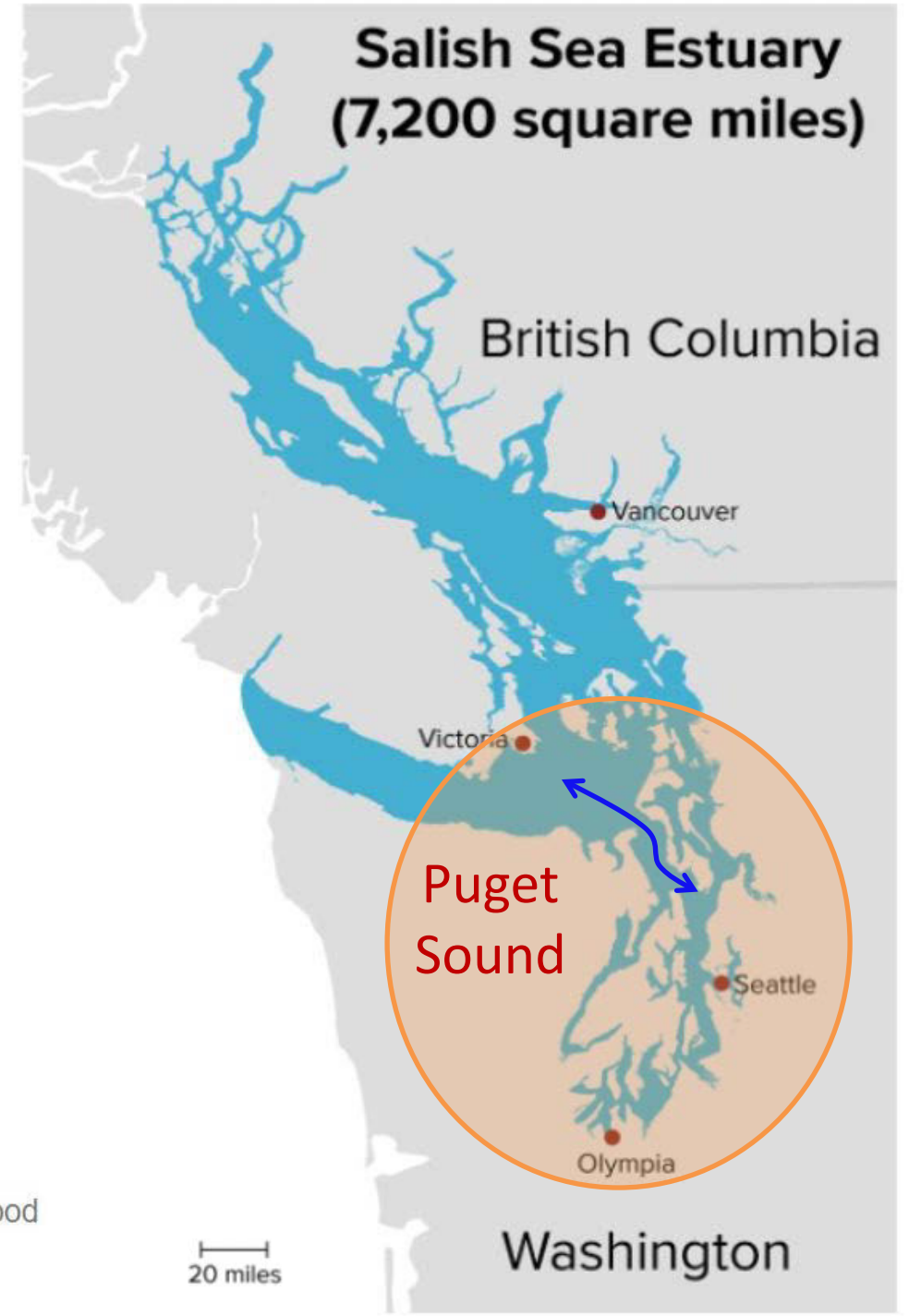




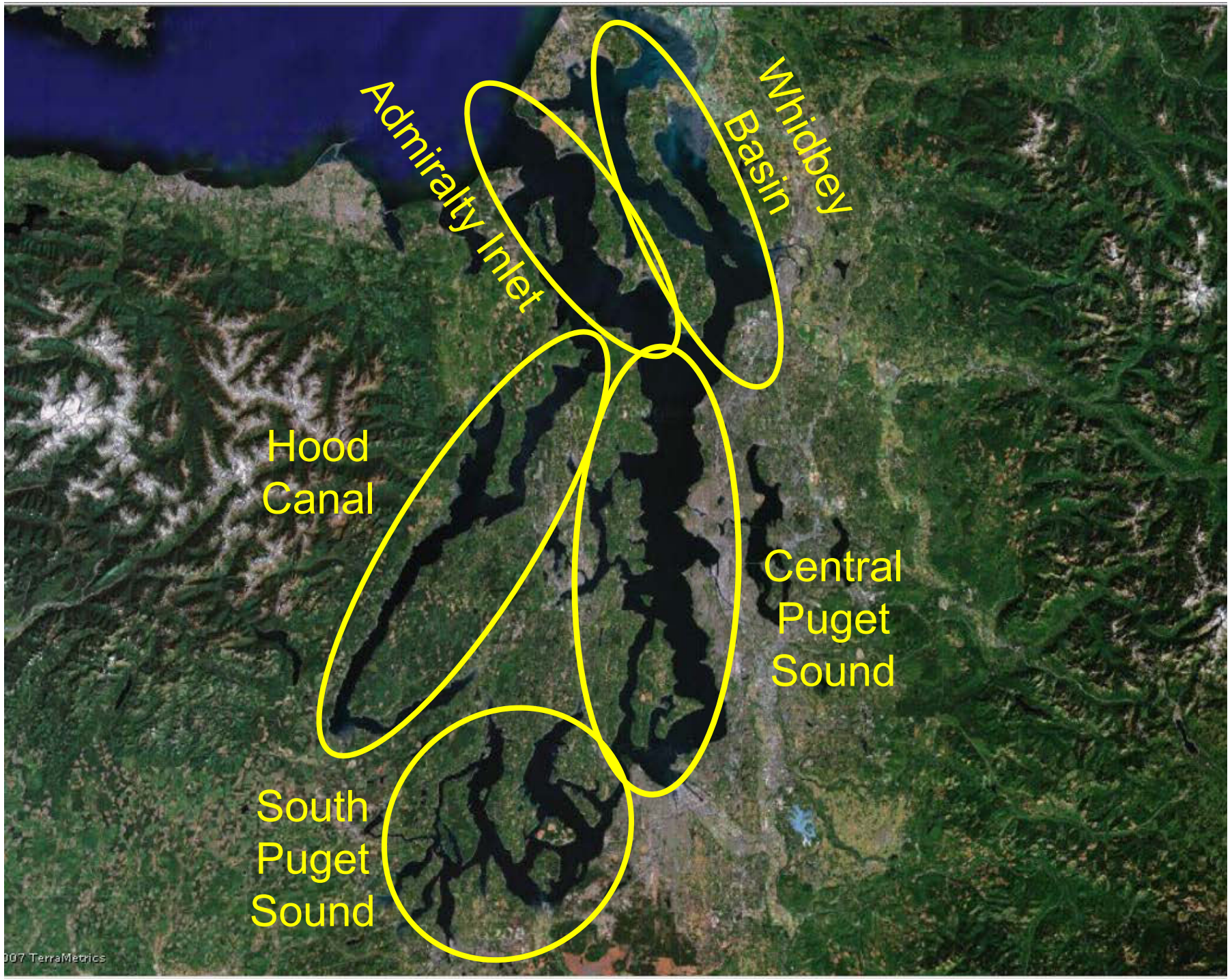
*A **Strategic Initiative** sponsored by EPA's National Estuary Program that connects Vital Sign science to policy to align and focus recovery efforts for Puget Sound recovery*

https://pugetsoundestuary.wa.gov/stormwater-strategic-initiative/

- The *Salish Sea* -- inland marine and estuarine waters
- *Puget Sound* is a deep, fjord estuary
- Constricted connection with Pacific Ocean
- Hydrological and biological isolation which tends to retain contaminants
- Highly stratified – warmer fresh water tends to lay above colder salt water

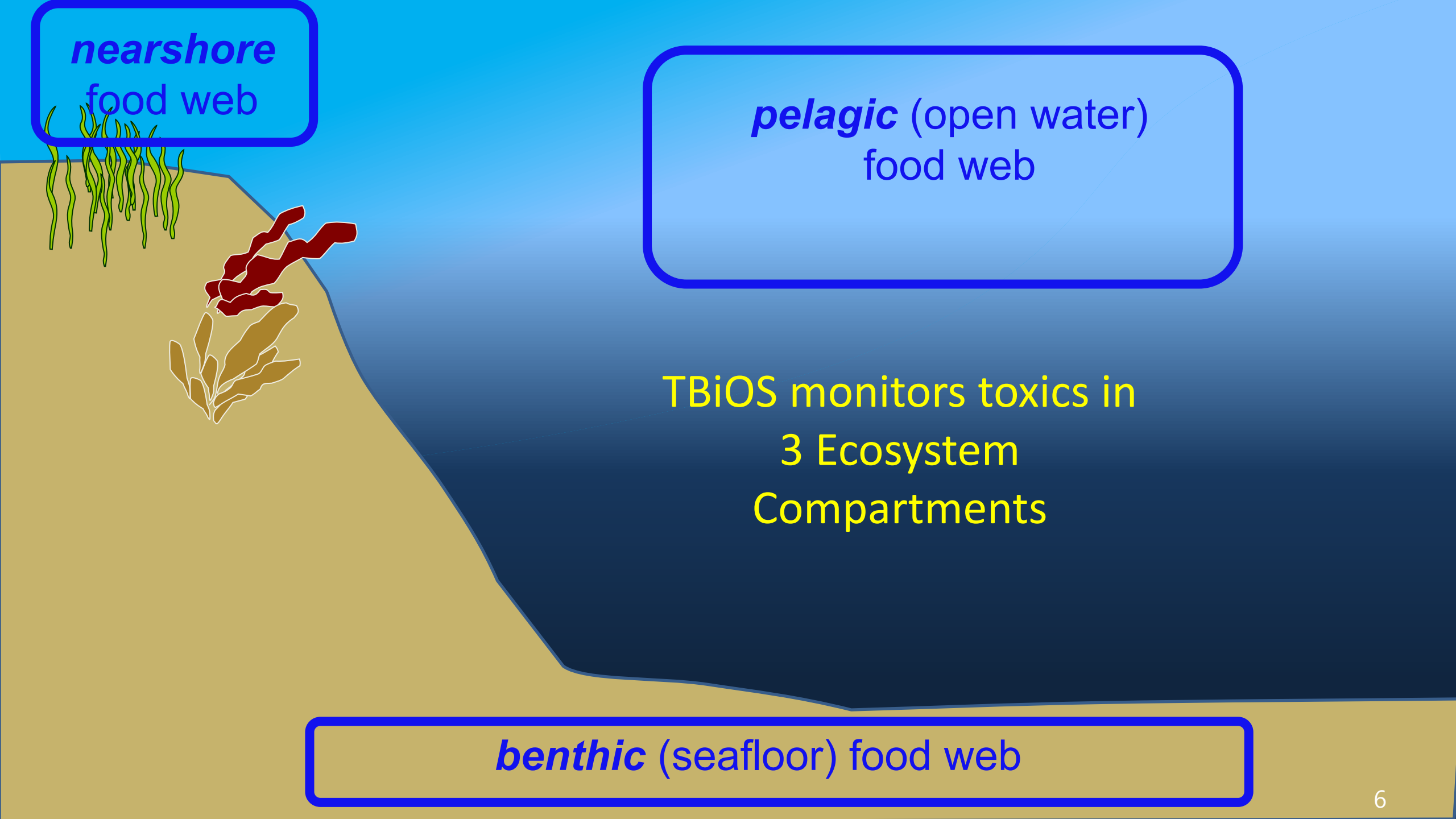


Sources: Salish Sea Atlas (Flower 2021), Adapting to Rising Tides East Contra Costa Shoreline Flood Explorer. Prepared by Gokce Sencan, PPIC.



Puget Sound's Basins range from:

- **highly developed (central), to**
- **medium develop-ment (Whidbey and south basins),**
- **low development (Hood Canal), and**
- **transition between inland waters and more oceanic waters (Admiralty Inlet)**


nearshore food web
pelagic (open water) food web
TBiOS monitors toxics in 3 Ecosystem Compartments
benthic (seafloor) food web

juvenile Chinook salmon

transplanted mussels

Pacific herring

resident Chinook salmon

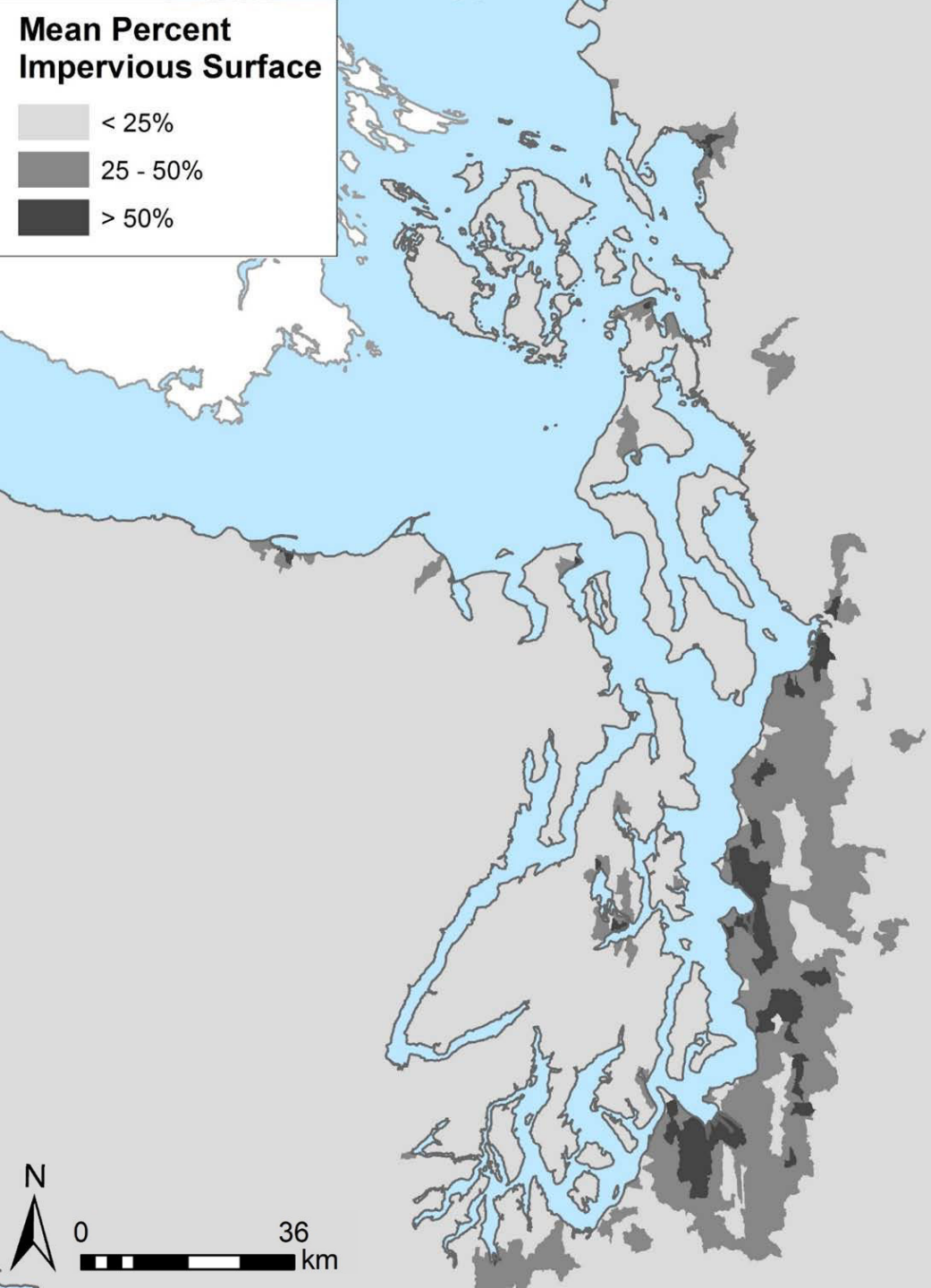
TBiOS Indicator Species

English sole

juvenile Chinook salmon

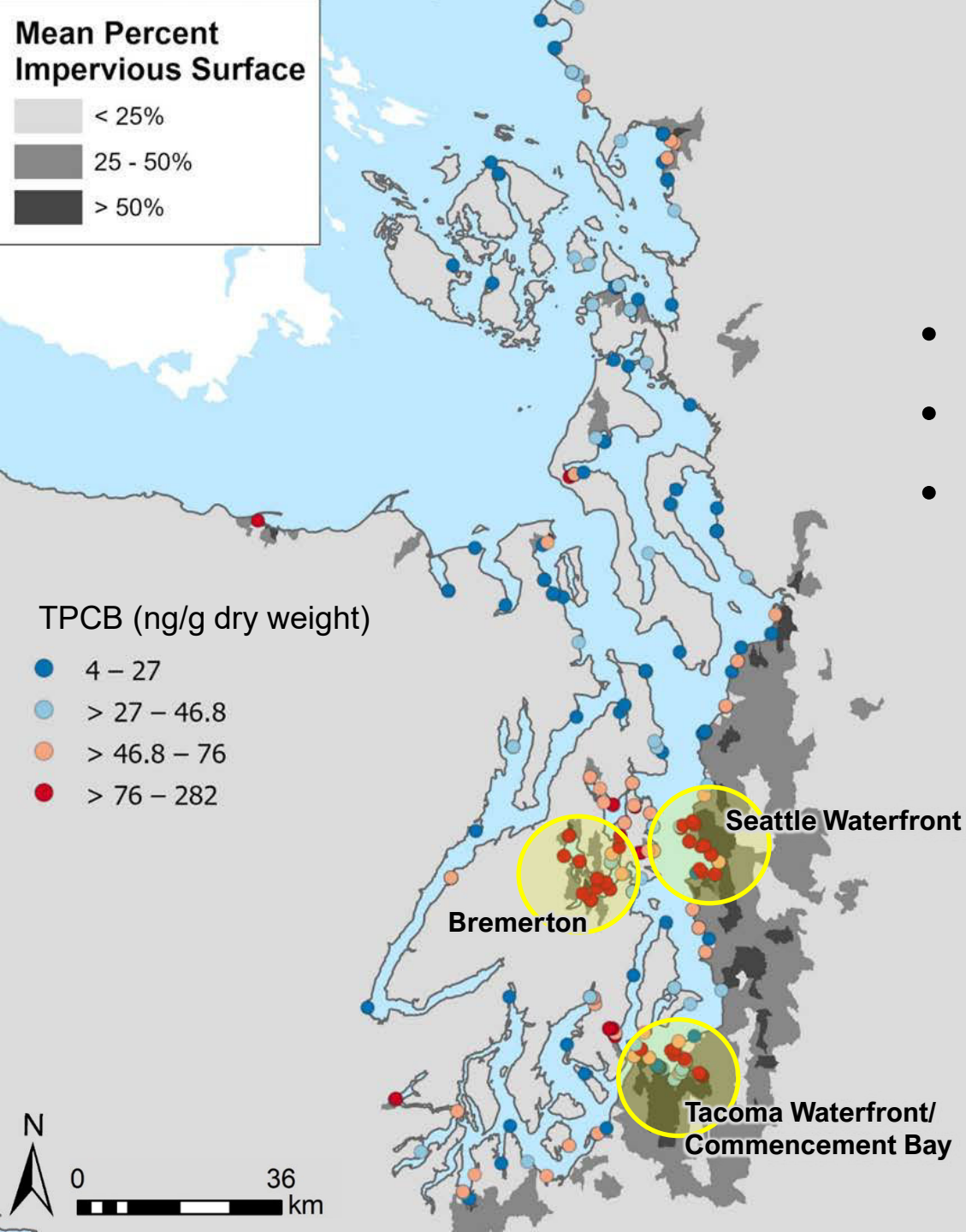
transplanted mussels

Nearshore food web



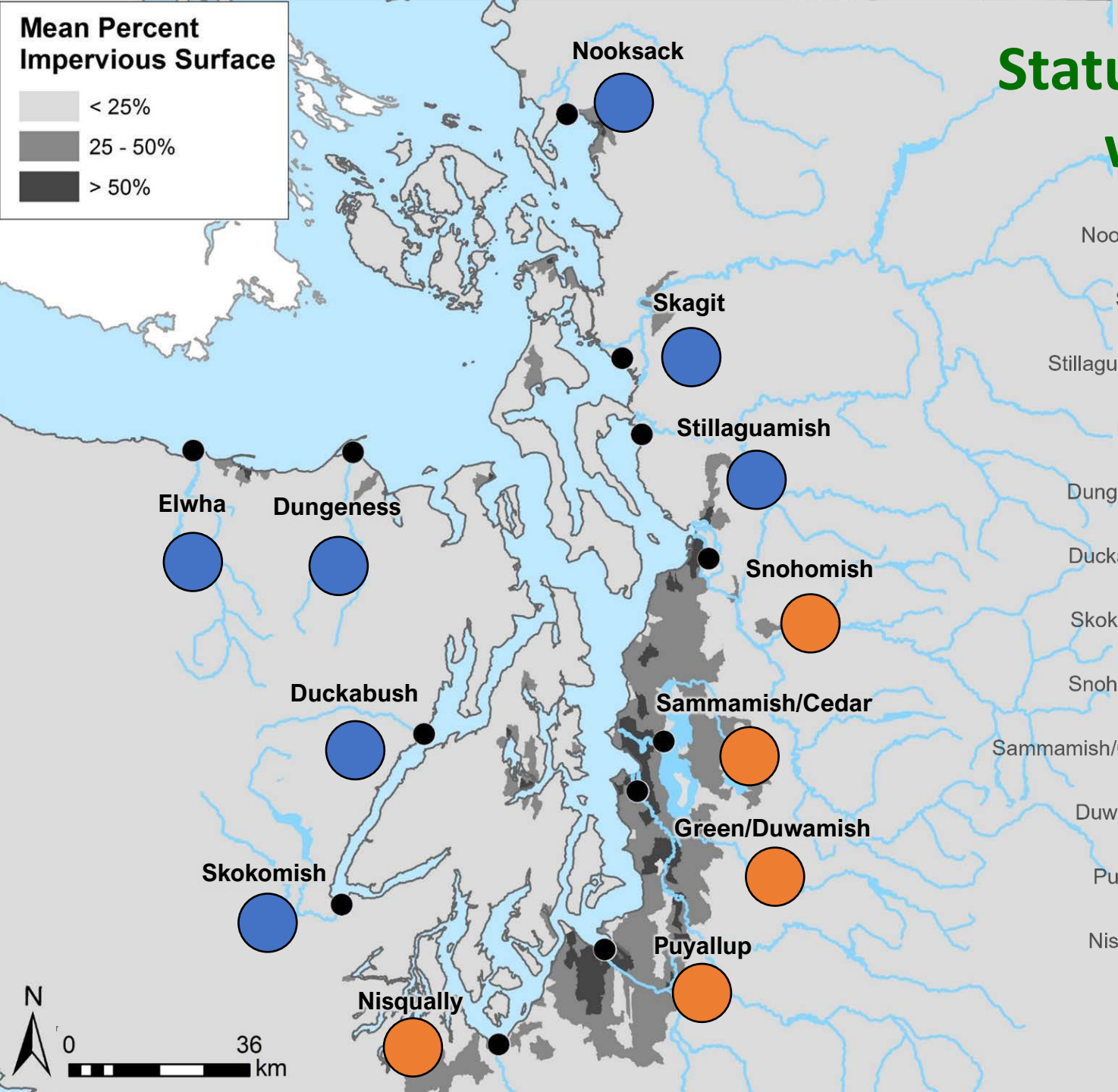
Impervious Surface of adjacent shoreline is used as a proxy for degree of development and potential sources of contaminants like PCBs

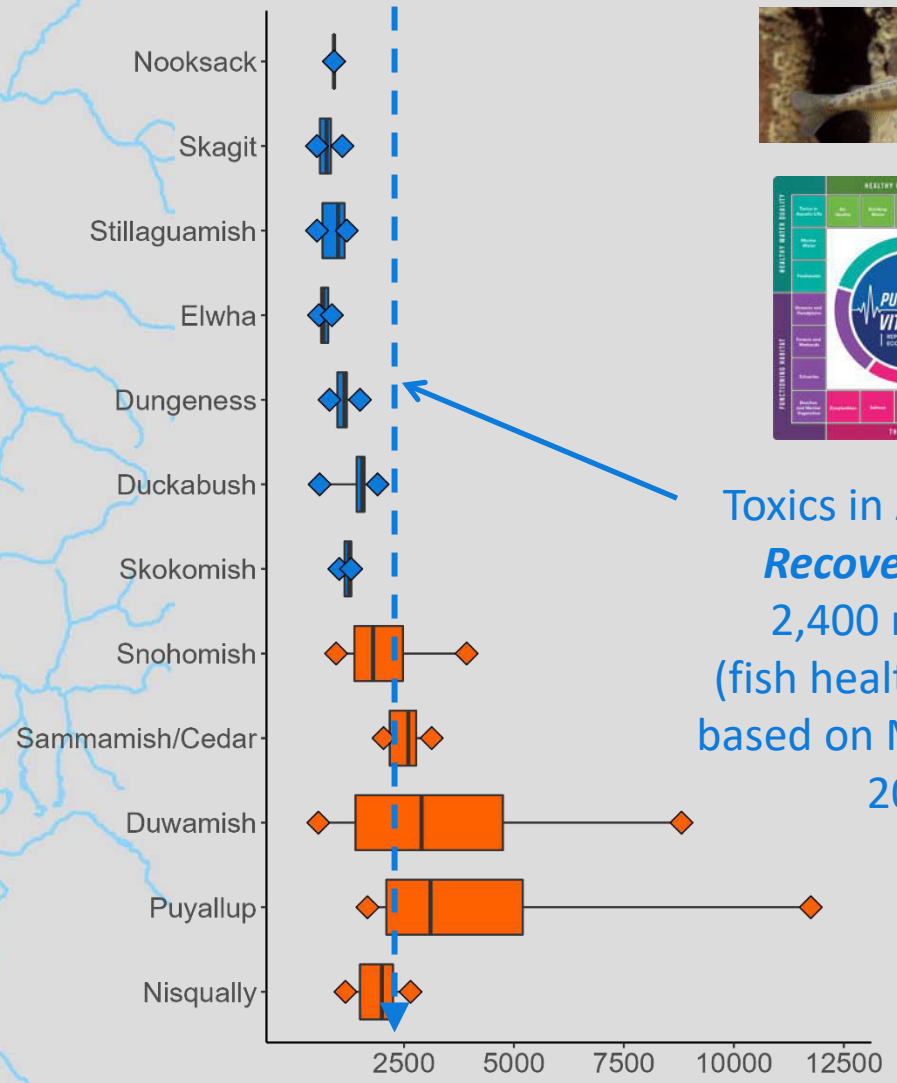
PCBs in deployed bay mussels (2012-2020)

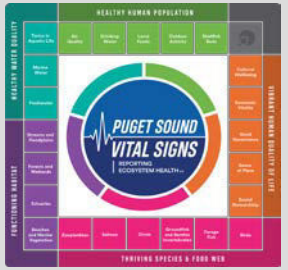


- 2- to 3-month winter deployments
- Reflect very local conditions
- Greatest concentration in urbanized embayments or near known sources

Status of PCBs in juvenile Chinook whole bodies (2013-2018)







Toxics in Aquatic Life
Recovery Target
2,400 ng/g lipid
(fish health threshold based on Meador et al. 2002)

English sole

benthic (seafloor) food web

PCBs in marine sediments are greatest in urban areas (e.g., Elliott Bay)

However, much of Puget Sound's shoreline looks like this (less developed).

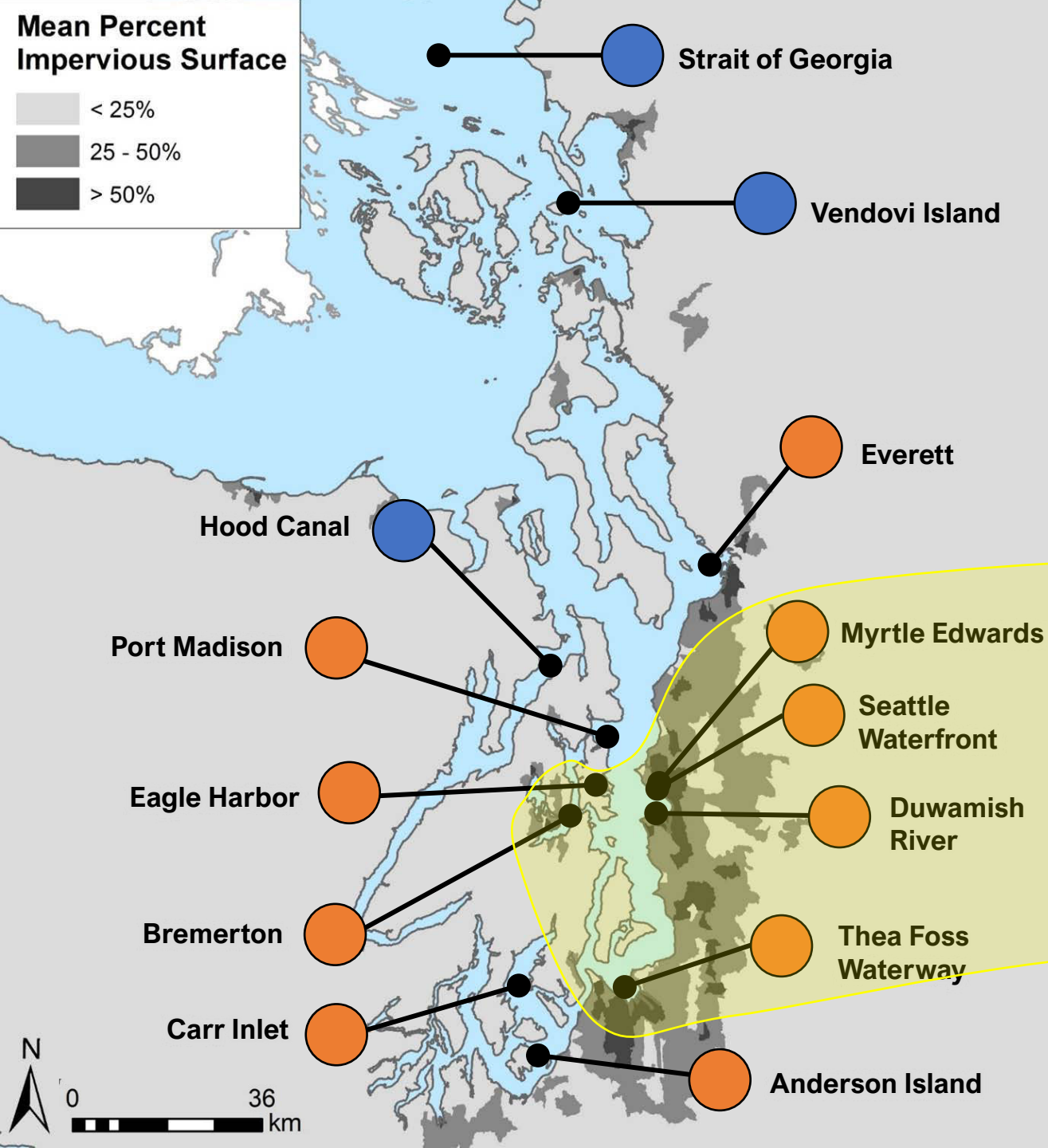
PCBs in marine sediments are

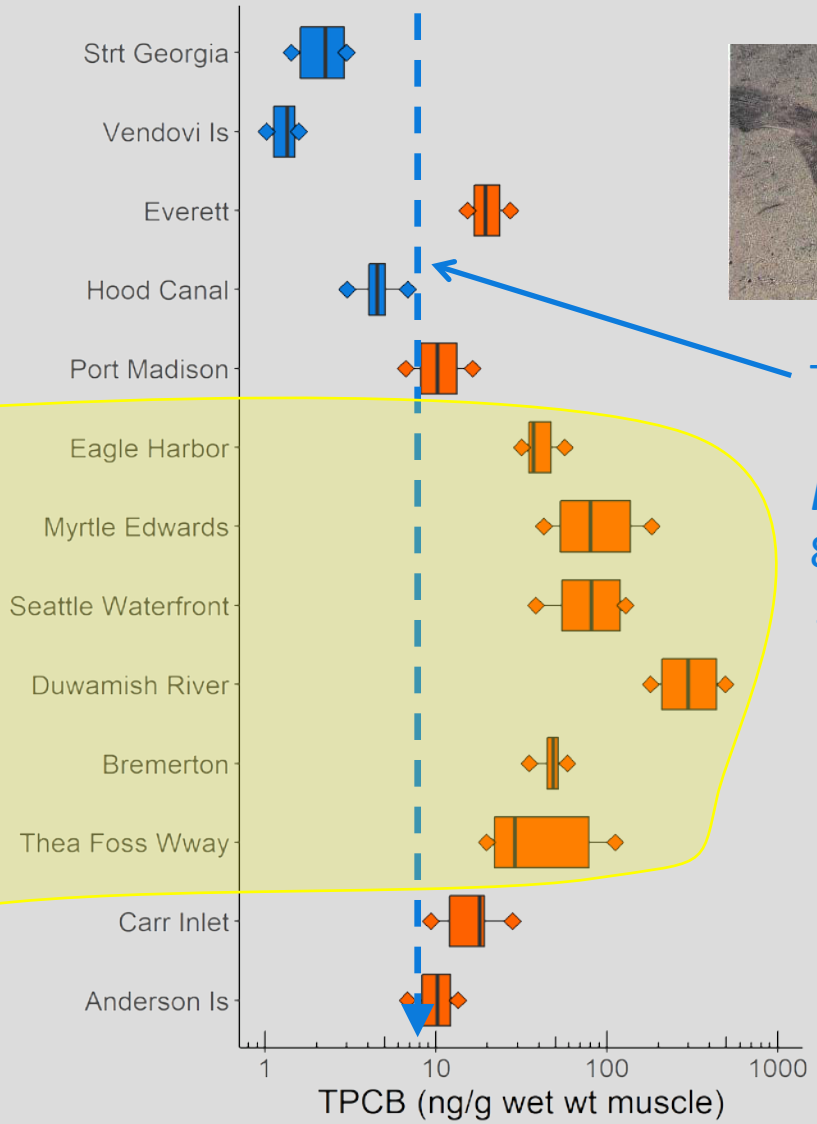
"Relative to many other estuaries and marine bays of the USA, Puget Sound sediments ranked among those with minimal evidence of toxicant-induced degradation." (on a total area basis)

Source: Long ER, Dutch M, Aasen S, Welch K, Hameedi MJ. 2005. Spatial extent of degraded sediment quality in Puget Sound (Washington State, U.S.A.) based upon measures of the sediment quality triad. Environmental Monitoring and Assessment 111:173-222.

shoreline looks like this (less developed).

Status of PCBs in English sole fillet (2019-2021)



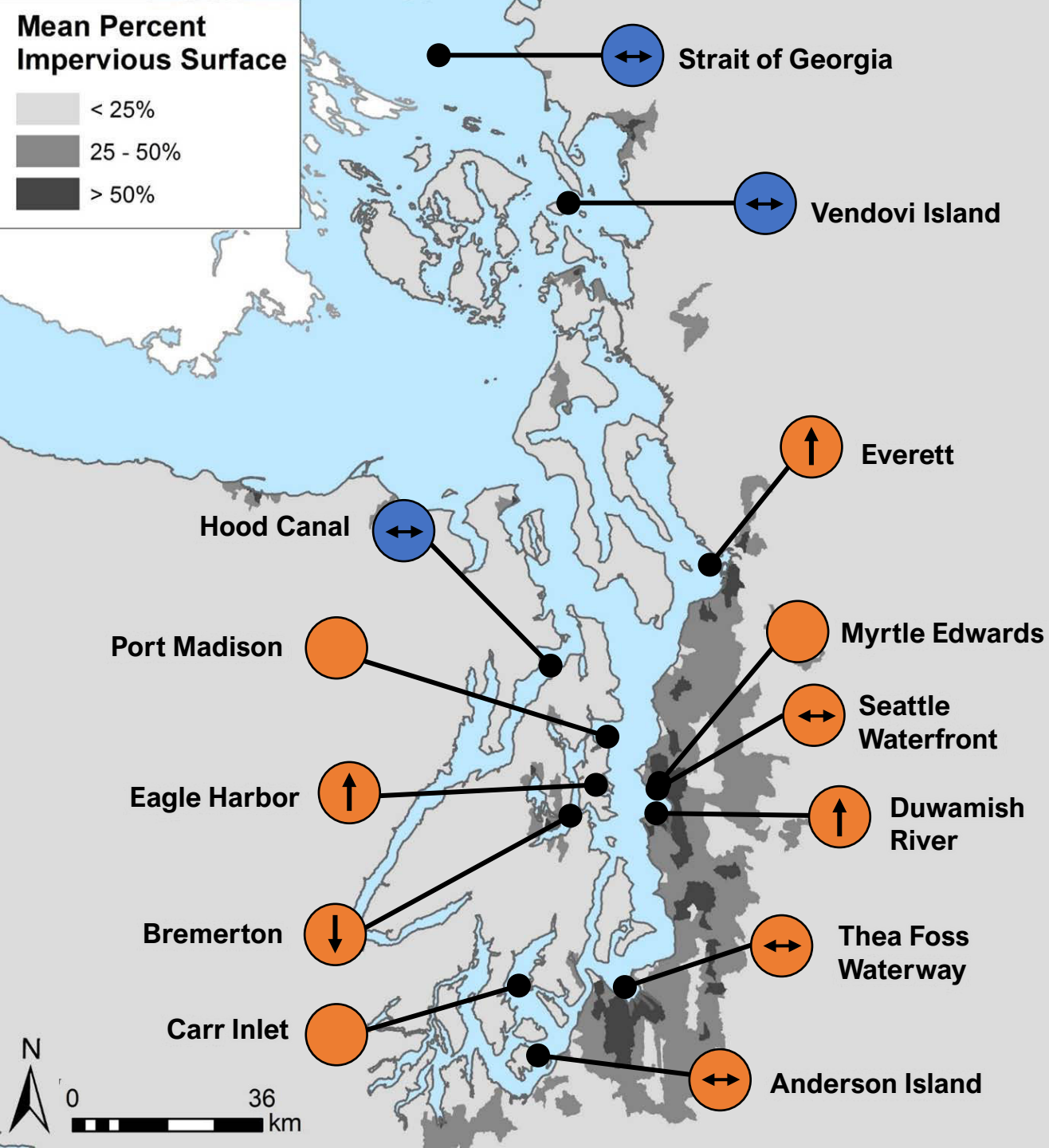


Toxics in Aquatic Life Vital Sign

Recovery Target

8 ng/g ww; DOH Screening Value

PCB trends in English sole fillet (1997-2019)



Conducted quantile regressions to determine trends in the 95th percentile of PCB concentrations. Trends are available for 10 sites:

- 1 is decreasing
- 3 are increasing
- 6 not changing

PCB trends in English sole fillet (1997-2019)

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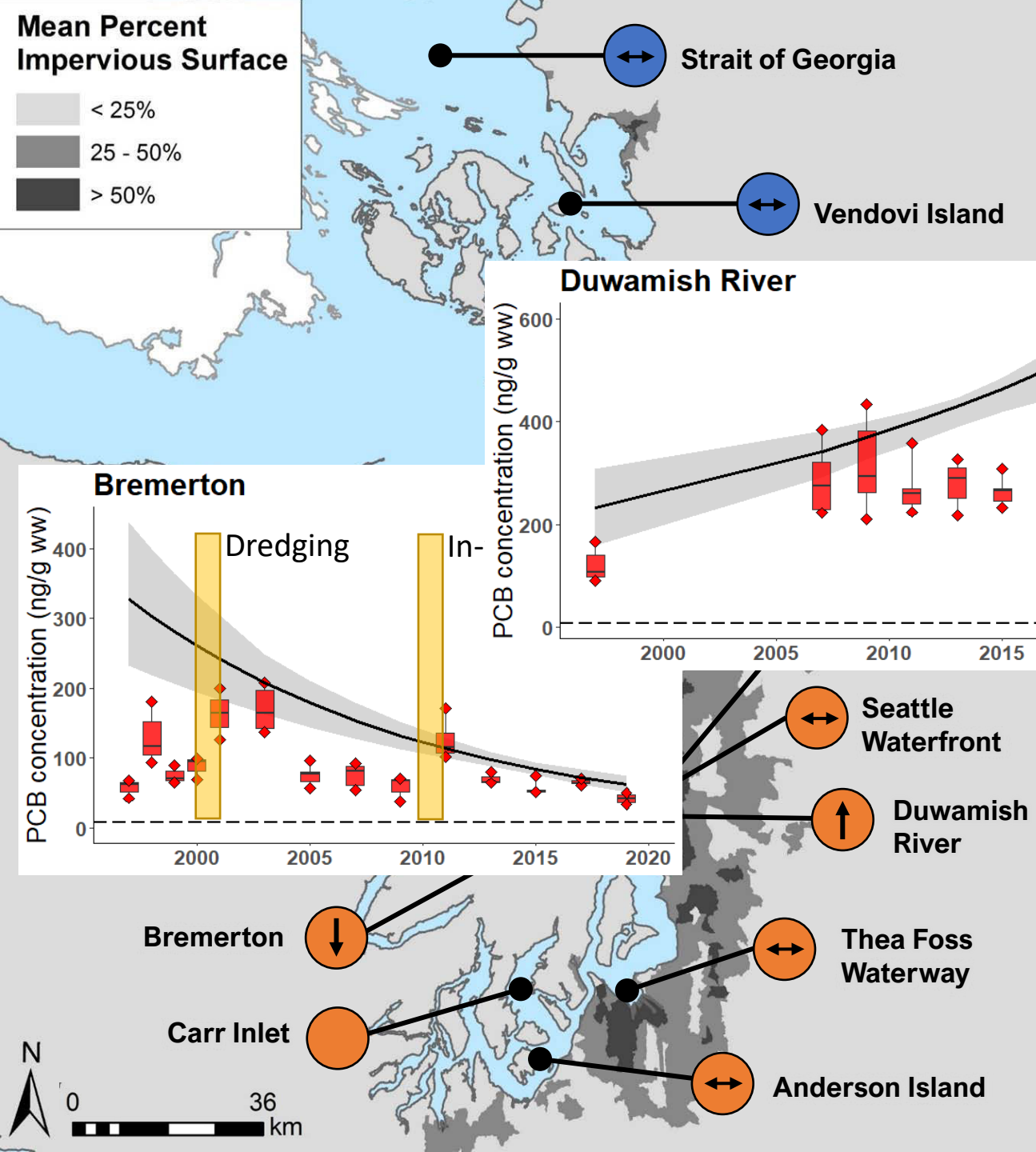
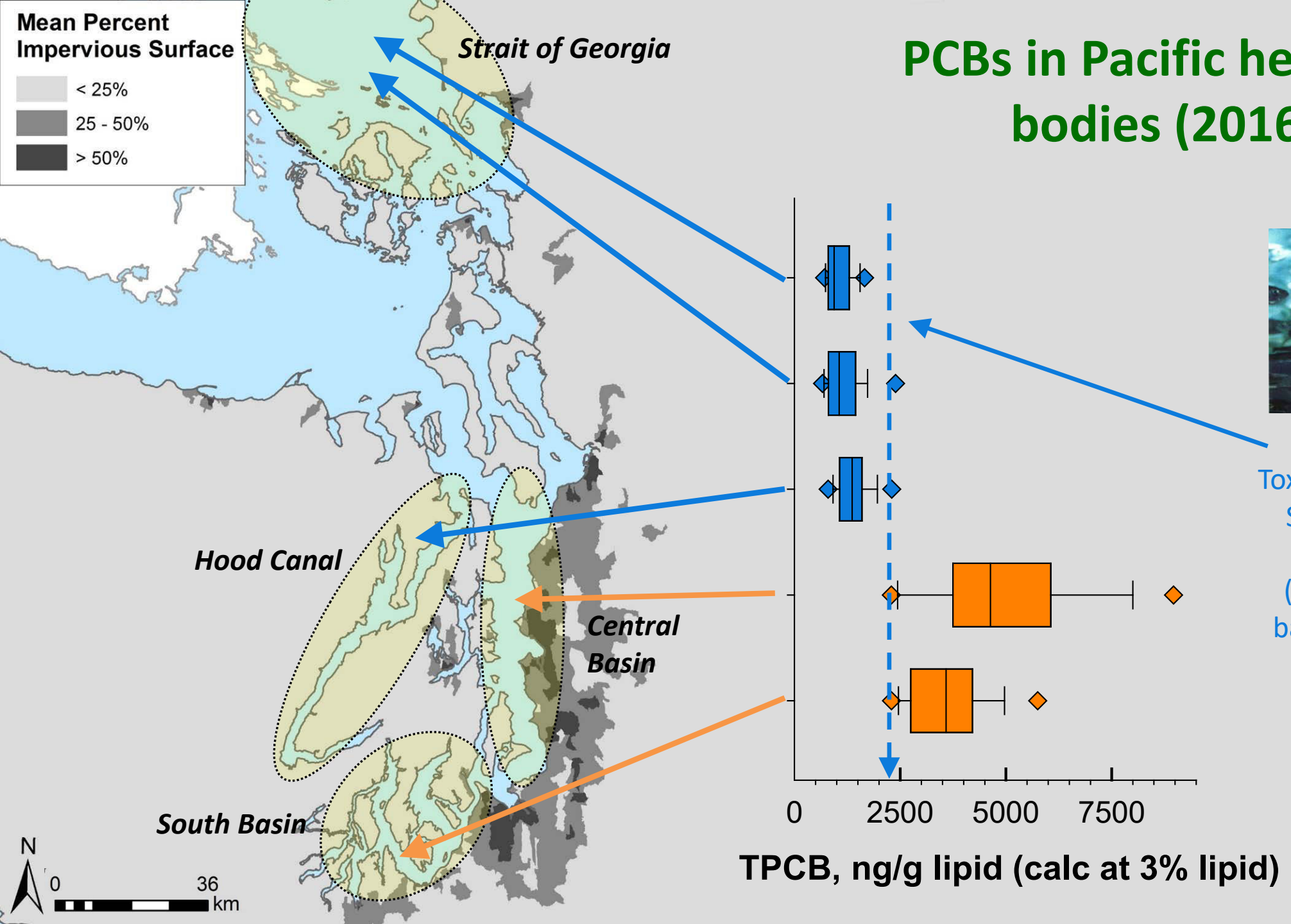


pelagic (open water) food web

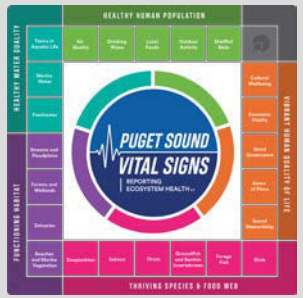
Pacific herring

Chinook salmon

PCBs in Pacific herring whole bodies (2016-2020)

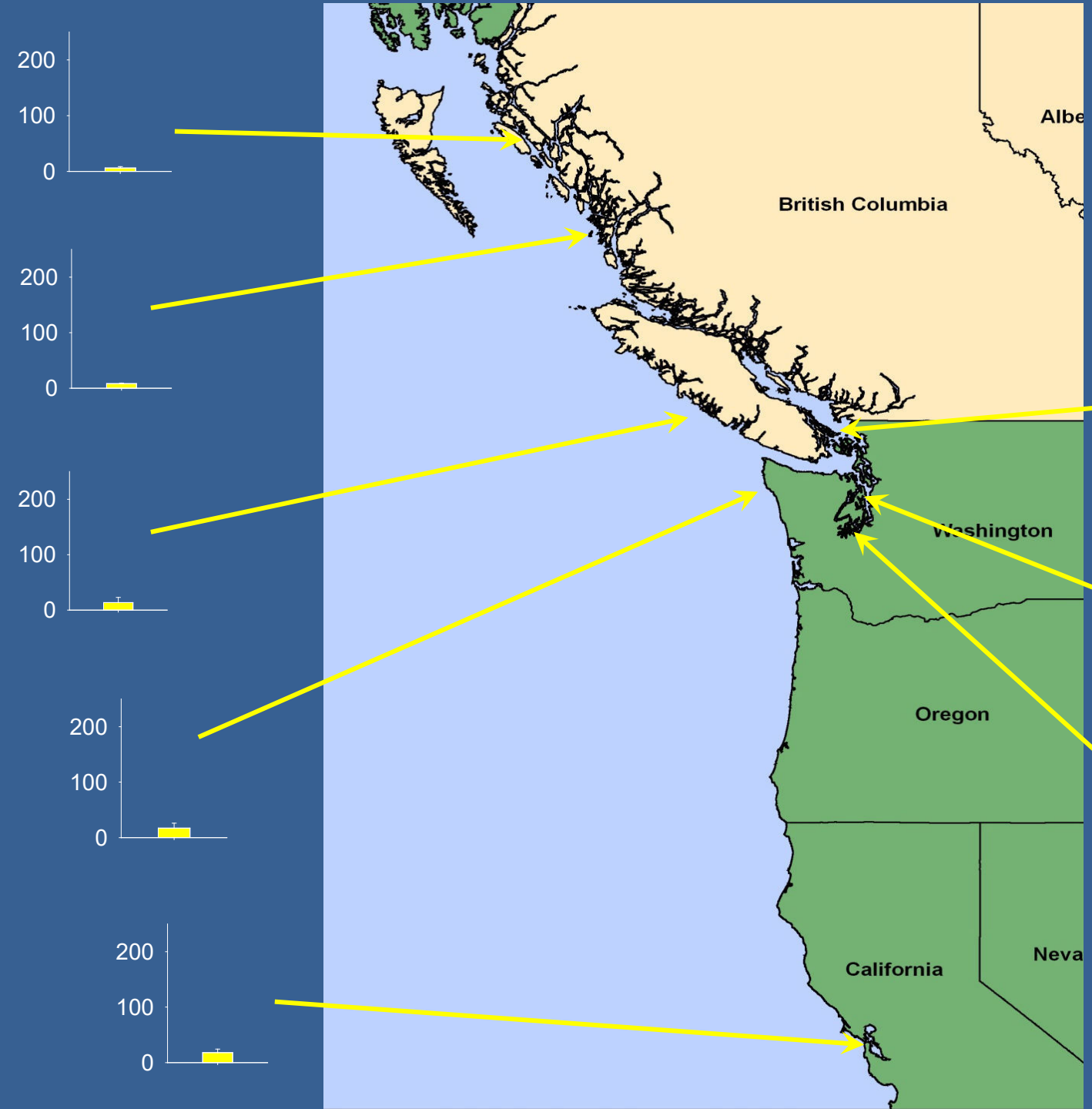


Toxics in Aquatic Life Vital Sign ***Recovery Target*** 2,400 ng/g lipid (fish health threshold based on Meador et al. 2002)

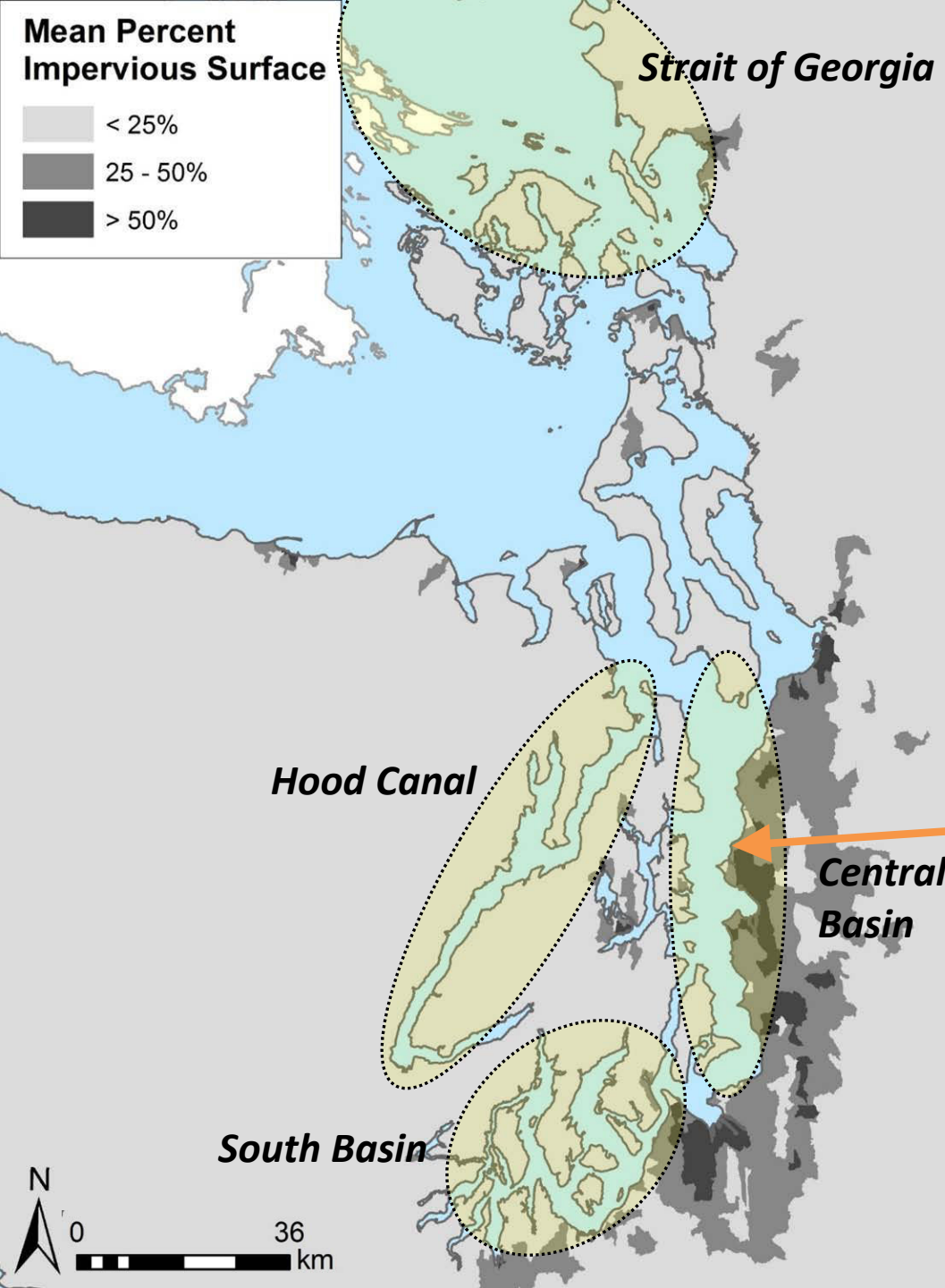


Puget Sound is a regional hot spot for PCBs in the pelagic food web

(2006 Pacific herring, whole body)



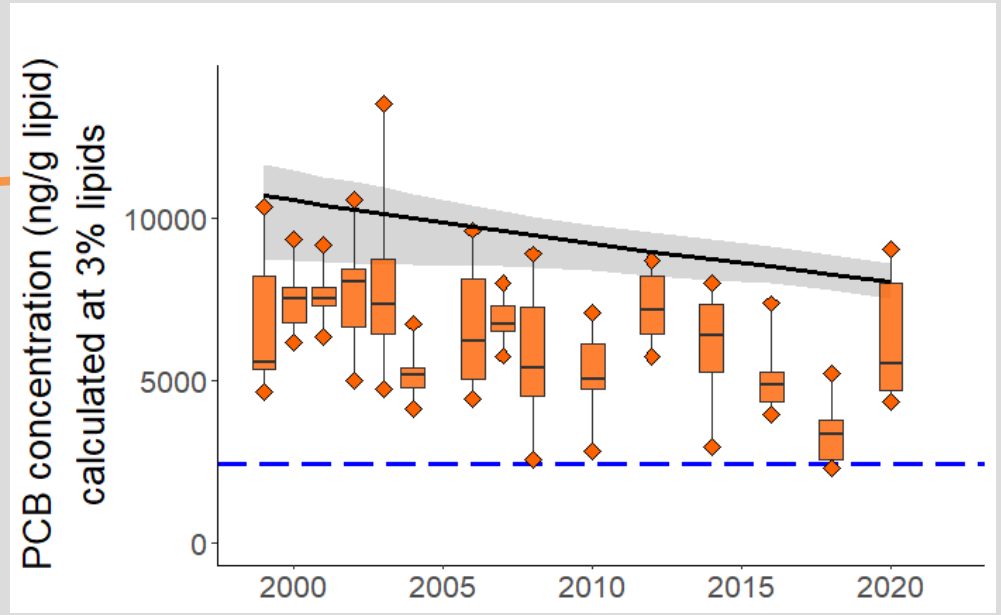
TPCB, ng/g wet wt



PCB trends in Pacific herring whole bodies (1999-2020)

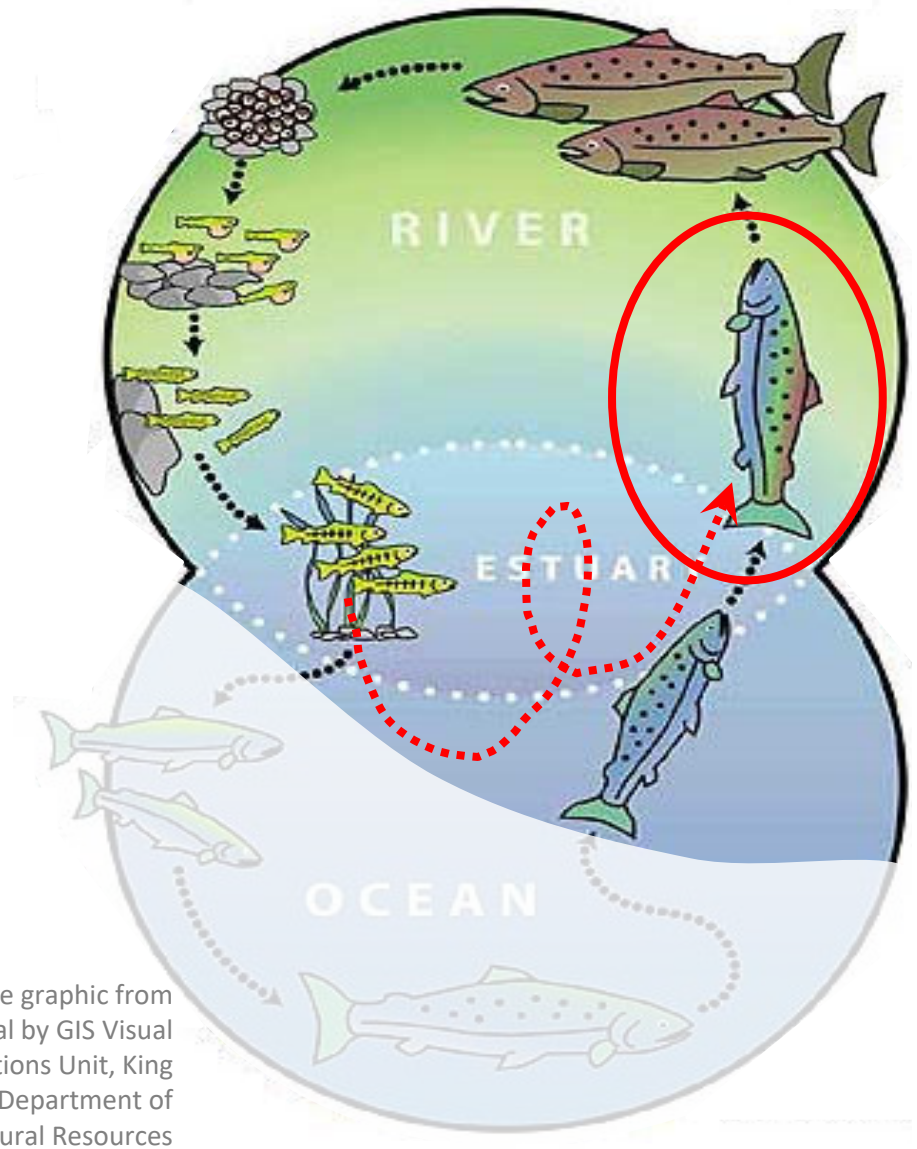
Conducted quantile regressions to determine trends in the 95th percentile of PCB concentrations.

- PCB levels in herring from Central Basin are beginning to decline, but at a rate of < 1% per year.



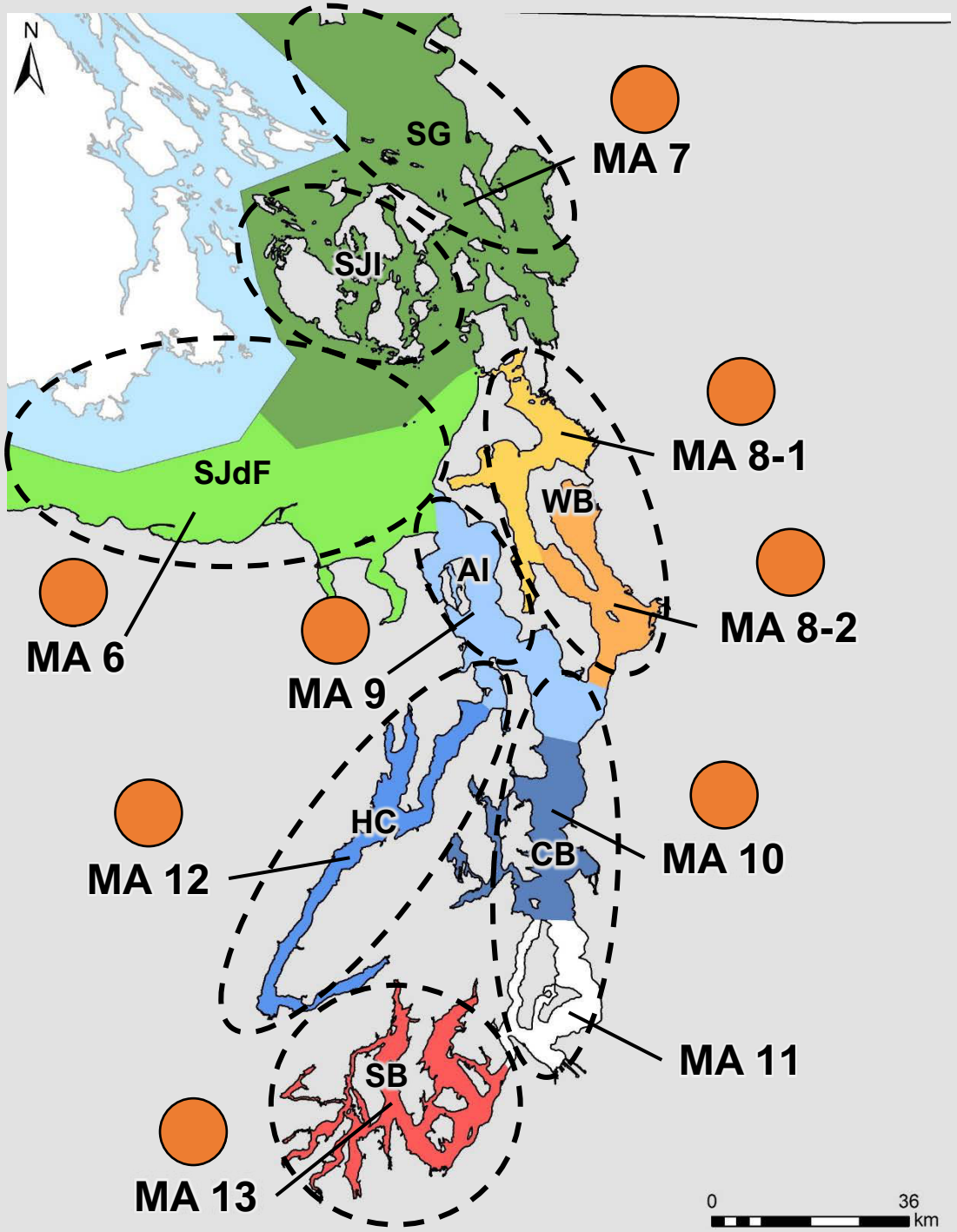
Salmon may be exposed to contaminants in various habitats throughout their life cycle…

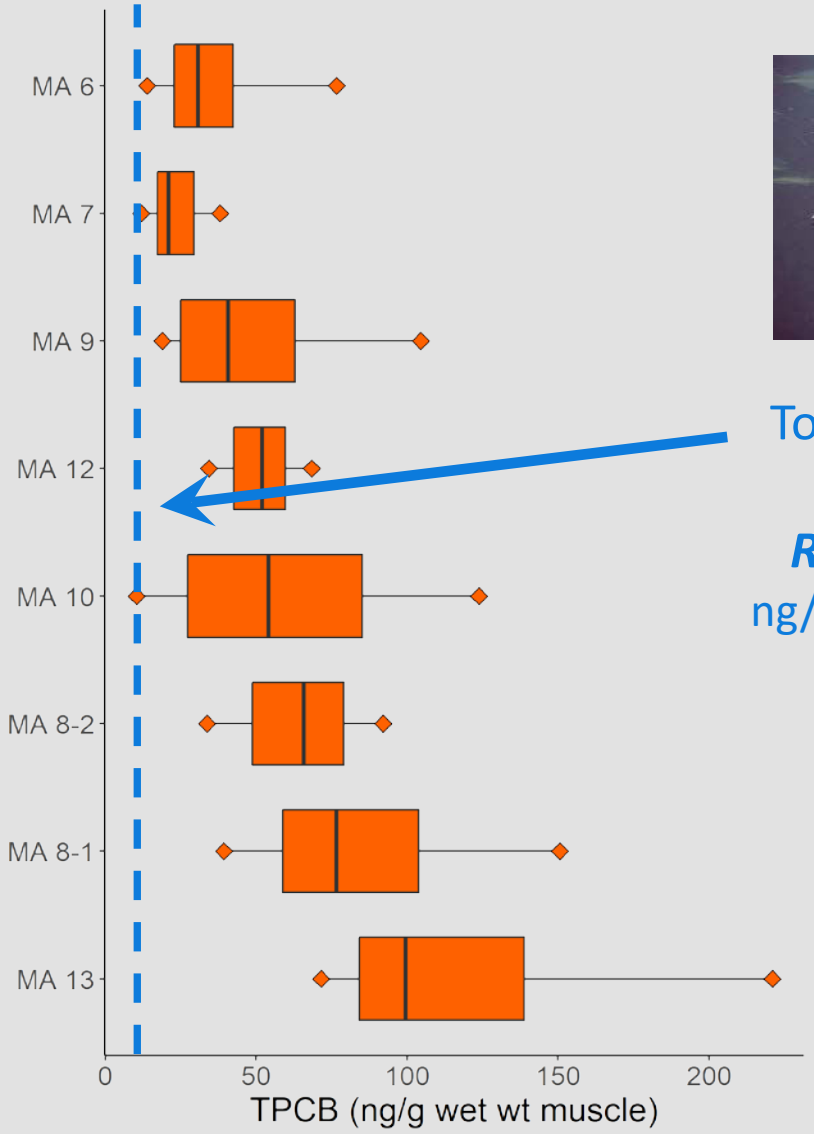
Up to one third of Puget Sound Chinook are "resident"



Life cycle graphic from original by GIS Visual Communications Unit, King County Department of Natural Resources

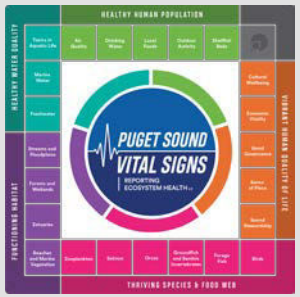
PCBs in Puget Sound-resident Chinook salmon fillet



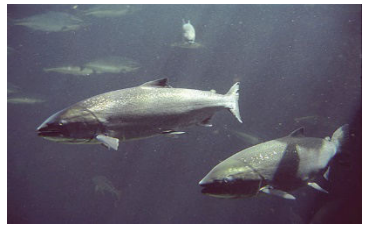


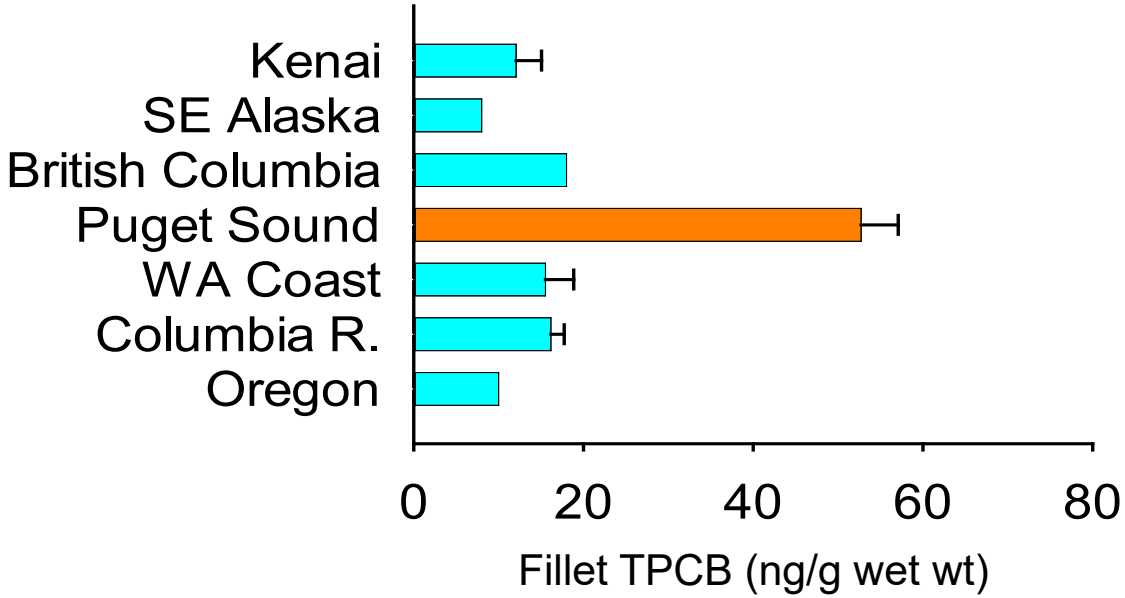
Toxics in Aquatic Life Vital Sign

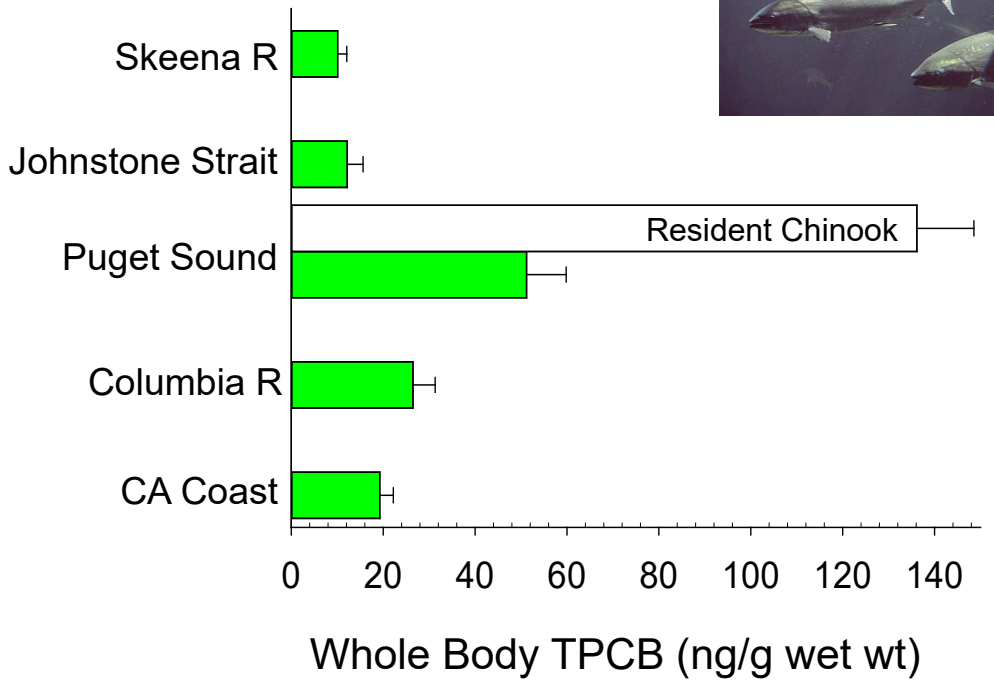
Recovery Target (8 ng/g ww; DOH screening value)



PCBs in Adult Chinook Salmon







- Puget Sound Chinook are 3 to 5 times more contaminated than other west coast populations
- Adult salmon mostly accumulate PCBs in saltwater, including Puget Sound
- One-third of Puget Sound Chinook are resident, where they are exposed to high PCB levels via contaminated prey

O'Neill and West 2009. Marine distribution, life history traits, and the accumulation of polychlorinated biphenyls in Chinook Salmon from Puget Sound, Washington. Trans. Am. Fish. Soc. 138:616–632

Puget Sound is a PCB hotspot for marine mammals.


Photo by Graeme Ellis

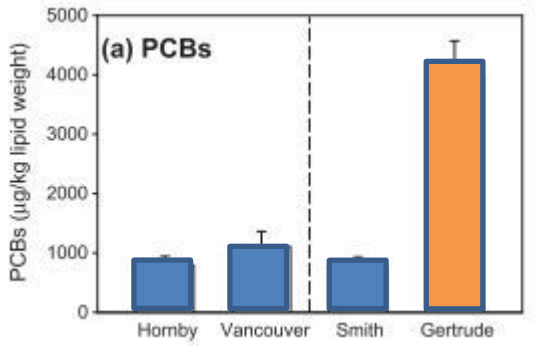
63,100 µg/kg lipids

44,193 µg/kg lipids

Average PCBs ~ 1.5 X greater in southern resident killer whales (SRKWs) that spend more time feeding in Puget Sound (J pod) than those feed more along OR/CA coast (K/L pod)

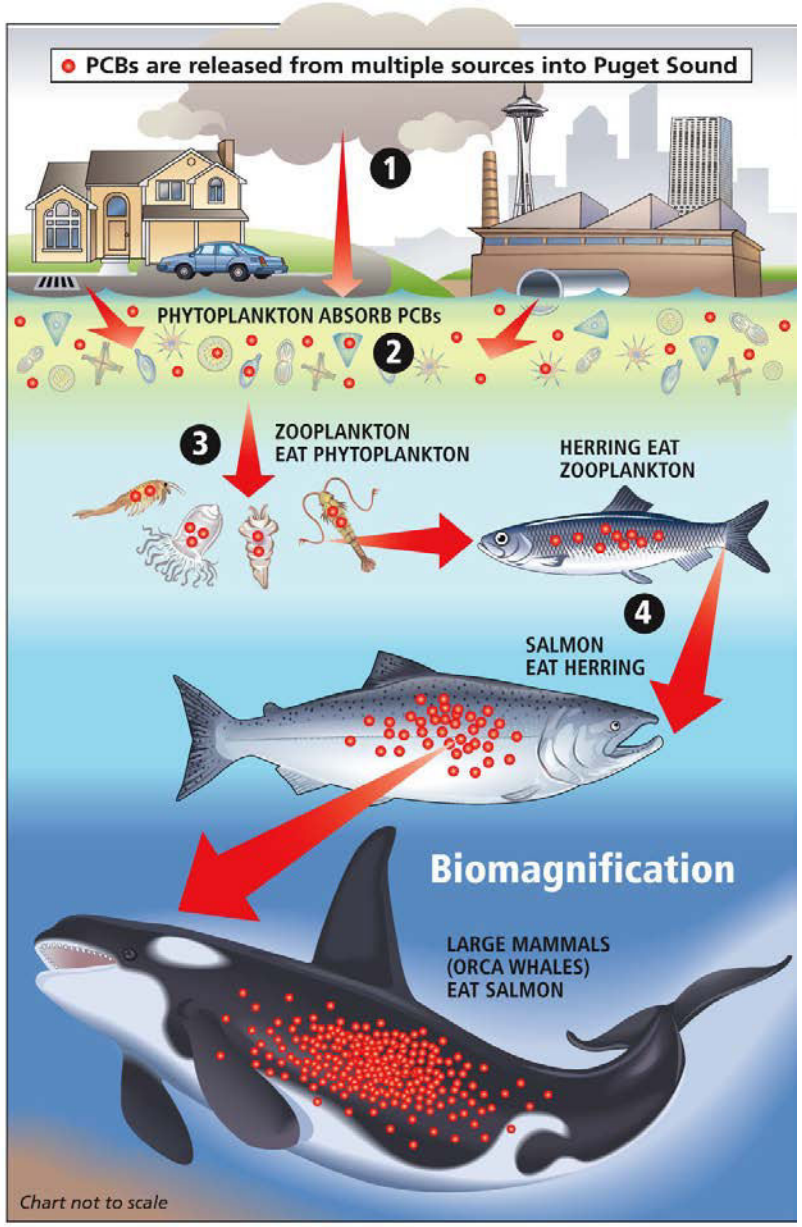
Adapted from Krahn et al 2007 and Krahn et al. 2009


Photo by Peter Ross



PCBs 5 X greater in seals from Puget Sound than Strait of Georgia

Modified from Ross et al. 2013

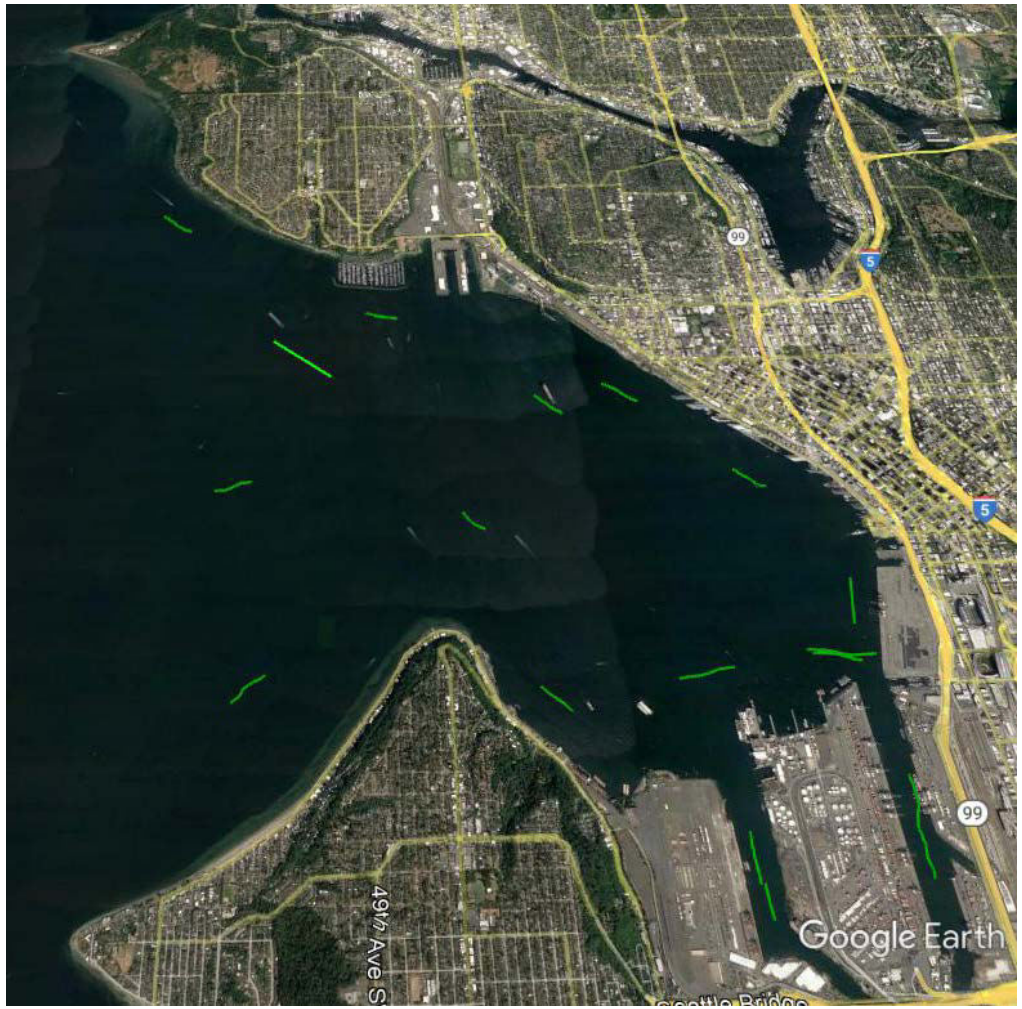


Source: Seattle Post-Intelligencer "The Zone" thezone@seattlepi.com

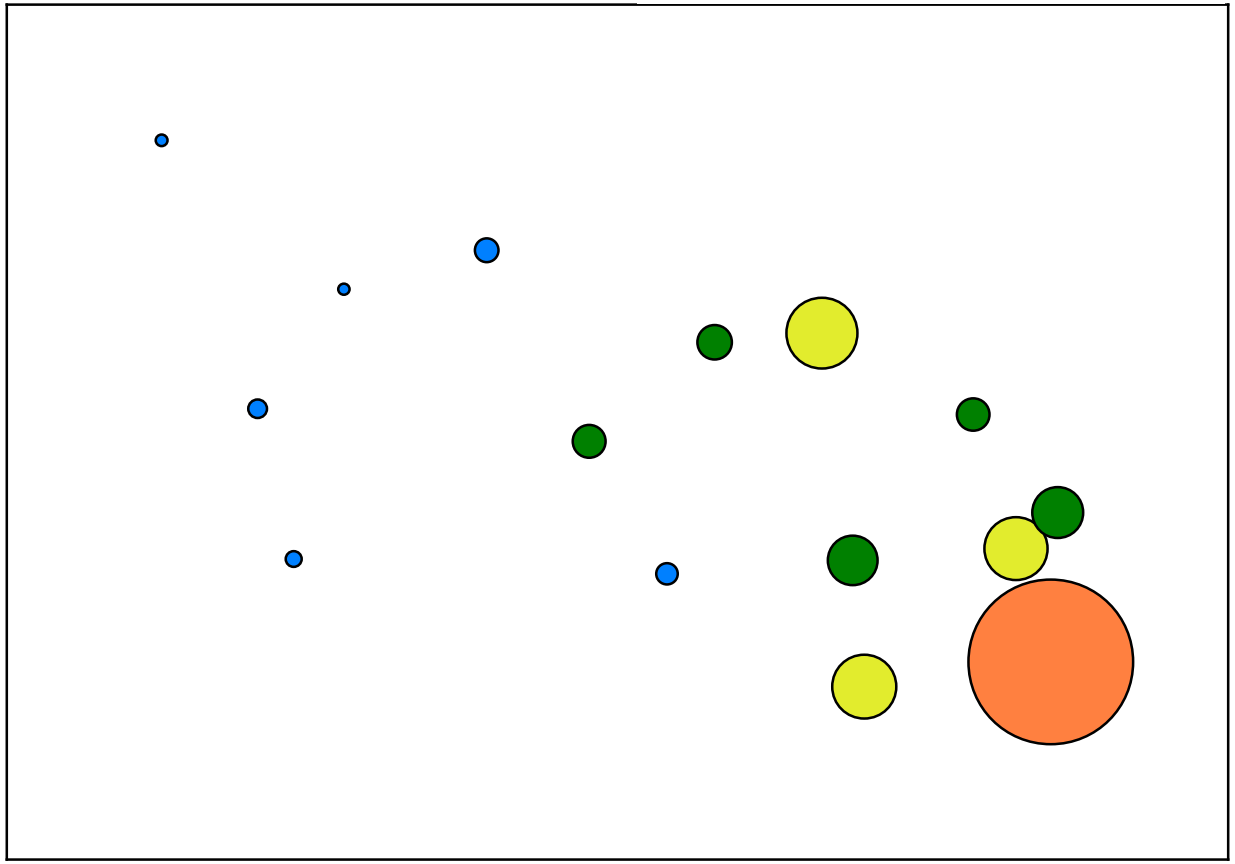
Why is Puget Sound's ***pelagic food web*** so contaminated with PCBs?

- Hydrology of Puget Sound retains pollutants entering the water column
  - restricted circulation
  - great depth
  - density stratification
- Pelagic biota (e.g. phytoplankton) may absorb PCBs directly from water column and biomagnify up the food chain
- Puget Sound's complex and deep system allows anadromous and fully marine species to complete their life cycle in close proximity to urban watersheds and PCB sources.

What's next?? PCB concentrations in surface POM



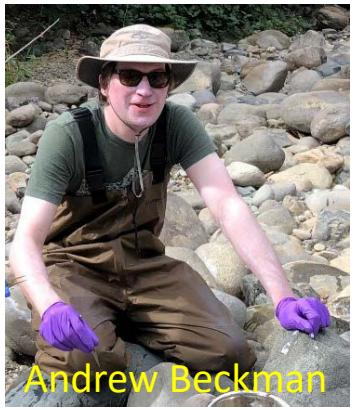
[PCB] range 0.5-45 ng/g ww



Some conclusions from 30 years of TBiOS Monitoring PCBs

- PCBs remain ***one of most concerning toxic contaminants*** we know of in Puget Sound; not declining rapidly enough to meet recovery targets
- PCBs in herring, English sole, ESA-listed Chinook salmon, and other species are ***high enough to impair their health***
- PCBs in resident Chinook salmon, English sole, and others are ***high enough to result in DOH consumption advisories***
- PCBs in southern resident killer whales (SRKW) are high enough to ***impair their health and population recovery***
- Benthic fish reflect local, ***bay-scale sediment PCB levels***; greatest PCB contamination limited to urban areas
- Pelagic organisms reflect ***basin-scale PCB contamination***; PCB contamination pervasive in central and south basin pelagic food web

TBiOS Team



Collaborators

NOAA National Oceanic and Atmospheric Administration U.S. Department of Commerce

Long Live the Kings

Puget Sound Partnership

PSEMP

Puget Sound Ecosystem Monitoring Program

The SeaDoc Society People and science healing the sea

United States Environmental Protection Agency

Washington State Department of Health

University of Washington 1861

Department of Ecology State of Washington

nəxʷqíyt nəxʷsƛ̓ áy̓əm̓ Port Gamble S'Klallam Tribe

Pacific Northwest National Laboratory

Tulalip Tribes

Stillaguamish Tribe of Indians

Puyallup Tribe of Indians

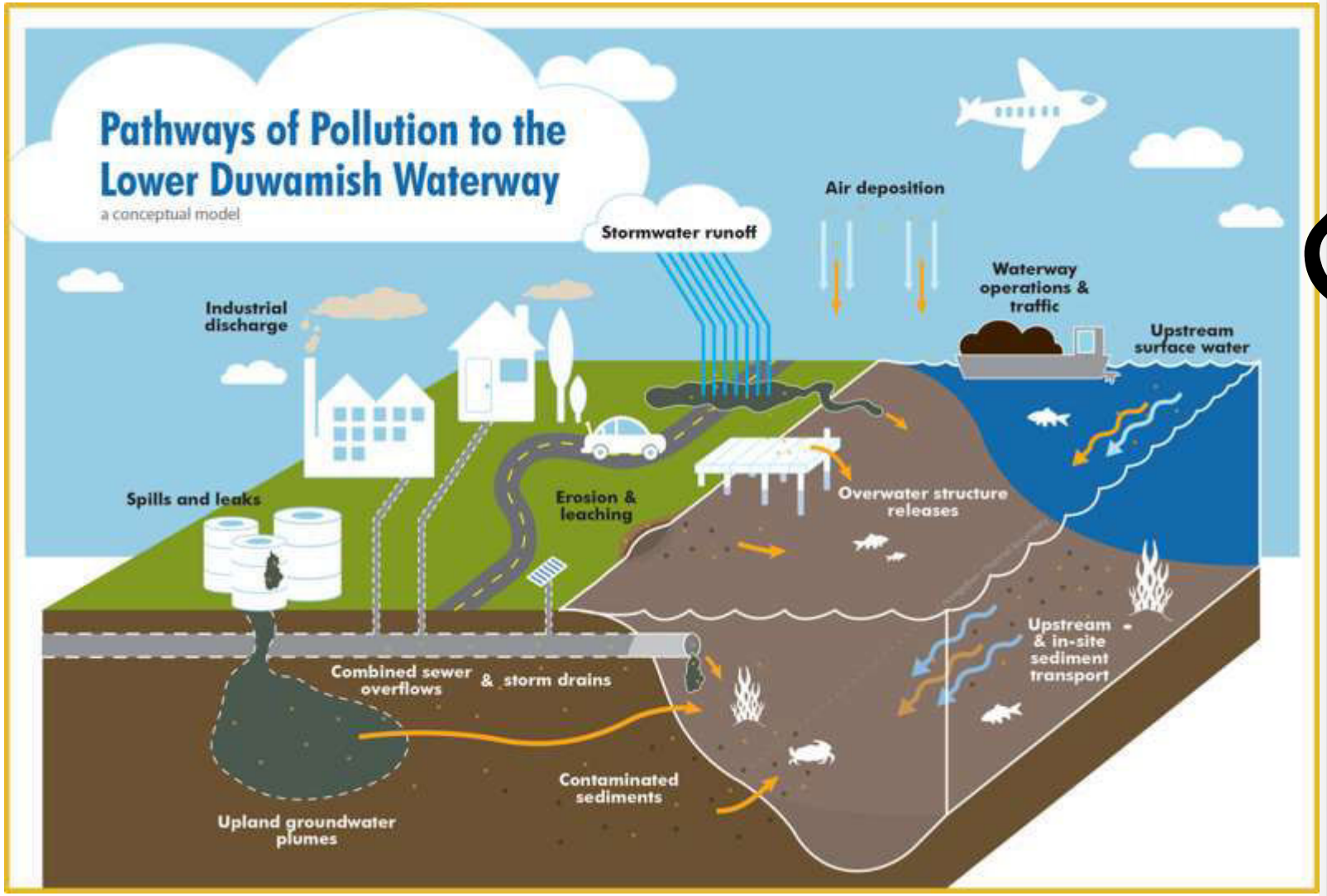
Western Washington University

PCBs are everywhere! What can be done?

PCB Symposium 1/24/2023

Rachel McCrea, Section Manager
Northwest Region Water Quality Program
Department of Ecology

Focus on the Sources and the Pathways



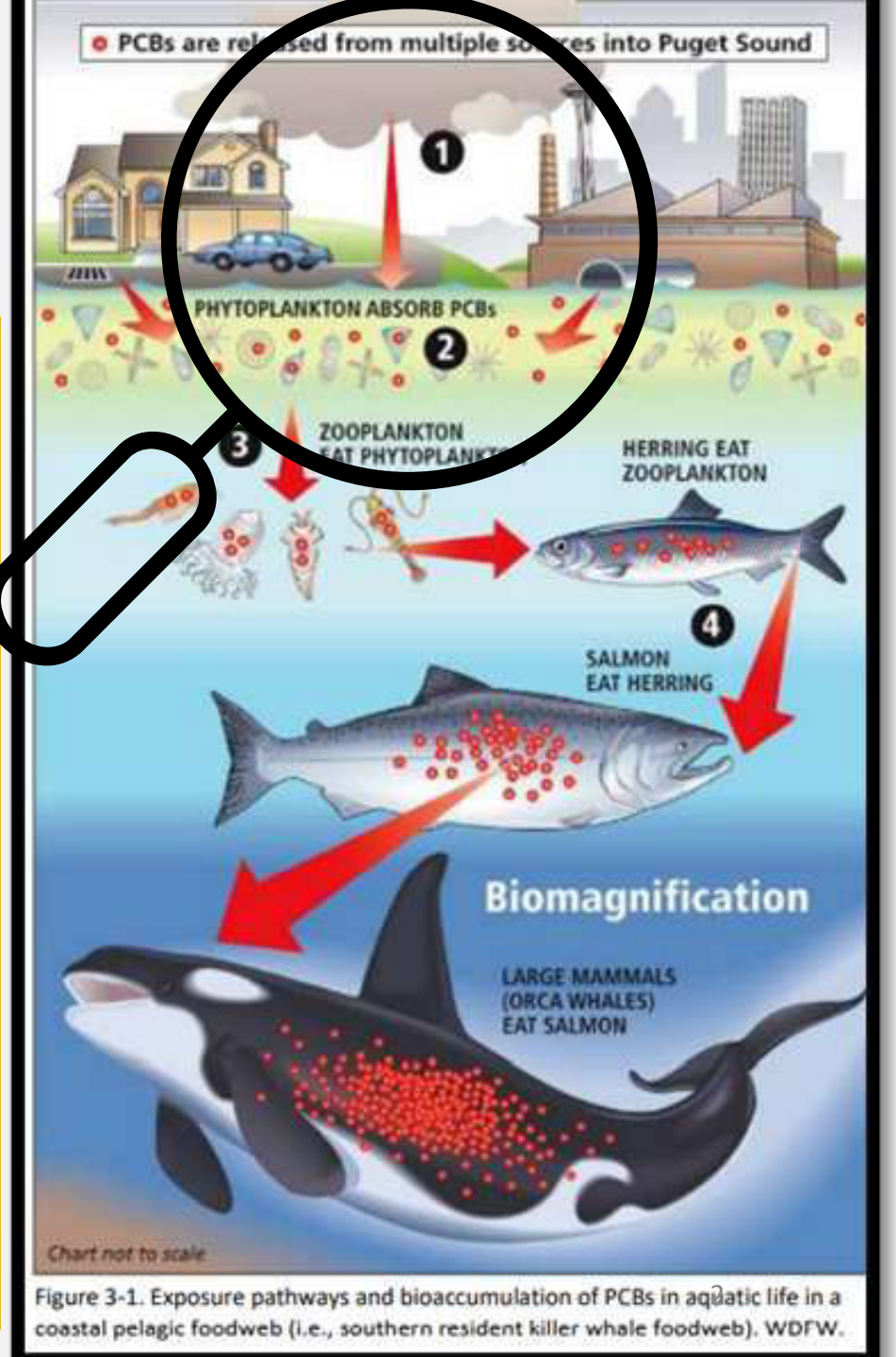
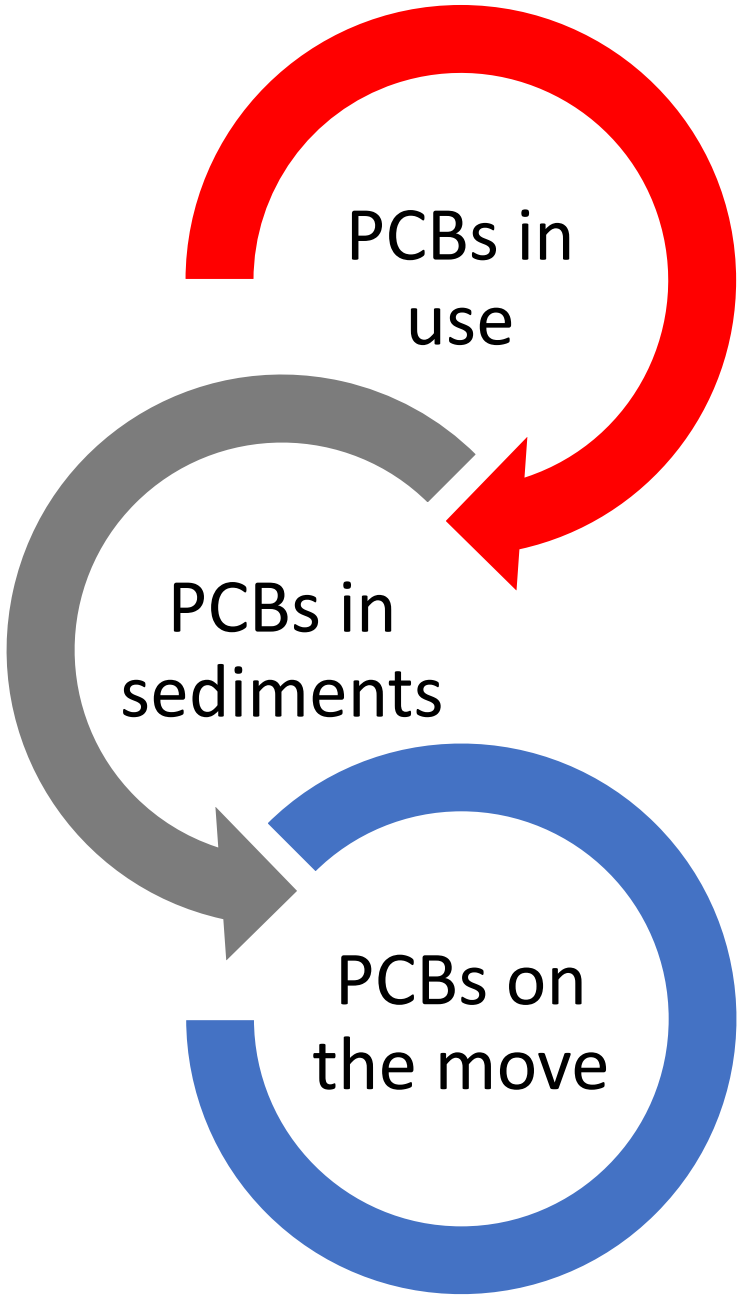


Figure 3-1. Exposure pathways and bioaccumulation of PCBs in aquatic life in a coastal pelagic foodweb (i.e., southern resident killer whale foodweb). WDFW.



Address Original Source PCBs

- Find them and abate/encapsulate/remove
- Manage the waste & recycling processes

Remediate PCBs in Sediments and Particulates

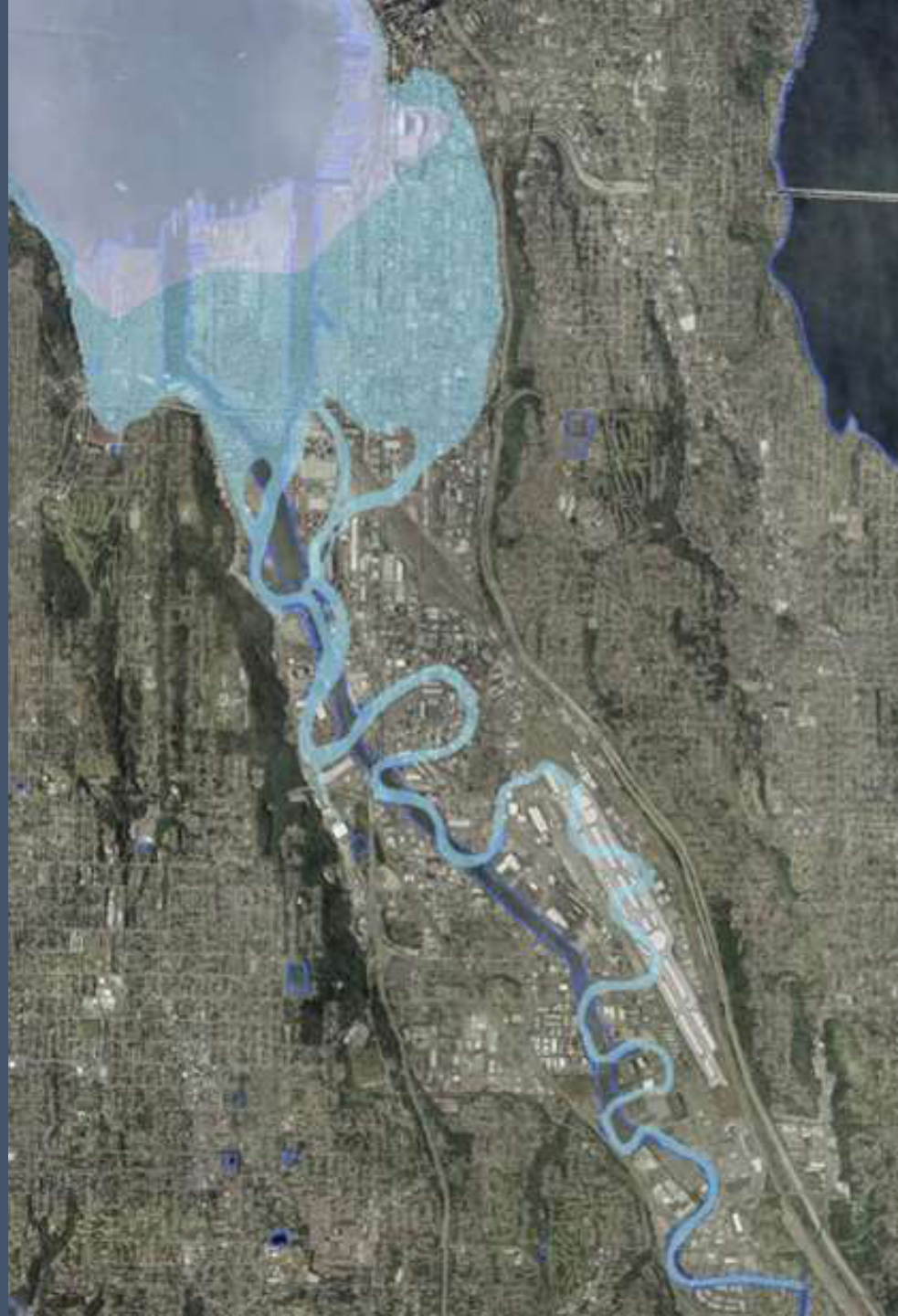
- Implement contaminated site cleanups
- Treat stormwater in high priority areas

Intercept PCBs Cycling in the System

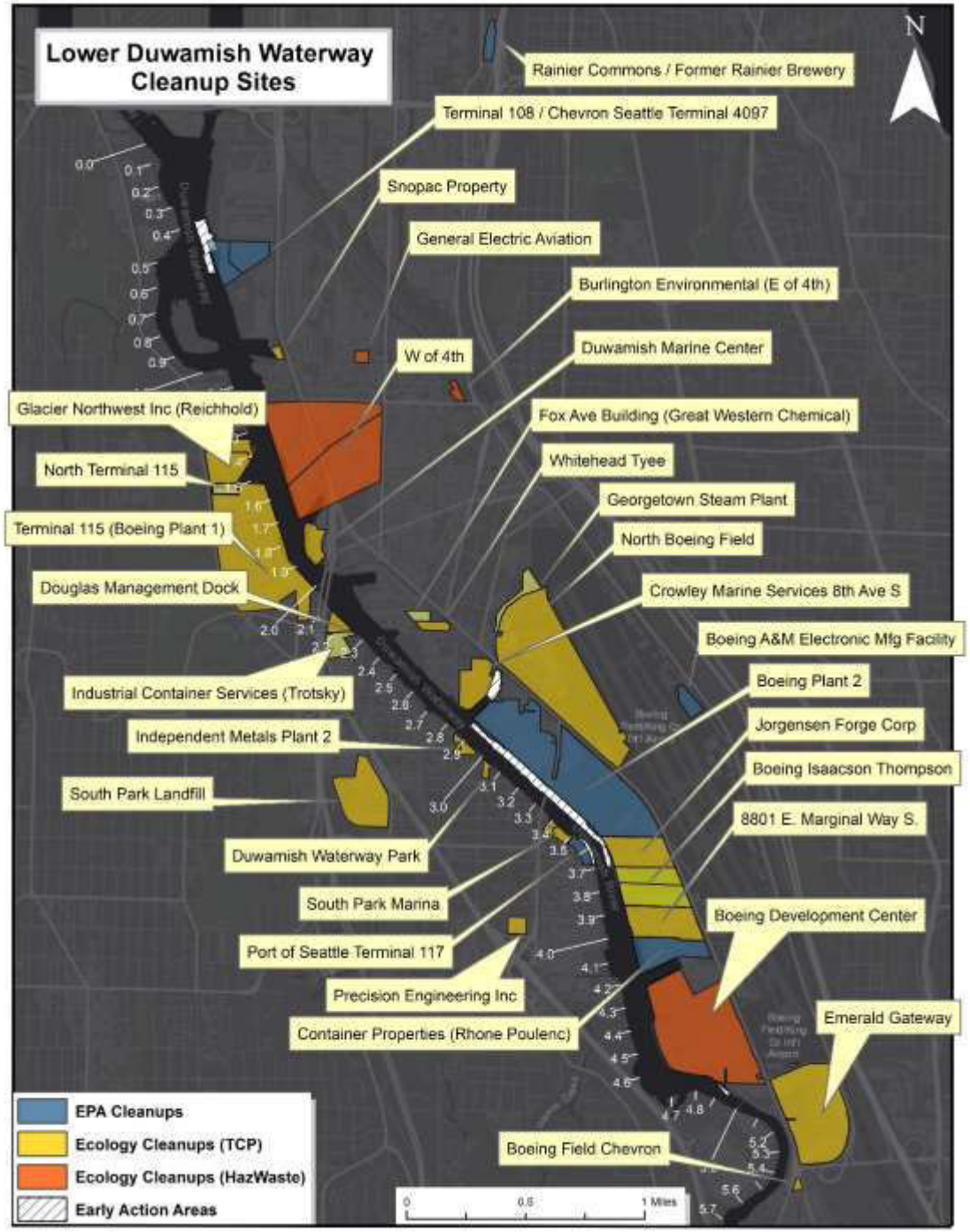
- Contaminated sediments move around
- High concentrations in building sources and in sediments net export PCBs to air
- PCBs in air deposition contribute to stormwater pollution
- PCBs in goose poo & otter scat contribute to nonpoint pollution
- PCBs are present in surface water and groundwater at lower concentrations
- Wastewater & stormwater treatment extract solids containing PCBs

What the Lower Duwamish Waterway has Taught us about Controlling PCBs

Two decades of learning and counting…



Cleanup Projects Control Secondary Sources



Sediment Cleanup Takes Time and Is Worth It

Vessel congestion during simultaneous Early Action dredging & capping events

Lower Duwamish Waterway-wide Estimated Cleanup Stats

Cleanup	ROD Remedy
Dredge or partial dredge and cap	105 acres
Cap	24 acres
Enhanced natural recovery	48 acres
Monitored natural recovery	235 acres
Dredge volume	790,000 cy
Construction time frame	7-9 years
Time to reduce contamination	17 years
Cost Estimate	$342 million

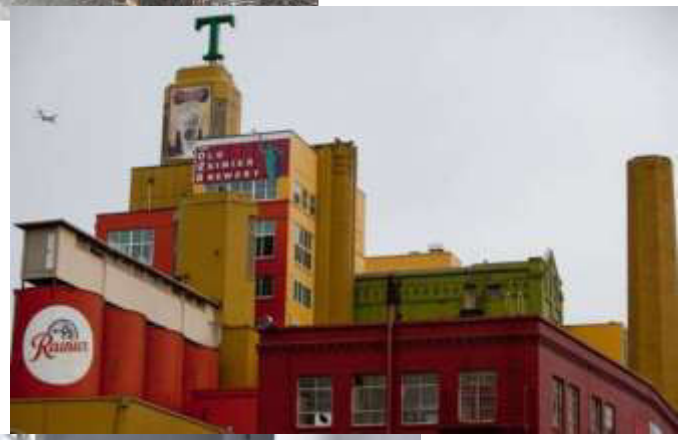
Source Tracing Tools Lead to Finding PCB Sources

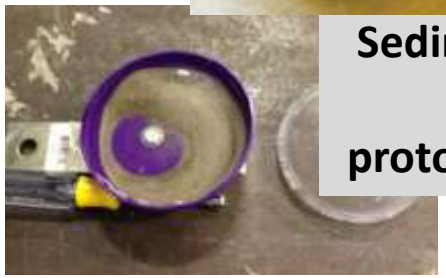
COMMON TOOLS

- Review historical records
- Sample PCBs in storm system solids, street dirt
- Inline sampling for tracking down
- Inspect businesses (± sampling)
- Clean pipes for a fresh start, resample
- Test materials and products

NEW TOOLS

- Smaller ‘sediment trap’ for smaller pipes
- PCB Detection Dog

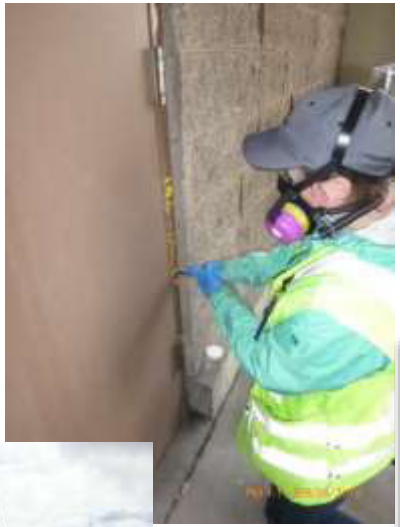




Sediment trap prototype

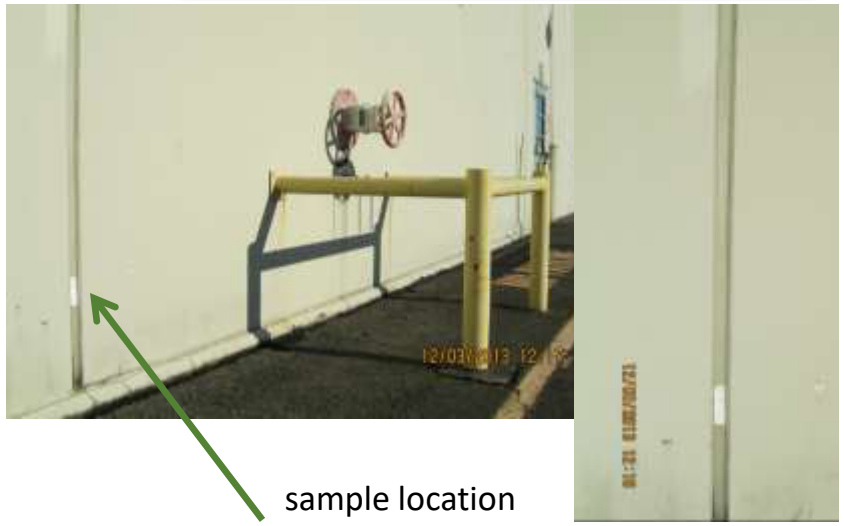
Found PCB Sources

- Building paint
- Building caulk
- Pavement caulk (& surrounding concrete)
- Metal recycling
- Brick recycling
- Bollard paint
- Transformer dismantling



As of ~2017, The Boeing Company had removed over 23 miles of PCB-contaminated concrete joint compound at their Duwamish properties

Rainier Commons: PCB-laden paint



sample location

Above photos courtesy of The Boeing Company

Stormwater Best Practices for PCBs

Industrial Stormwater Treatment

- Numerous treatment systems installed over last 10 years
- Treatment technologies remove solids from the discharge
- Different polishing steps (filter media) used
- Effectiveness measured to approx. 0.1 ug/L

PCB Management Practices

- PCB source tracing in the municipal system
- Industrial stormwater PCB monitoring
- Referral to EPA TSCA (slow remediation actions)
- Site-specific PCB Pollutant Minimization Plans
- Targeted BMPs during construction activities

Scaling up to Puget Sound

Much is underway & much more to do

Puget Sound Sediment Cleanup Projects

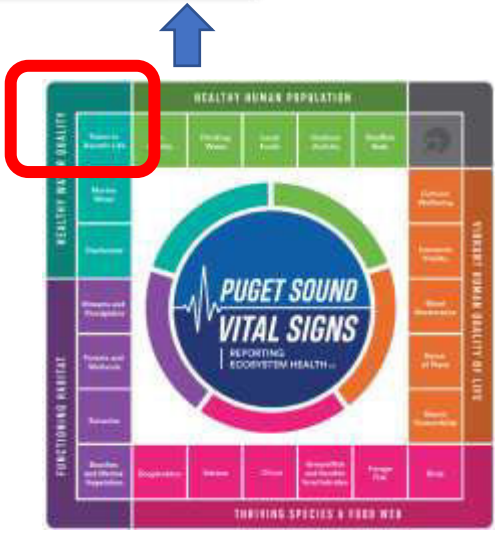
WA STATE ECOLOGY-OVERSEEN SITES

- Priority bays and urban waters (see fig.)
- More info at [Puget Sound cleanup - Washington State Department of Ecology]

USEPA-OVERSEEN ‘TIER 1’ SITES

- Commencement Bay
- Harbor Island vicinity
- Manchester Lab
- Puget Sound Naval Shipyard
- Wyckoff/Eagle Harbor

PUGETSOUND PARTNERSHIP



The National Estuary Program Opportunity:

Existing and New PCB Reduction Projects Support Puget Sound Recovery Goals

PUGET SOUND
National Estuary Program

funds projects to tackle these strategies

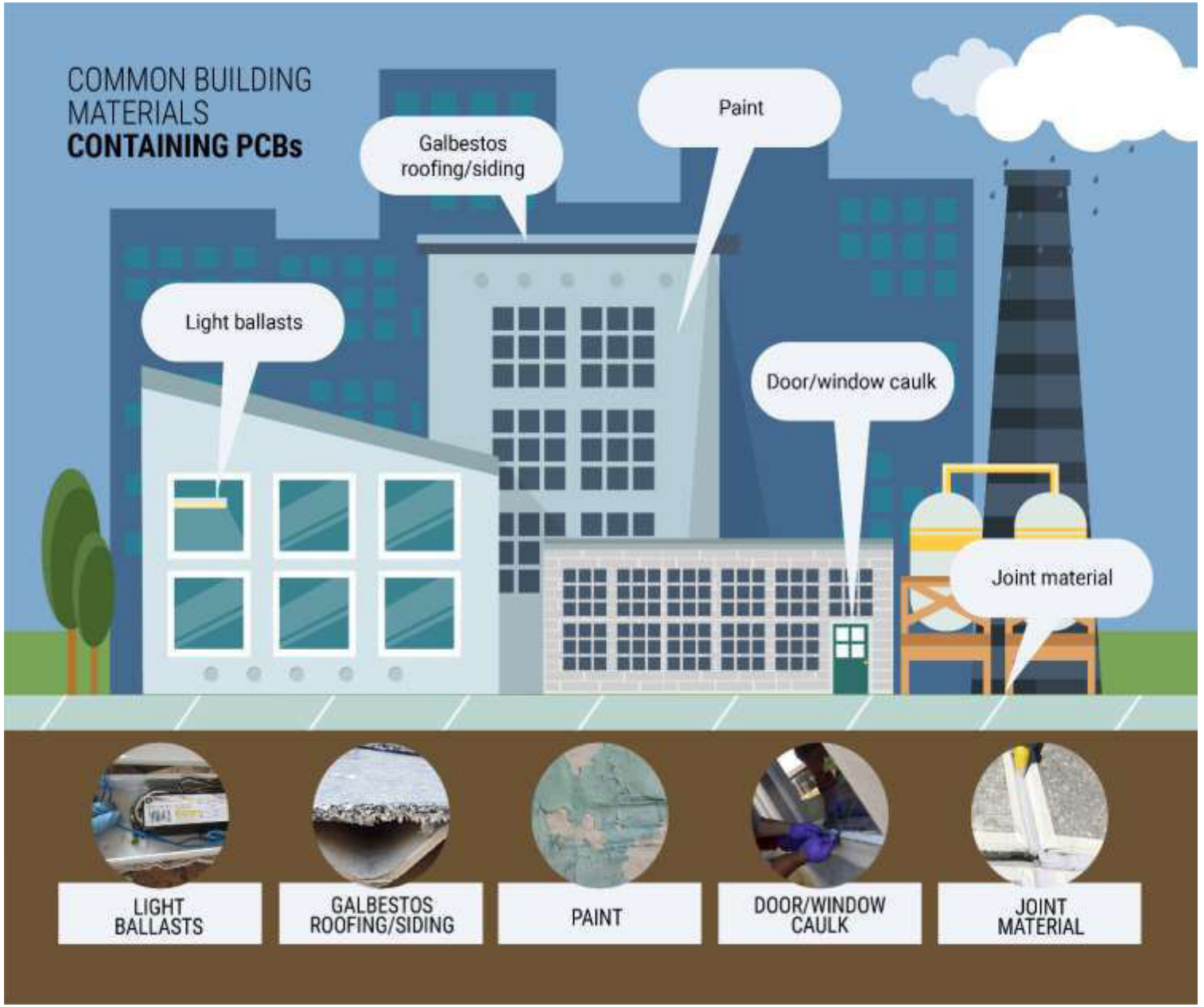
- Regulatory Implementation tools
- Voluntary actions
- Strategic program development

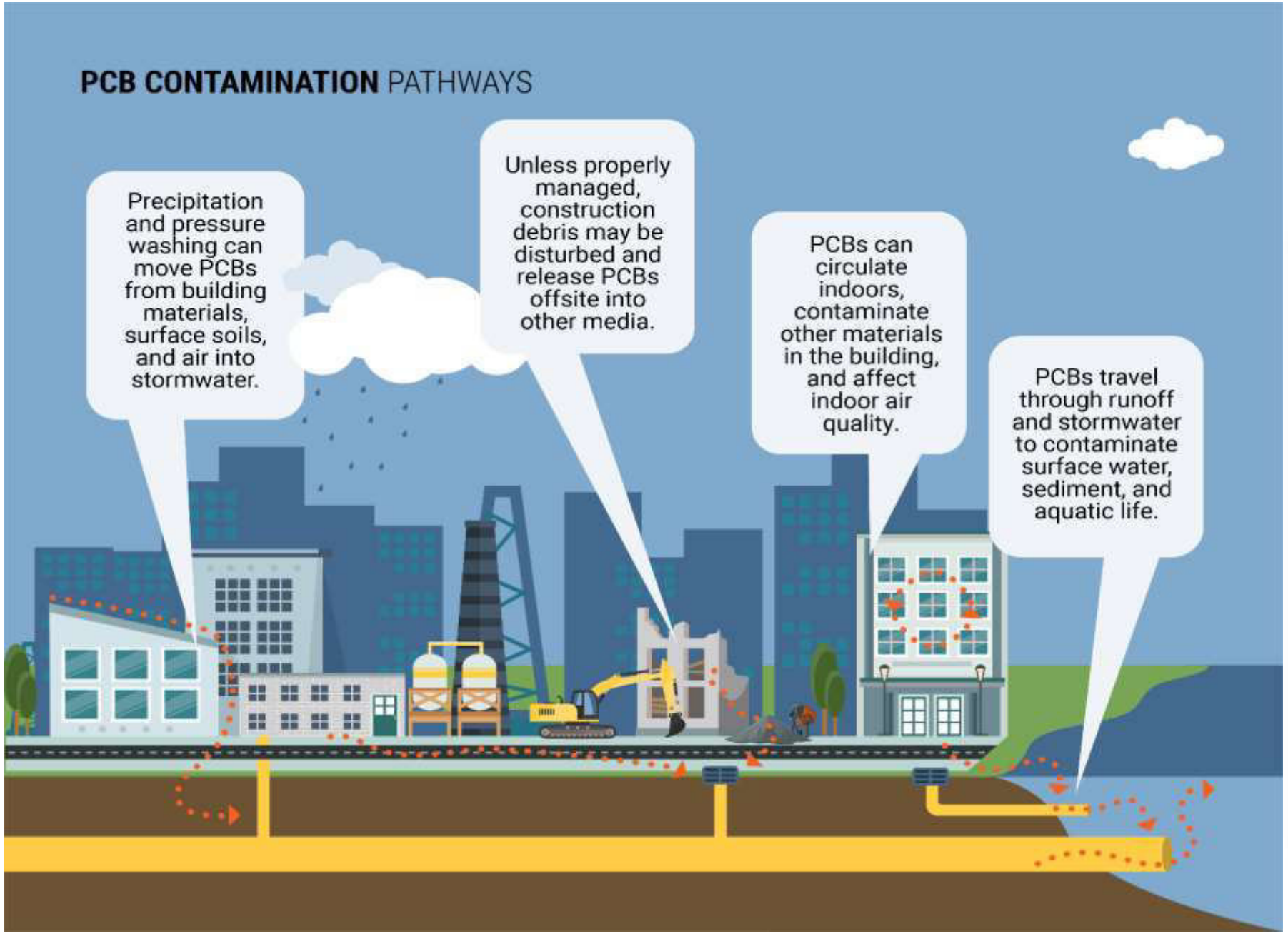
PCBs in Building Materials

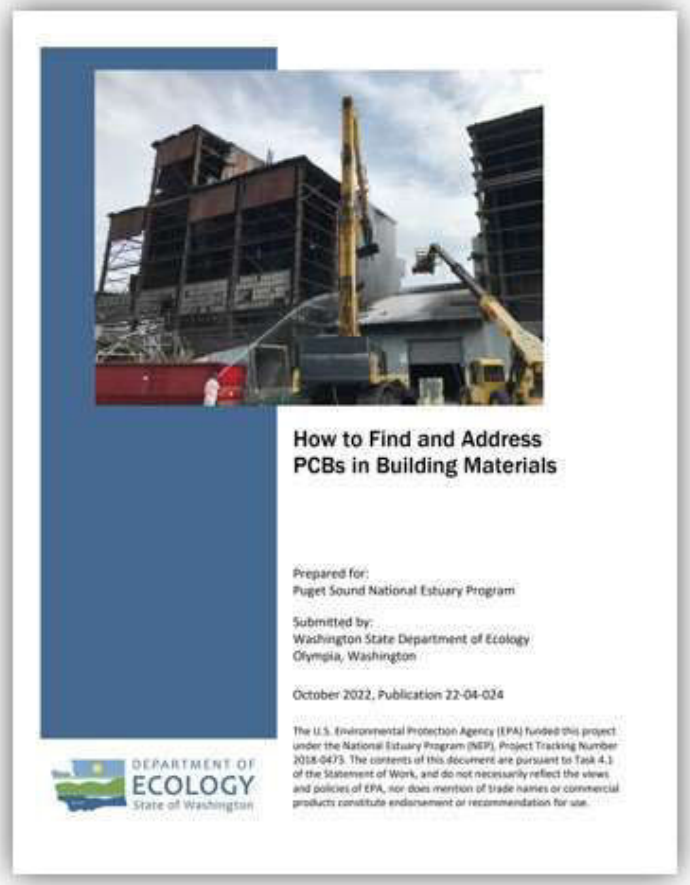
- **Open sources**
  - Building materials and ground surfaces (joints)
- **Closed sources**
  - Insulating oil for transformers, ballasts, capacitors

Common sources of PCBs in building materials in WA

- Caulk and Paint (up to 100,000 ppm)
- Caulk has been found to contain PCBs at 40% by volume




PCB CONTAMINATION PATHWAYS
Precipitation and pressure washing can move PCBs from building materials, surface soils, and air into stormwater.
Unless properly managed, construction debris may be disturbed and release PCBs offsite into other media.
PCBs can circulate indoors, contaminate other materials in the building, and affect indoor air quality.
PCBs travel through runoff and stormwater to contaminate surface water, sediment, and aquatic life.


How to Find and Address PCBs in Building Materials
Prepared for:
Puget Sound National Estuary Program
Submitted by:
Washington State Department of Ecology
Olympia, Washington
October 2022, Publication 22-04-024
DEPARTMENT OF ECOLOGY
State of Washington

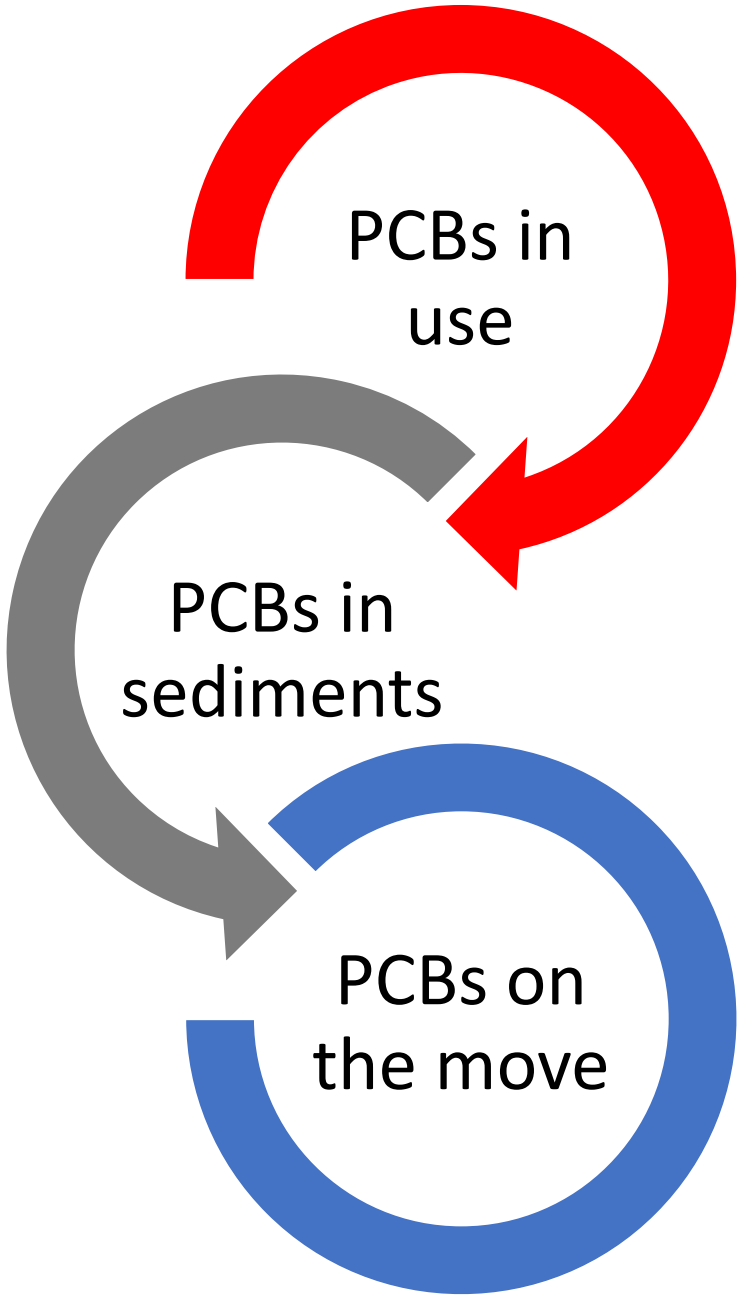
PCB-Specific Source Control Efforts in Washington

Looking Back…

- 2015 PCB Chemical Action Plan (CAP)
  - Acknowledged PCBs in building materials
- 2016 Review of PCB Source Tracing Programs
- PCB Detection Dog
  - Odor of Aroclors 1254 & 1260 at 1 mg/kg & 0.1 mg/kg
- PCB Congener Study for Green/ Duwamish watershed
- Ecology Permit Writer's Manual
  - Guides use of different analytical methods
- Stormwater Action Monitoring study on PCBs in bioretention

Looking Forward…

- Statewide ambient PCB monitoring network under development
- Guidance for PCB control actions
- PCB-specific municipal stormwater permit requirements out for preliminary review
- Pollutant minimization BMPs in NPDES permits
- Potential new analytical method
- Ongoing Green/Duwamish Watershed toxics modeling project



Address Original Source PCBs

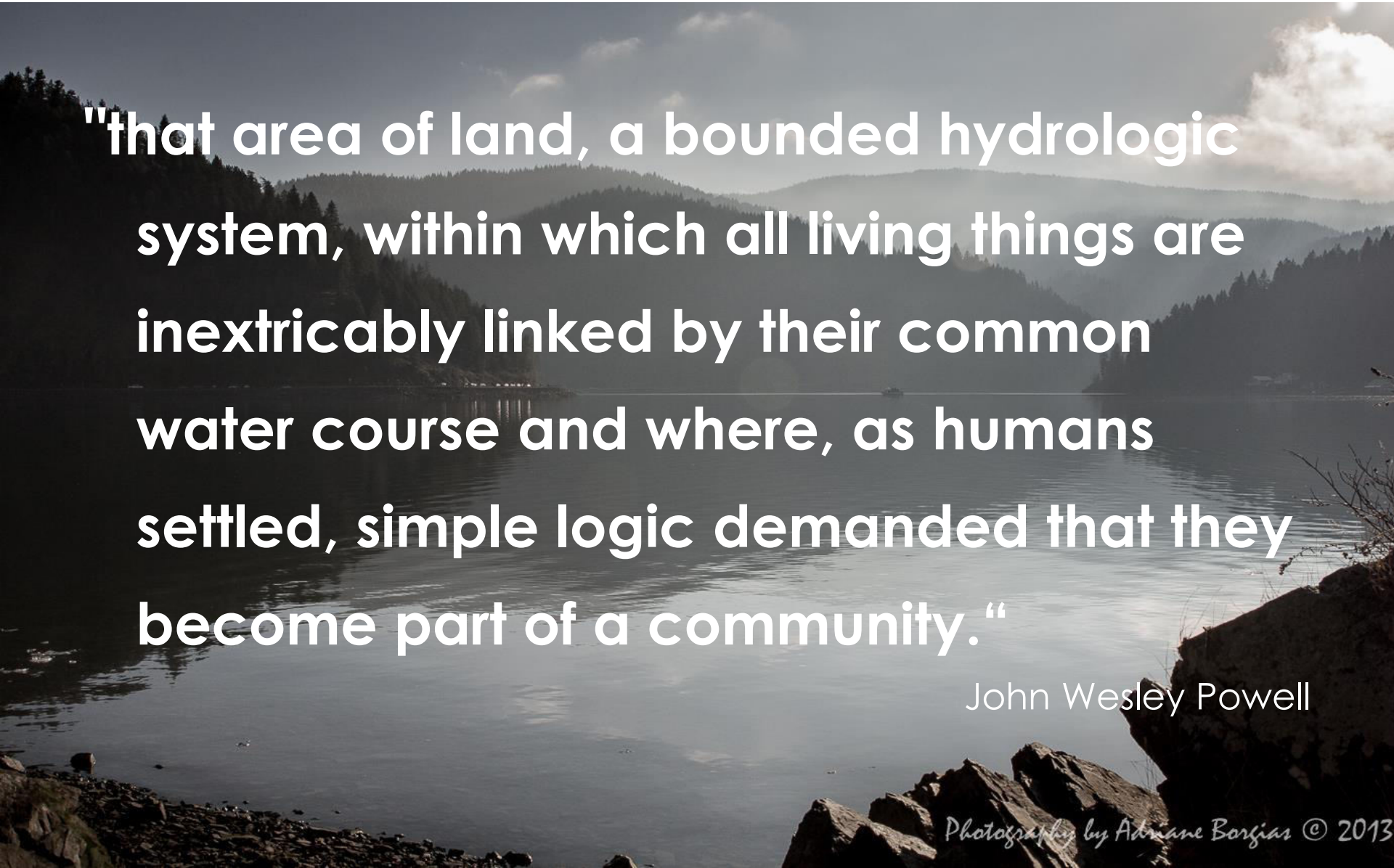
Remediate PCBs in Sediments and Particulates

Intercept PCBs Cycling in the System

Thank you!

Rachel McCrea
Rachel.mccrea@ecy.wa.gov

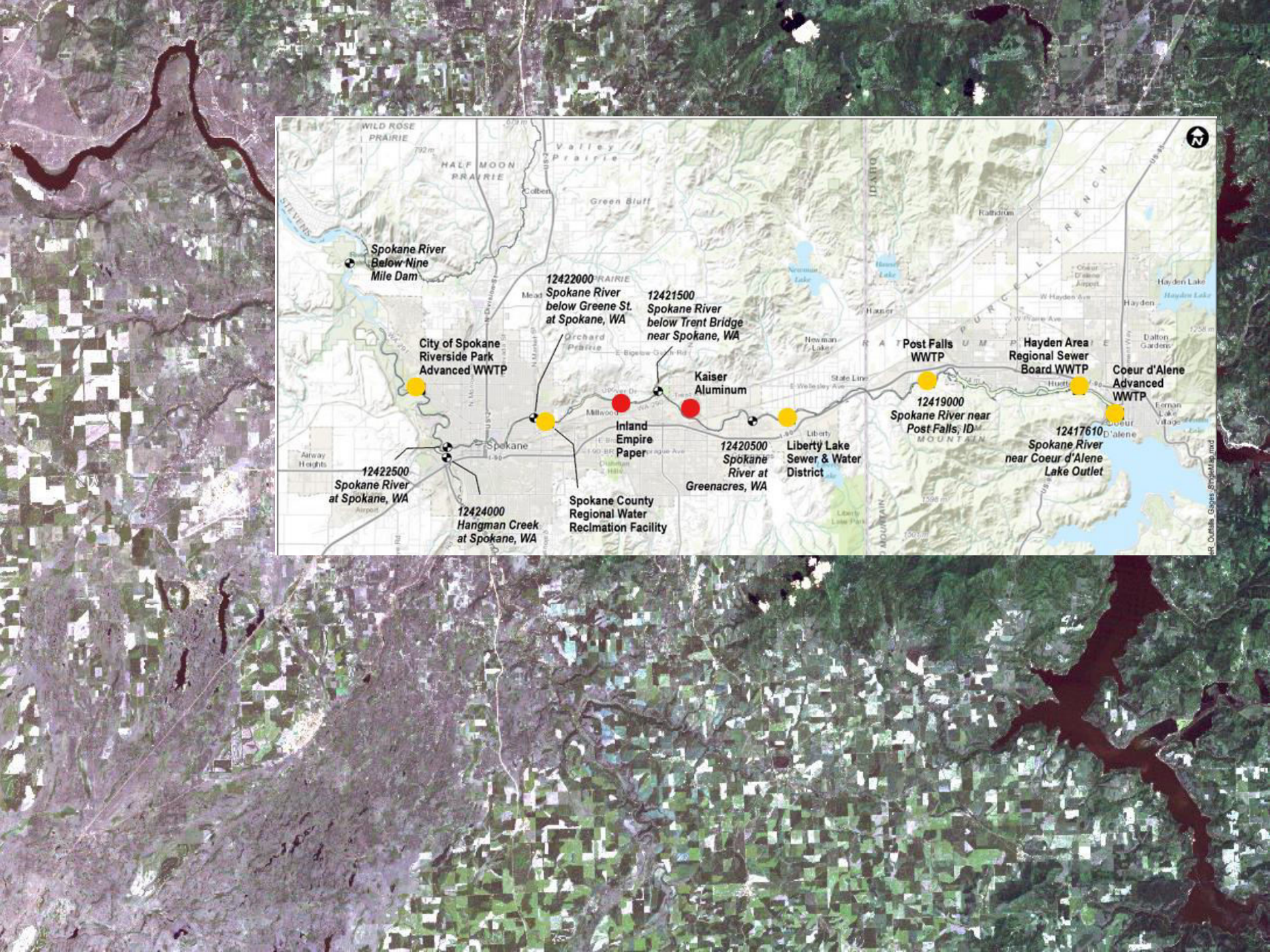
Solutions at the Watershed Level



Spokane River

Collaborative Problem Solving
at the Community Level

- A Historical Perspective -


Spokane River Below Nine Mile Dam
12422000 Spokane River below Greene St. at Spokane, WA
12421500 Spokane River below Trent Bridge near Spokane, WA
City of Spokane Riverside Park Advanced WWTP
Kaiser Aluminum
Post Falls WWTP
Hayden Area Regional Sewer Board WWTP
Coeur d'Alene Advanced WWTP
Inland Empire Paper
12419000 Spokane River near Post Falls, ID
12420500 Spokane River at Greenacres, WA
Liberty Lake Sewer & Water District
12417610 Spokane River near Coeur d'Alene Lake Outlet
12422500 Spokane River at Spokane, WA
12424000 Hangman Creek at Spokane, WA
Spokane County Regional Water Reclmation Facility


FLOW

The Problem (in 2012)

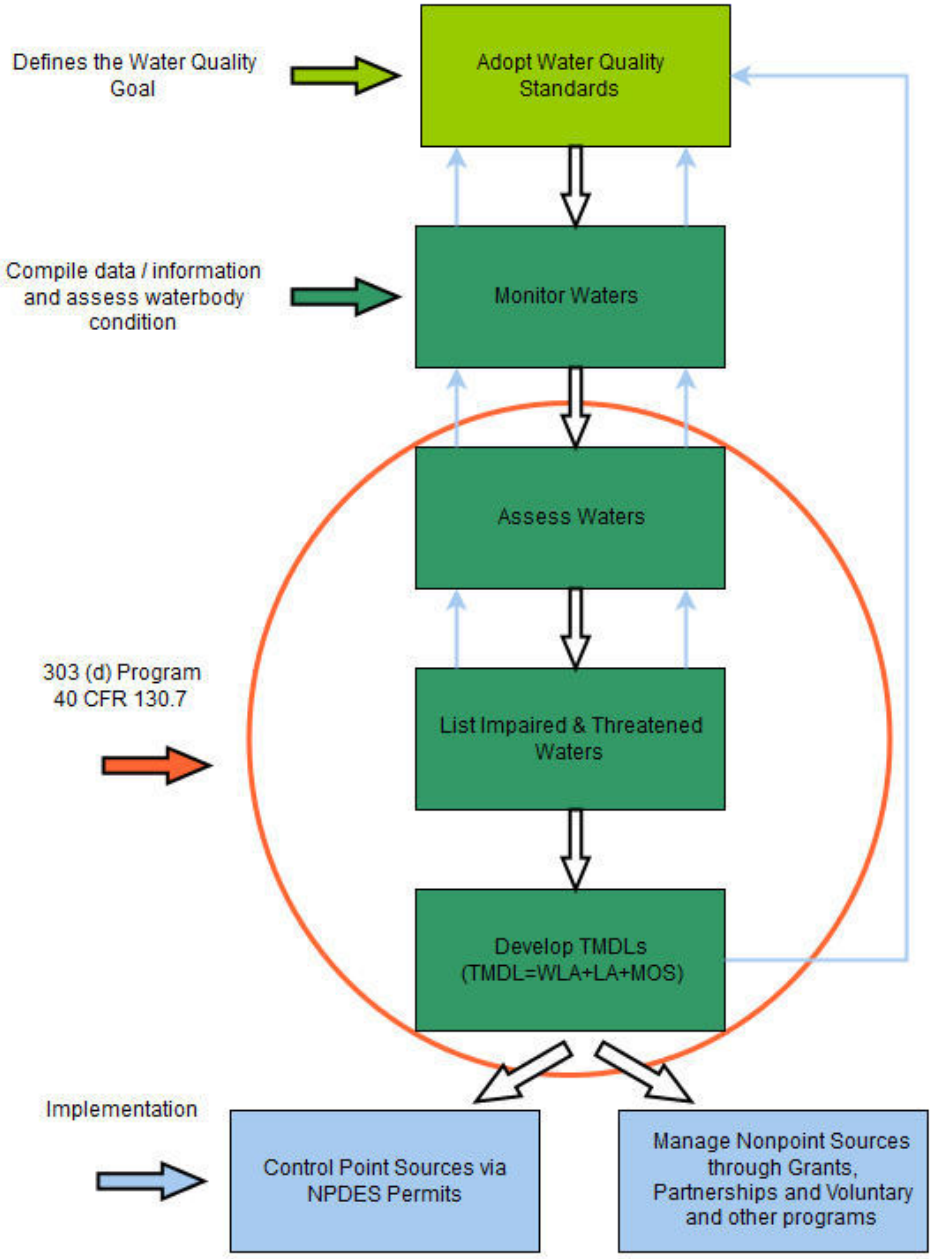
Spokane River does not meet water quality standards for PCBs

- Washington = 170 ppq (2010)
  = 7 ppq (2022)
- Spokane Tribe = 1.34 ppq (downstream standard)

The Regulatory Context

- States set standards and assess waters.
- "Listed waters": Section 303(d)
- Total Maximum Daily Load = a "pollution budget"
- Implementation
  - Pre TMDL
  - Post TMDL

"Direct to Implementation" approach - This does not replace a TMDL but can shorten the time needed to achieve clean water.



SPOKANE RIVER
REGIONAL TOXICS TASK FORCE

COLLABORATION INNOVATION PROGRESS

Community Based Problem Solving

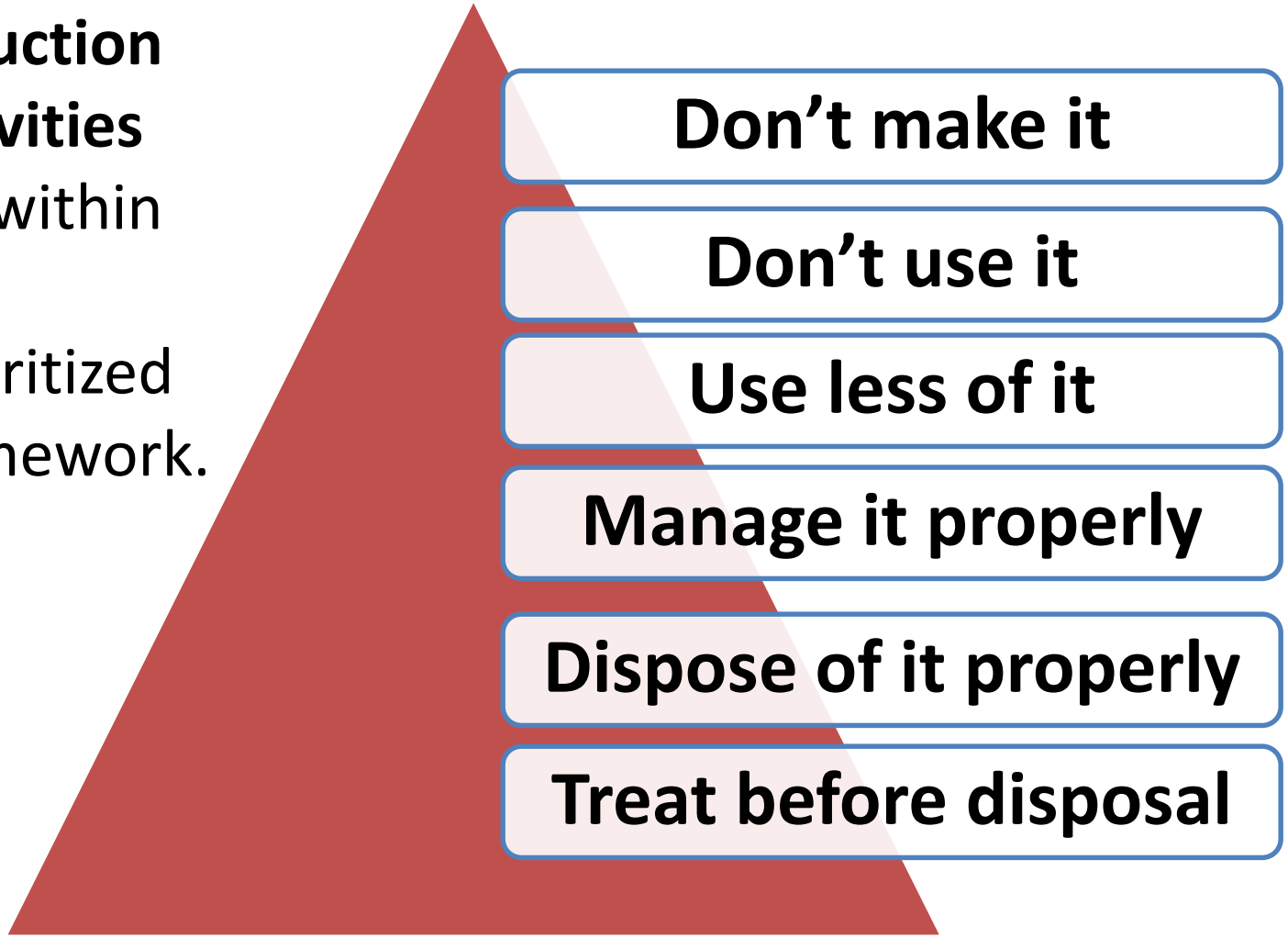
The Spokane River Regional Toxics Task Force: Key Members & Participants

Principles of Collaboration

The Moving Pieces

"Out of the Box"

All **source reduction activities** fall within this prioritized framework.



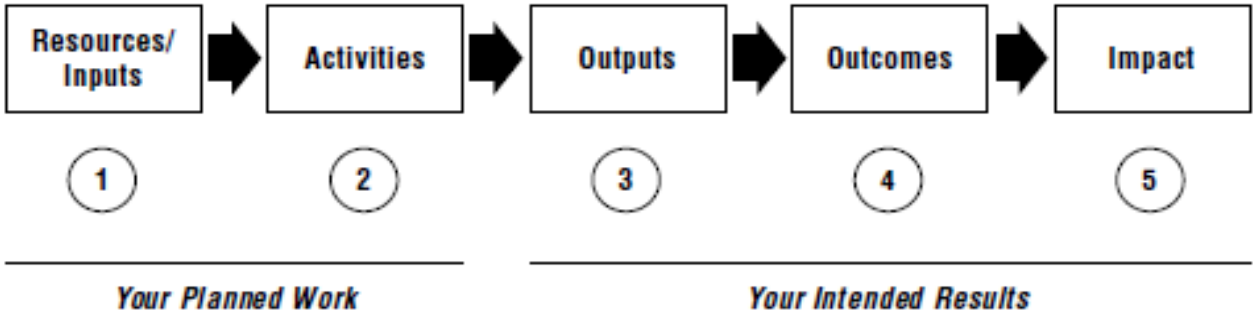
https://srrttf.org/wp-content/uploads/2016/04/2016_Comp_Plan_Final_Approved.pdf

Table 9. Initial Summarization of Control Actions

Control Action	Magnitude of Pathway	Reduction Efficiency	Cost	Implementing Entity	Pollution Prevention Hierarchy	Ancillary Benefit	Overlap w/Existing Efforts	Time frame for Implementation	Timeframe for Response
Waste disposal assistance									
LID ordinance									
Leaf removal									
Street sweeping									
Catch basin/pipe cleanout									
Purchasing standards									
Survey of local electrical equipment									
Regulation of waste disposal									
Removal of carp from L. Spokane									
Building demolition and renovation									
PCB product labeling law									
Leak prevention/detection									
Accelerated sewer construction									
PCB Identication during inspections									
Regulatory rulemaking									
Compliance with PCB regulations									
Support of green chemistry alternatives									
Survey schools and public buildings									
Education/outreach on PCB sources									
Education on septic discharge									
Education on filtering post-consumer									
PCB product testing									
Stormwater - pipe entrance									
Stormwater - pipe system									
Stormwater - end of pipe									
Wastewater treatment									
Identication of contaminated sites									
Clean up of contaminated sites									

Key	
Unknown	
Magnitude of Pathway	
>1% of total load	
0.1 - 1% of total load	
<0.1% of total load	
Reduction Efficiency	
>50% reduction	
10-50% reduction	
<10% reduction	
Cost	
<$100k	
$100k-$1M	
>$1M	
Implementing Entity	
Identified and willing	
Identified	
None identified	
Pollution Prevention Hierarchy	
Controls production or use	
Manages mobility	
End of pipe control	
Ancillary Benefit	
Significant	
Some	
Minimal	
Existing Controls	
Not currently being addressed	
Expands upon existing controls	
Redundant	
Time Frame	
W/in two years	
W/in five years	
> five years	

How Do We Know it is Working?

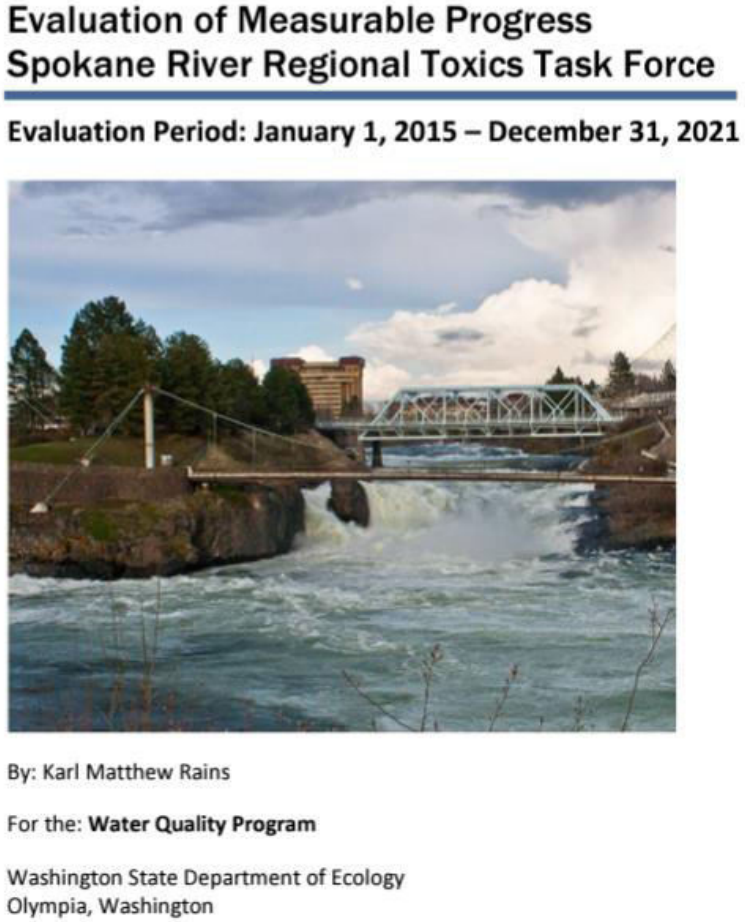


Definition of **Measurable Progress**

- Are we working together? (inputs)
- Are we doing things? (outputs)
- Are we seeing results? (outcomes)

What Success Looks Like

- 10 years: fully funded and functional
- Cutting edge work in sampling, analysis and source identification
- Regulatory influence:
  - Washington products containing PCBs
  - Toxic Substances Control Act petition
- Inspired major clean up activities
  - Kaiser Aluminum – new groundwater treatment technologies
  - EPA emergency action removed 5000 pounds of PCBs
- Spokane River achieved the EPA milestone of 170 ppq PCB



The EPA PCB TMDL

EPA to develop (2024)

- TMDL =
  - Waste Load Allocations
  - Load Allocations
  - Margin of Safety
  - Reserve Capacity
  - Reasonable Assurances

Ecology to develop (2026)

  - PCB TMDL Implementation Plan

Spokane River Technical Perspective

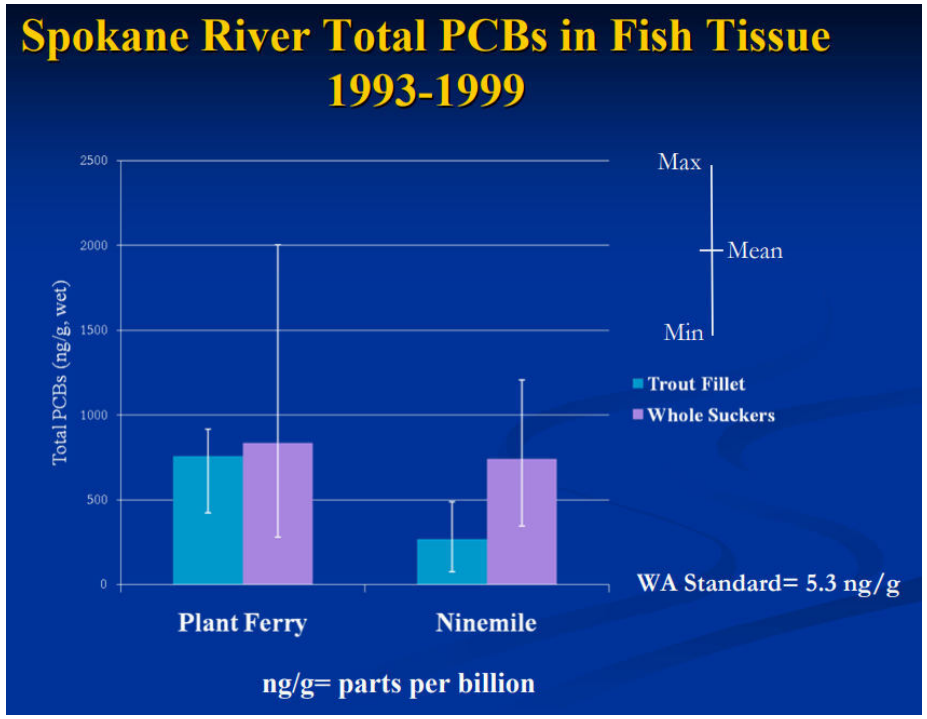
David Dilks, PhD
LimnoTech
Ann Arbor MI

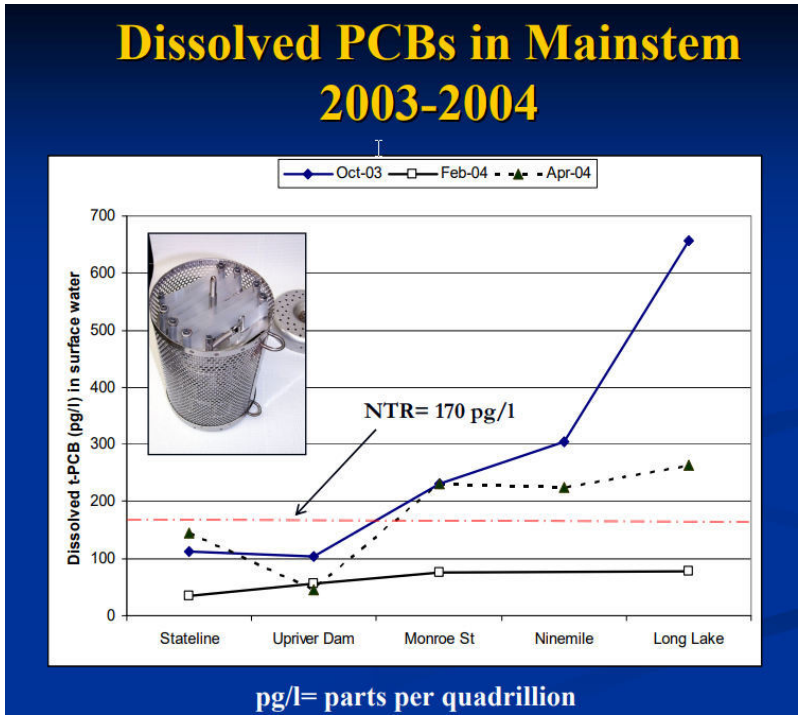
Outline

- Historical assessments
- Task Force technical activities
- Takeaways/future challenges

Historical PCB Status

- Comprehensive assessment of historical PCB status conducted by Ecology prior to formation of Task Force

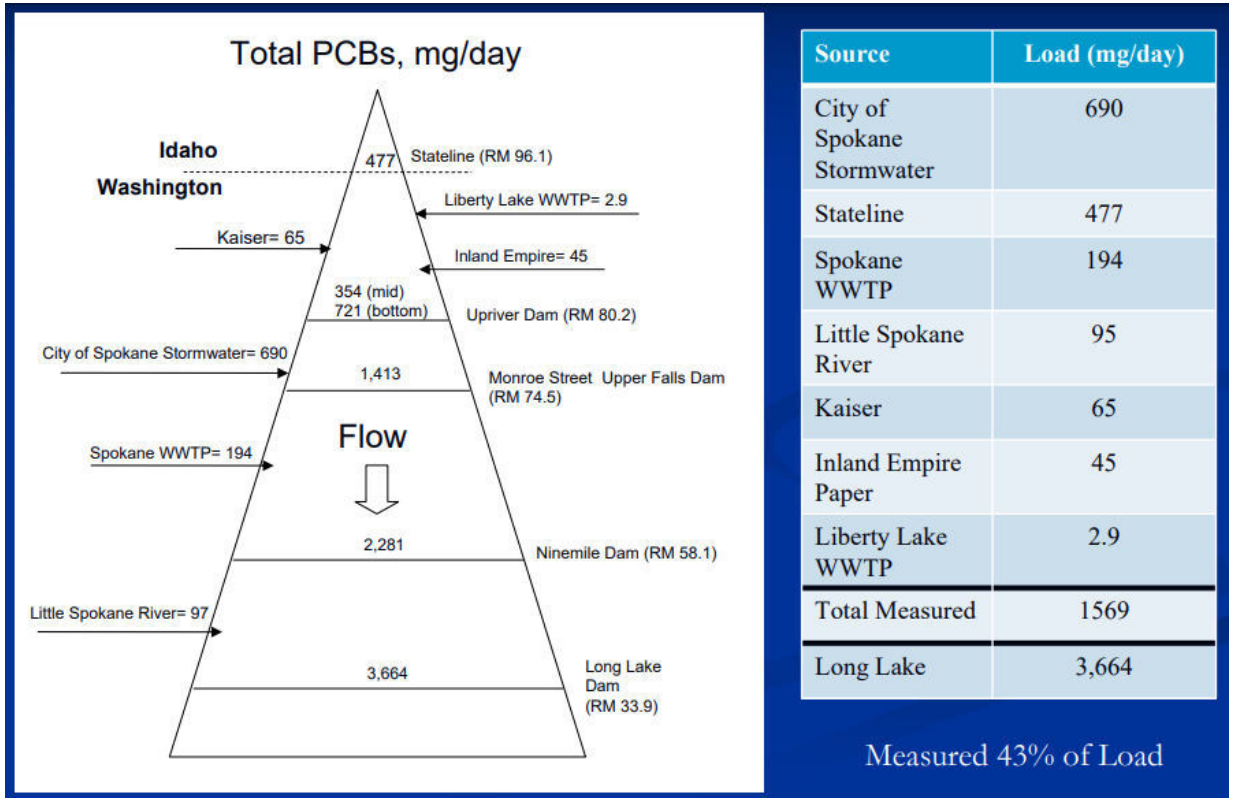




(Source: Ecology, 2011)

Historical Loading Assessment

- Ecology also performed a system-wide PCB loading estimate
  - External and in-river loads estimated from flow and PCB concentrations
  - Cumulative external load was only 43% of the calculated in-river load



Source	Load (mg/day)
City of Spokane Stormwater	690
Stateline	477
Spokane WWTP	194
Little Spokane River	95
Kaiser	65
Inland Empire Paper	45
Liberty Lake WWTP	2.9
Total Measured	1569
Long Lake	3,664

Measured 43% of Load

(Source: Ecology, 2011)

Outline

- Historical assessments
- Task Force technical activities
- Takeaways/future challenges

Technical Focus of the Task Force

- Follows from Mission Statement

  The Regional Toxics Task Force will work collaboratively to characterize the sources of toxics in the Spokane River and identify and implement appropriate actions needed to make measurable progress towards meeting applicable water quality standards for the State of Washington

Task Force Technical Activities

- Characterize the sources of PCBs
- Develop a comprehensive plan for PCB control
- Continue source identification
- Support status and trends assessment

Task Force Technical Activities

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- Develop a comprehensive plan for PCB control
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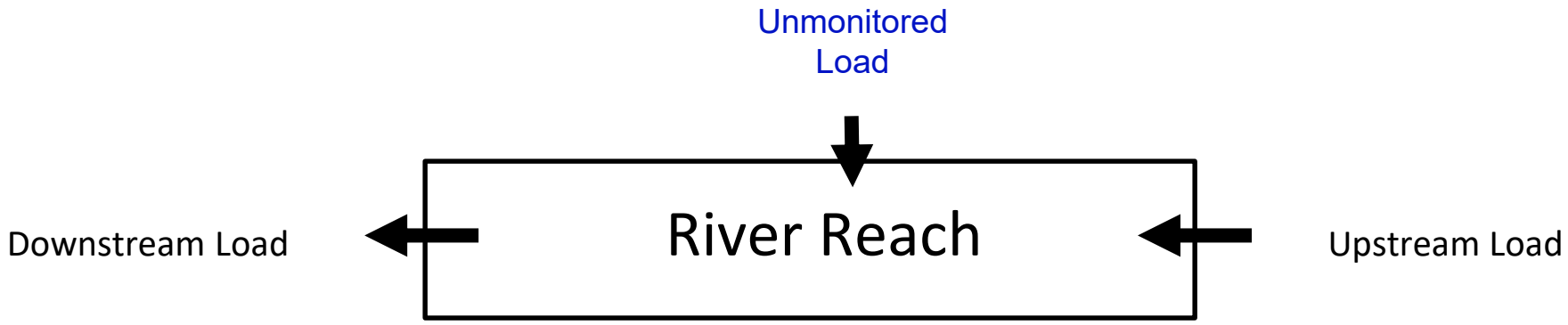
Characterize Sources of PCBs via Mass Balance Approach

- Measure flow and concentration of known loading sources
  - Point source, tributaries
- Calculate presence of unmonitored load entering the river between upstream and downstream stations
  - Measure flows and concentrations during steady state conditions
  - Unmonitored load = Downstream load – upstream load



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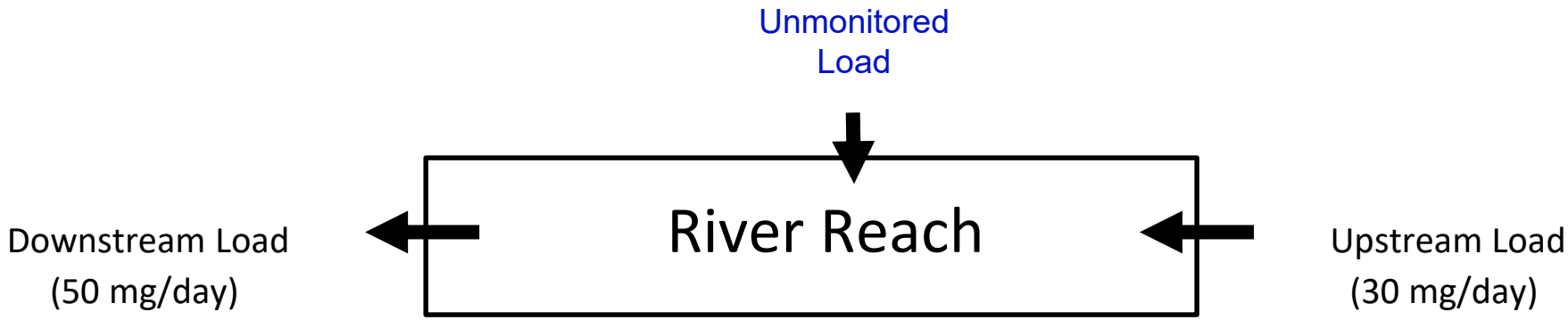

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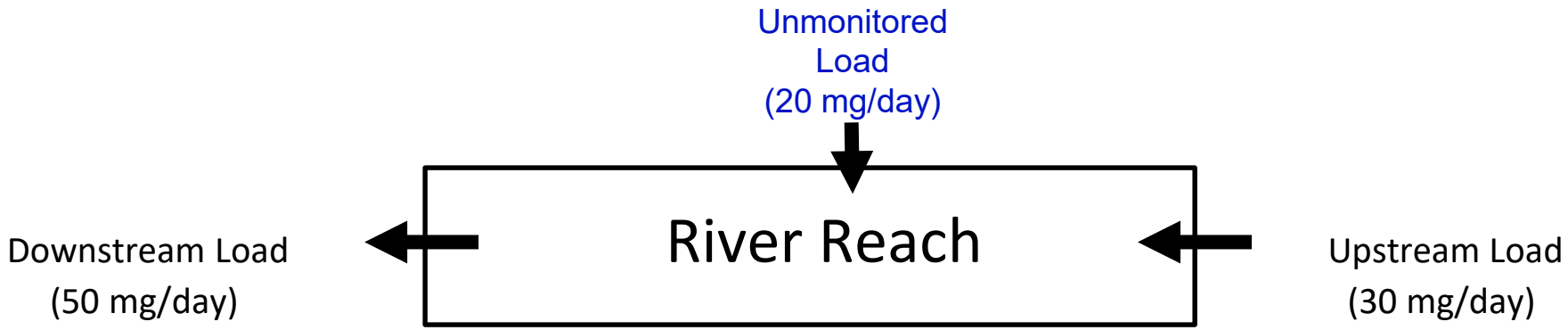

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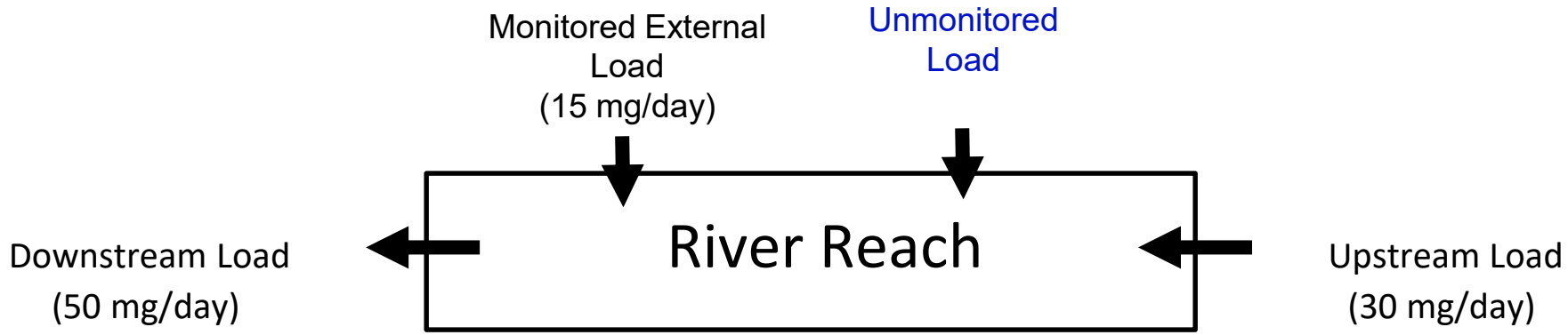

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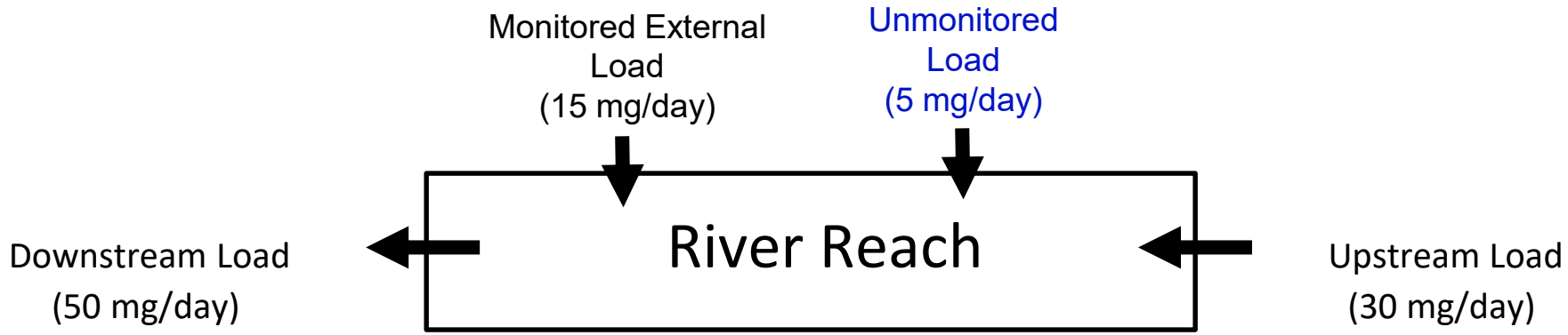
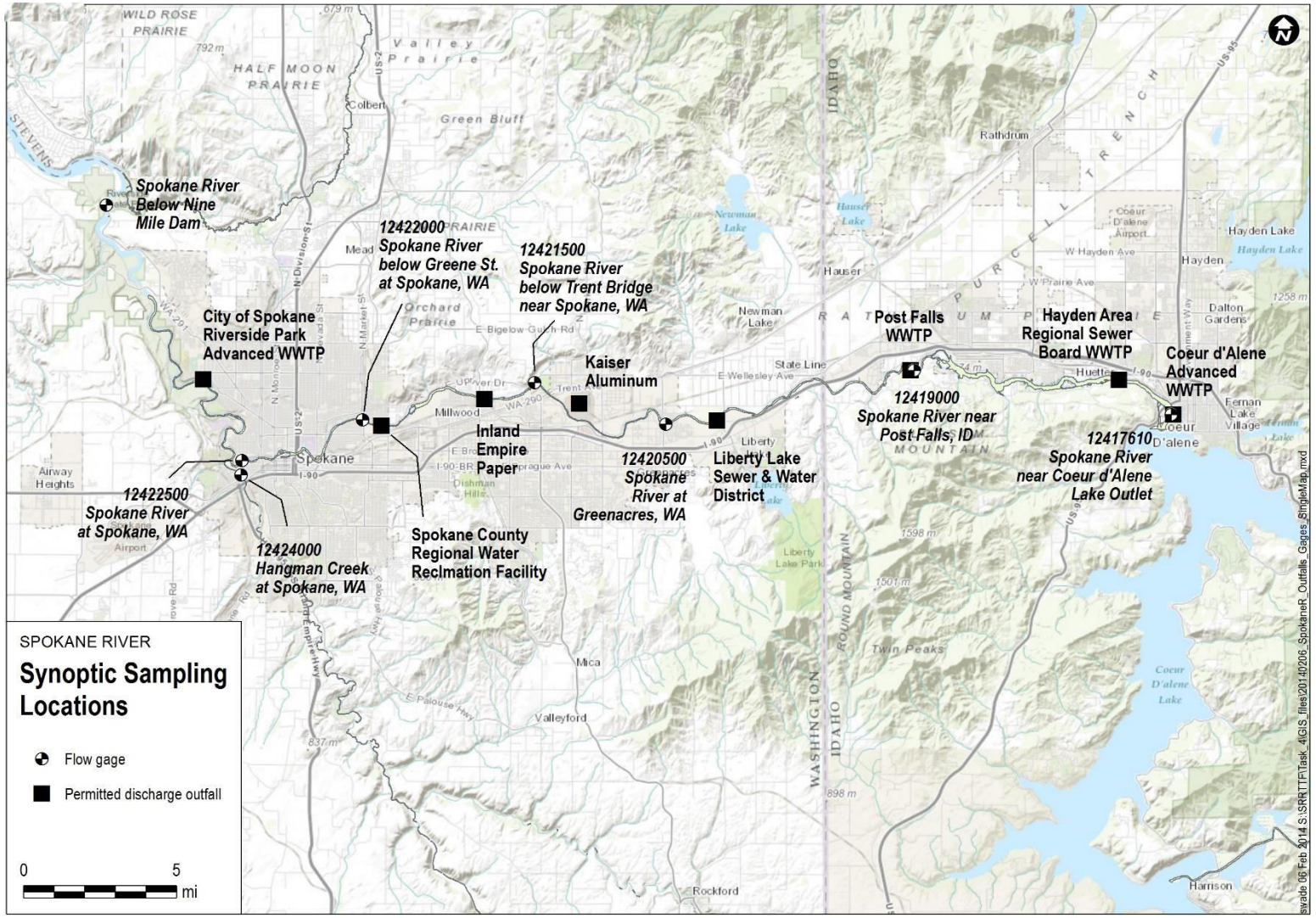


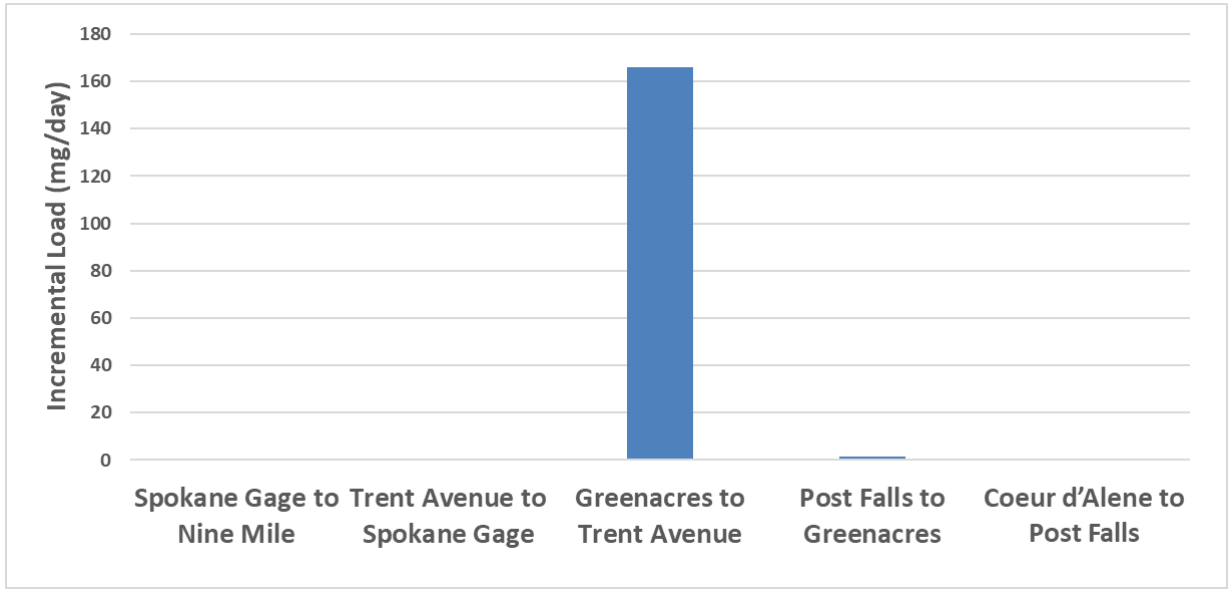
Synoptic Survey – 2014

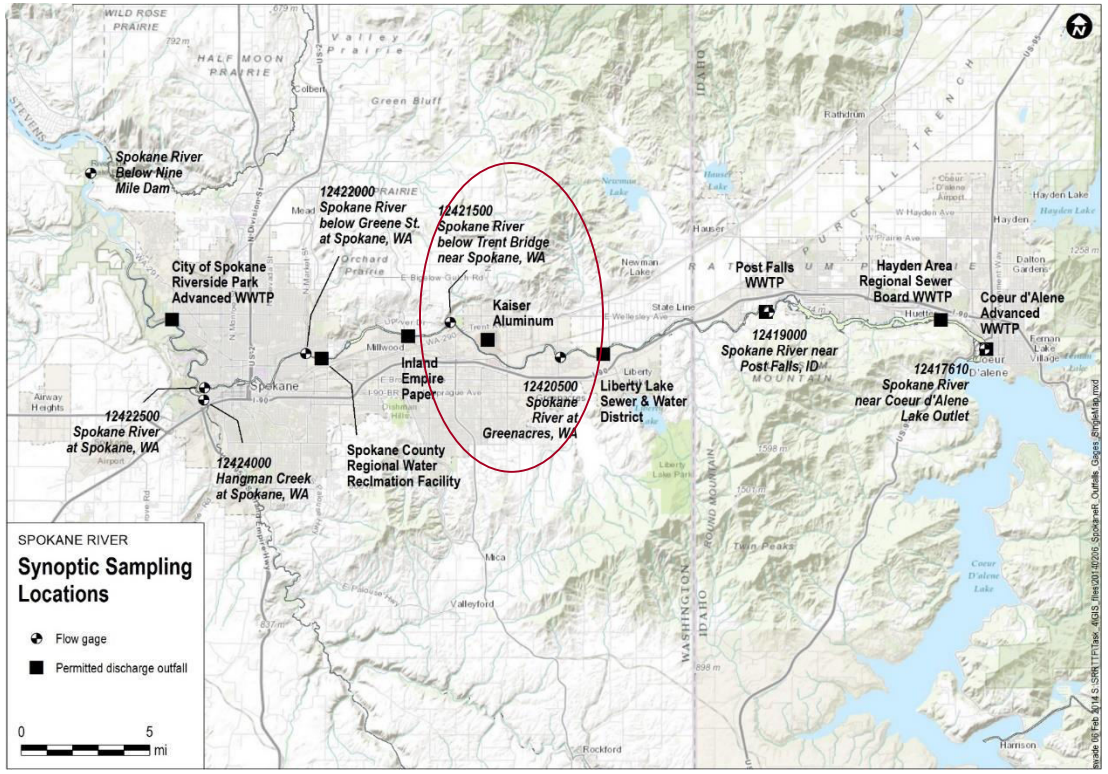
- Week-long survey during summer low flow
- Measure flows and loads from Lake Coeur d'Alene outlet to Nine Mile Dam



2014 Mass Balance Results

- Indication of a large unmonitored load entering the river between Greenacres and Trent Avenue

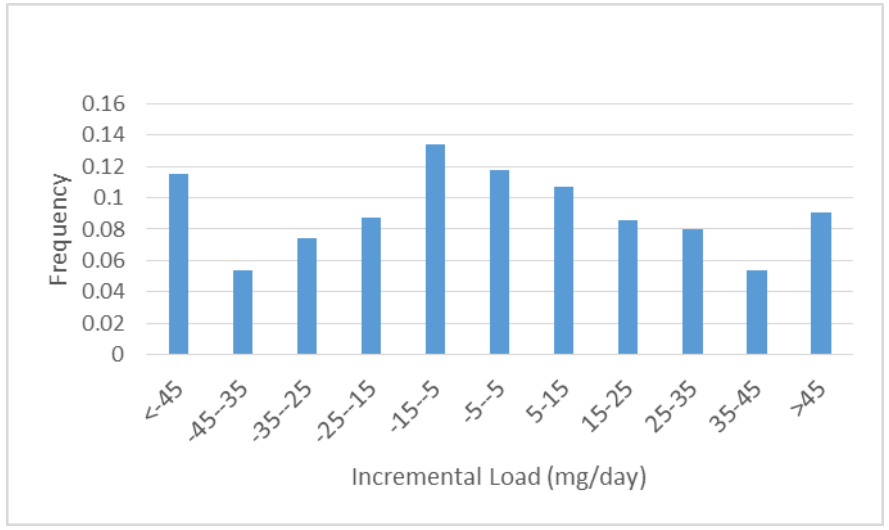




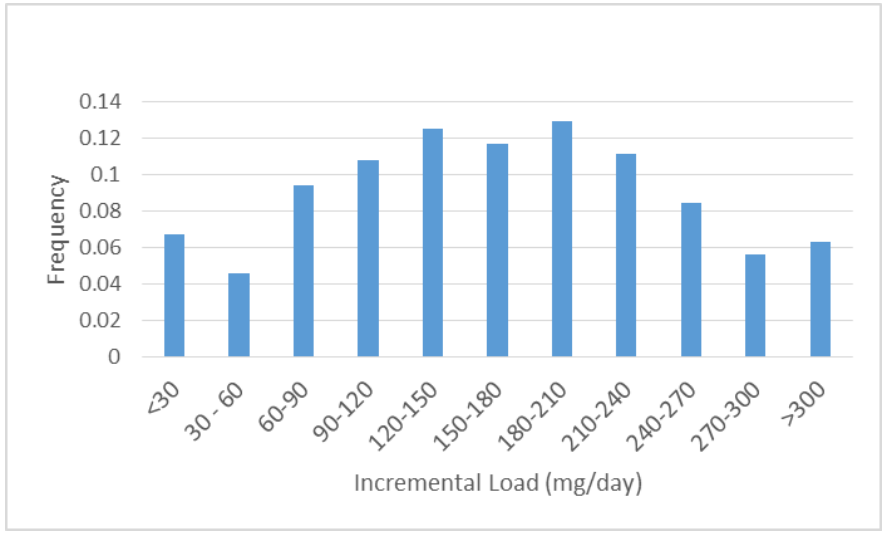
2014 Mass Balance Uncertainty Analysis

- Recognized that results were uncertain due to river PCB concentrations being only slightly larger than laboratory blank concentrations
  - Uncertainty analysis conducted as part of mass balance
  - Results for some segments were more conclusive than other

Inconclusive: Coeur d'Alene to Post Falls

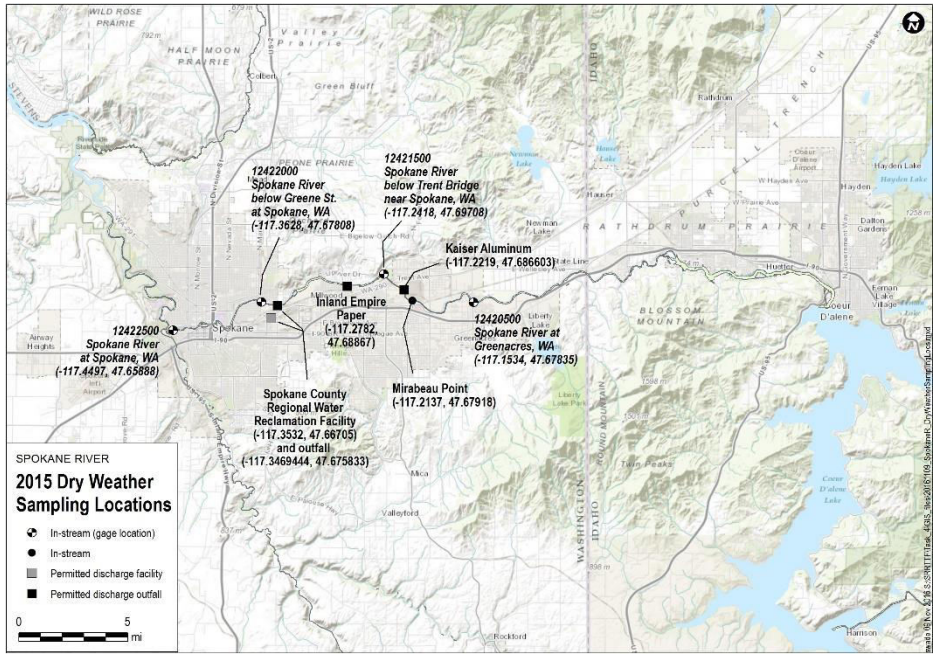


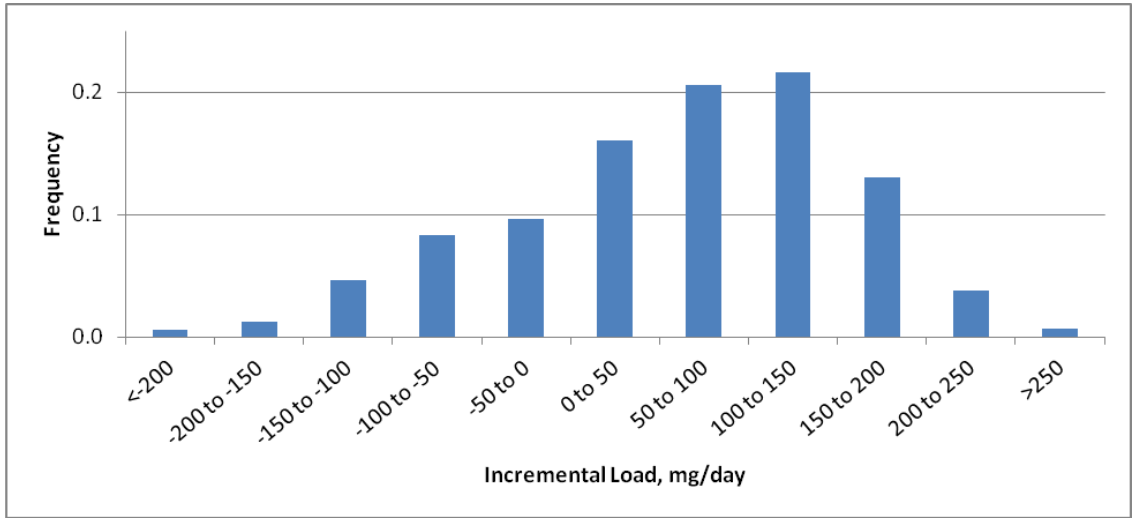
More conclusive: Greenacres to Plantes Ferry



Synoptic Surveys – 2015 and 2018

- Additional surveys conducted to supplement 2014 mass balance
  - Results consistently suggest presence of an unmonitored load entering the river near the Kaiser facility





Task Force Technical Activities

- Characterize the sources of PCBs
- Develop a comprehensive plan for PCB control
- Continue source identification
- Support status and trends assessment

Comprehensive Plan

- Data collected by the Task Force was used to develop a Comprehensive Plan to describe:
  - *Source Assessment* of the magnitude of all known PCB sources
  - *PCB Control Actions* under consideration, and their expected costs and removal efficiency
  - *Implementation Plan* defining specific management practices, the schedule for their implementation, and measurable milestones to assess effectiveness
  - *Future Studies* designed to fill identified data gaps

Comprehensive Plan: Source Assessment

- Loading dominated by five sources:
  - Groundwater loading near Kaiser facility
  - Upstream Lake Coeur d'Alene
  - Two industrial wastewater facilities
  - One municipal wastewater facility

Comprehensive Plan: Control Actions

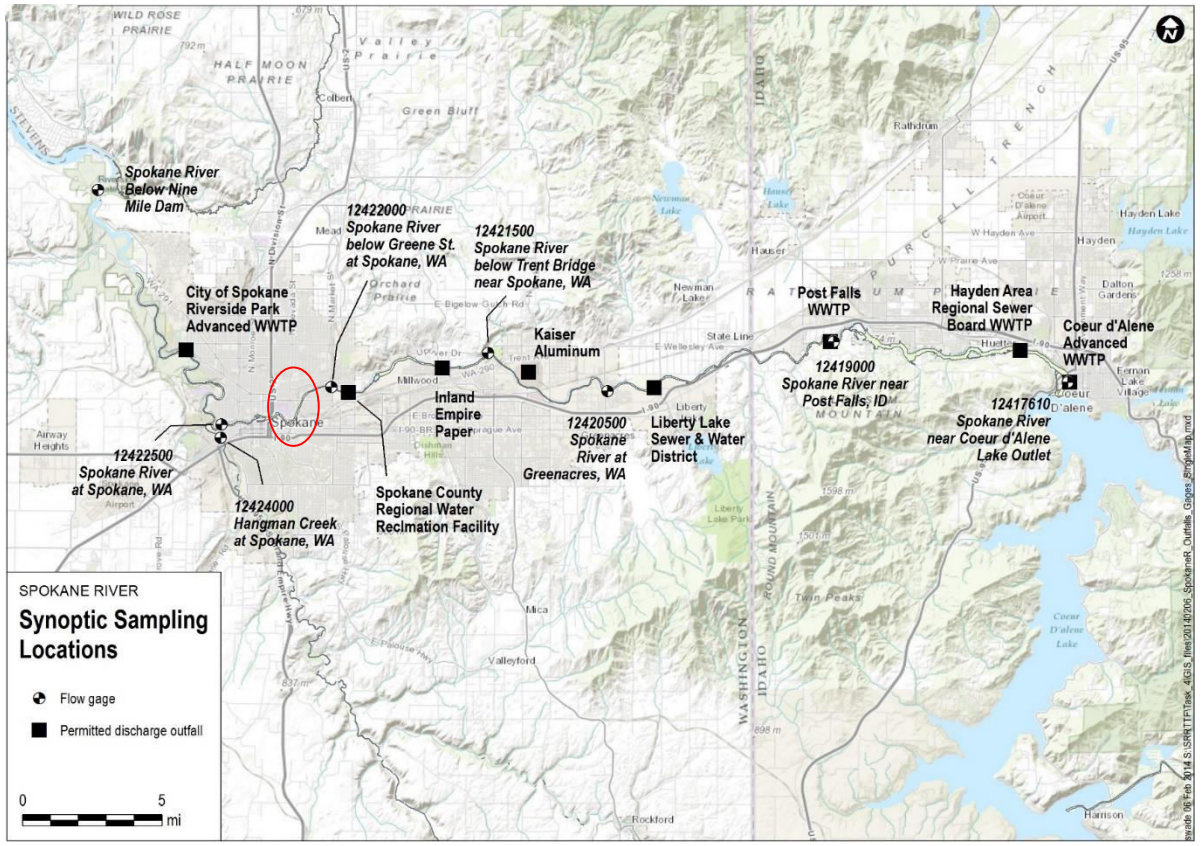
- Loading dominated by five sources:
  - Groundwater loading near Kaiser facility
    - Clean-up occurring under Consent Order
  - Upstream Lake Coeur d'Alene
    - None
  - Wastewater facilities
    - Installing (or have installed) next level of treatment

Task Force Technical Activities

- Characterize the sources of PCBs
- Develop a comprehensive plan for PCB control
- Continue source identification
- Support status and trends assessment

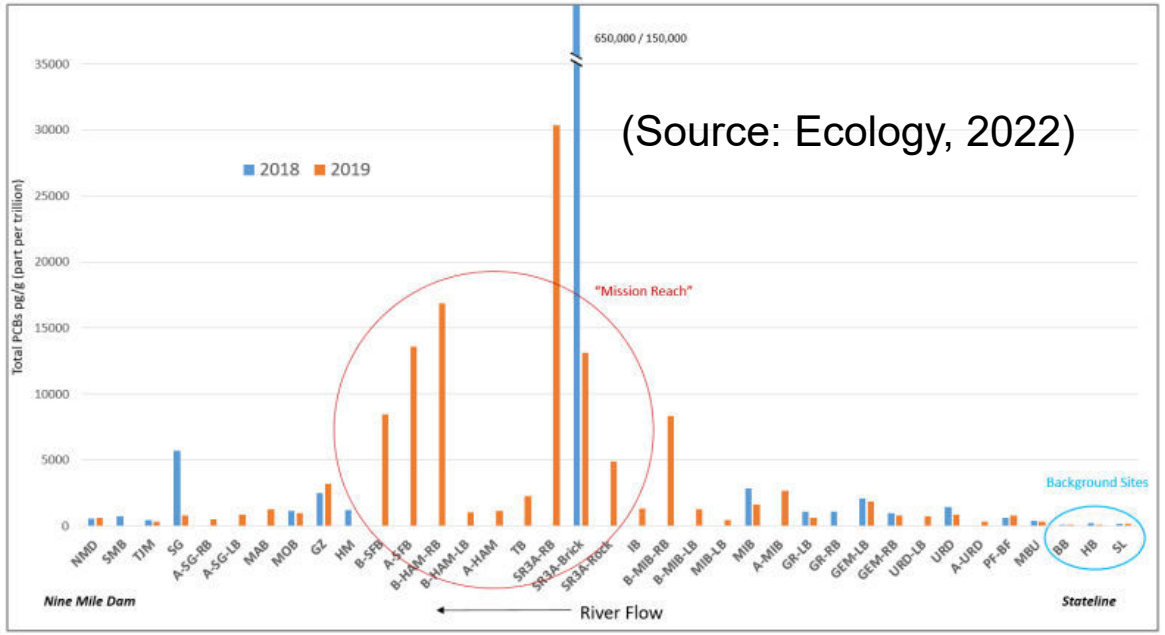
Further Source Identification

- Monitoring of PCBs in biofilm by Ecology in 2018 and 2019 showed elevated PCB concentrations in what is termed the Mission Reach



Further Source Identification

- Monitoring of PCBs in biofilm by Ecology in 2018 and 2019 showed elevated PCB concentrations in what is termed the Mission Reach



  - Not correlated to water column concentration or any known load to the water column
  - Consistent with historical observations of elevated fish tissue PCB concentrations in the Mission Reach

Further Source Identification

- Potential explanations for Mission Reach biofilm contamination
  - Legacy sediment contamination from historical upstream sources
  - Buried PCB-containing objects
  - PCB-contaminated artificial bottom fill
  - Contaminated groundwater
  - Contaminated stormwater

Further Source Identification

- Several actions undertaken/ongoing to identify Mission Reach source
  - Buried PCB-containing objects
    - Object detection survey defined the presence of buried metallic objects
    - Follow-up sediment and biofilm sampling in direct vicinity of identified objects
  - PCB-contaminated artificial bottom fill
    - Sampling of concrete and brick obtained from river bottom
  - Contaminated groundwater
    - Historical source assessment
  - Contaminated stormwater
    - Stormwater catch-basin sampling in area of suspected contamination

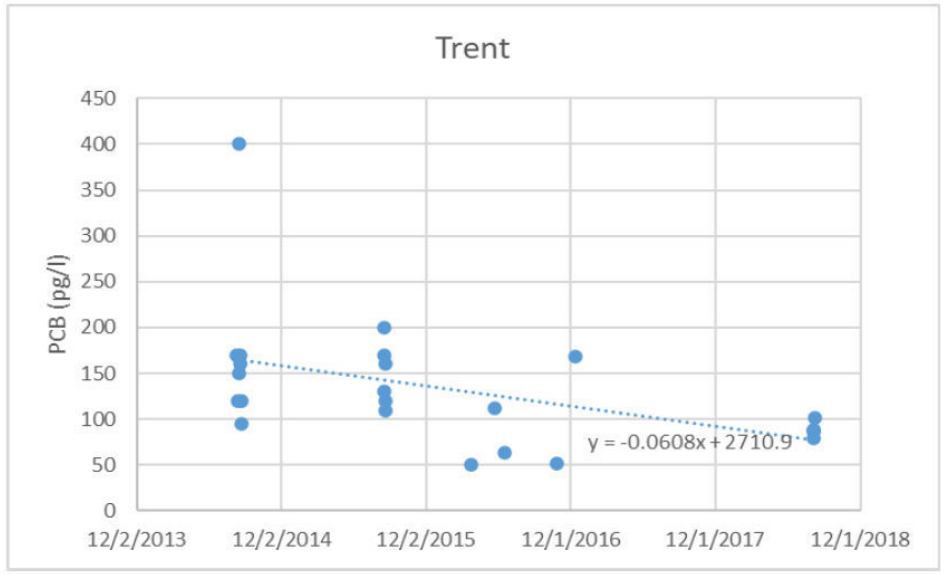
Task Force Technical Activities

- Characterize the sources of PCBs
- Develop a comprehensive plan for PCB control
- Continue source identification
- Support status and trends assessment

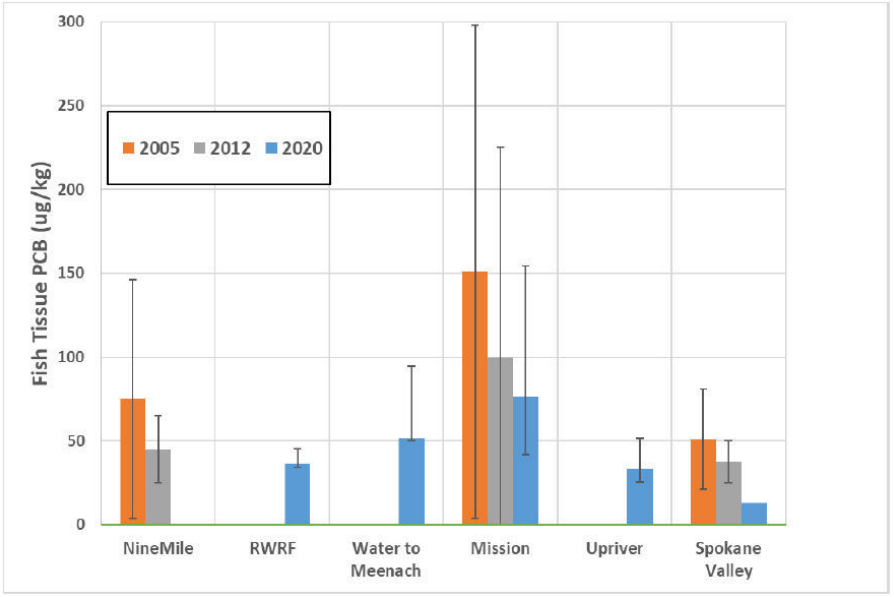
Status and Trends

- Water column and fish tissue PCB data suggest that concentrations are decreasing over time
  - Data are generally very noisy and not always consistently collected/analyzed

Water Column



Fish Tissue



Status and Trends

- Task Force has implemented consistent sampling programs to support future trend assessment
- Month-long deployment of semi-permeable membrane devices during three different seasonal flow regimes of each year
  - 2020-2021, 2022-2023
- Fish tissue sampling of juvenile redband trout
  - Fall 2020, Fall 2022

Outline

- Historical assessments
- Task Force technical activities
- Takeaways/future challenges

Takeaway Messages/Future Challenges

- Mass balance assessment can be effective in identifying PCB sources
- Smaller sources are more difficult to define
- Trend assessment requires a lot of data
- Attaining water quality standards will be extremely challenging

Takeaway Messages/Future Challenges

- Mass balance assessment can be effective in identifying PCB sources
  - If the source is large enough
- Smaller sources are more difficult to define
- Trend assessment requires a lot of data
- Attaining water quality standards will be extremely challenging

Takeaway Messages/Future Challenges

- Mass balance assessment can be effective in identifying PCB sources
- Smaller sources are more difficult to define
  - Biofilm monitoring can identify PCB sources not found by water column sampling
- Trend assessment requires a lot of data
- Attaining water quality standards will be extremely challenging

Takeaway Messages/Future Challenges

- Mass balance assessment can be effective in identifying PCB sources
- Smaller sources are more difficult to define
- Trend assessment requires a lot of data
  - Especially as concentrations decrease
- Attaining water quality standards will be extremely challenging

Takeaway Messages/Future Challenges

- Mass balance assessment can be effective in identifying PCB sources
- Smaller sources are more difficult to define
- Trend assessment requires a lot of data
- Attaining water quality standards will be extremely challenging
  - Feasible level of control for identified sources
  - Unidentified sources

Questions?

Chesapeake Bay Watershed

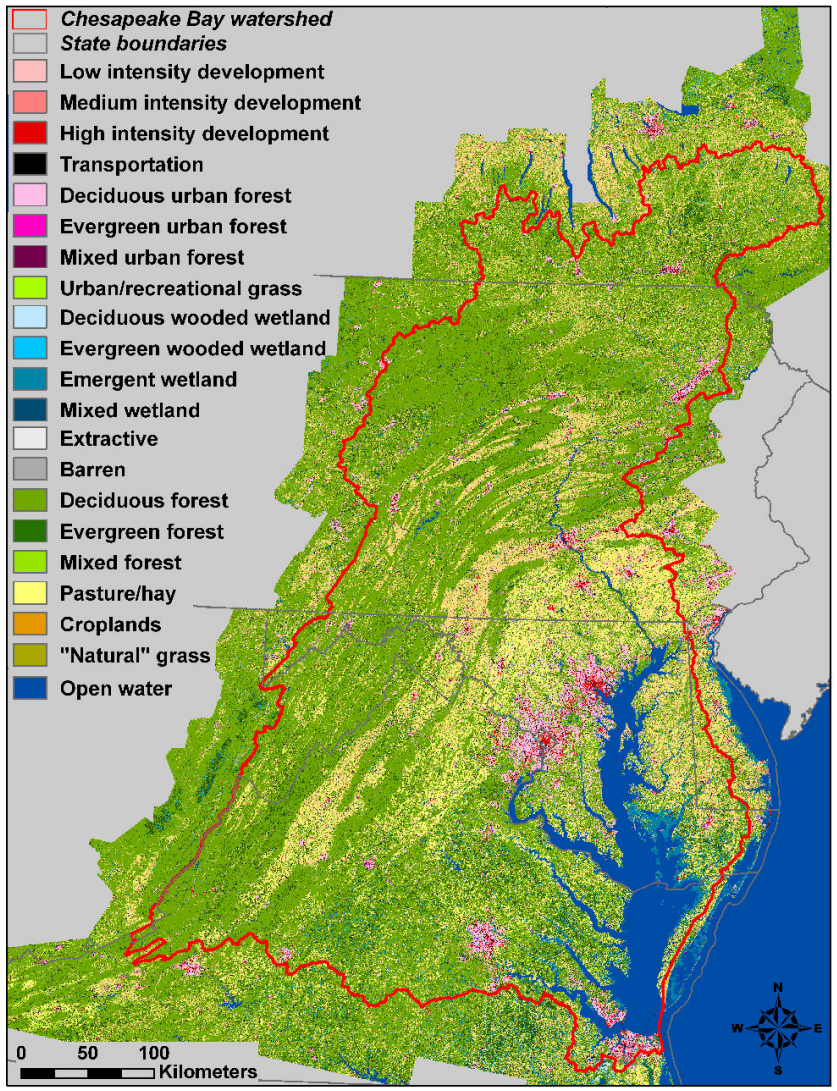
Status of PCB Total Maximum Daily Loads and PCB Reduction Strategies

Cross Geo-Programs Contaminants Conference

January 25, 2023

Greg Allen, USEPA, Chesapeake Bay Program Office

Chesapeake Bay Watershed Facts



- 64,000 square miles of land
- 21 ft. average depth
- High land:water ratio, 14:1
- Largest estuary in the USA
- 18 million residents; grows by 1 million/decade

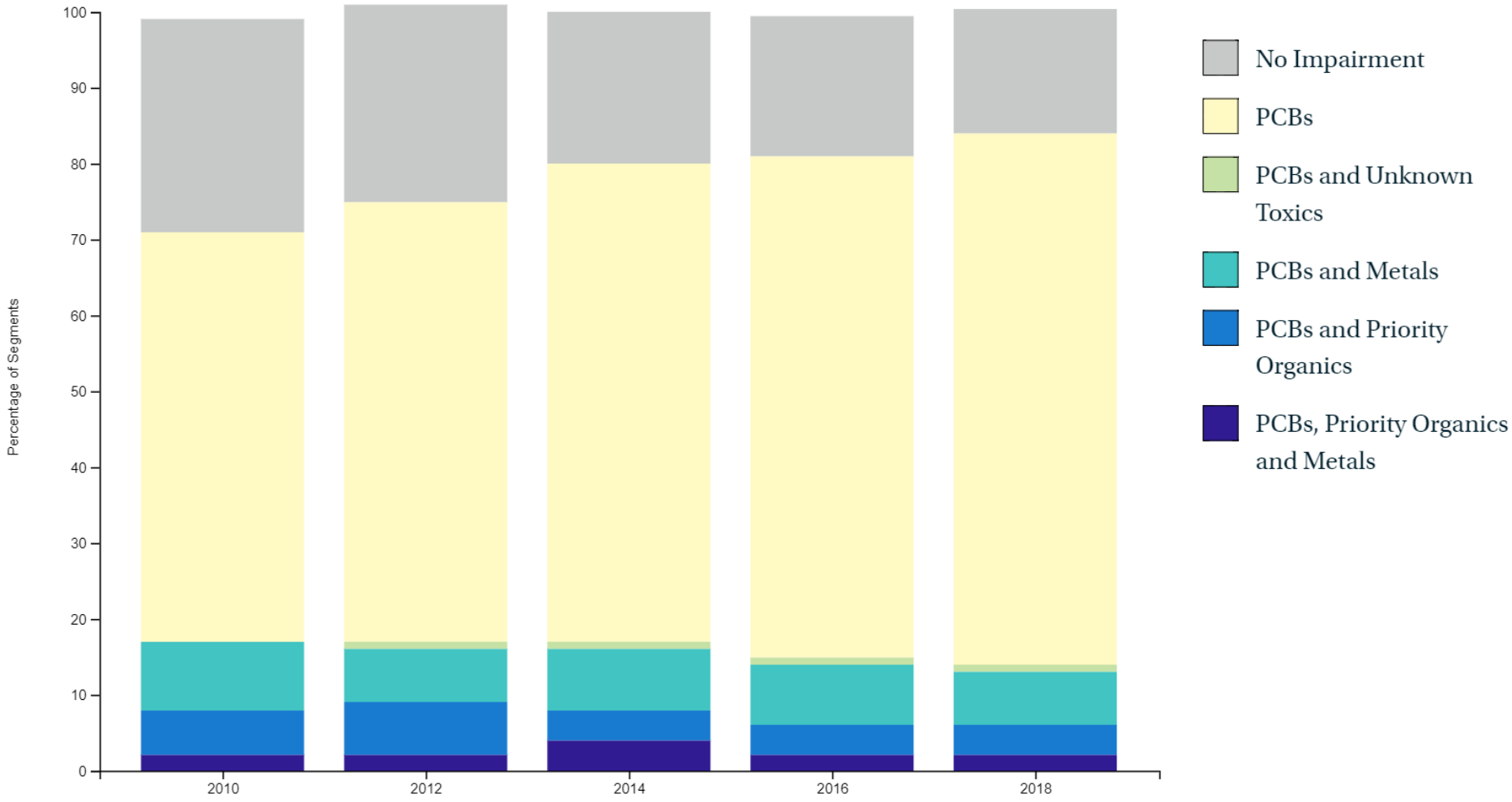
33 Species of fish under fish consumption advisory in the watershed

84% of Chesapeake Bay tidal segments are partially or fully impaired by contaminants … an increase from 81.5% in 2016

Toxic Impairments in the Tidal Chesapeake Bay (2010-2018)

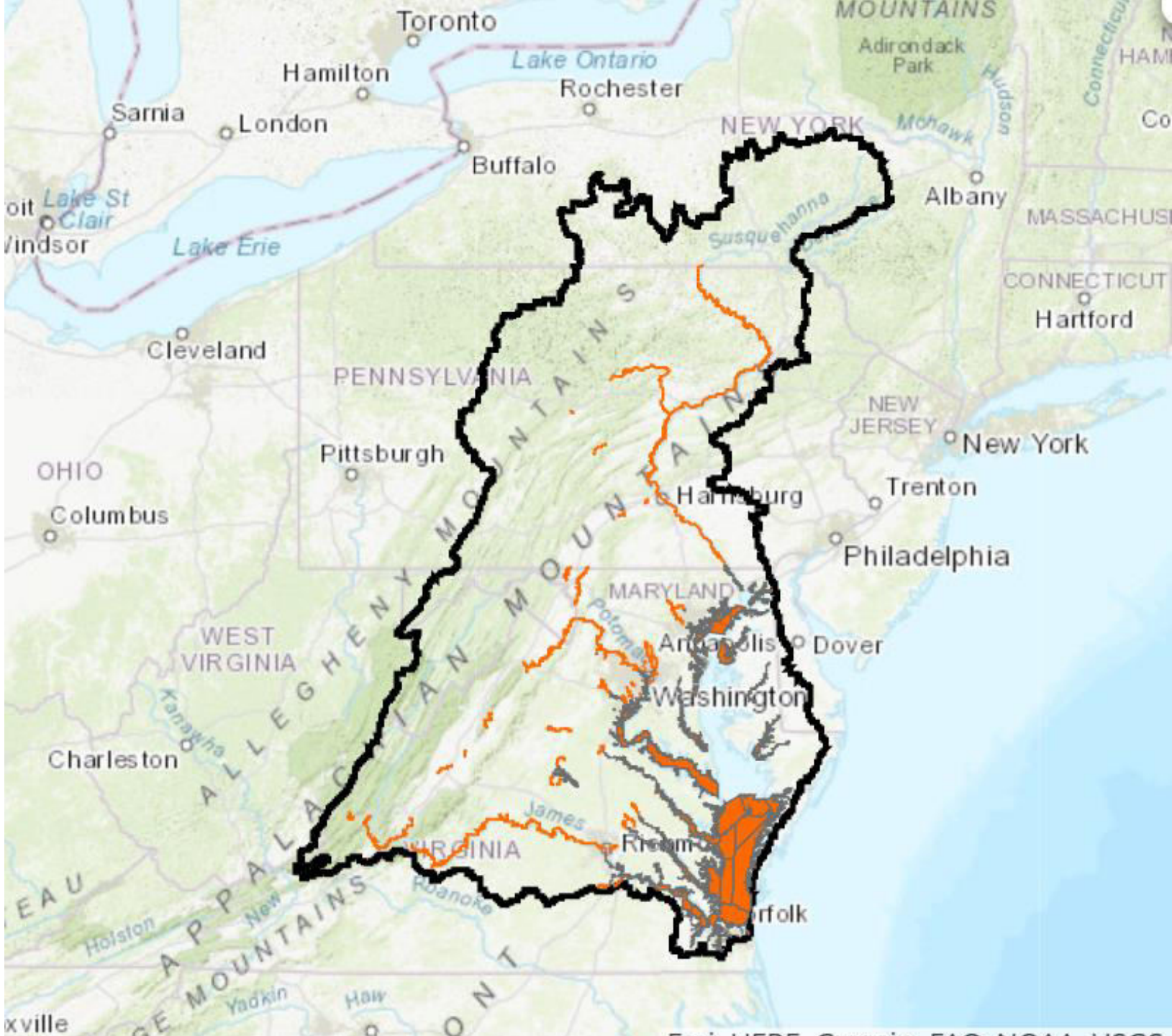
Percentage of Tidal Segments in Delaware, Maryland, Virginia and the District of Columbia with Partial or Full Impairments Due to Chemical Contaminants

VIEW CHART VIEW TABLE



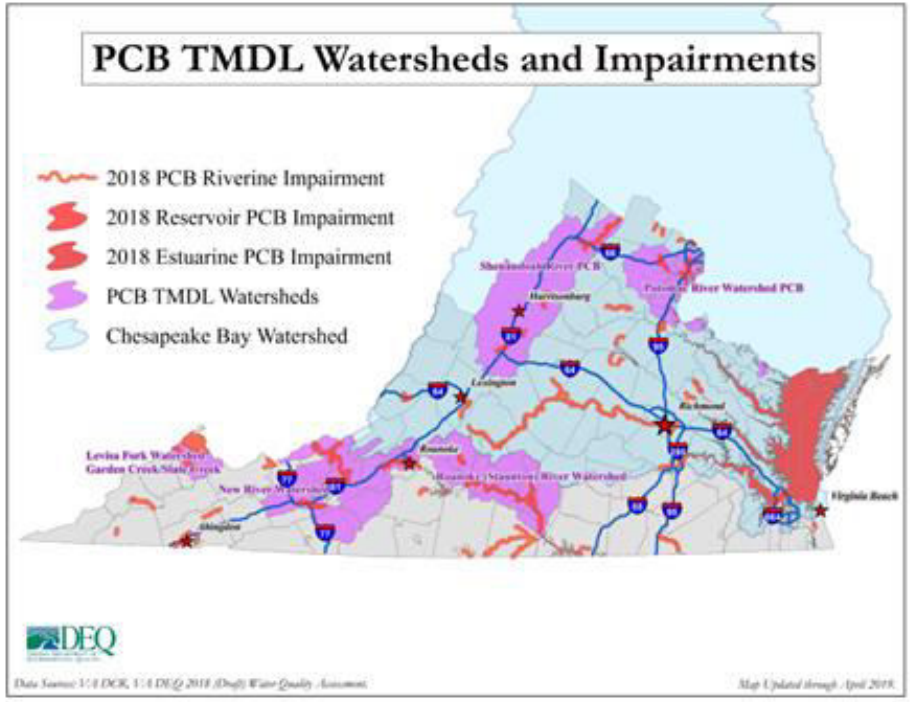
PCBs in the Chesapeake Bay 2022

[*Story map*]



Virginia

PCB Impairments and Sources



PCB impairments - 2022 - 305(b)/303(d) Integrated Report

- 1,355 river miles
- 75,729 lake acres
- 2,057 estuarine square miles

TMDL Source Investigation studies have identified urban, industrial and commercial land uses:

- ***Point sources*** include municipal WWTPs, industrial sources, and MS4s
- ***Non-point sources*** include contaminated sites (CERCLA, RCRA Corrective Action, Voluntary Remediation sites, Brownfield)

Virginia

Overview of Main PCB Activities

Va PCB Fish monitoring – visit each river basin on a three-year cycle

TMDL Development

- PCB Monitoring and analysis with method 1668 (water and sediment)
- PCB Screening of municipal and industrial point sources assigned WLAs within the TMDL
- Identify Contaminated sites

TMDL Implementation

- Utilize Pollutant Minimization Plans (PMPs) as part of the NPDES Permitting Program
- Collaborate with Land Division Programs to address PCB contamination (e.g., CERCLA, RCRA, VA Voluntary Remediation Program)
- As funds allow search for sources that may contribute to the “unregulated surface load TMDL category”

Virginia

PCB Needs and Future Direction

Needs

- **Case studies** or examples of Track Down studies that have identified major sources of PCBs
  - Municipal Systems and Industrial sites
  - MS4s
- **Case studies** or examples of treatment trains or other approaches to plan Best Management Practices (BMPs) that effectively reduce PCBs

Future Direction

- Continue with PCB TMDL development targeting impaired waters
- Address TMDL implementation under the NPDES Program using Pollutant Minimization Plans (PMPs)

Washington, D.C.

PCB Impairments

Surface Water-Related Impacts

29 out of 36 (≈ 81%) assessment units in DC are impaired for PCBs.

Two approved PCB TMDLs address these impairments:

- Tidal Potomac and Anacostia Rivers PCB TMDL (2007)
- PCB TMDLs for Small Tributaries in the Rock Creek Watershed (2016)
- No pending PCB TMDLs

Washington, D.C.

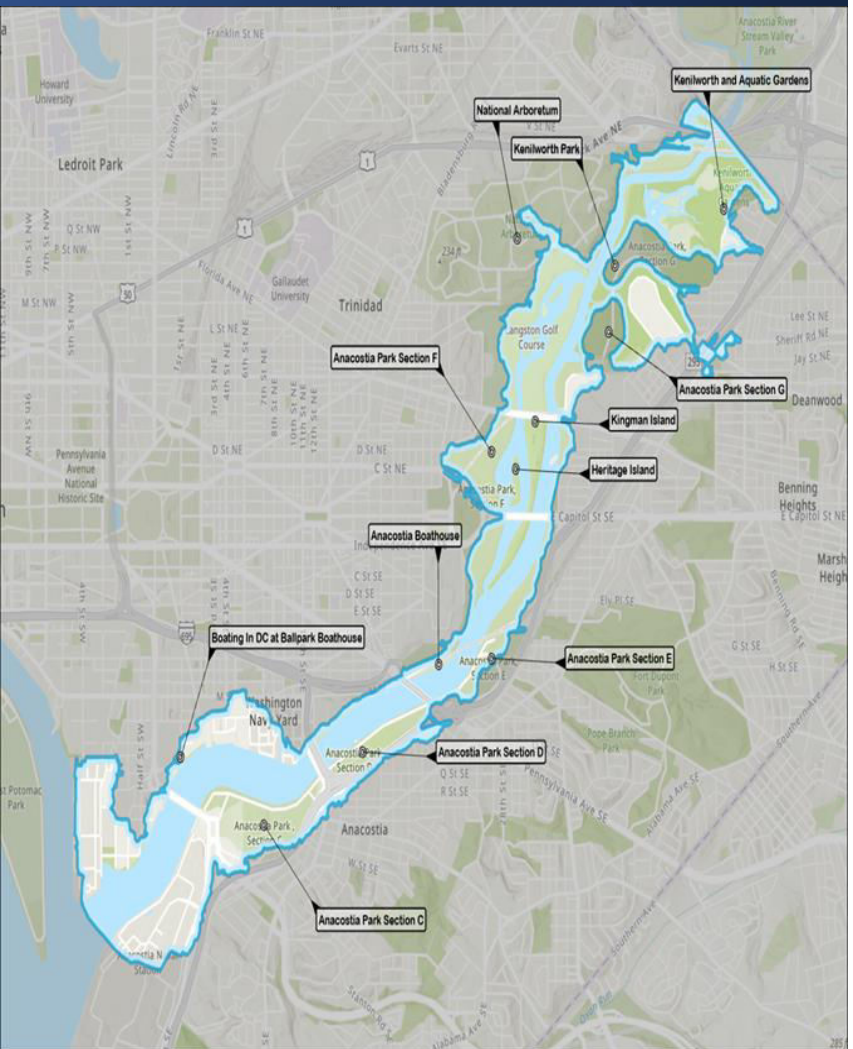
Land Uses

Land uses that generate pollution load, including PCBs, are generally classified by land cover and regulatory status:

- **{Land Cover} => impervious**, **pervious developed or turf**, and **forest**

- **{Regulatory status} =>** municipal separate storm water system (**MS4**), combined sewer system (**CSS**), and **direct drainage**

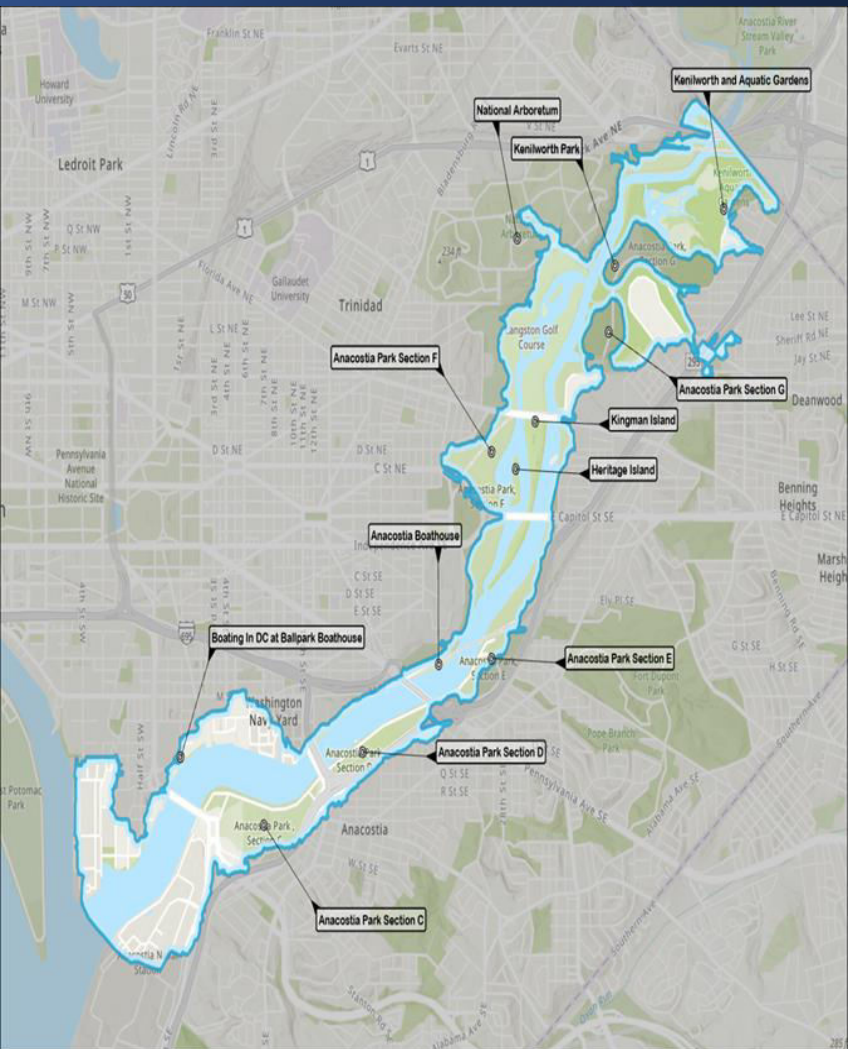
Washington, D.C.



Anacostia River - Sediment Focus

- Anacostia River Sediment Project advancing - addresses sediments impacted by PCBs
  - Interim Record of Decision (**Interim ROD**) 09/30/2020
  - Includes ≈ the lower 9-mile tidal portion of the Anacostia River
  - 11 early action areas (EAAs) in 3 operable units:
    - Mainstem Anacostia River
    - Kingman Lake
    - Washington Ship Channel
- Identifies the early action cleanup remedies for the most contaminated areas in the river and outlines the process for their implementation.
- The remedy outlined in the **Interim ROD** will be implemented through an adaptive management approach.

Washington, D.C.



Implementation of Anacostia PCBs Load Reduction Plan (see the 2022 TMDL IP (pg. 50))

- Employs both *structural* and *non-structural controls* that remove TSS, such as street sweeping, erosion and sediment control, and other practices
- Maximizes *effectiveness and efficiency of BMP implementation* in the District because PCBs load reduction is based on BMP implementation instead of numeric waste load allocations (WLAs).
- Monitoring is on-going - water column, fish tissue and sediment.

Washington, D.C.

PCB

Challenges

Cleaning up Anacostia River PCBs hot spots

- Both technical and transboundary-related challenges.

Long-term monitoring of ultra-low dissolved concentrations of PCBs is difficult and costly.

Controlling on-going use of PCBs and associated impacts

- **Open applications** of PCBs (e.g., from non-legacy PCB congeners from modern materials, book bindings, paints, sealants, cabinetry, installations and machinery) not typically included in national inventories, makes them difficult to track.
- **Unintentional production and releases** from industries and combustion, etc.

Maintain robust Conceptual Site Model and track key uncertainties

- Strength of link between sediment to fish tissue concentrations
- Source control in upland areas and tributaries

Washington, D.C.

PCB Management Needs

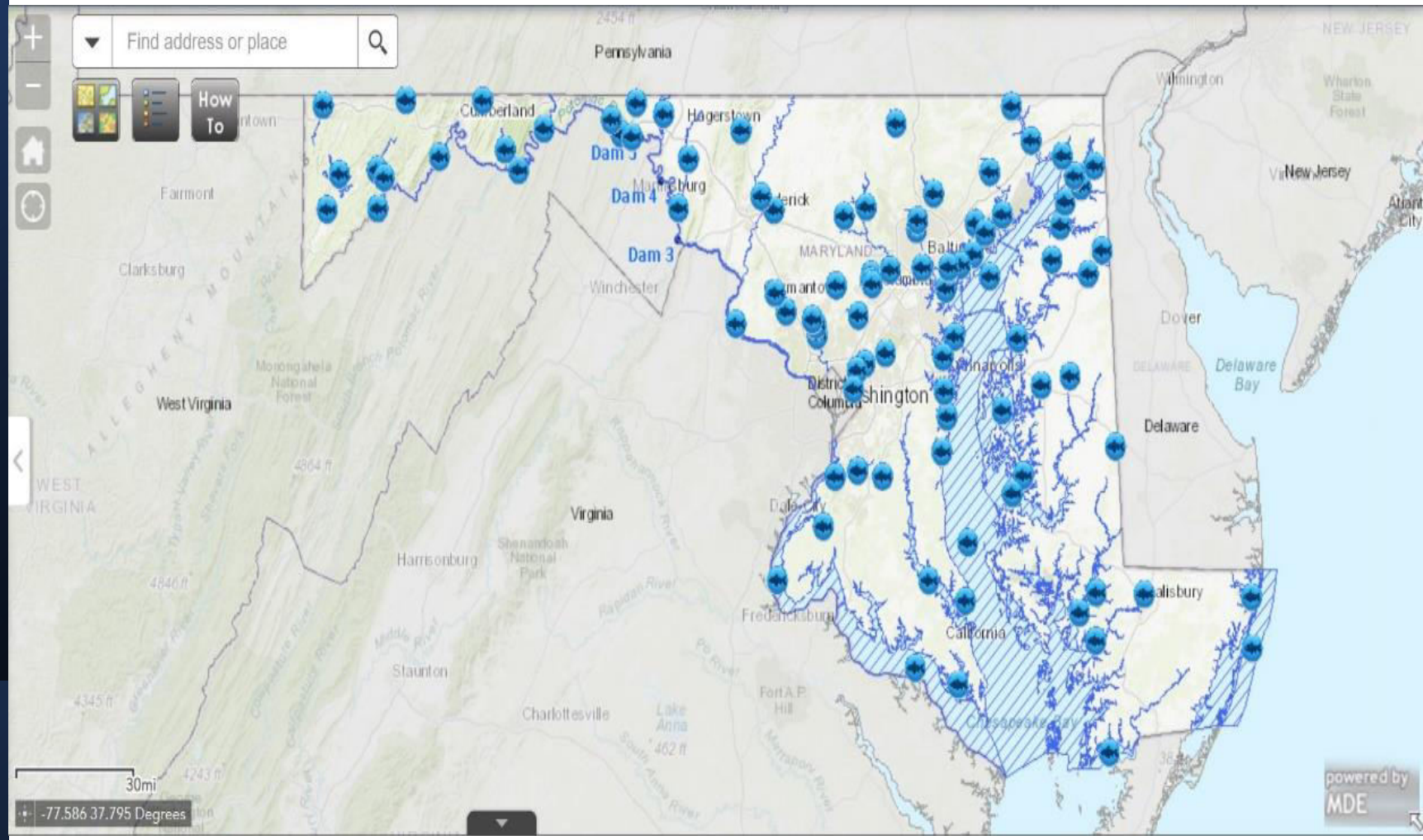
- A comprehensive DC PCB trackdown strategy.
- Determine the future of long-term transboundary (upstream) Anacostia River's PCBs monitoring collaborative.
- Adapting the existing FCAs to make them current with the times and more effective in informing DC citizens about potential risks associated with eating locally caught fish.
  - Include other engagement channels such as radio, field days, and workshops. Need more efficient delivery of information at all levels.
  - Make the existing FCAs messaging more amenable to social media platforms.
    - Develop and incorporate animated versions of the current FCAs that the Chesapeake Bay Program's TCW helped develop.
- Trended monitoring results (baseline and performance) directly document remedy effectiveness and progress toward a final ROD

Fish Consumption Infographic

Scroll to “Project Infographics”

https://www.chesapeakebay.net/who/group/toxic-contaminants-workgroup

Online map of MD's Fish Consumption Advisories: https://mdewin64.mde.state.md.us/WSA/FCA/index.html

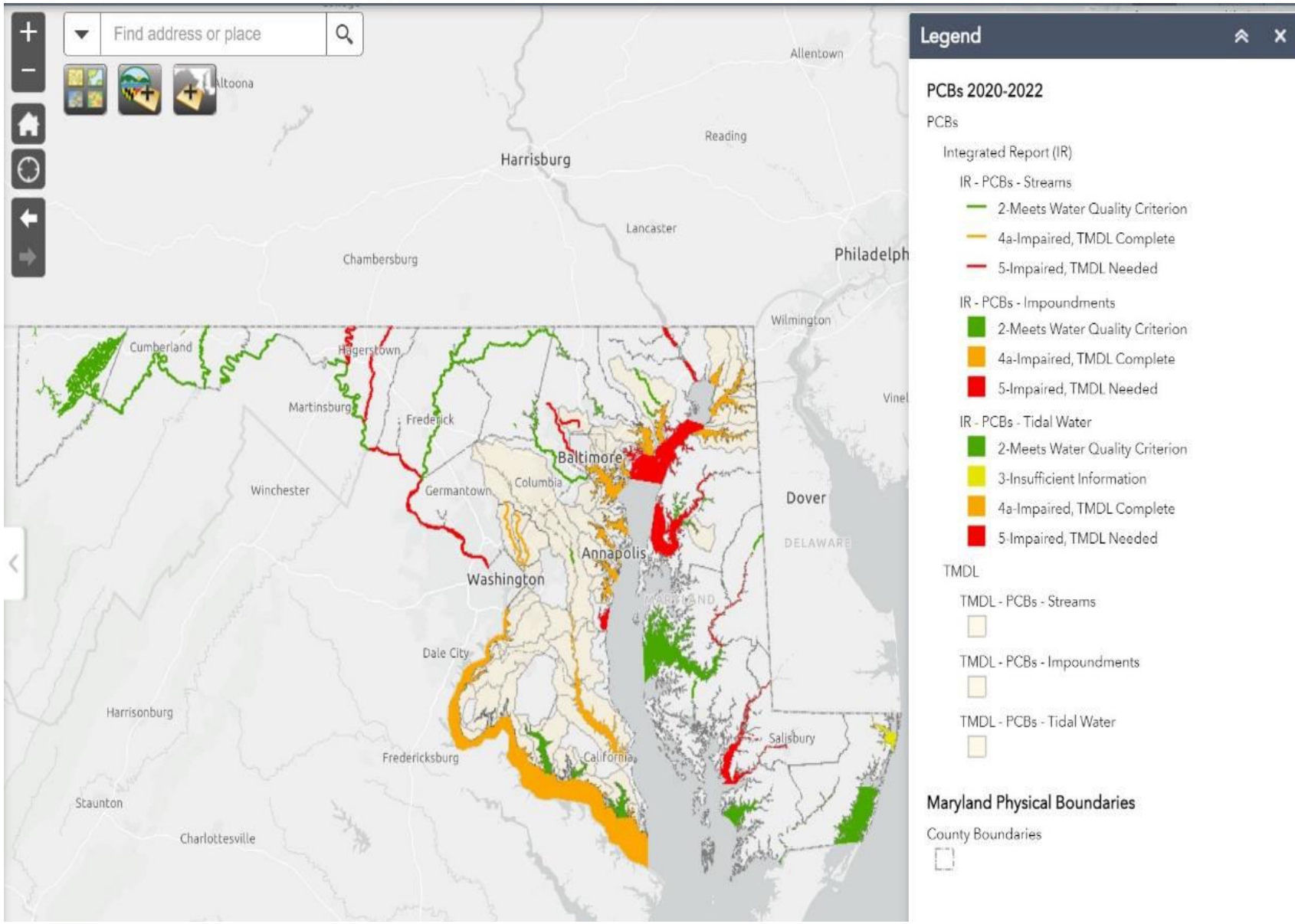


Geo Programs PCB Conference Chesapeake Bay Jan. 25, 2023

PCB TMDLs in Maryland

- MD began PCB TMDL development in 2007
- 18 PCB fish tissue impairment listings remain in Category 5 of Maryland's Integrated Report
- 5 PCB fish tissue impairment delisted to Category 2 as new fish tissue data demonstrates levels are below listing thresholds
- PCB TMDLs have been developed to address 29 PCB impairment listings (27 fish tissue and 2 sediment) from Category 5
- MD is currently developing three PCB TMDLs (Conowingo Pool, Lower Susquehanna River, and Middle River)

Online map of MD's IR listings and TMDLs: https://mdewin64.mde.state.md.us/WSA/IR-TMDL/index.html?webmap=781f15f1fd9d49ec8ead41afb03e1761



Geo Programs PCB Conference Chesapeake Bay Jan. 25, 2023

Maryland

PCB TMDL Essentials

- PCB TMDLs requiring significant watershed load reductions are located in urban watersheds with high density residential, commercial, and industrial land use developed during the PCB era (e.g., Baltimore Harbor, Back River, Anacostia River).

- PCB TMDLs have been developed using tidal prism models, 1-D numeric water quality models, and EFDC 3-D hydrodynamic/water quality models (in-house development and VIMS).

- Phase I MS4s jurisdictions (7 counties) have been assigned NPDES regulated stormwater WLA reductions in 7 PCB TMDLs . New Phase I MS4 permits include a PCB source trackdown requirement and control or remediation through MDE regulatory actions or local management/programmatic actions.

Maryland

New MS4 Guidance for PCB TMDLs

- MDE released guidance in September 2022 to assist Phase I MS4s in developing their source trackdown plans: https://mde.maryland.gov/programs/water/TMDL/DataCenter/Pages/TMDLStormwaterImplementation.aspx

- Guidance requires Phase I MS4s to conduct a PCB source assessment (desktop analysis), subwatershed prioritization strategy, and multi-phase source trackdown investigation (long term adaptive process)

- MDE is providing field support to assist Phase I MS4s in sampling for their PCB source trackdown investigations

PCB TMDL Highlights and Needs

Maryland

Comprehensive water quality monitoring of fish tissue, sediments, and water column to support water quality model development, TMDL endpoint development, and watershed load estimation.

- Low-cost low detection level PCB analytical methods to reduce monitoring expenses
- Innovative monitoring techniques for stormwater outfall sampling and storm sewer trackback investigations
- Innovative stormwater management practices for enhancing capture of PCBs

Watershed PCB Science Needs

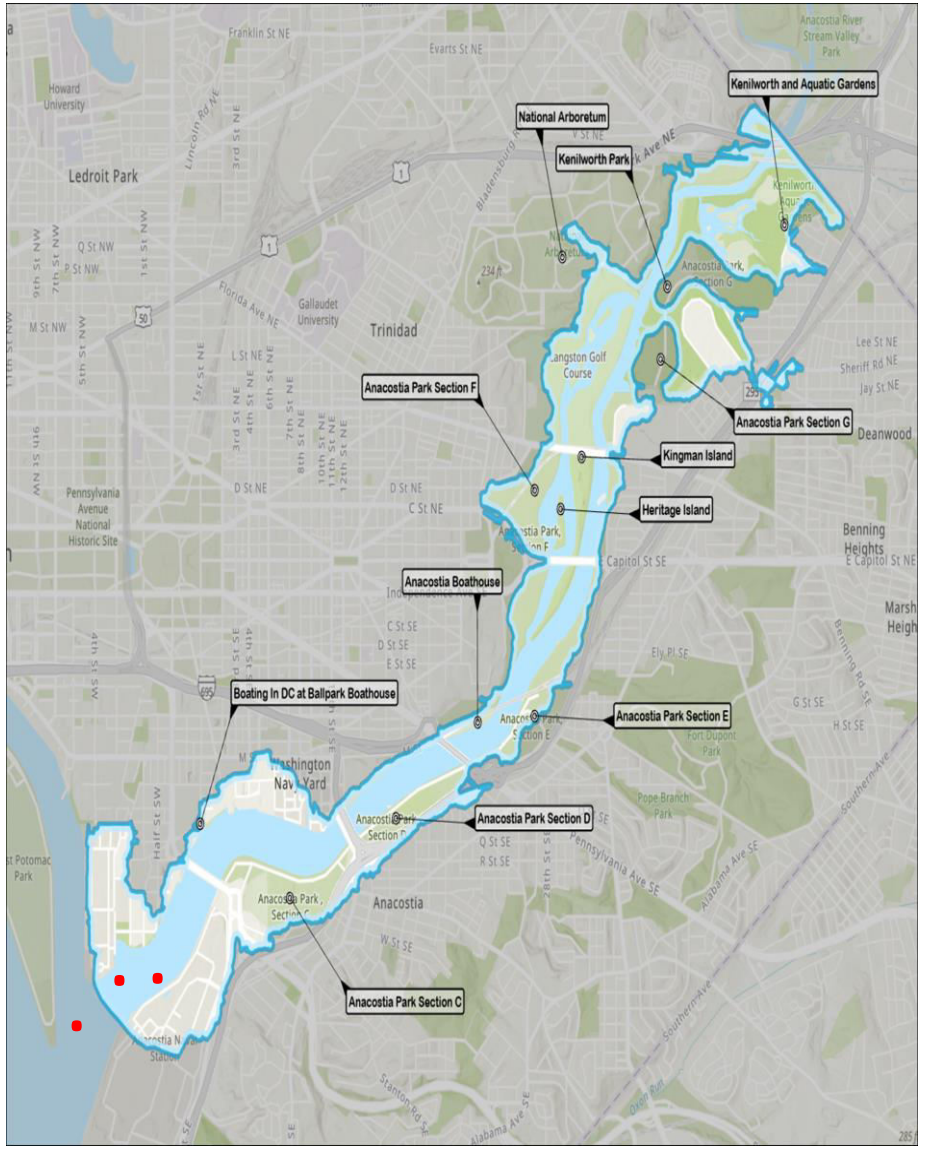
Document occurrence, concentration, and sources of PCBs in different landscape settings

- Method 1668 database and develop a statistical model to examine congener occurrence, concentration and source with different land use categories. Make transferable to watersheds without such databases.
- Utilize compiled data sets from states and federal agencies to examine trends in concentrations in 3 basins of different dominant land use of the Chesapeake Bay.
- Influence of historic and current land use practices on PCB contamination of soils and stormwater sediments (Kjellerup and Davis, UMCP)
- Occurrence of PCBs in stormwater management pond sediment and relationship to land use (Needham and others, in preparation, USGS)

Watershed PCB Science Needs

Design and Implement a PCB Monitoring Program to assess changes in concentrations associated with mitigation actions

- Geographically-focused areas with PCB TMDLs and other ongoing PCB remediation
- Surface water and fish sampling and analysis using common methods, time intervals
- Design at a scale not currently being assessed by jurisdictions



Chesapeake Bay PCB TMDL Contacts		
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DC Dept. of Energy and Environment	George Onyullo	george.onyullo@dc.gov
VA Dept. of Environmental Quality	Mark Richards	mark.richards@deq.virginia.gov

Cross Geo-Programs Contaminants Conference
January 25, 2023

PCBS IN THE DELAWARE RIVER AND DELAWARE'S EFFORTS TO ACCELERATE PCB REDUCTIONS

EPA Cross Program Contaminant Symposium

John G. Cargill IV, P.G.

Delaware Department of Natural Resources and Environmental Control

Division of Watershed Stewardship

January 25, 2023

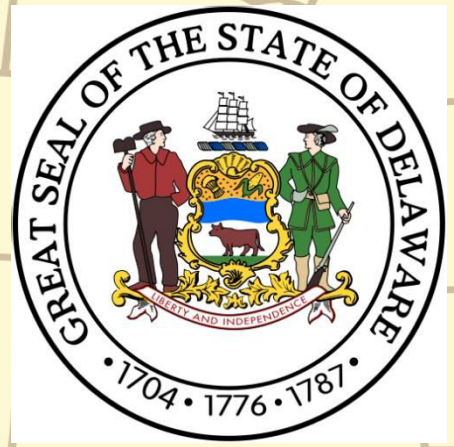
PRESENTATION OUTLINE

The Delaware River and Basin

DRBC and PCB TMDLs

Delaware's Approach & Example

DELAWHERE?


GREAT SEAL OF THE STATE OF DELAWARE
LIBERTY AND INDEPENDENCE
•1704 • 1776 • 1787•

DELAWARE RIVER AND BASIN

- Longest undammed river East of the Mississippi River
- Contains both tidal and non-tidal environments
- 330 miles long, entirely interstate
- Headwaters begin in Hancock, NY
- Mouth is located at Cape May, NJ and Lewes, DE where it drains to the Atlantic Ocean
- More than 2,000 tributaries, 216 classified as "major tributaries"
- Non-tidal portion stretches 200 miles from NY to Trenton, NJ
- Tidal potion extends 133 miles from Trenton, NJ to Delaware Bay (aka Delaware Estuary)

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https://www.state.nj.us/drbc/basin/

DELAWARE RIVER AND BASIN

- Basin includes 10 main sub-watersheds
- 5 physiographic regions
- 4 states
- 42 Counties
- 868 municipalities
- 13.3 million people rely of its water for drinking, agriculture and industrial use
- 6.4 billion gallons of water withdrawn daily
- Supports Philadelphia and New York City, two of the nation's largest cities
- 850 million gallons/day is consumed and not returned
- Supports a $20 billion water-based economy annually
- Supports 600,000 jobs

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https://www.state.nj.us/drbc/basin/

BRIEF POLLUTION HISTORY

- By the mid-1900s, the urbanized part of the river around Philadelphia was being used as an open water sewer.
- The resulting lack of dissolved oxygen caused tremendous aquatic life impacts – fish couldn't survive
- By 1964, about 1M pounds of non-disinfected waste per day was being discharged by sewage treatment plants and industries
- Discharges also included slaughterhouse waste, oil from refineries, and toxic waste from chemical companies
- Sturgeon and shad, among other aquatic species all but disappeared

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https://whyy.org/articles/the-death-of-the-delaware-river/

DELAWARE RIVER BASIN COMMISSION

- In 1961, President Kennedy and the Governors of DE, NJ, PENN and NY signed legislation that created the Delaware River Basin Commission (DRBC).
- Charge is to "oversee a unified approach to managing a river system without regard to political boundaries"

- In 1972 Congress passed the Clean Water Act.
- Over the course of decades, efforts have resulted in noticeable improvement.
- Today, efforts continue to restore this great natural resource.

https://www.state.nj.us/drbc/

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DRBC FUNCTIONAL RESPONSIBILITIES

- Water Supply
- Drought Management
- Flood Loss Reduction
- **Water Quality**
- Watershed Planning
- Regulatory Review (permitting)
- Outreach/Education
- Recreation

https://www.state.nj.us/drbc/basin/

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TAKE A TOUR OF THE DELAWARE RIVER BASIN

https://www.state.nj.us/drbc/library/documents/DelawareRiverTour_DoaneAcademy_jan2019.pdf

FOR MORE INFORMATION

https://www.state.nj.us/drbc/basin/

Delaware River Basin Commission

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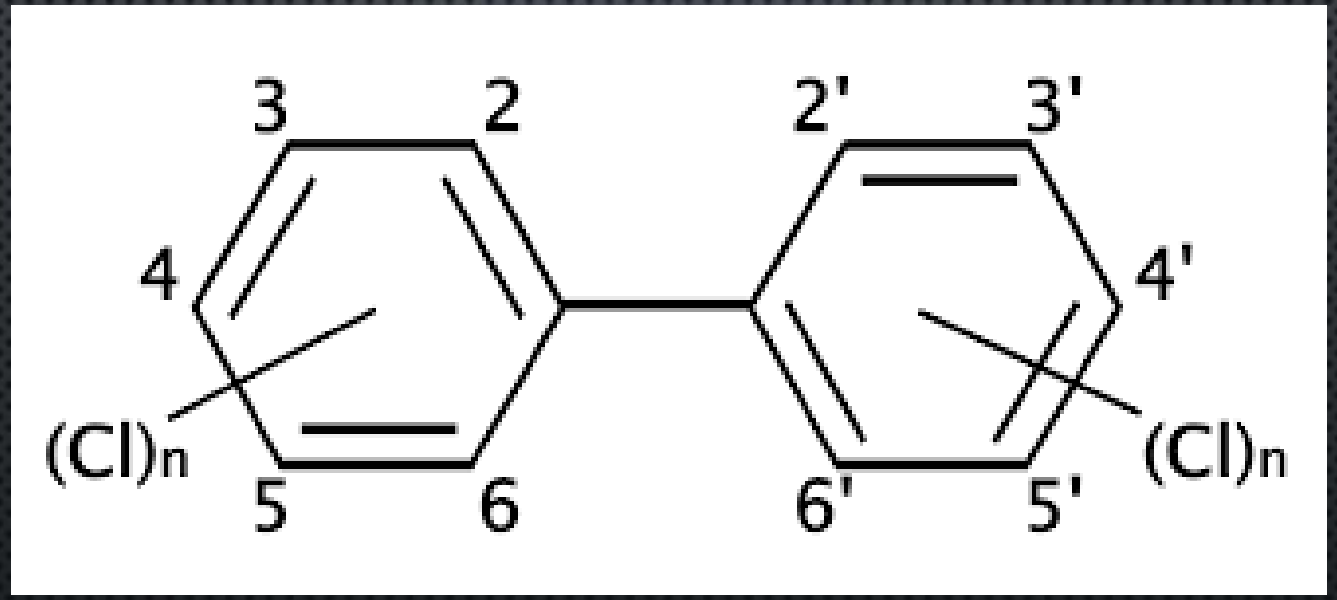
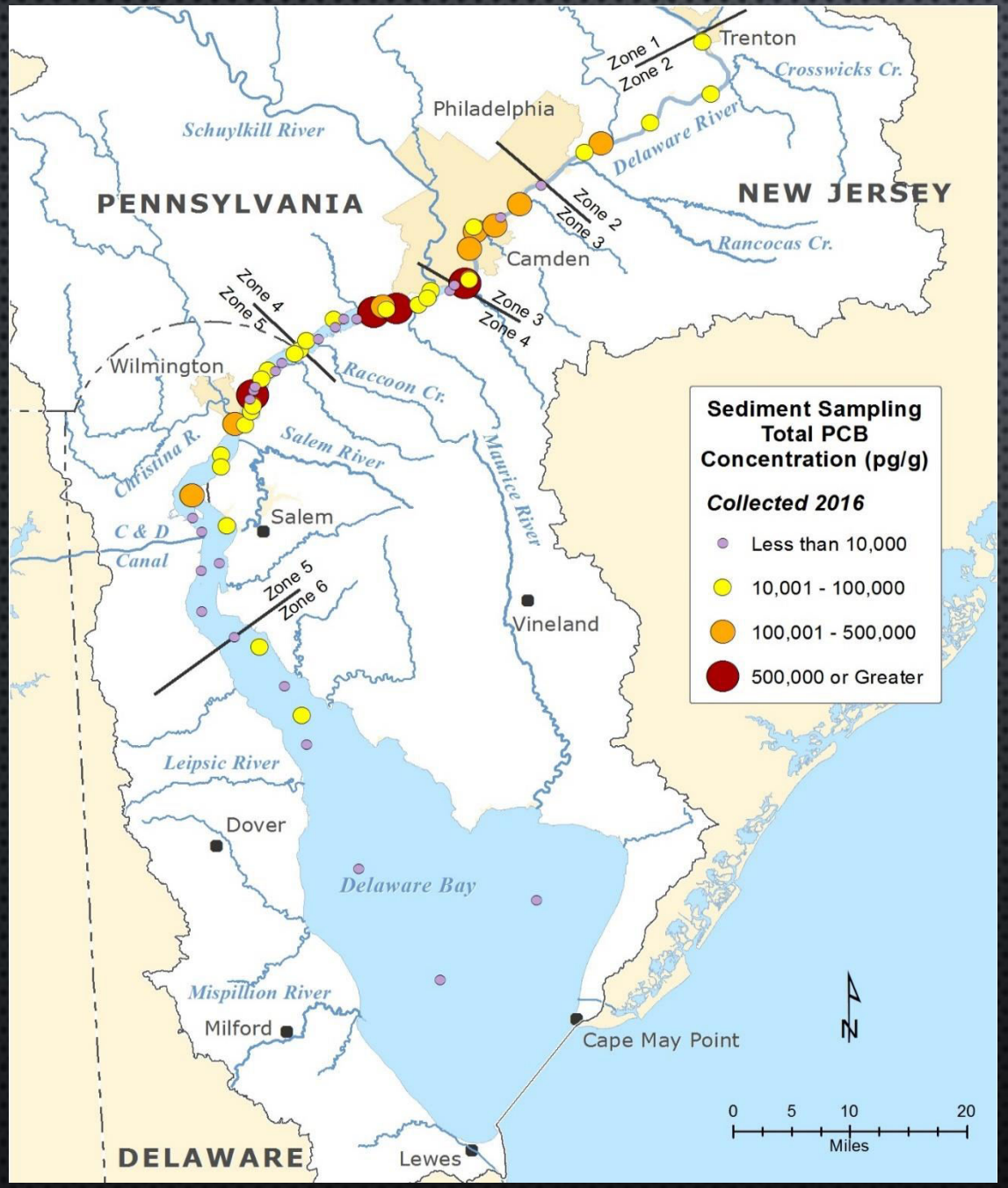
LET'S TALK ABOUT THE PCBS



PCB WATER QUALITY CRITERIA – DE RIVER ESTUARY

Aquatic Life	Acute (µg/L)	Chronic (µg/L)
Freshwater (0-5 ppt)	1.0	0.014
Marine (>5 ppt)	5.0	0.03

Human Health (at 10^{-6})	Water + Fish Consumption (µg/L)	Fish Consumption Only (µg/L)
Freshwater	0.000016	0.000016
Marine	NA	0.000016
Human Health - Systemic	**Water + Fish Consumption (µg/L)**	**Fish Consumption Only (µg/L)**
Freshwater	0.00839	0.00849
Marine	NA	0.00149



MONITORING SEDIMENT QUALITY (DRBC)

- Sediment can be a significant source of PCBs
- Understanding the distribution, concentrations and chemical signature provides information regarding potential sources
- DRBC sediment sampling for PCBs last occurred in 2016 (n=60)

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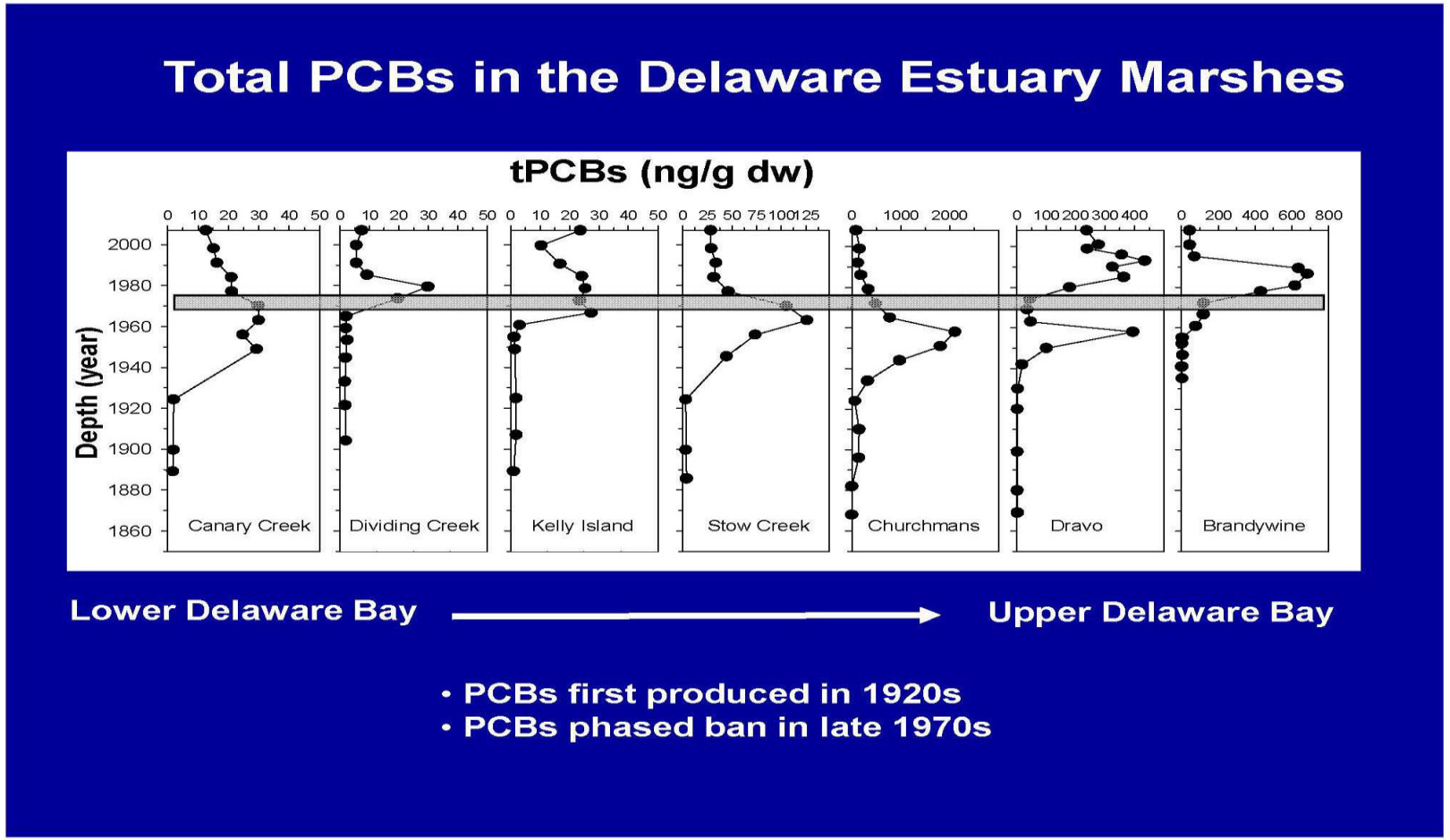
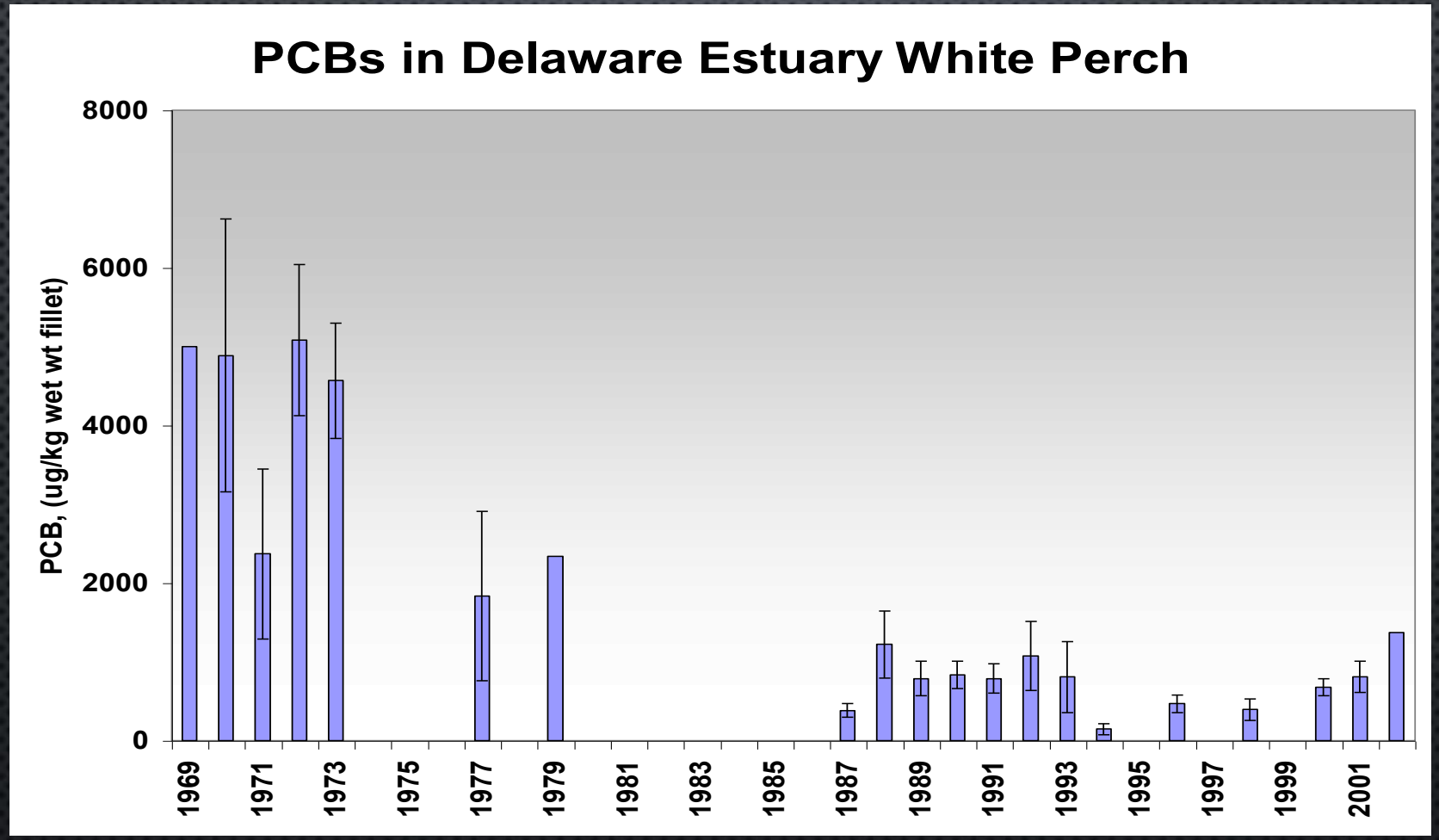
PCBS IN FRINGE MARSHES ADJACENT TO DE ESTUARY



Sampling conducted in 2007 & 2008 by Univ. of DE and Academy of Natural Sciences

MONITORING FISH QUALITY

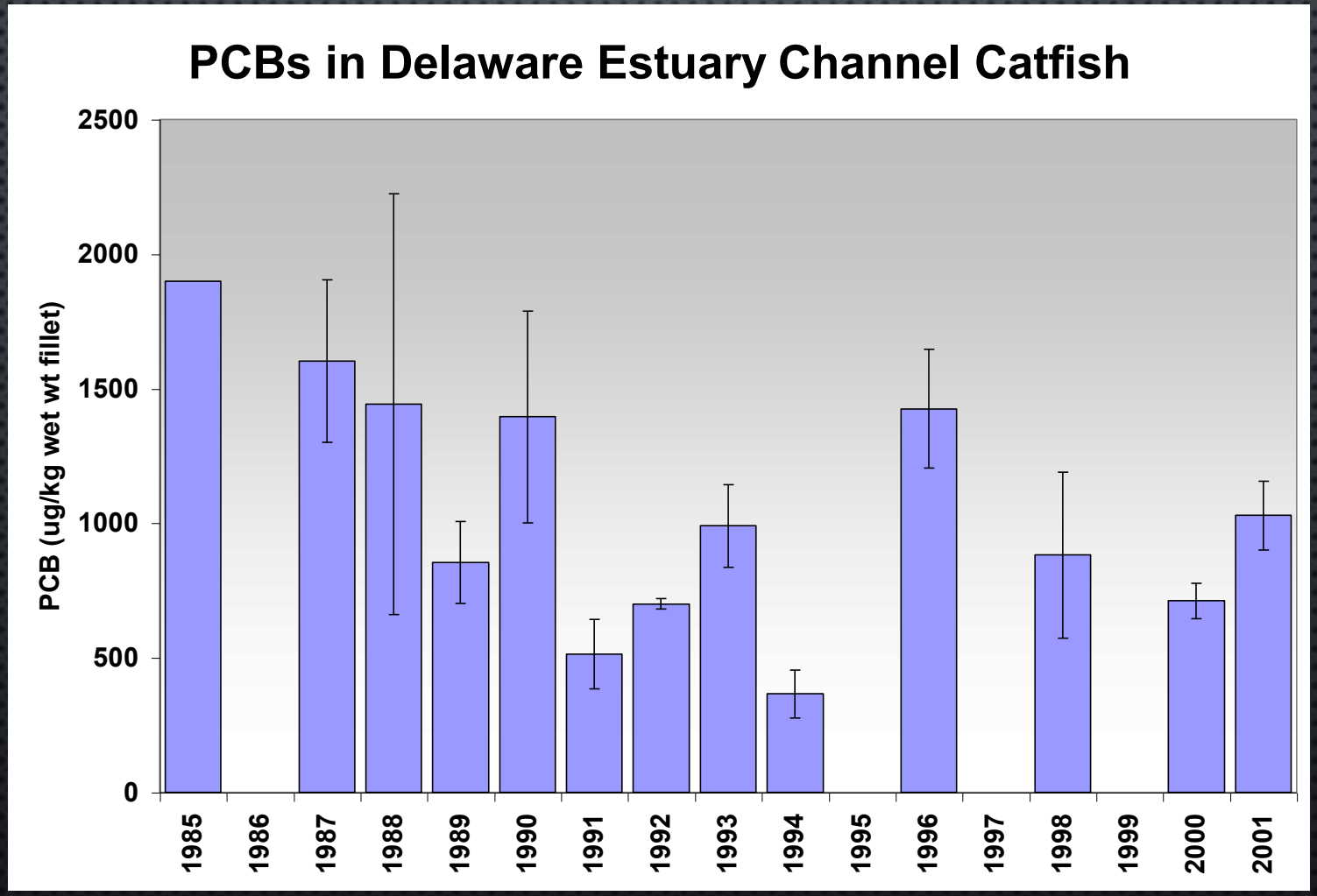


Longest Record Available

Mean & S.E. averaged over Zones 2-6

PCB Levels Dropping Overall

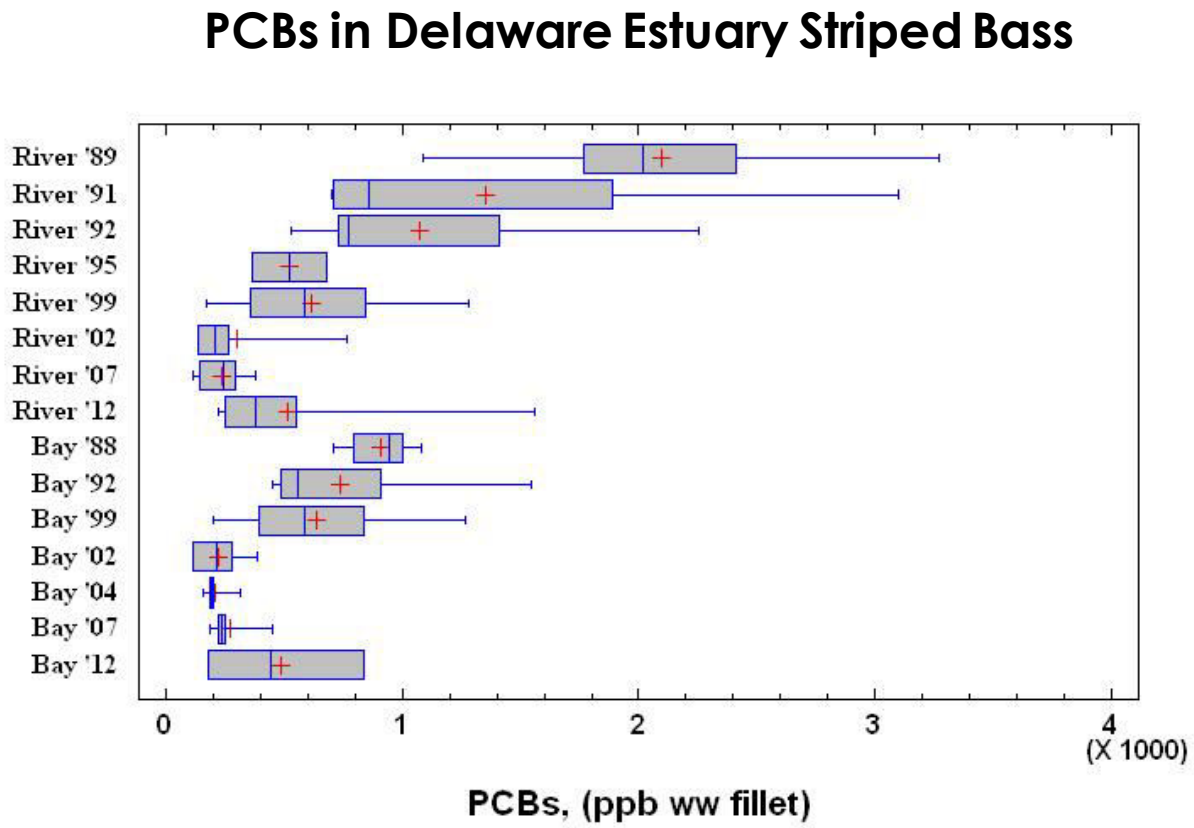
MONITORING FISH QUALITY



Mean and S.E. averaged over Zones 2-6

PCB Levels dropping overall

MONITORING FISH QUALITY



River = Cherry Island Flats – upper estuary spawning grounds in Zone 5

Bay = Lower Estuary in Zone 6

PCB Levels Dropping Overall

PCB TOTAL MAXIMUM DAILY LOAD

Delaware Estuary portion of the Basin (133 river miles) consists of 5 water quality management units called "Zones"

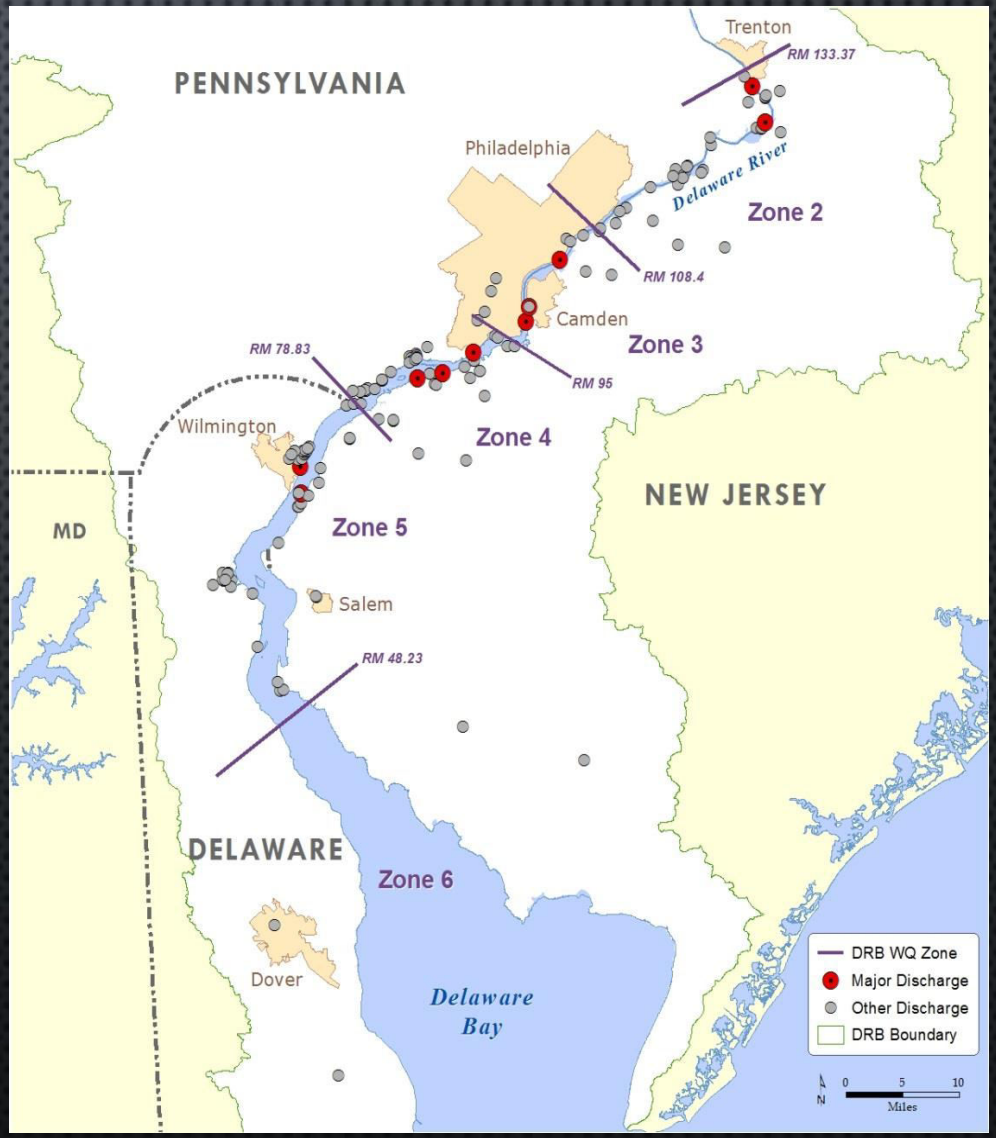
- Zone 3 to upper Zone 5 is urban/industrial
- Zone 6 agriculture/rural/marsh

Delaware Estuary was listed as impaired on 303(d) list for PCBs in fish in mid-late 1990s

Stage 1 PCB TMDLs established for Zones 2-5 in 2003, and for Zone 6 in 2006

PCB Water Quality Criterion of 16 pg/L adopted by DRBC in 2013

State 2 PCB TMDL is currently in development



https://www.state.nj.us/drbc/basin/

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STAGE 1 PCB TMDL REQUIREMENTS

- Monitoring using EPA Method 1668 A
- Development of Pollutant Minimization Plans (PMPs)
- Implementation of minimization measures identified by PMPs

- Monitoring and PMPs required through NPDES permits or directly through DRBC regulations (>90% of dischargers participating)
- DRBC Coordinates TMDL activities between EPA Regions 2 and 3 and the basin States
- DRBC developed and maintains a PCB Database

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POLLUTANT MINIMIZATION PLANS (PMPS)

Goal: Reduction of PCB loadings to the Estuary

Key PMP Elements

- Source identification and reduction
- Monitoring and progress report
- Remediation/reduction activities

PMP Approaches:

- Perform trackdown studies to identify sources
- Remove PCB transformers and capacitors
- Contaminated sediment control and/or removal
- Control solids
- Investigate inadvertent PCB production

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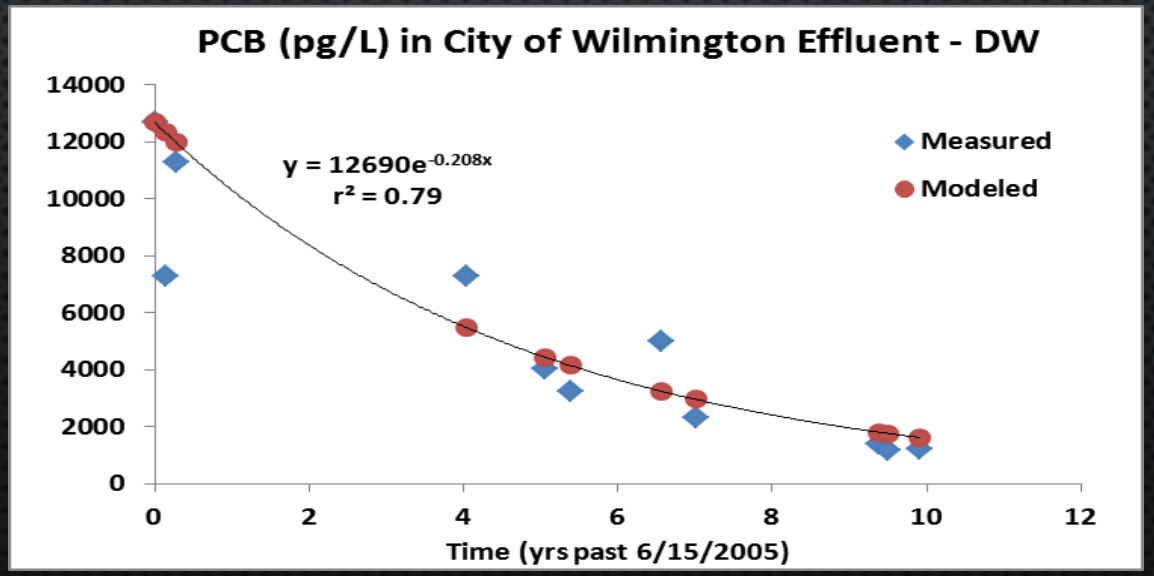
OVERALL PCB POINT SOURCE LOADING REDUCTIONS

- PCB reductions observed in municipal and industrial discharges across the entire Estuary
- The 10 largest point sources reduced loadings by 76% between 2005 and 2016.
- All point sources reduced loadings by 64% between 2005 and 2013



PHASE I PCB TMDL CONCLUSIONS

The implementation of the PCB TMDLs in the Delaware Estuary and Bay has achieved remarkable success. The realization is that more needs to be done.

Essential elements include:

- Consistent monitoring (Method 1668A) and reporting methodologies, and a centralized database management system to track reductions
- Continued implementation of PMPs which provide a framework for evaluating PCB loadings and subsequent reductions
  - Identifying and removing sources
  - Trackdown of legacy contamination and performance of remedial measures
- Review of annual reports and feedback to dischargers, fostering an environment of collaboration

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FISH CONSUMPTION ADVISORY CHANGES

NEWS for immediate release

For more information: DNREC Public Affairs Office 302-739-9902

Contact: Melanie Rapp, DNREC Public Affairs, 302-739-9902
DHSS: Rita Landgraf, Secretary; Jill Fredel, Director of Communications, 302-255-9047

Delaware issues updated fish consumption advisory

Updated advisory for the tidal Delaware River reflects long-term environmental improvements

DOVER (Oct. 23, 2013) – The Department of Natural Resources and Environmental Control and the Department of Health and Social Services' Division of Public Health today updated the fish consumption advisory for fish caught in the tidal Delaware River. The updated advisory is a result of analysis of chemical contaminants in fish caught in the tidal Delaware River and elsewhere throughout the state. The change reflects long-term environmental improvements in the tidal Delaware River.

The fish consumption advisory for the tidal Delaware River from the Delaware/Pennsylvania/New Jersey border to the C&D Canal has been updated to a less restrictive advisory due to falling levels of polychlorinated biphenyls (PCBs), dioxins and furans, chlorinated pesticides, and mercury. For the general adult population, the current advice has been changed from "eat no finfish caught in the tidal Delaware River north of the C&D Canal" to "eat no more than one eight ounce meal of finfish per year," while retaining the "do not eat" advice for women of childbearing age and young children. This advisory is being issued today in collaboration with the New Jersey Toxics in Biota Committee and the Delaware River Basin Commission.

In 2018, for the general adult population, the advice was changed again, from "eat nor more than one eight-ounce meal of finfish per year caught in the Delaware River north of the C&D Canal" to "eat no more than three eight-ounce meals of finfish per year."

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DRAFT STAGE 2 PCB TMDL*

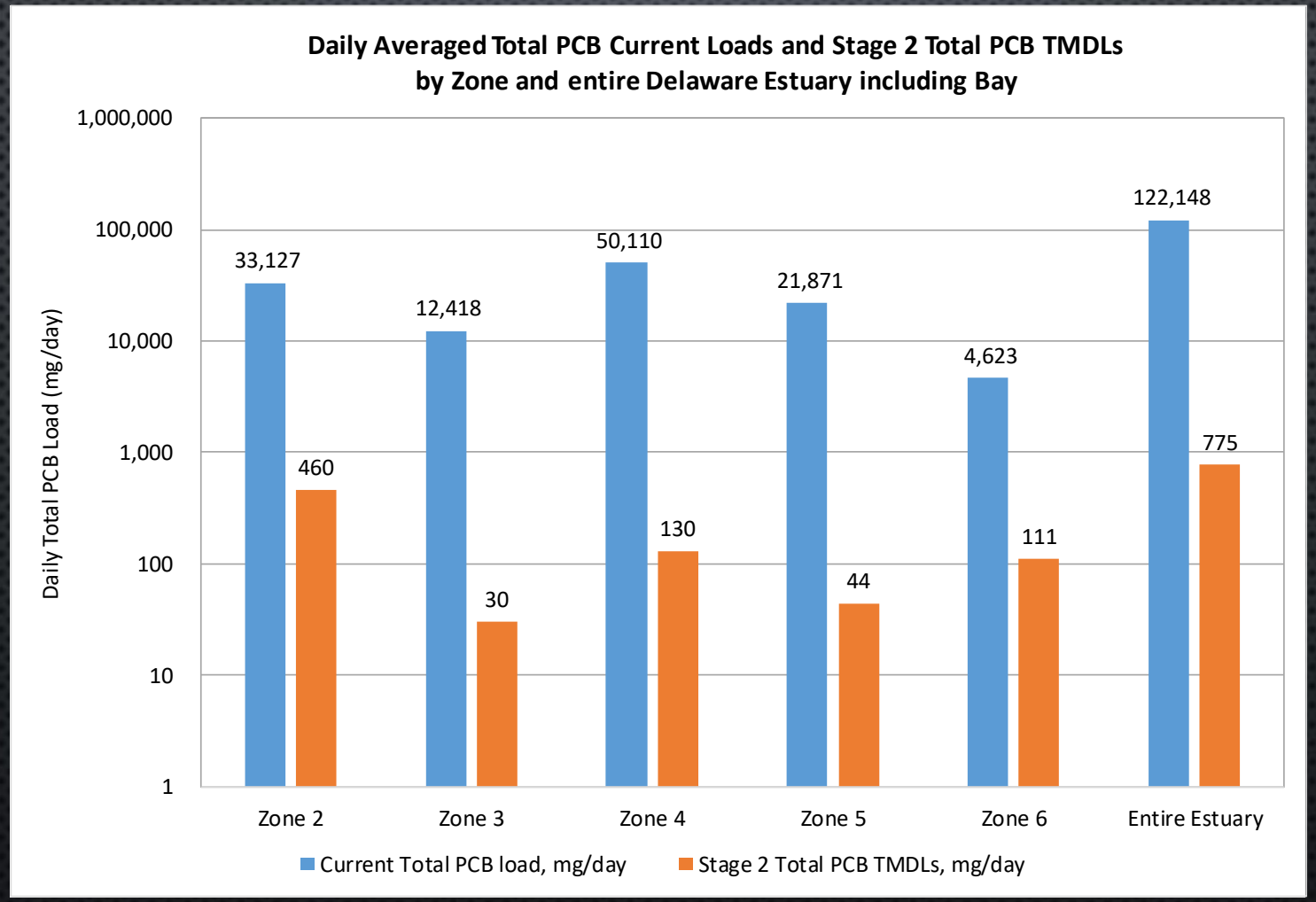
EPA, DRBC, and the basin States have been working on the Stage 2 PCB TMDL for the Delaware River Estuary and Bay since 2017.

Primary Differences, if approved:

- Revised water quality standard set at 16 pg/L
- Updated current source loads
- Allocation Procedure: Equal Percent Reduction (EPR) to Equal Effluent Concentration (EEC)
  - All source categories assigned an allocation based upon a uniform effluent concentration. Allocation = Flow * 15.2 pg/L (criterion - MOS)
  - Allocations for updated source inventory including 83 contaminated sites
  - Updated Pollution Minimization Plan (PMP) approach to reach WLAs

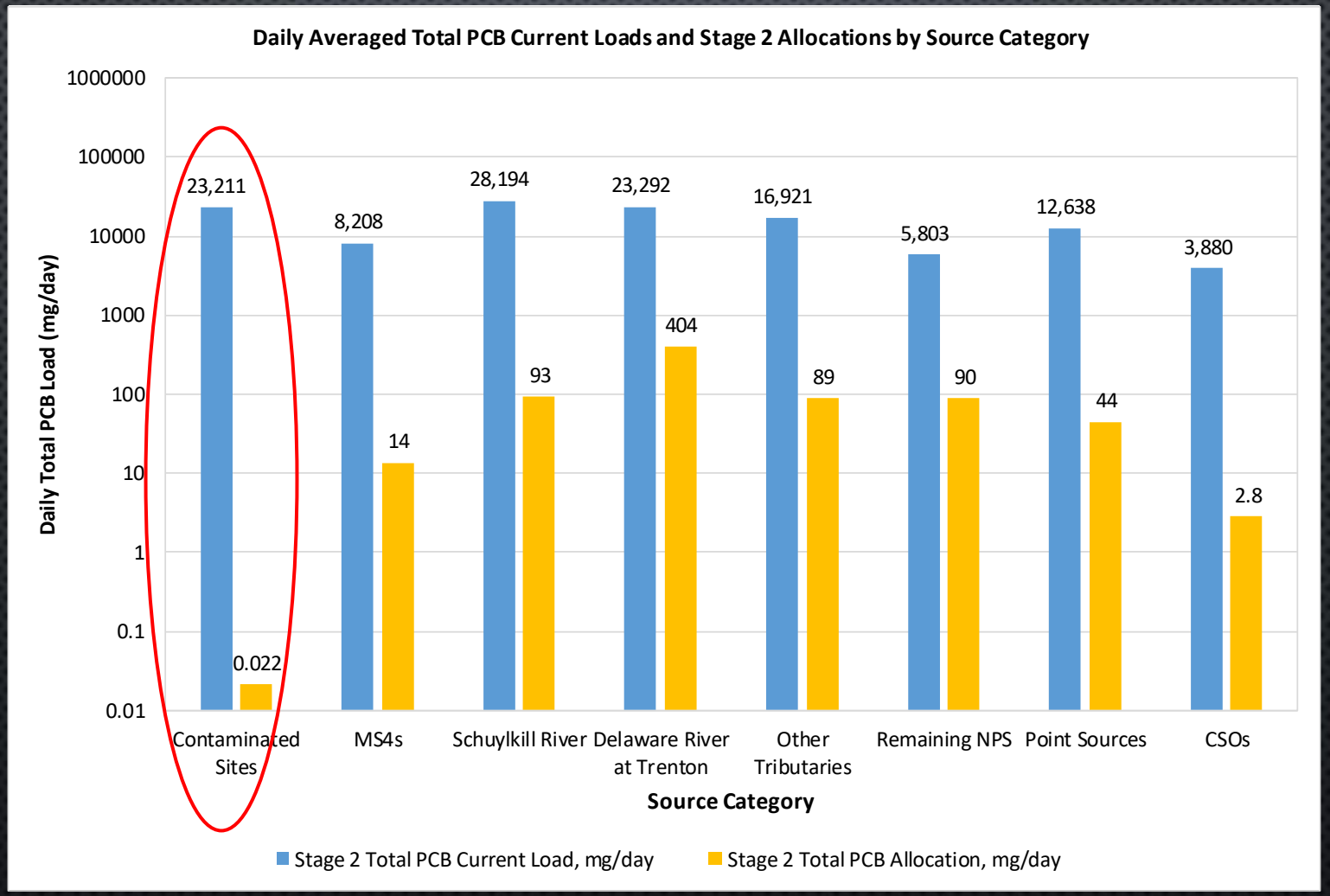
*Stage 2 PCB TMDL is under development, and is considered DRAFT

CURRENT PCB LOAD VS DRAFT STAGE 2 PCB TMDL*



*Stage 2 PCB TMDL is under development, and is considered DRAFT

CURRENT PCB LOAD VS STAGE 2 TMDL ALLOCATION*



*Stage 2 PCB TMDL is under EPA review/edit, and is considered DRAFT

WHAT IS DELAWARE DOING TO HELP?

DNREC'S APPROACH TO THE PCB PROBLEM

- Holistic - A matter of scale and too much to do alone

- Collaborative – Delaware committed to being part of the solution along with other Delaware River Basin states.
  - Delaware River Basin Commission (DRBC) is the integrator
  - EPA, with support from DRBC and basin states, issued Delaware River PCB Total Maximum Daily Load (TMDL) which applies to Delaware River and tidal tributaries.

- Through **WATAR** – DNREC program that combines goals of multiple Sections:
  - DNREC-Remediation Section– CERCLA/RCRA style cleanup programs
  - DNREC Watershed Assessment & Management Section– CWA compliance programs
  - DNREC-Surface Water Discharges Section– CWA permitting programs

De.gov/WATAR

WHAT IS WATAR?

WATERSHED APPROACH TO TOXICS ASSESSMENT AND RESTORATION

- **"Whole Basin Management" framework** – "*…programs from throughout DNREC work in an integrated manner to assess different geographic areas of the State defined on the basis of drainage patterns*"
- **Focus on Persistent, Bioaccumulative, and Toxic (PBT) compounds** – *Risk drivers for fish consumption advisories*
- **Linking Sources and Sinks** – *advanced sampling and analysis utilizing multiple lines of evidence*
- **Major Goal –** fishable, swimmable and potable in the shortest timeframe possible

OBJECTIVES OF WATAR

- Compile toxics data for the surface waters, sediments, and biota
- Create a "clearing house" of data for regulatory and remedial decision making and prioritization (EQuIS)
- Sample levels of toxic substances in priority waters
- Establish TMDLs/TMDL Alternatives for toxics as needed
- Identify high priority remediation projects that have potential for significant watershed scale improvement
- Facilitate technology transfer to incorporate WATAR into management decisions

FISHABLE, SWIMMABLE & POTABLE IN THE SHORTEST TIMEFRAME POSSIBLE

HIGH RESOLUTION MULTI-MEDIA SAMPLING

SURFACE WATER

- PCBs by EPA Method 1668
- Dioxins and Furans by EPA Method 1613
- Organochlorine Pesticides by EPA Method 1699
- PAHs + Alkylated Homologs by EPA Method 8270/1625

General WATER parameters and sorbents

- BC of Suspended Sediments
- PC, POC, DOC
- Chl-a
- TSS
- DO, T, Cond, pH

SEDIMENT

- PCBs by EPA Method 680/1668
- Dioxins and Furans by EPA Method 1613
- Organochlorine Pesticides by EPA Method 8081
- PAHs + Alkylated Homologs by EPA Method 8270 SIM
- Mercury by EPA Method 7471
- Metals by EPA Method 6020 (Christina Basin)

General SEDIMENT parameters and sorbents

- TOC/BC
- Bulk Density
- Specific Gravity of Solids
- % Moisture
- Grain Size

FISH TISSUE

- PCBs by EPA Method 1668
- Dioxins and Furans by EPA Method 1613
- Organochlorine Pesticides by EPA Method 1699
- PAHs + Alkylated Homologs by EPA Method 8270/1625
- Total Mercury by EPA Method 1631
- Methyl Mercury by EPA Method 1630
- PFAS by EPA Method 537(M)
- % lipid

Other for Water, Sediment and Fish

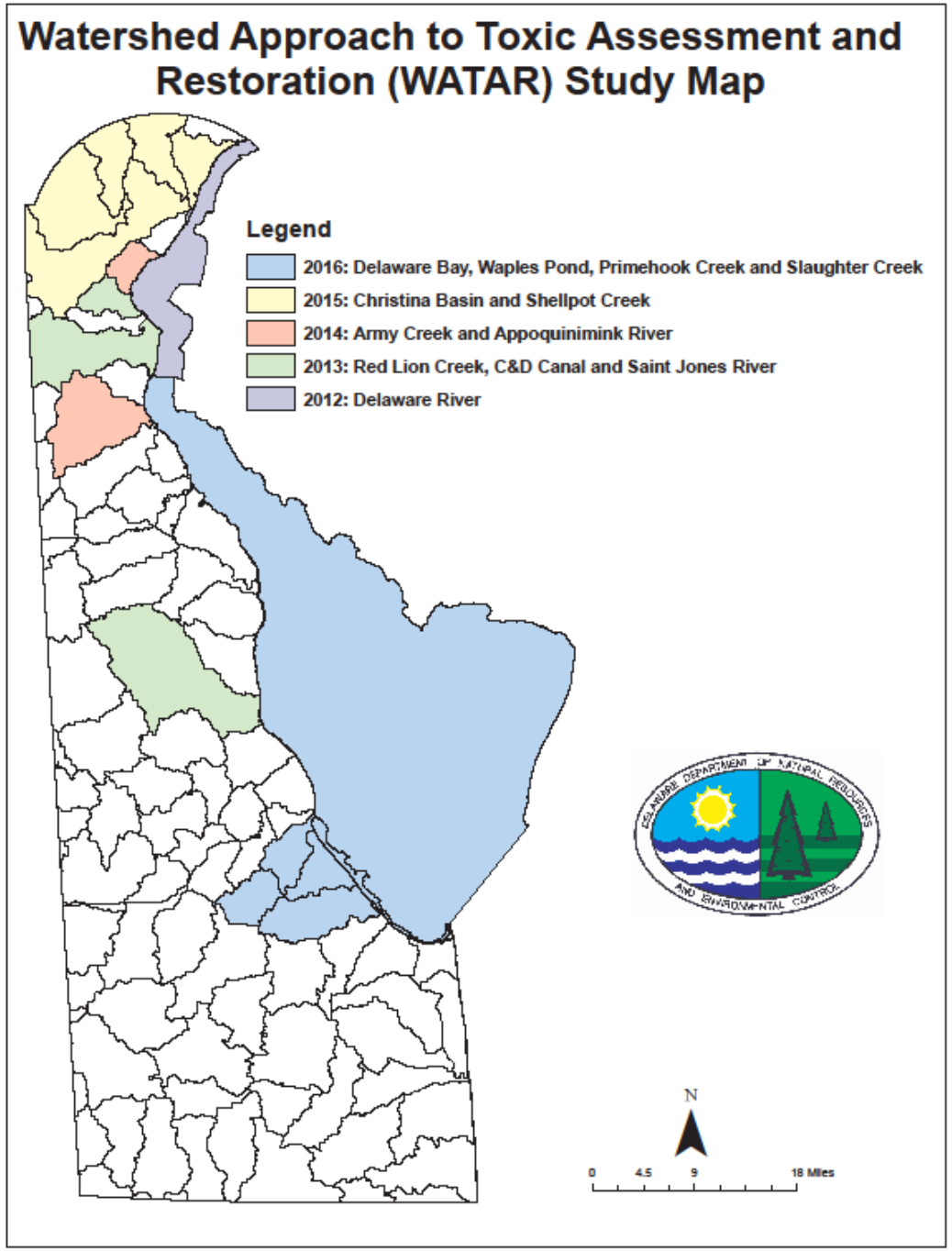
- Chlorinated Benzenes in Red Lion Watershed
- Ambient toxicity (Water only – DRBC)

HOW ARE THE DATA BEING USED ?

- Document improvements (trends) in fish contamination and support revised fish consumption advisories
- Improve/Justify 303(d) listing/delisting decisions and TMDLs
- Identify/Prioritize target areas for follow-up investigation/remediation
- Develop State-specific BAFs & BSAFs and associated human health water quality criteria
- Support NRDA evaluations/actions
- Support other DNREC programs when addressing toxic contaminant issues

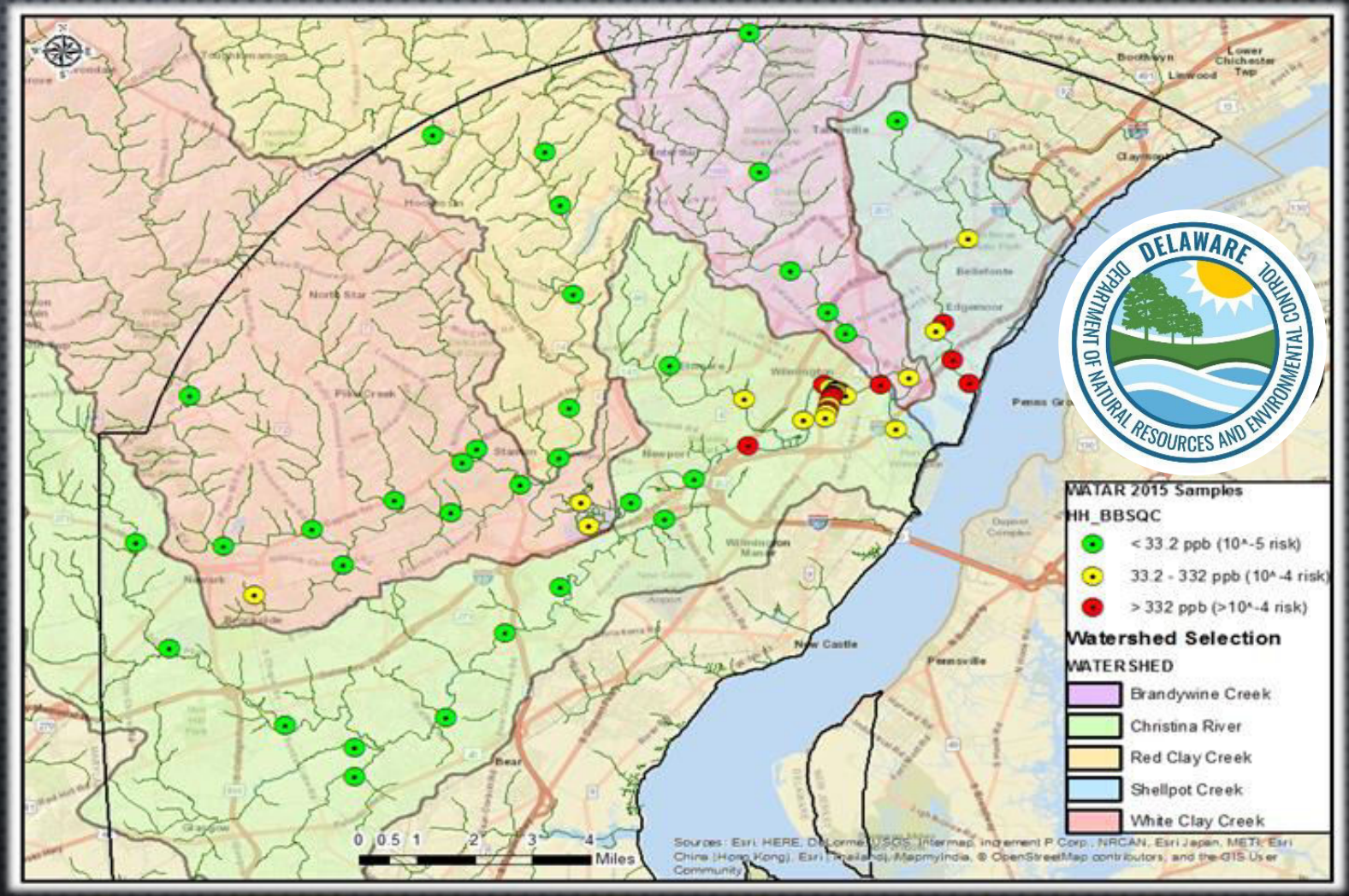
WATERSHEDS SAMPLED

- **2012 -** Delaware River
- **2013 -** Red Lion Creek, C&D Canal, Saint Jones River
- **2014 -** Army Creek, Appoquinimink River
- **2015 -** Christina River Basin (Christina River, White Clay Creek, Red Clay Creek, Brandywine Creek) and Shellpot Creek
- **2016 -** Delaware Bay, Waples Pond, Prime Hook Creek, Slaughter Creek, Red Clay Creek Trout Study
- **2017-2018 -** Chesapeake Bay Drainages
- **2019-2023 -** Return to impacted watersheds and AOCs (tidal Christina/Brandywine); continue to collect fish data for trend assessments



2015 – CHRISTINA BASIN, SHELLPOT WATERSHED

- 65 Sediment Samples
- 25 Surface Water Samples
- 25 Fish Tissue Samples



PCB Risk to Human Health: Sediment to Fish

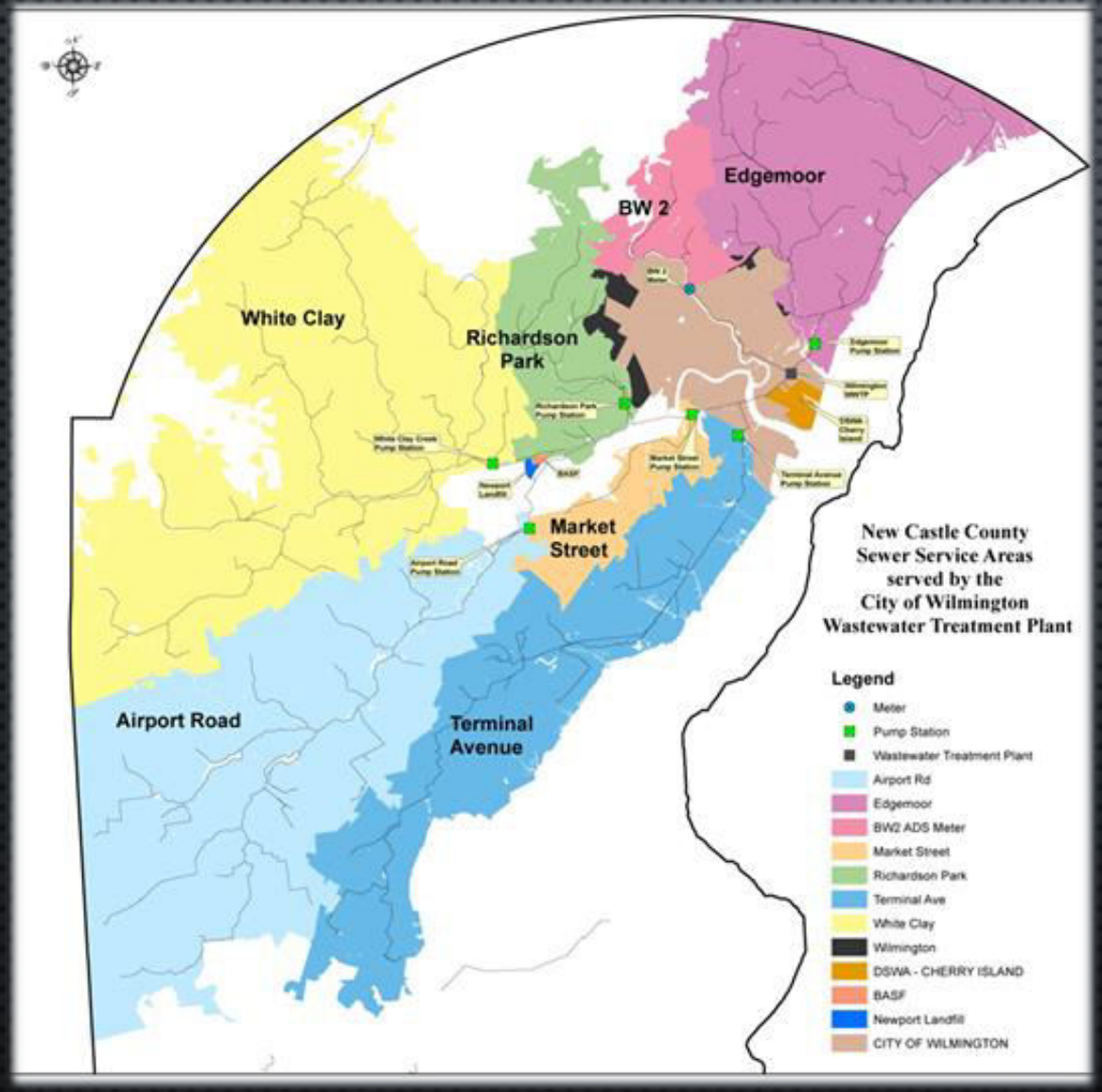
WATAR COORDINATION AMONG PROGRAMS

What are the main sources of PCBs and other PBTs?

1. NPDES Permitted Discharges
2. Storm-Water Discharges
3. Hazardous Substance (waste) Site Loads

TMDL = WLA + LA + MOS

SANITARY SEWERSHED TRACKBACK



City of Wilmington has NPDES permit to discharge treated wastewater to Delaware Estuary.

WWTP PCB discharge exceeds waste load allocation in TMDL.

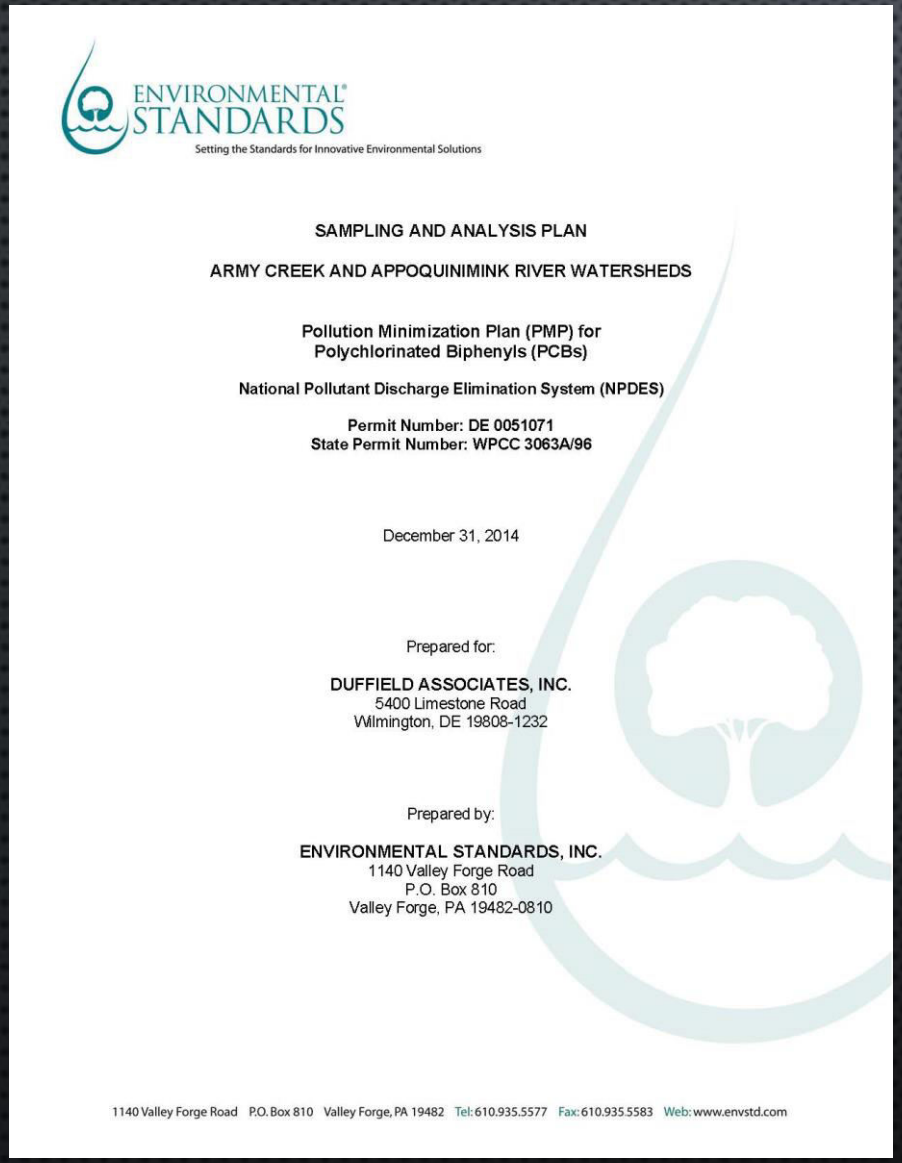
Permit has condition to reduce PCB load through pollutant minimization plan (PMP).

Key element of PMP is a PCB trackback to locate & mitigate sources.

WATAR team assists in data assessment.

Progress continues to show reduction in load to WWTP.

NCC/DELDOT MS4 PCB PMP



ENVIRONMENTAL STANDARDS
Setting the Standards for Innovative Environmental Solutions

SAMPLING AND ANALYSIS PLAN

ARMY CREEK AND APPOQUINIMINK RIVER WATERSHEDS

Pollution Minimization Plan (PMP) for
Polychlorinated Biphenyls (PCBs)

National Pollutant Discharge Elimination System (NPDES)

Permit Number: DE 0051071
State Permit Number: WPCC 3063A/96

December 31, 2014

Prepared for:

DUFFIELD ASSOCIATES, INC.
5400 Limestone Road
Wilmington, DE 19808-1232

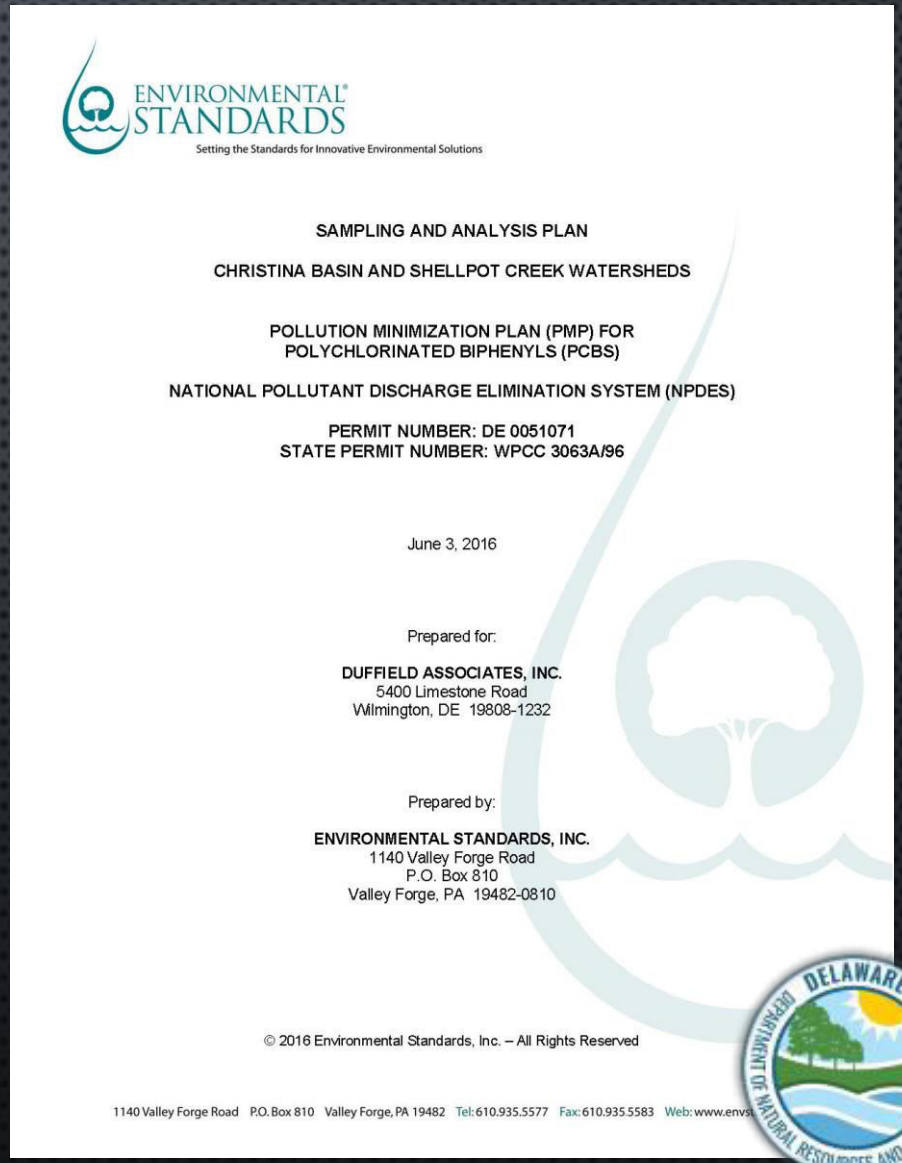
Prepared by:

ENVIRONMENTAL STANDARDS, INC.
1140 Valley Forge Road
P.O. Box 810
Valley Forge, PA 19482-0810

1140 Valley Forge Road P.O. Box 810 Valley Forge, PA 19482 Tel: 610.935.5577 Fax: 610.935.5583 Web: www.envstd.com

WATAR assisted in SAP design & suggested an approach for data assessment/display

Compliance through progress solidifies partnerships



ENVIRONMENTAL STANDARDS
Setting the Standards for Innovative Environmental Solutions

SAMPLING AND ANALYSIS PLAN

CHRISTINA BASIN AND SHELLPOT CREEK WATERSHEDS

POLLUTION MINIMIZATION PLAN (PMP) FOR
POLYCHLORINATED BIPHENYLS (PCBS)

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES)

PERMIT NUMBER: DE 0051071
STATE PERMIT NUMBER: WPCC 3063A/96

June 3, 2016

Prepared for:

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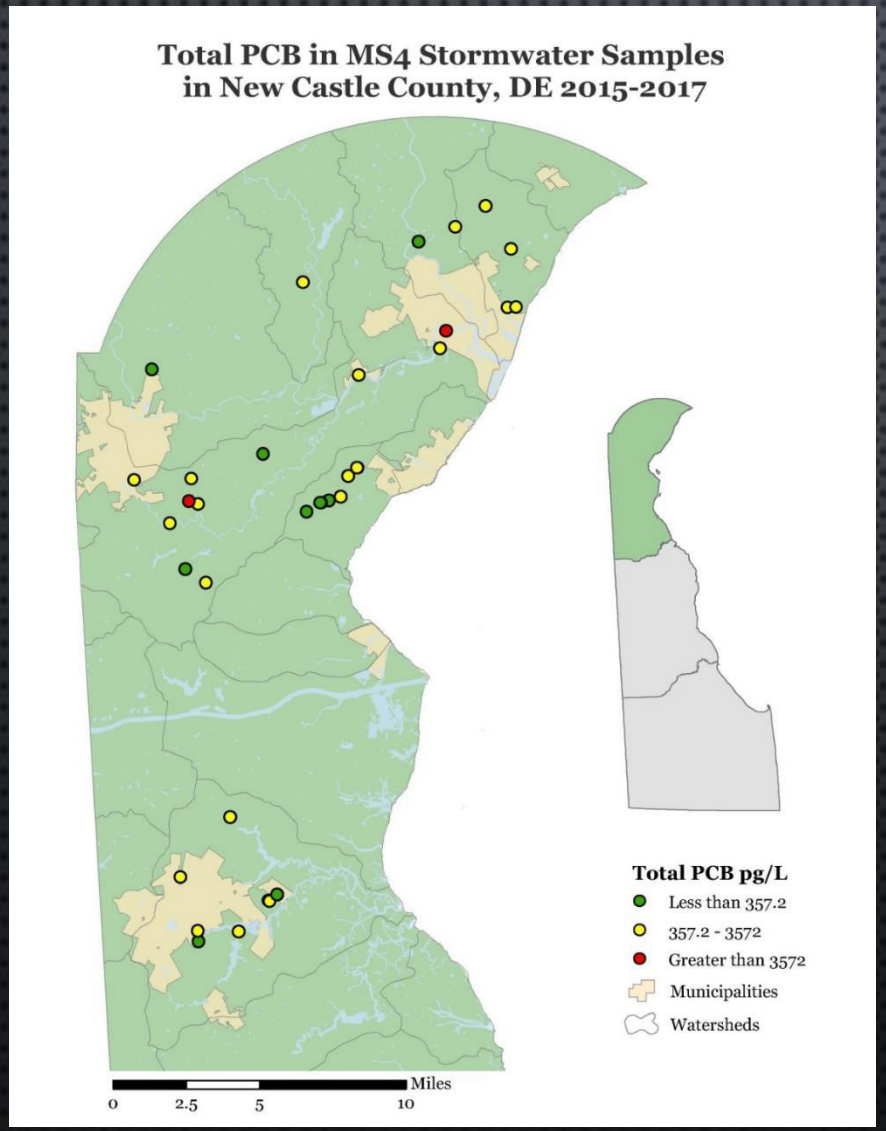
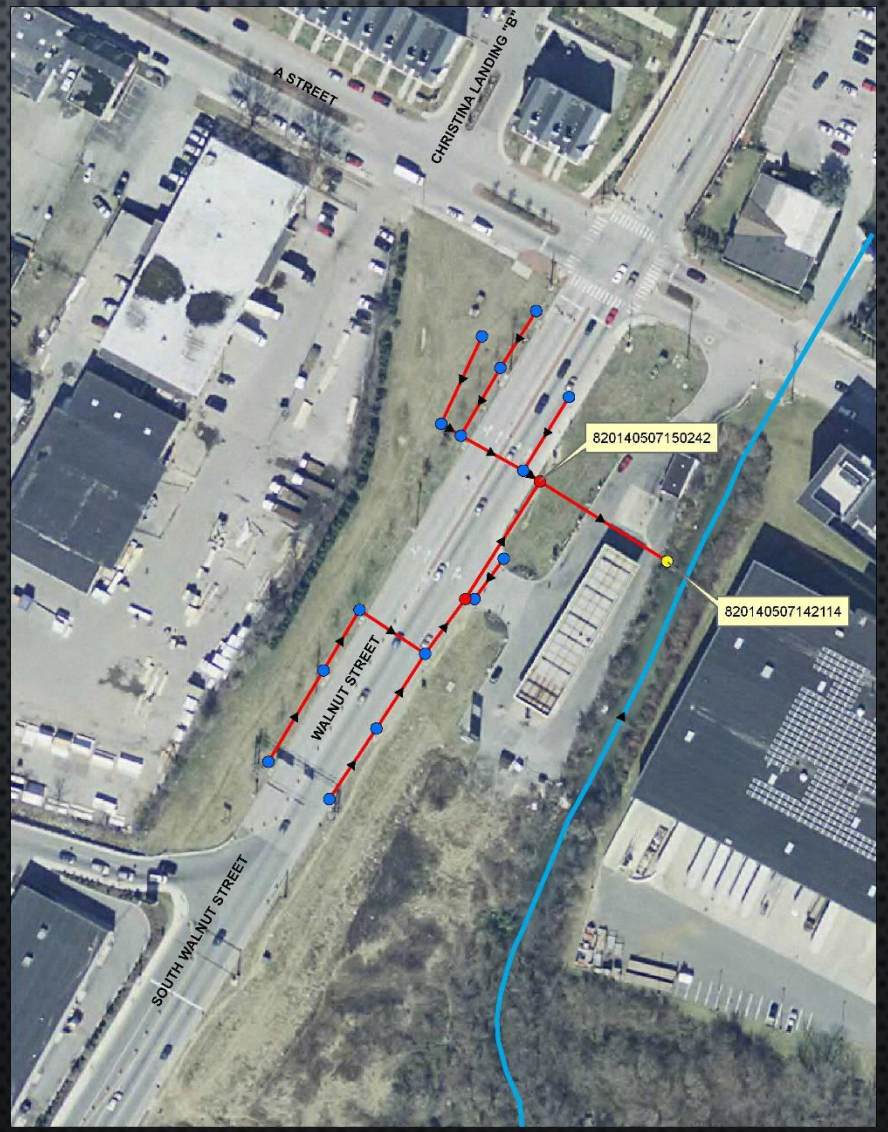
DELAWARE DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL

EXAMPLE: PCB CONCENTRATIONS ABOVE BACKGROUND IN SELECT STORMWATER SYSTEMS





Baseline for comparison: PCBs in rainwater

COORDINATION WITH DNREC-REMEDIATION SECTION

Hazardous Substance Cleanup Act (HSCA) sites along the Christina River in New Castle County, Delaware

PCB MASS LOADING FROM DE WASTE SITES

Purpose: Estimate PCB load from waste sites to surface water via overland flow + groundwater transport

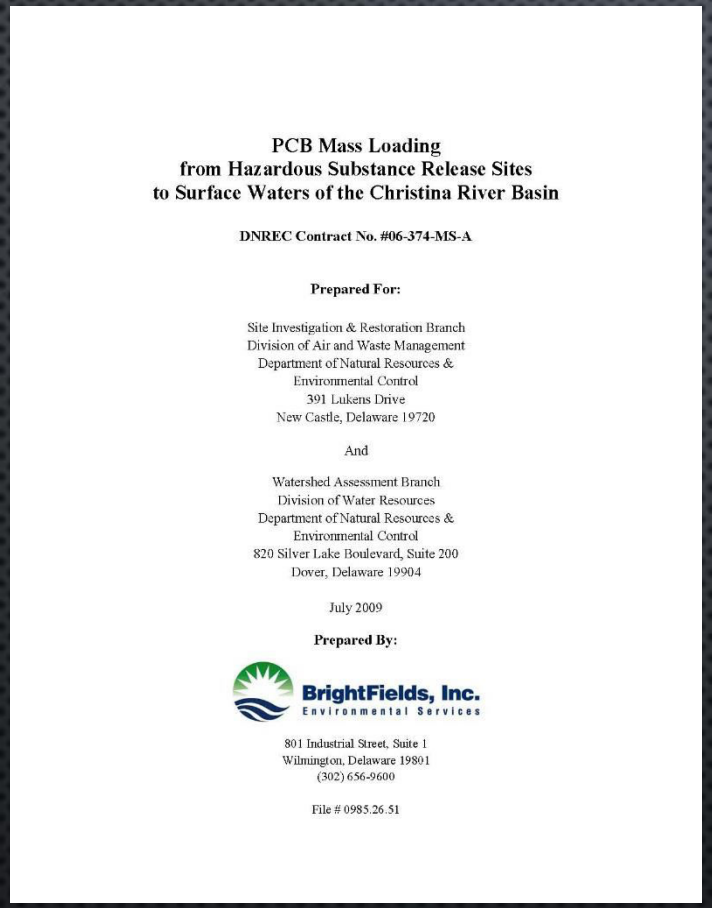
Collaboration between RS & WAMS served as catalyst for WATAR Program development

Phase I completed 2009 (n = 32, Christina Basin); Phase II completed 2015 (n = 29, rest of DE); Updated in 2017; Currently under review again.

Directly supports the DRBC PCB TMDL

https://dnrec.alpha.delaware.gov/waste-hazardous/remediation/watar/pcb-mass-loading/

WASTE SITE LOADING – 2017 UPDATE



PCB Mass Loading
from Hazardous Substance Release Sites
to Surface Waters of the Christina River Basin

DNREC Contract No. #06-374-MS-A

Prepared For:

Site Investigation & Restoration Branch
Division of Air and Waste Management
Department of Natural Resources &
Environmental Control
391 Lukens Drive
New Castle, Delaware 19720

And

Watershed Assessment Branch
Division of Water Resources
Department of Natural Resources &
Environmental Control
820 Silver Lake Boulevard, Suite 200
Dover, Delaware 19904

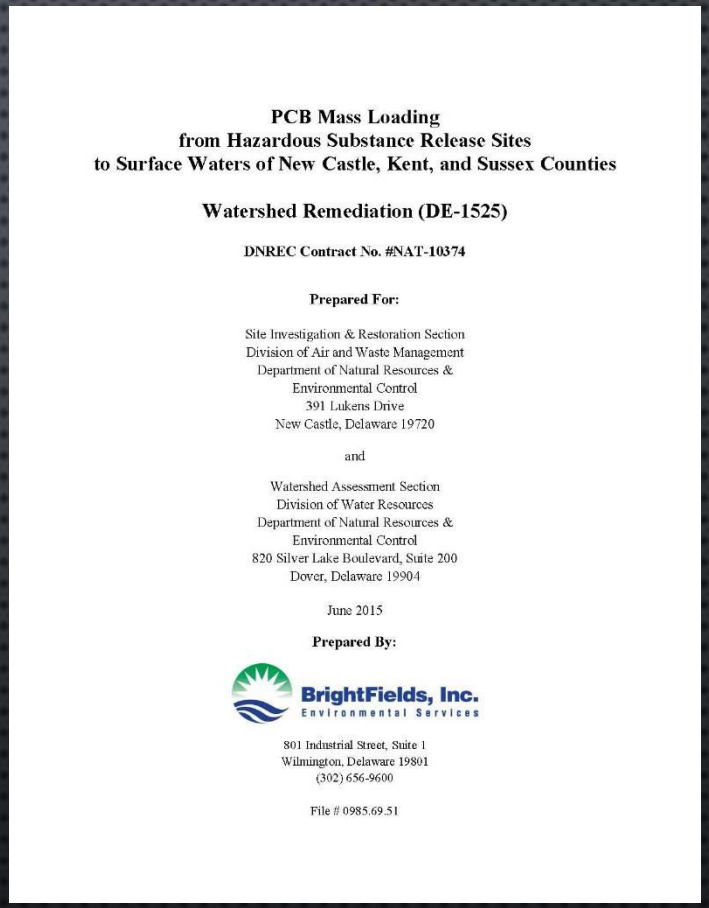
July 2009

Prepared By:

BrightFields, Inc.
Environmental Services

801 Industrial Street, Suite 1
Wilmington, Delaware 19801
(302) 656-9600

File # 0985.26.51



PCB Mass Loading
from Hazardous Substance Release Sites
to Surface Waters of New Castle, Kent, and Sussex Counties

Watershed Remediation (DE-1525)

DNREC Contract No. #NAT-10374

Prepared For:

Site Investigation & Restoration Section
Division of Air and Waste Management
Department of Natural Resources &
Environmental Control
391 Lukens Drive
New Castle, Delaware 19720

and

Watershed Assessment Section
Division of Water Resources
Department of Natural Resources &
Environmental Control
820 Silver Lake Boulevard, Suite 200
Dover, Delaware 19904

June 2015

Prepared By:

BrightFields, Inc.
Environmental Services

801 Industrial Street, Suite 1
Wilmington, Delaware 19801
(302) 656-9600

File # 0985.69.51

2017 update for Stage II PCB TMDL development - Uncontrolled PCB Waste sites reduced from 58 to 22

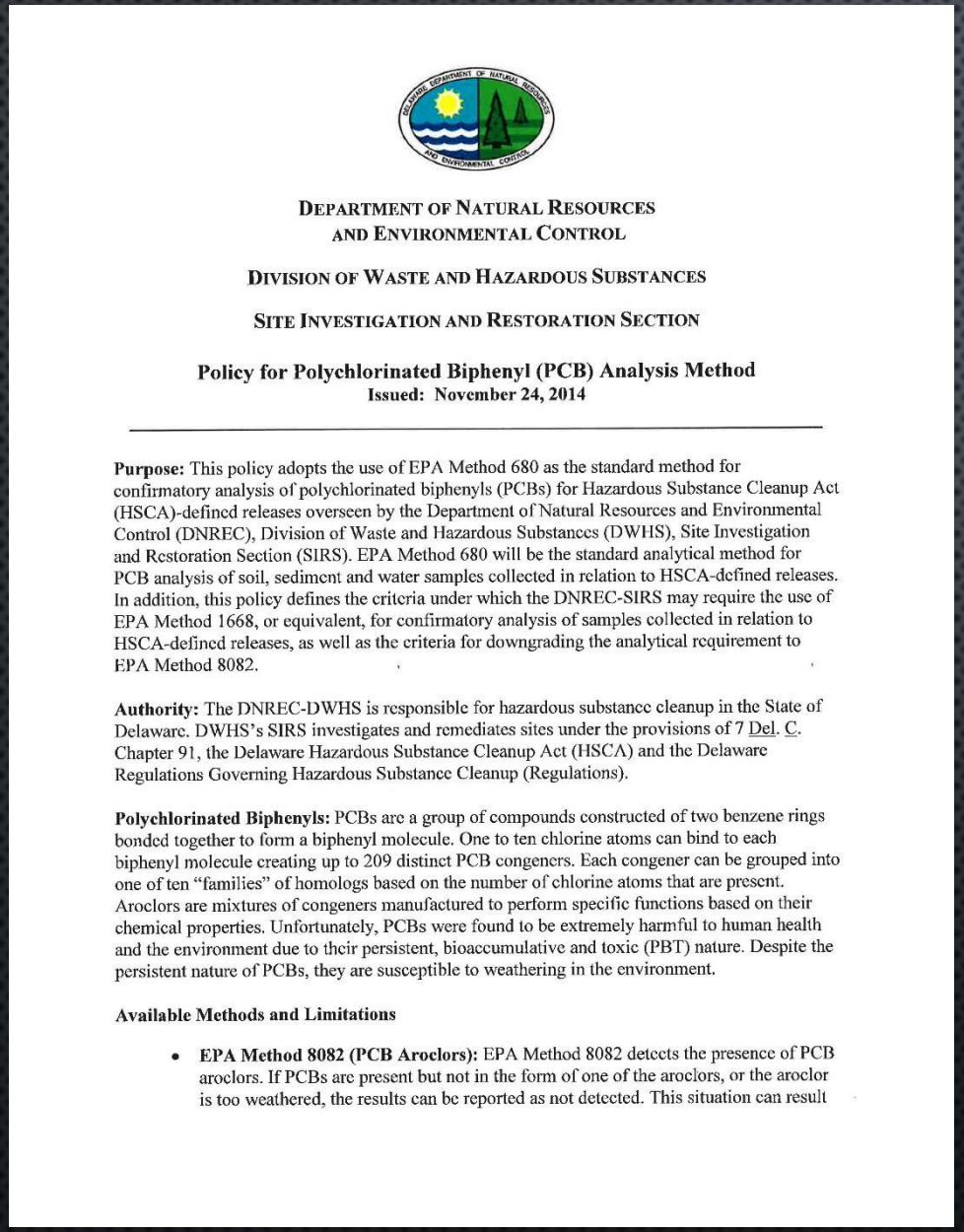
Potential PCB load changed from 24,400 mg/day to 12,600 mg/day (Zone 5) – 48% Reduction

WASTE SITE PCB LOADING – TOP 10*

1. Amtrak Refueling (DE-0266) – Final Plan Issued August 2020 – Estimated $43M for cleanup
2. Amtrak Maintenance (DE-0170) – Final Plan Issued February 2022 – Estimated $12M for cleanup
3. Amtrak West Yards (DE-0159) – Remedial Investigation Approved January 2022
4. ~~American Scrap & Waste (DE-1131)~~
5. ~~South Wilmington Wetland Area (Kreiger Sites & Marsh) (DE-1500)~~
6. ~~Former Carney Harris (DE-1397)~~
7. ~~Dravo Shipyard – Harbor Associates (DE-1096)~~
8. American Tank & Trailer Cleaning (DE-1180) – TSCA Removal > 50ppm in 2018, Cap required by 2024
9. ~~Purina Tower B (DE-1246)~~
10. ~~Electric Hose & Rubber (DE-0174)~~

*Based Upon 2009 Mass Loading Summary Report with 2017/2022 Updates.

---------- Negligible Load Following Site Remediation



DEPARTMENT OF NATURAL RESOURCES
AND ENVIRONMENTAL CONTROL

DIVISION OF WASTE AND HAZARDOUS SUBSTANCES

SITE INVESTIGATION AND RESTORATION SECTION

Policy for Polychlorinated Biphenyl (PCB) Analysis Method
Issued: November 24, 2014

Purpose: This policy adopts the use of EPA Method 680 as the standard method for confirmatory analysis of polychlorinated biphenyls (PCBs) for Hazardous Substance Cleanup Act (HSCA)-defined releases overseen by the Department of Natural Resources and Environmental Control (DNREC), Division of Waste and Hazardous Substances (DWHS), Site Investigation and Restoration Section (SIRS). EPA Method 680 will be the standard analytical method for PCB analysis of soil, sediment and water samples collected in relation to HSCA-defined releases. In addition, this policy defines the criteria under which the DNREC-SIRS may require the use of EPA Method 1668, or equivalent, for confirmatory analysis of samples collected in relation to HSCA-defined releases, as well as the criteria for downgrading the analytical requirement to EPA Method 8082.

Authority: The DNREC-DWHS is responsible for hazardous substance cleanup in the State of Delaware. DWHS's SIRS investigates and remediates sites under the provisions of 7 Del. C. Chapter 91, the Delaware Hazardous Substance Cleanup Act (HSCA) and the Delaware Regulations Governing Hazardous Substance Cleanup (Regulations).

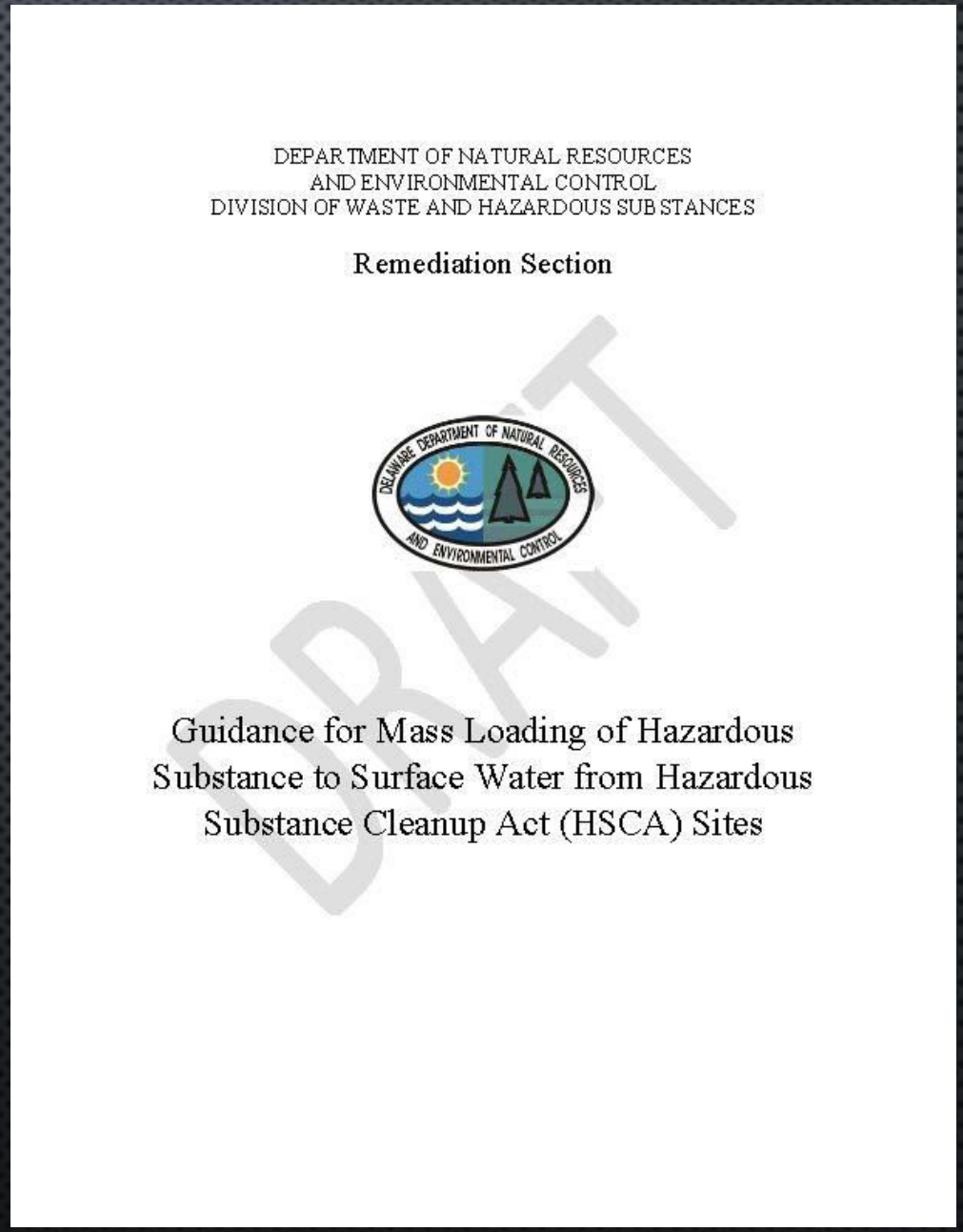
Polychlorinated Biphenyls: PCBs are a group of compounds constructed of two benzene rings bonded together to form a biphenyl molecule. One to ten chlorine atoms can bind to each biphenyl molecule creating up to 209 distinct PCB congeners. Each congener can be grouped into one of ten "families" of homologs based on the number of chlorine atoms that are present. Aroclors are mixtures of congeners manufactured to perform specific functions based on their chemical properties. Unfortunately, PCBs were found to be extremely harmful to human health and the environment due to their persistent, bioaccumulative and toxic (PBT) nature. Despite the persistent nature of PCBs, they are susceptible to weathering in the environment.

Available Methods and Limitations

- **EPA Method 8082 (PCB Aroclors):** EPA Method 8082 detects the presence of PCB aroclors. If PCBs are present but not in the form of one of the aroclors, or the aroclor is too weathered, the results can be reported as not detected. This situation can result

- Policy highlights ineffective use of EPA Method 8082 to characterize historic and weathered PCB releases.
- Requires use of EPA Method 680 (homolog method) as new standard for PCB confirmatory analysis of environmental samples collected at HSCA regulated sites.
- Specifies criteria for use of EPA Method 1668 (congener method) for environmental samples collected at waste sites that are in close proximity to 303(d) listed water bodies.

- Currently developing guidance for the calculation of specific contaminant mass loads from soils at contaminated sites.
- Intended to be used in 303(d) listed watersheds for risk driving contaminants.
- Information may be used as a line of evidence to evaluate impacts within remedial investigations/feasibility studies.


DEPARTMENT OF NATURAL RESOURCES
AND ENVIRONMENTAL CONTROL
DIVISION OF WASTE AND HAZARDOUS SUBSTANCES

Remediation Section

DRAFT

Guidance for Mass Loading of Hazardous Substance to Surface Water from Hazardous Substance Cleanup Act (HSCA) Sites

WATAR – INNOVATIVE REMEDIATION

- Mirror Lake
- Meco Ditch/Little Mill Creek
- Fort Dupont PRB
- Amtrak Eastern Drainage Ditch
- A-Street Ditch
- Planning CBR4 Project






OTHER WATAR ACTIVITIES/ONGOING INITIATIVES

Christina & Brandywine Rivers Remediation, Restoration & Resilience Project (CBR4)

A-Street Ditch SediMite™ Pilot Study

Brandywine Dam Sediment Assessment

White Clay Creek Dam Sediment Assessment

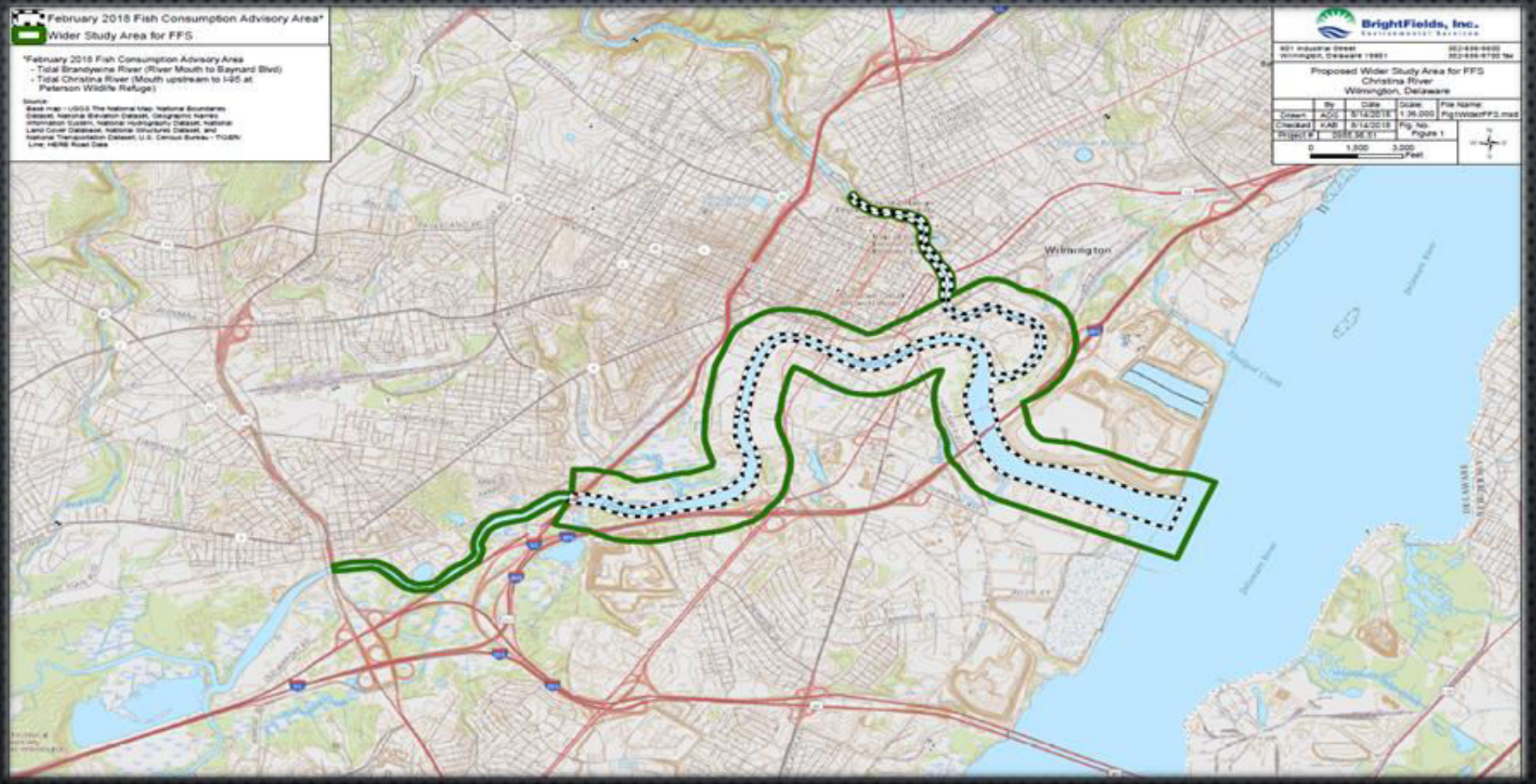
Advanced Restoration Plan Development

Delaware Dredging Framework Update

PFAS in Fish

PFAS in Surface Water

CHRISTINA & BRANDYWINE RIVERS REMEDIATION, RESTORATION & RESILIENCE PROJECT (CBR4)



2,183 acres and 7 linear miles of tidal mainstem river

https://dnrec.alpha.delaware.gov/waste-hazardous/remediation/watar/cbr4/

CHRISTINA & BRANDYWINE RIVERS *REMEDIATION*, RESTORATION & RESILIENCE PROJECT (CBR4)

- PCB loading from major land-based sources are either already controlled or are on track to be controlled in the near term.

THIS BY ITSELF WILL NOT BE ENOUGH TO ACHIEVE THE GOAL OF CLEAN WATER AND CLEAN FISH

- In-place, legacy contamination of aquatic sediments will remain a secondary source for decades.
- Transfer of contamination from secondary sediment sources to the food chain can be interrupted through a combination of targeted remedial actions.
- The time to plan for these targeted remediation actions is now …. while the last primary land-based sources are being controlled.
- DNREC WATAR has contracted Brightfields, Inc. and AnchorQEA to develop a sediment remediation Feasibility Study and cost estimate for the project area.

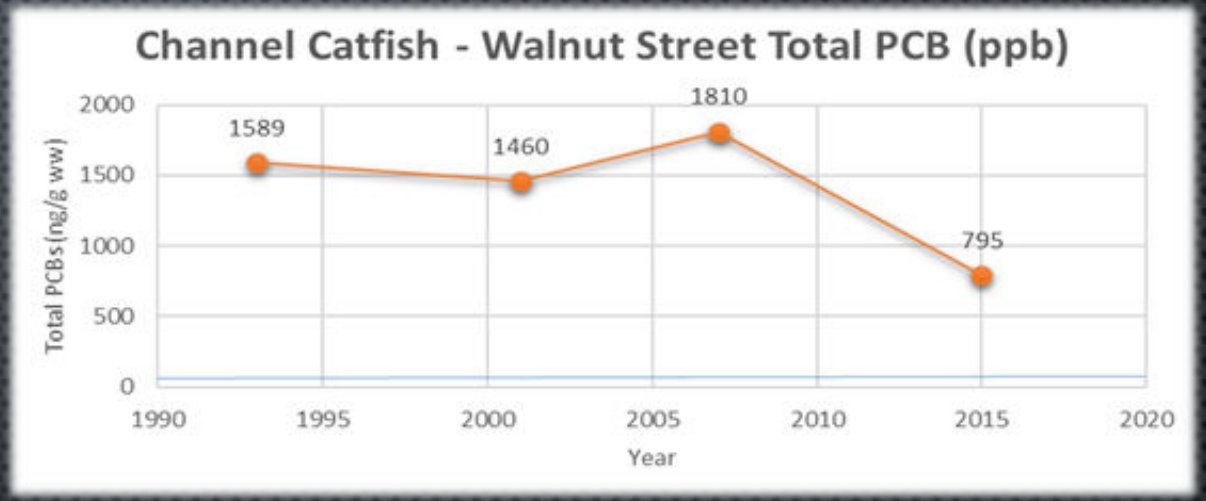
https://dnrec.alpha.delaware.gov/waste-hazardous/remediation/watar/cbr4/

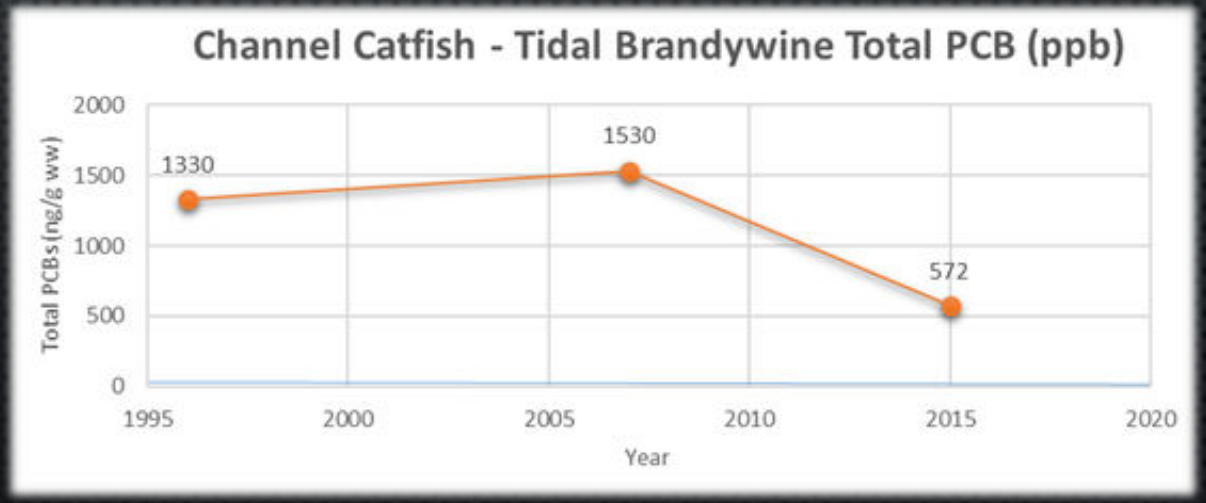
CHRISTINA & BRANDYWINE RIVERS REMEDIATION, *RESTORATION & RESILIENCE* PROJECT (CBR4)

- The Christina Conservancy and American Rivers received a NFWF Grant in 2021 to develop a "logical step-wise ecosystem-based approach to assess, prioritize and plan for a suite of restoration and resilience projects."
- Projects will be aimed at restoration of tidal wetlands, nearshore, onshore and riparian areas to improve habitat for critical fish species and populations and offer resilience to sea level rise and climate change.
- Development of project partners is a critical step.
- DNREC WATAR and DNREC Coastal Programs will help to ensure that NFWF grant goals and objectives will coordinate with remediation plans.

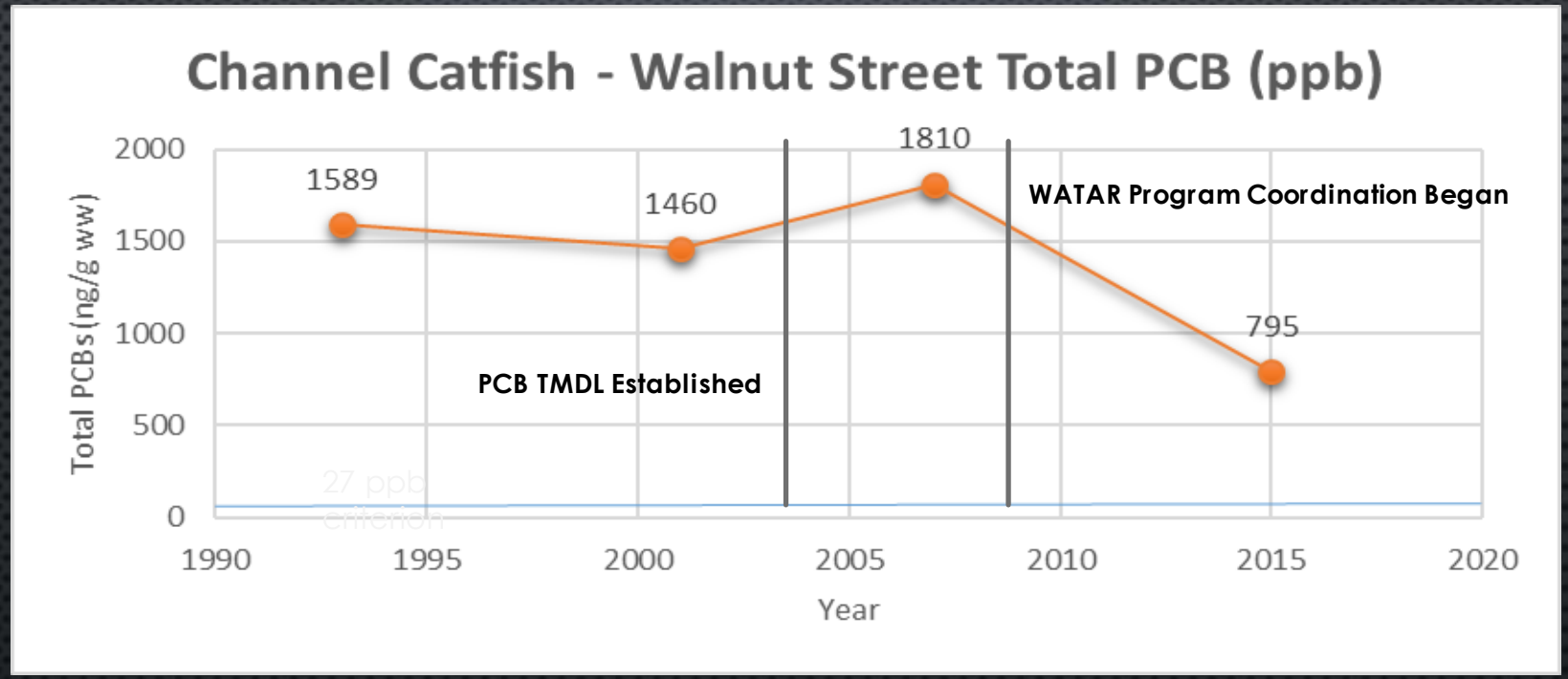
https://dnrec.alpha.delaware.gov/waste-hazardous/remediation/watar/cbr4/

FISH TISSUE TRENDS IN CBR4 AREA

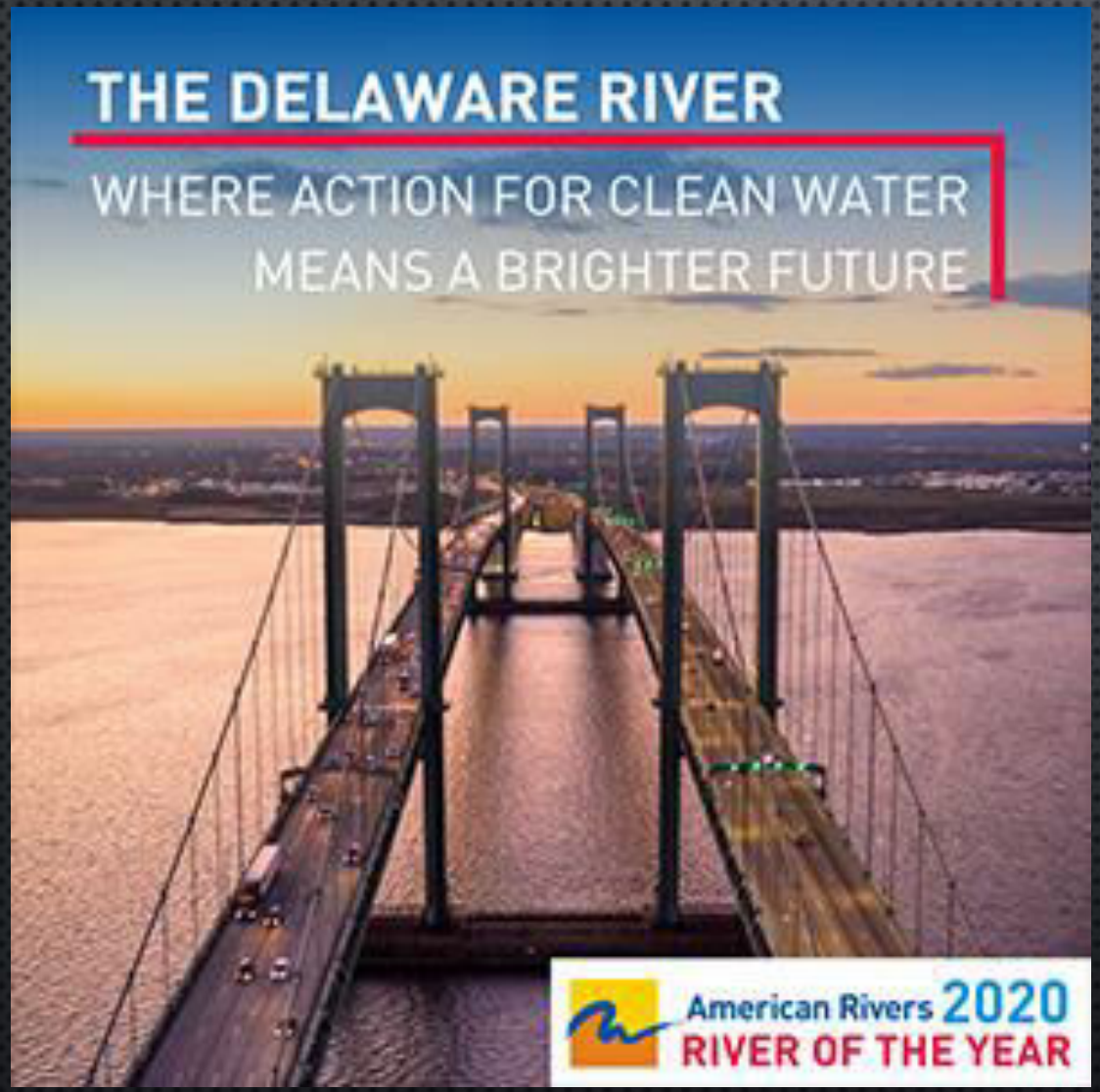




FISH TISSUE IMPROVEMENTS-TIDAL CHRISTINA RIVER



- Tidal Christina
  - Improvement attributed to cleanup of upland PCB sources, along with better control of NPDES and MS4 discharges. Highlights cooperation between WATAR and DRBC, along with other DNREC programs.



"Today, what was once a cesspool is a river reborn. Fish populations have returned, and the river now contributes about $25 Billion in annual economic activity."

"Detailed plans and science-driven policy by the DRBC have helped lead to way for the river's dramatic improvements we enjoy today."

"We also know there is more work that needs to be done."

http://www.americanrivers.org/Delaware2020

CONTACT INFORMATION

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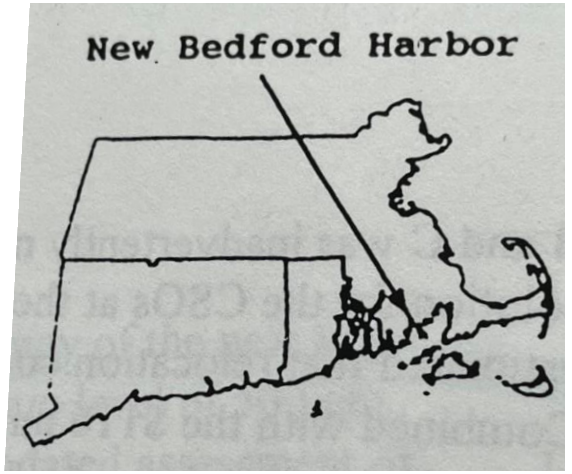
https://dnrec.alpha.delaware.gov/waste-hazardous/remediation/watar/

QUESTIONS ?

New Bedford Harbor Superfund Site



Jan 2023 PCB Symposium

The Upper Harbor, looking NW

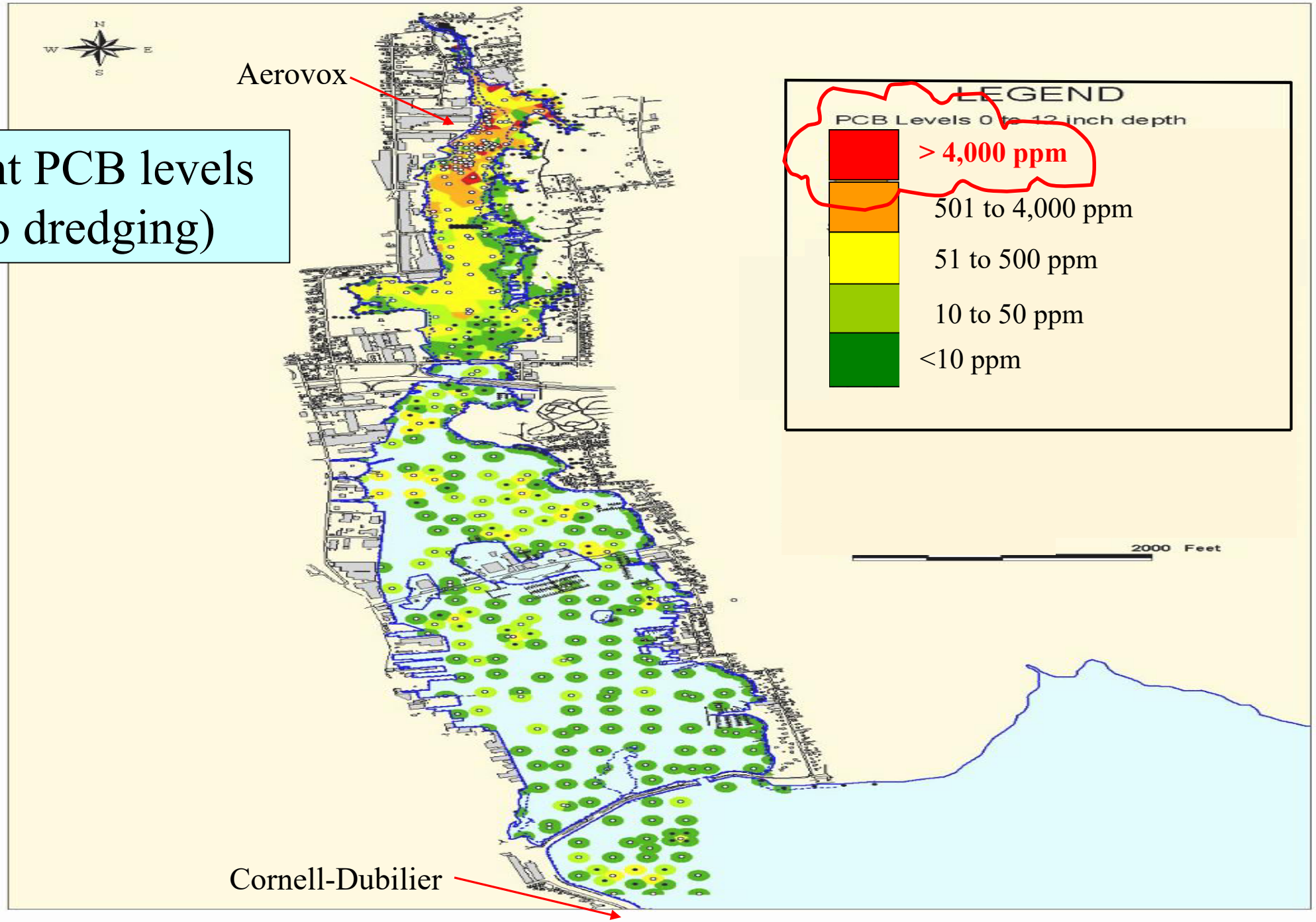
Lower Harbor is home to a large offshore fishing fleet and related shore-side industry

Former Aerovox capacitor plant
(main source of PCBs)

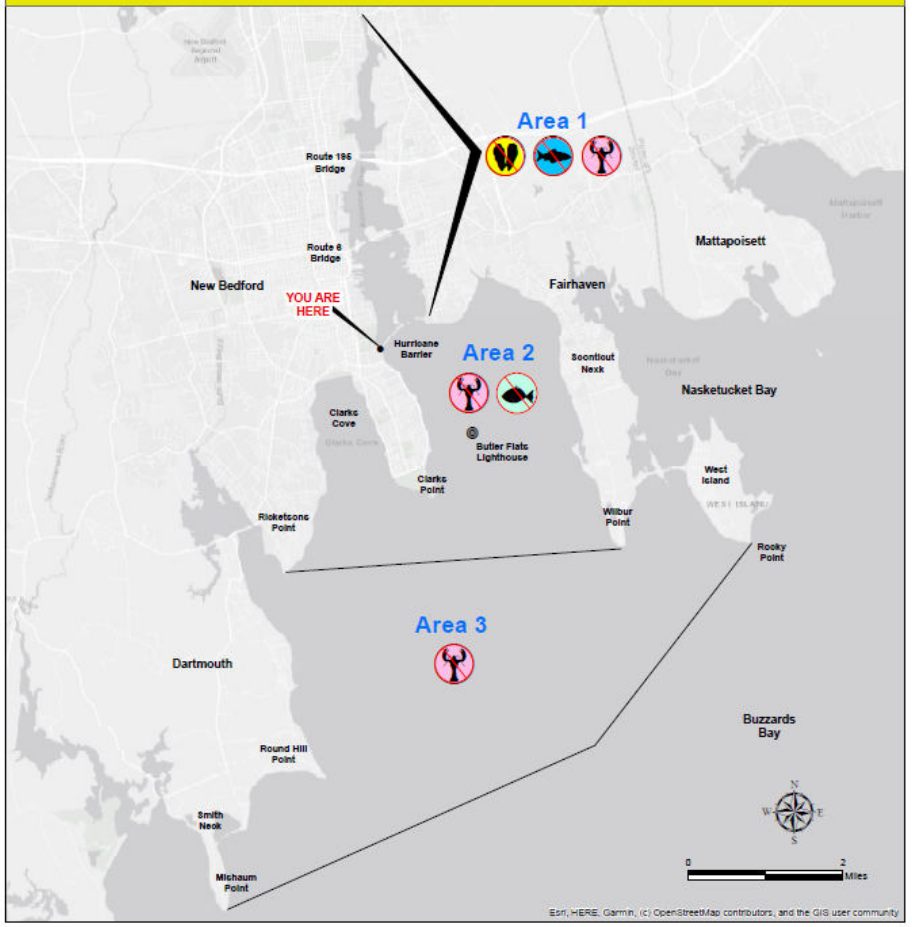
Aerovox building demolished in 2012 per EPA NTCRA.

Upland cleanup performed 2021-22 per State 21e program.

Sediment PCB levels (prior to dredging)



1979 State Fishing Ban - PCBs (still in effect)



Do NOT eat shellfish
No coma mariscos
Nao coma mariscos

Do NOT eat fish
No coma pescado
Nao coma peixe

Do NOT eat lobster
No coma langosta
Nao coma lagosta

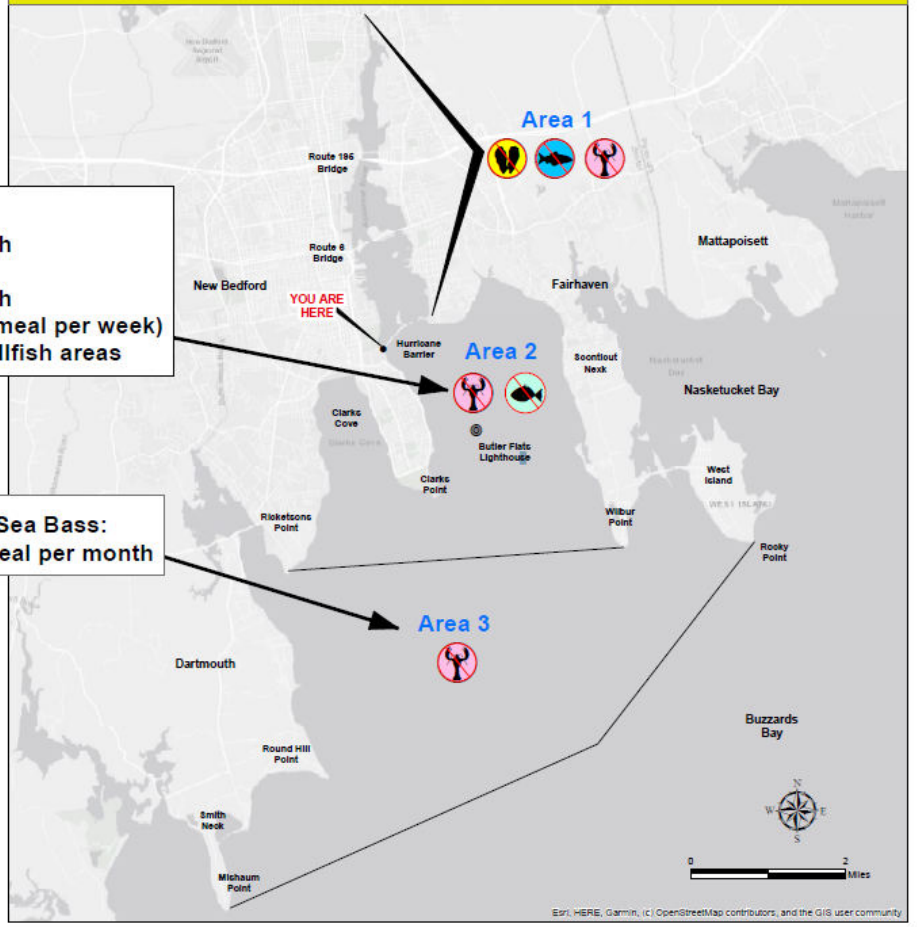
Do NOT eat bottom-feeding fish:
No coma pescado de fondo:
Nao coma peixe de fundo:
- flounder, tautog, scup, eel
- languado, tautoga, sargo, anguila
- solha, bodilio da ostra, sargo, anguila

For more info: https://www.epa.gov/new-bedford-harbor

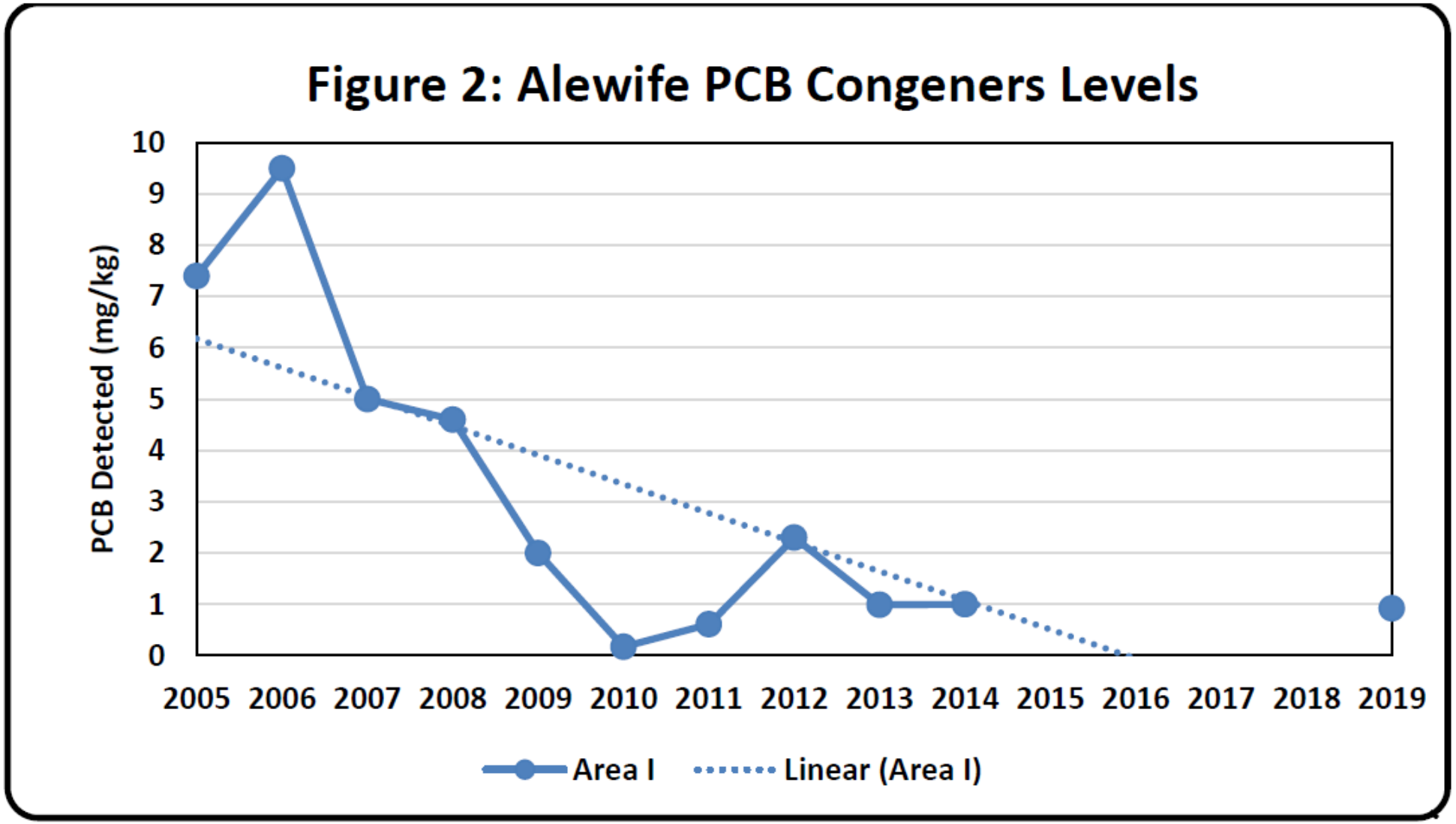
2010 USEPA Recommendations (still in effect)

Black Sea Bass:
1 meal per month
Shellfish:
1 meal per month
(Clark's Cove 1 meal per week)
in approved shellfish areas

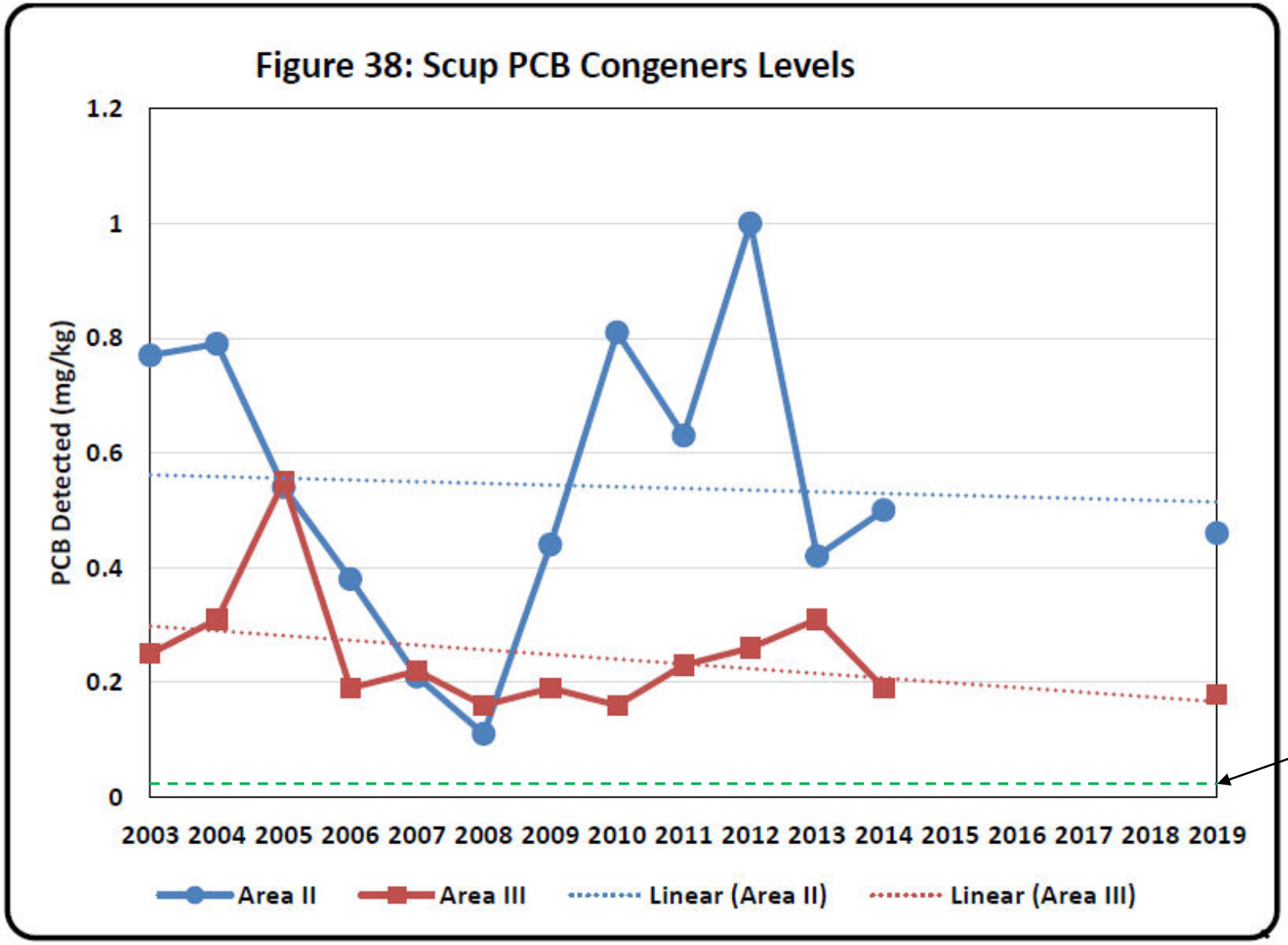
Black Sea Bass:
1 meal per month



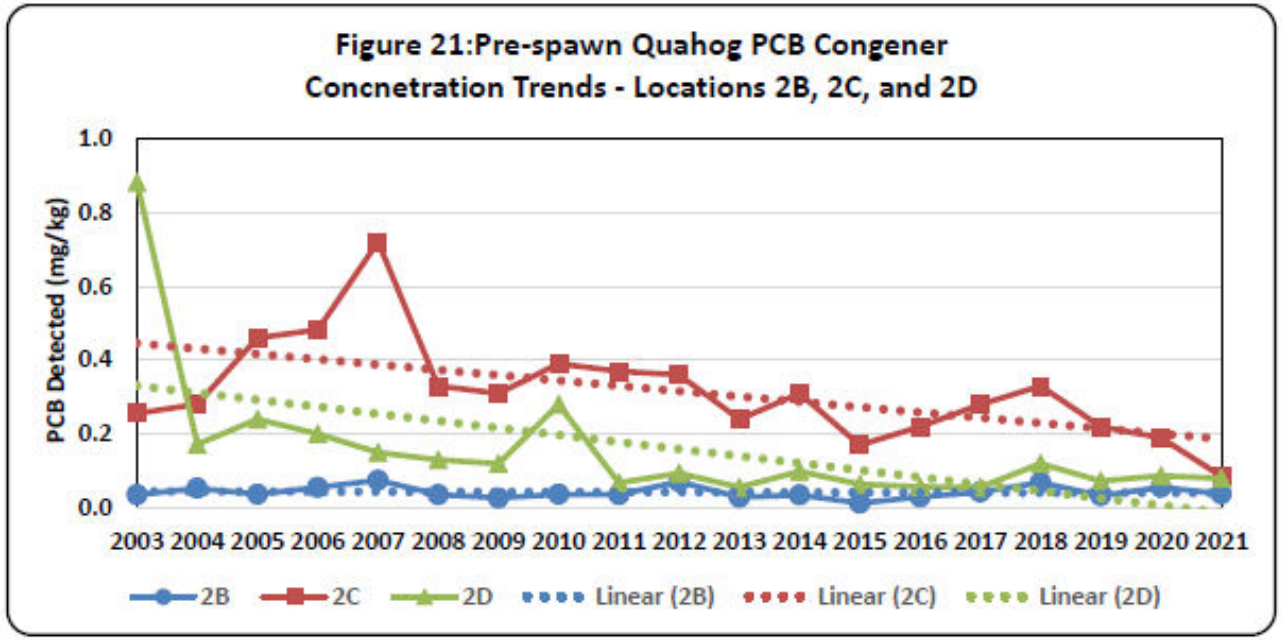
18,000 acre fish consumption restrictions and advisories

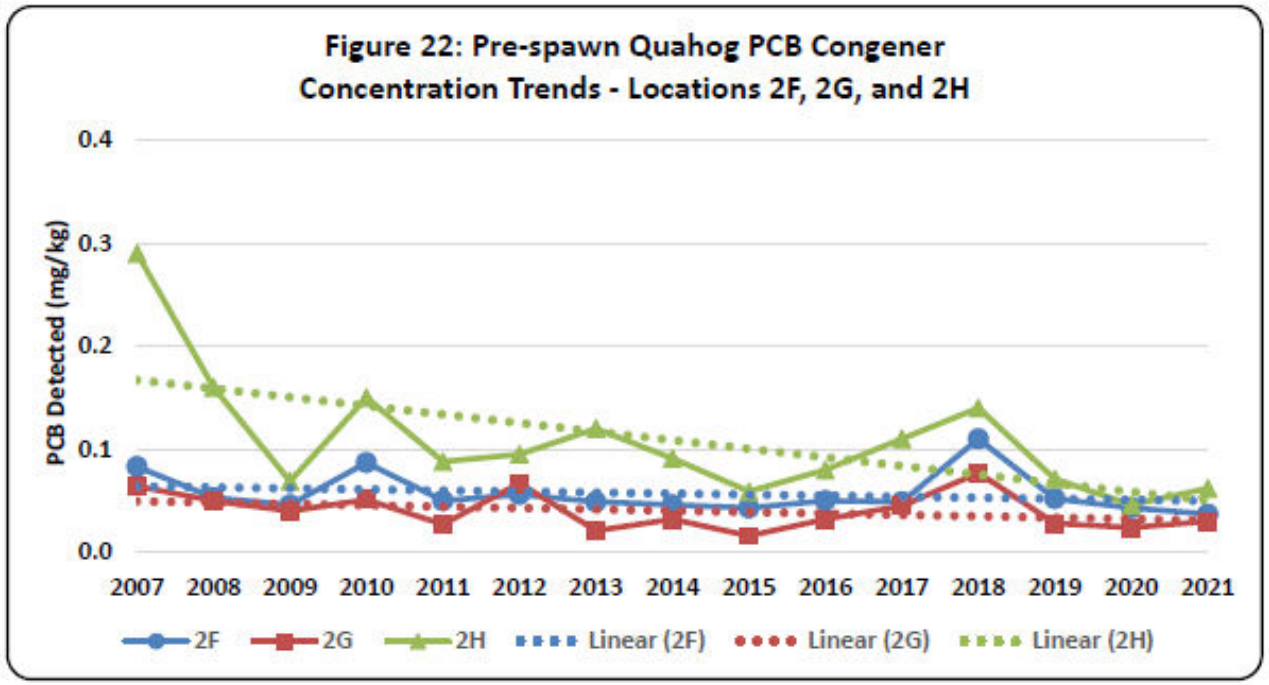


Source: PCB Trends Report for Seafood, MassDEP, March 2022



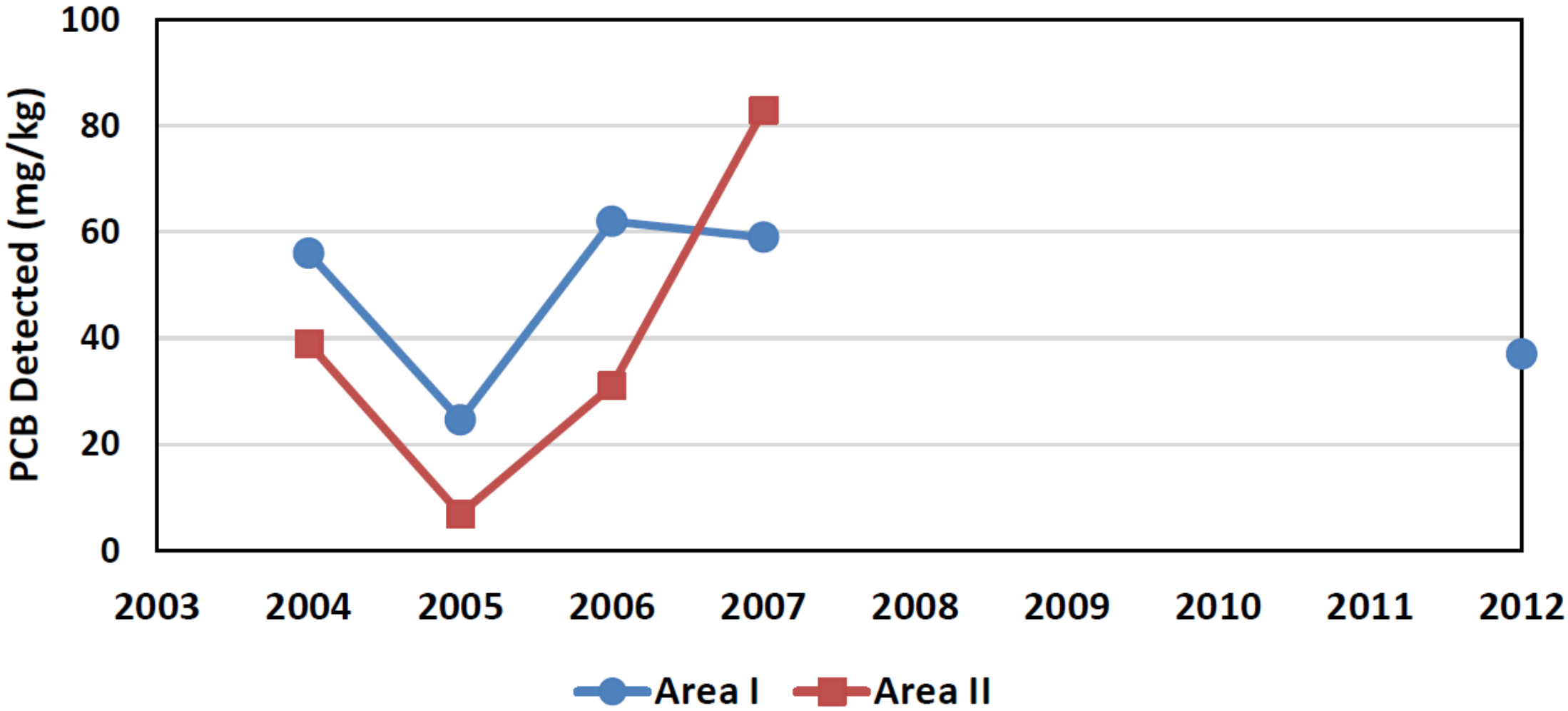
Source: PCB Trends Report for Seafood, MassDEP, March 2022



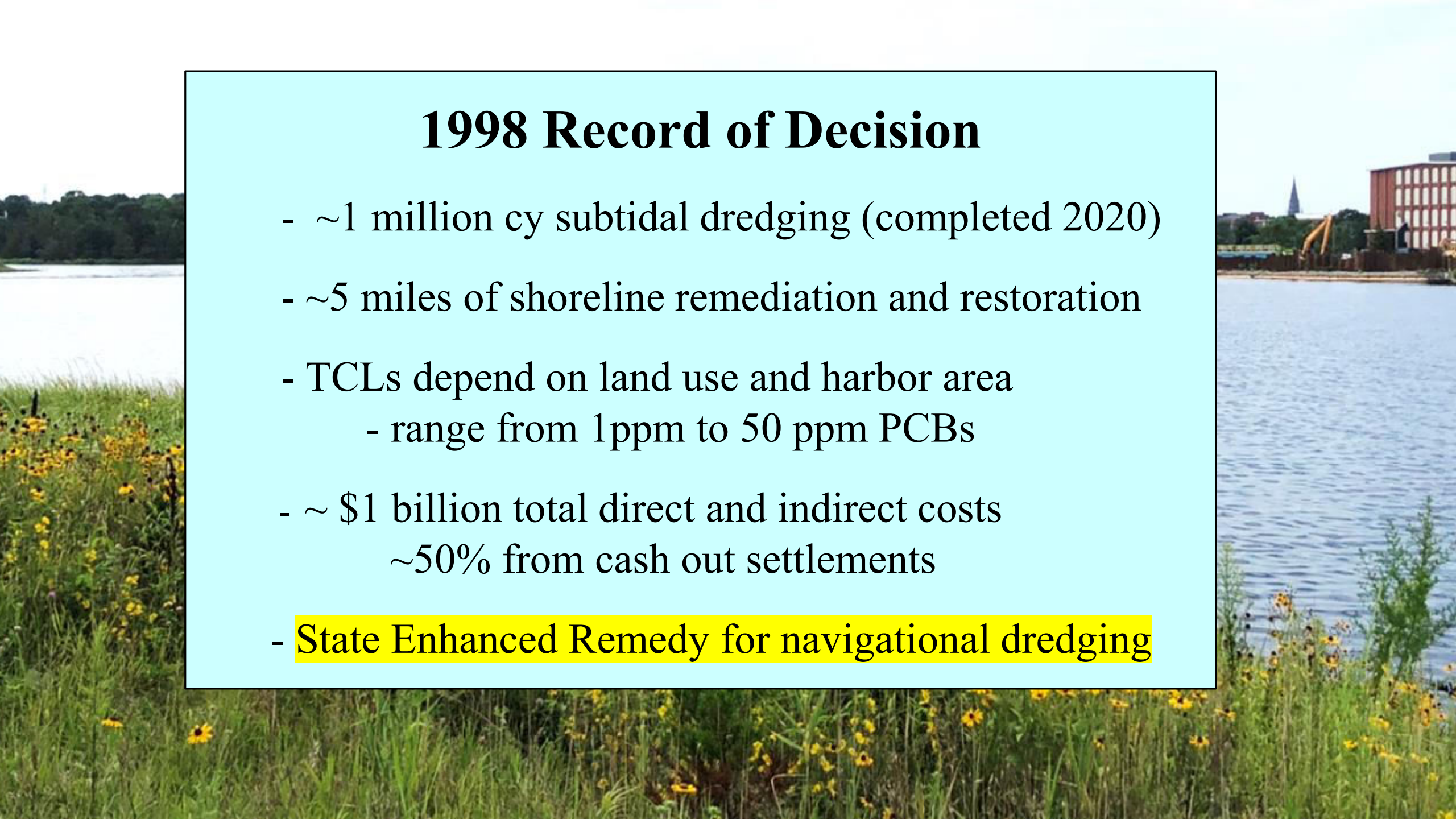


Source: PCB Trends Report for Seafood, MassDEP, March 2022

Figure 5: American Eel PCB Congeners Concentrations



Source: PCB Trends Report for Seafood, MassDEP, March 2022



1998 Record of Decision

- ~1 million cy subtidal dredging (completed 2020)

- ~5 miles of shoreline remediation and restoration

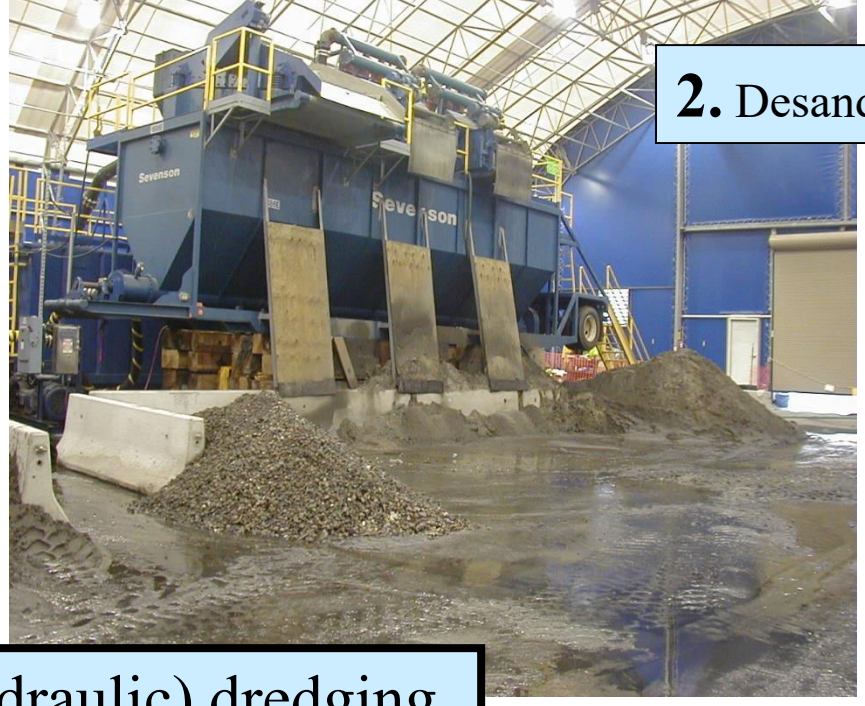
- TCLs depend on land use and harbor area
  - range from 1ppm to 50 ppm PCBs

- ~ $1 billion total direct and indirect costs
  ~50% from cash out settlements

- State Enhanced Remedy for navigational dredging

The 4 D's of (hydraulic) dredging

1. Dredging



2. Desanding

3. Dewatering

4. Disposal

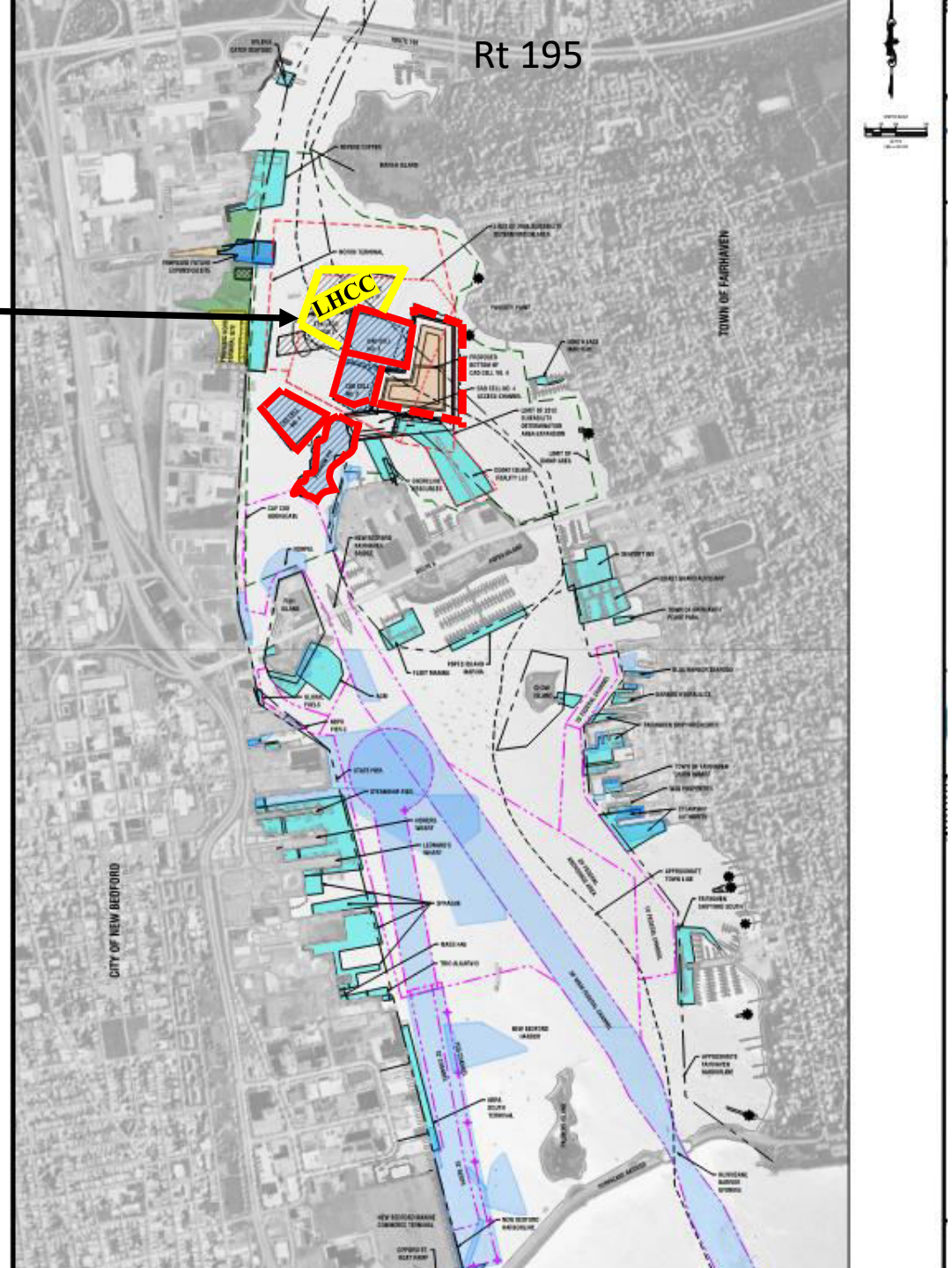
These facilities shown from above:

BUT……

In 2004 funding became limited to $15M/yr and these facilities lay unused for 8 months/year

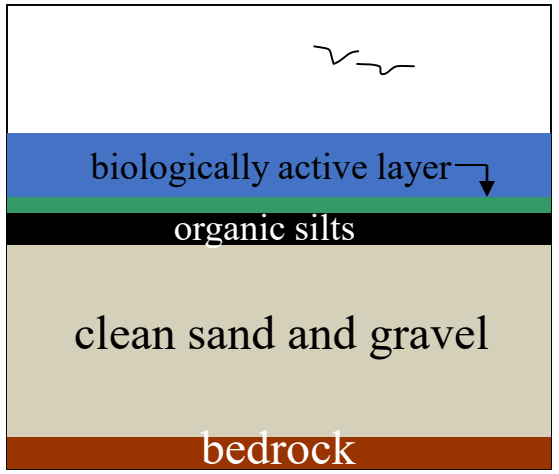
Offsite T&D by rail

2011 ESD added a 300,000 cy CAD Cell to the Superfund Remedy (the "Lower Harbor CAD Cell")

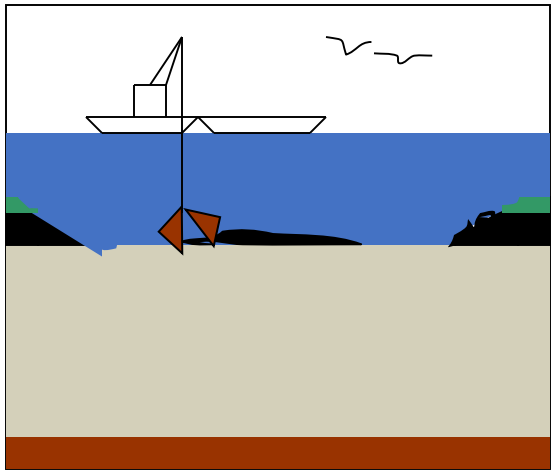


Legend:

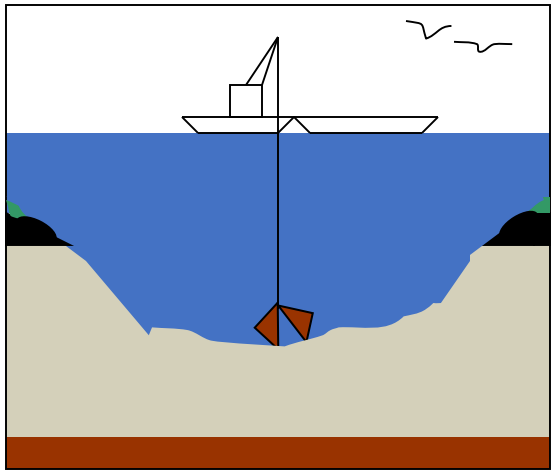
- *State Enhanced Remedy CAD cells*
- *Superfund LHCC*
- *navigational dredge areas (PCB levels below Superfund TCL)*



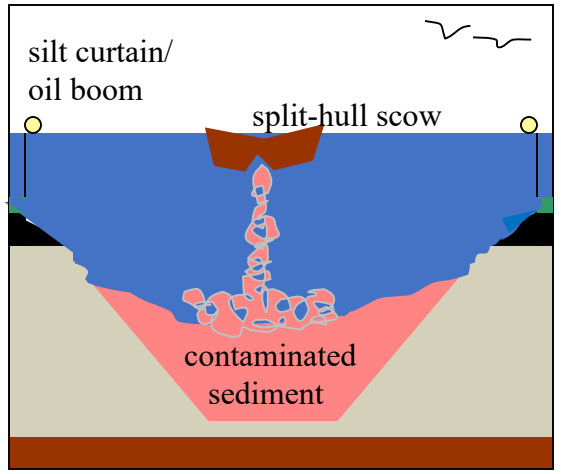
1. Harbor bottom as is



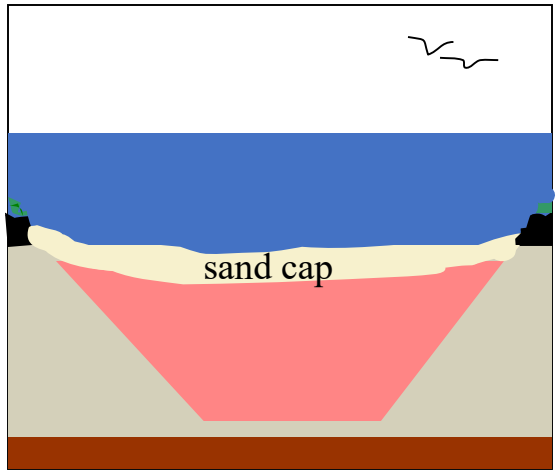
2. Excavation of top silts



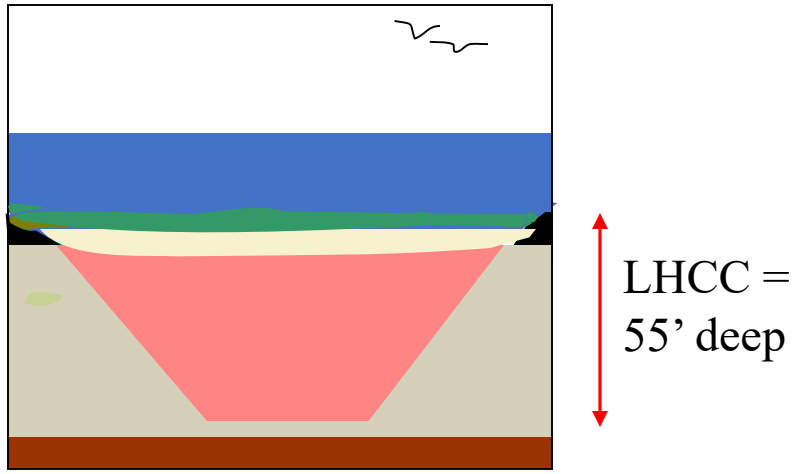
3. Excavation of clean sand



4. Placement of sediments



5. Placement of initial cap



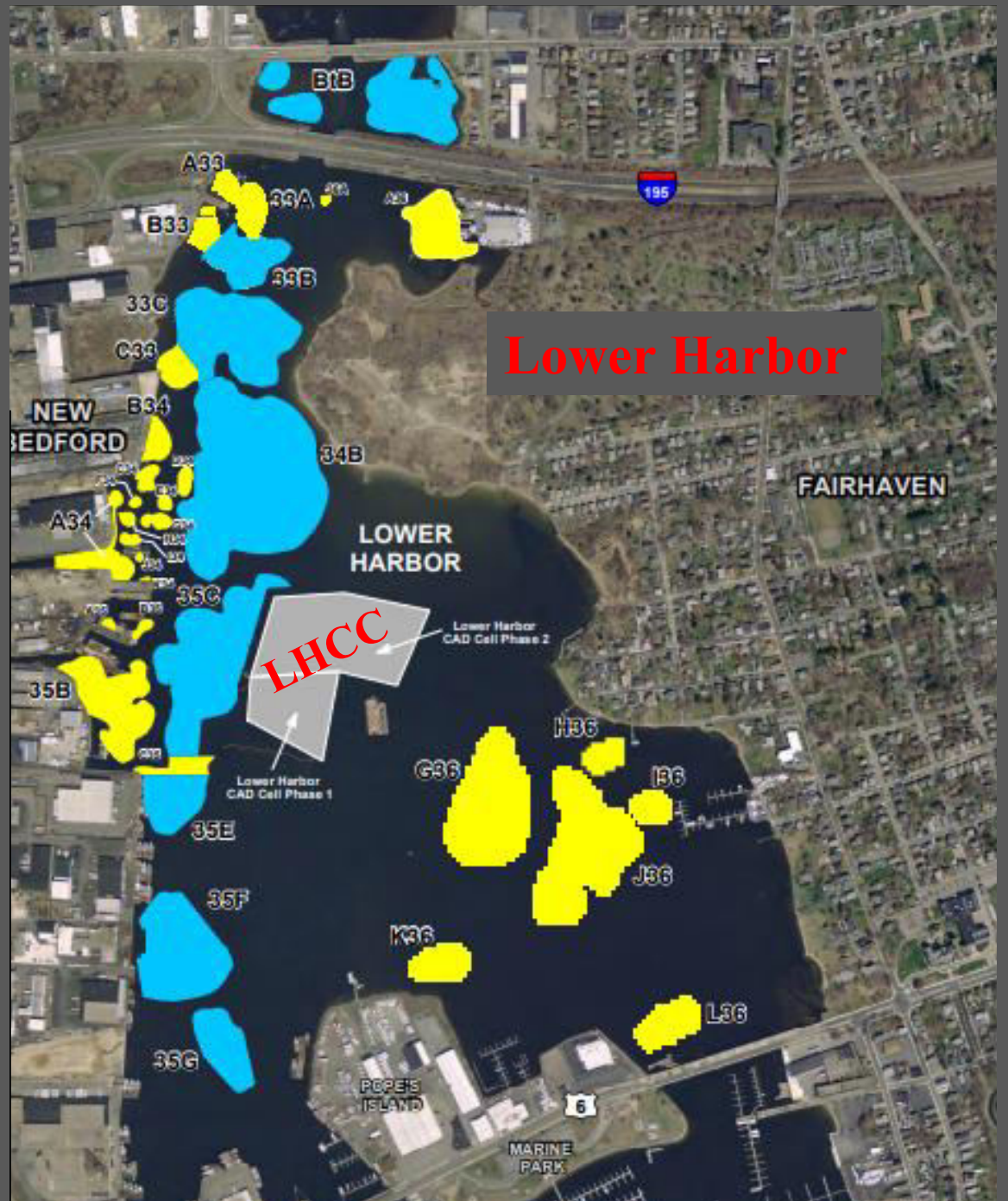
6. Surface fills in over time

CAD cell process

USEPA Region 1

A split-hull scow placing dredged sediments in a CAD cell

Superfund dredge areas in the Upper and Lower Harbor with disposal in the LHCC



Summary of Actual LHCC Costs

Excavation and Capping of LHCC ……$25 million
388,000 *insitu* cubic yards disposed equals……$64.4/cy
(*Cooperative Agreement with Port of New Bedford)*

Mechanical dredging and disposal in LHCC……$102/cy
(Inter-Agency Agreement with U.S. Army Corps of Engineers)

Total Unit Cost for CAD Cell Disposal ……$166.4/cy

→ Compares to $514/cy for hydraulic dredging and offsite T&D (TSCA)

→ (3x more expensive…$135 million saved using the LHCC)


CAD4
Sand from bottom of CAD4 will also be used for the LHCC cap
LHCC
Sand from bottom of CAD4 being used for North Terminal construction
Foth LLC photo

Cleanup Status

Jan 2023

97.5% complete by volume

Only the pink-colored shoreline areas remain to be remediated.

Current funding provided by BIL funds and (hopefully) a supplemental CD with CDE.

LEGEND:

- *subtidal dredging completed*
- *dredging not required*
- *shoreline/intertidal zones completed to date*
- *intertidal zones remaining*
- *sediment caps installed (not shown/off figure is the CDE outer harbor cap)*

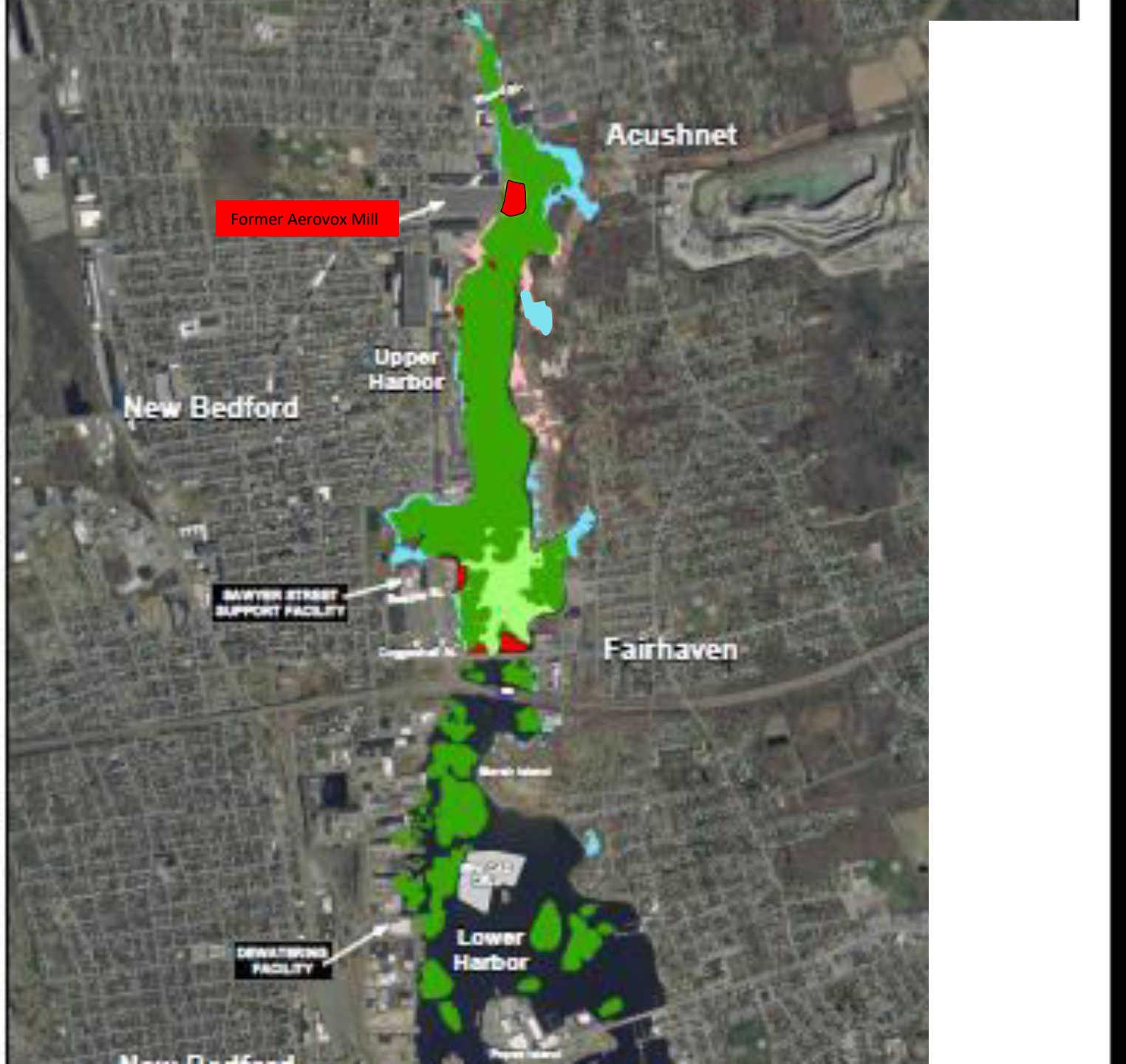
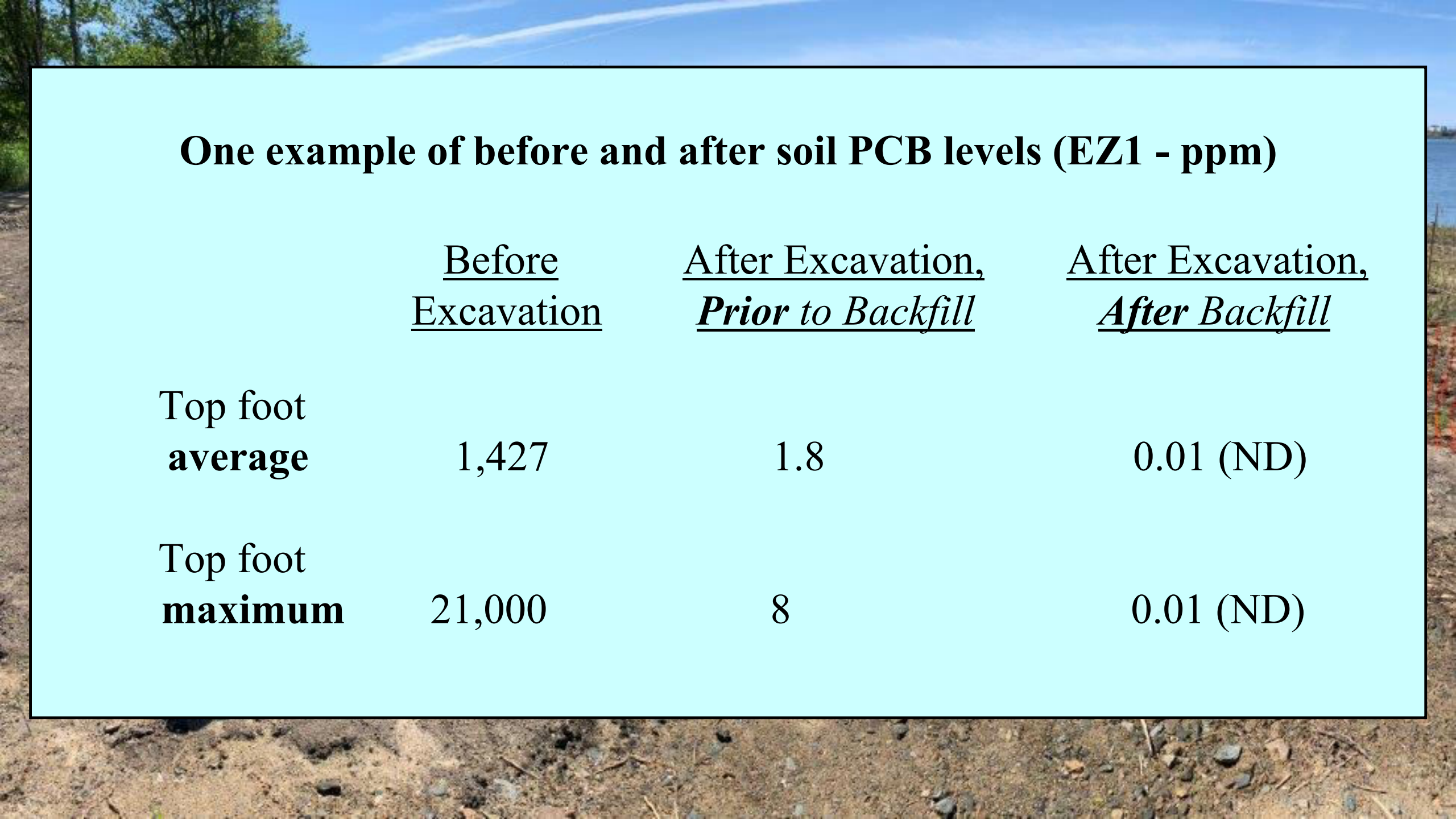


Photo: Ed Pepin



One example of before and after soil PCB levels (EZ1 - ppm)

	Before Excavation	After Excavation, ***Prior** to Backfill*	After Excavation, ***After** Backfill*
Top foot **average**	1,427	1.8	0.01 (ND)
Top foot **maximum**	21,000	8	0.01 (ND)

Restoration Monitoring

Mapping of:

1 – sparce vegetation

2 – invasive species

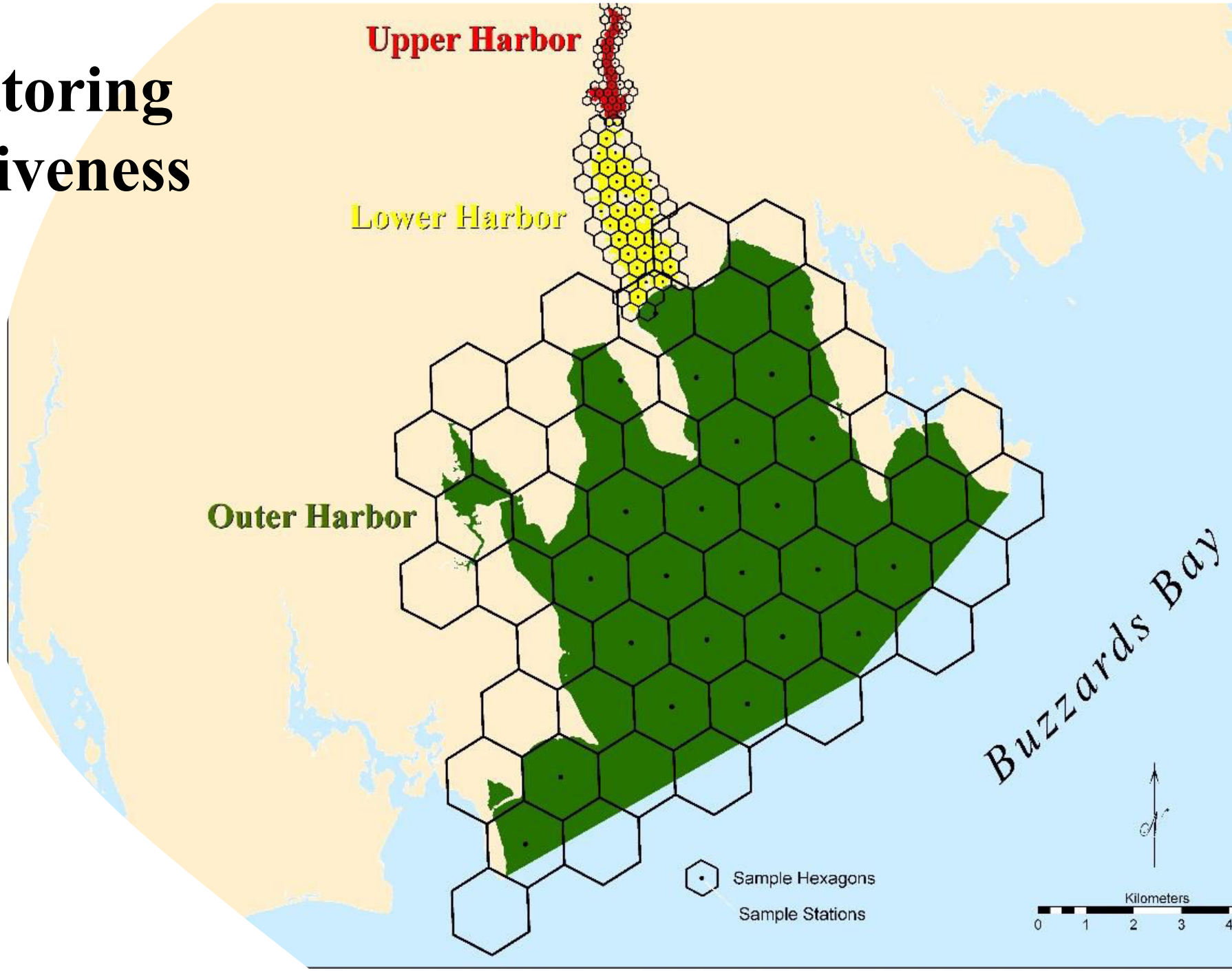
3 – erosional areas

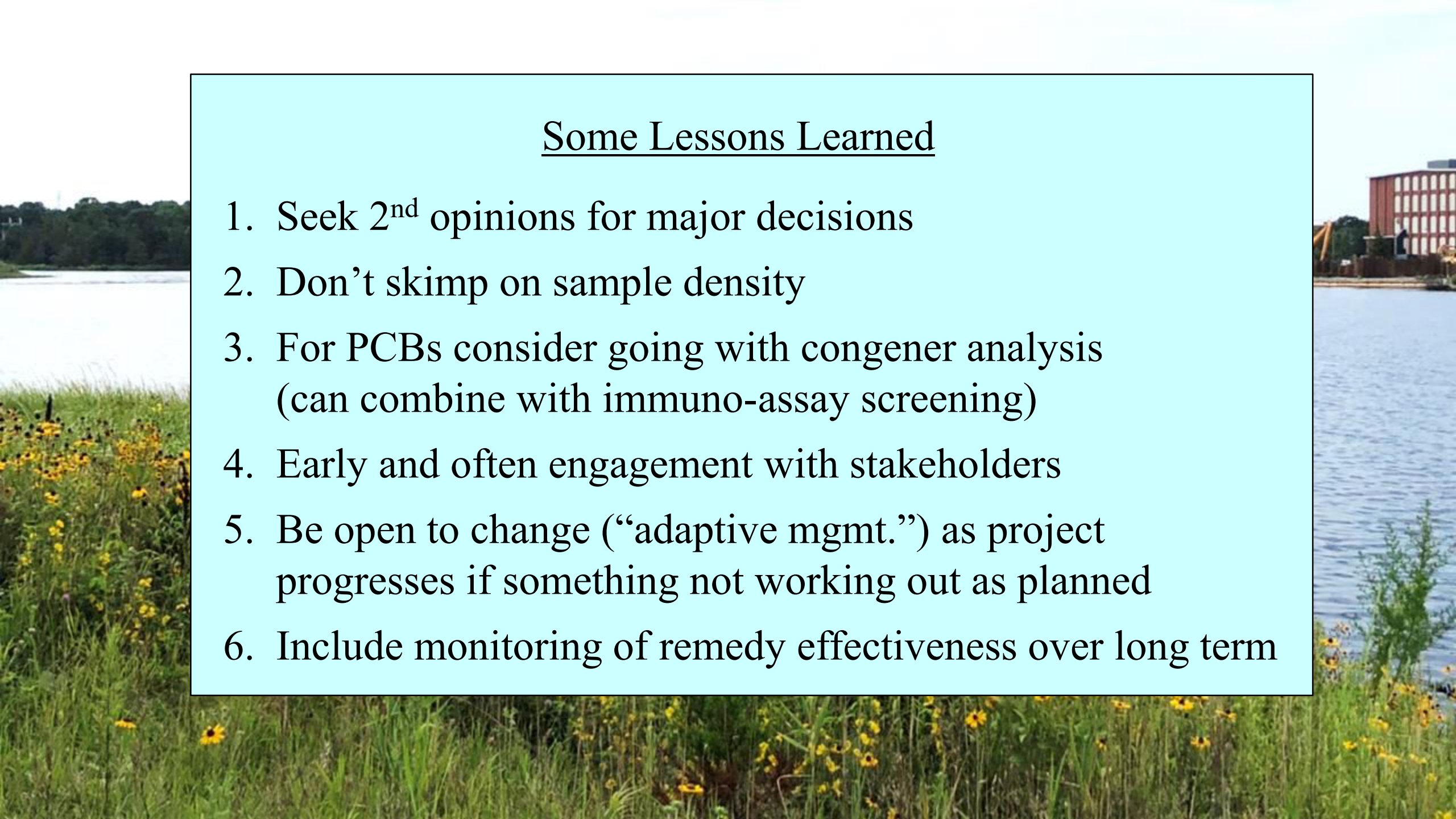
Legend:

- sparce vegetation
- *Pragmites* (invasive)
- purple loose-strive (invasive)
- erosional areas

Long term monitoring of remedy effectiveness

- 18,000 acres
- Sediment chemistry and physical properties
- Benthic organism counts
- Performed every 5 years or after significant milestones





Some Lessons Learned

1. Seek 2nd opinions for major decisions
2. Don't skimp on sample density
3. For PCBs consider going with congener analysis (can combine with immuno-assay screening)
4. Early and often engagement with stakeholders
5. Be open to change ("adaptive mgmt.") as project progresses if something not working out as planned
6. Include monitoring of remedy effectiveness over long term

Questions? Comments?

www.epa.gov/superfund/newbedford

D. Dickerson