

# LOWER DUWAMISH WATERWAY WA

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# Objectives of Remediation

- Final Remedy Remedial Action objectives
  - RAO 1: Reduce human health risks associated with the consumption of resident LDW fish and shellfish by reducing sediment and surface water COC concentrations to protective levels
  - RAO 2: Reduce human health risks associated with direct contact
  - RAO 3: Reduce risks to benthic invertebrates by complying with the Washington State SMS
  - RAO 4: Reduce risks to crabs, fish, birds, and mammals

## RISK DRIVERS

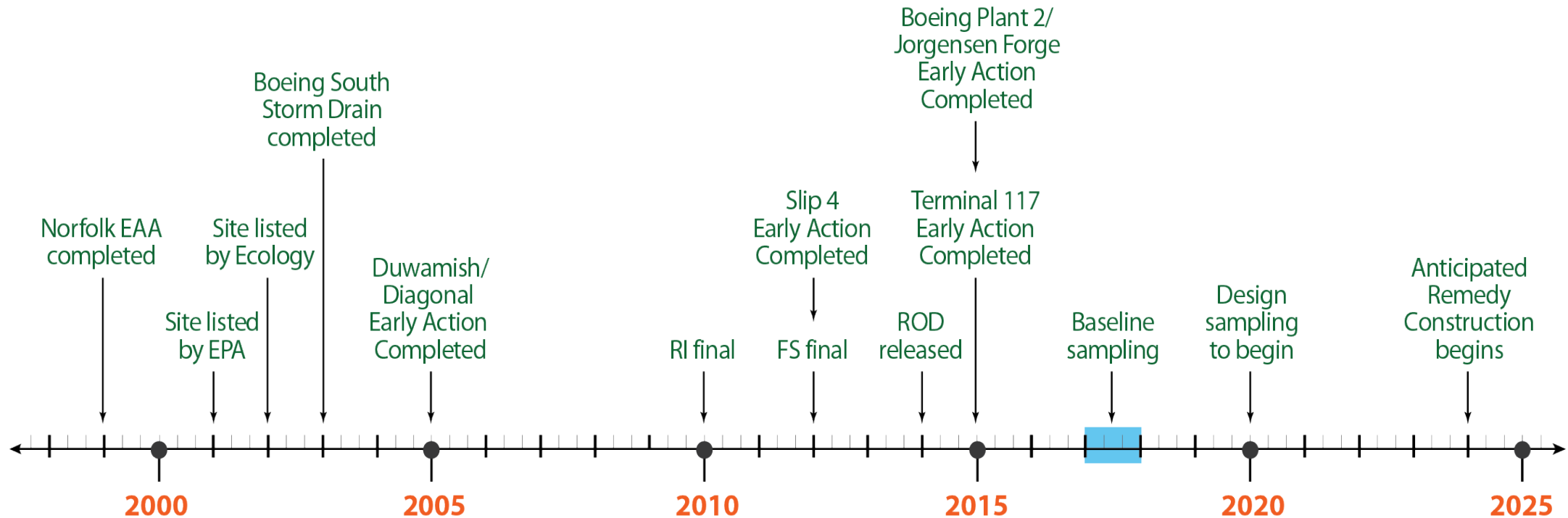
### Human Health

- PCBs
- cPAHs
- Dioxins/furans
- Arsenic

### Ecological

- PCBs (Otters)
- 34 Washington State SMS chemicals (benthic invertebrate community)

# Timeline

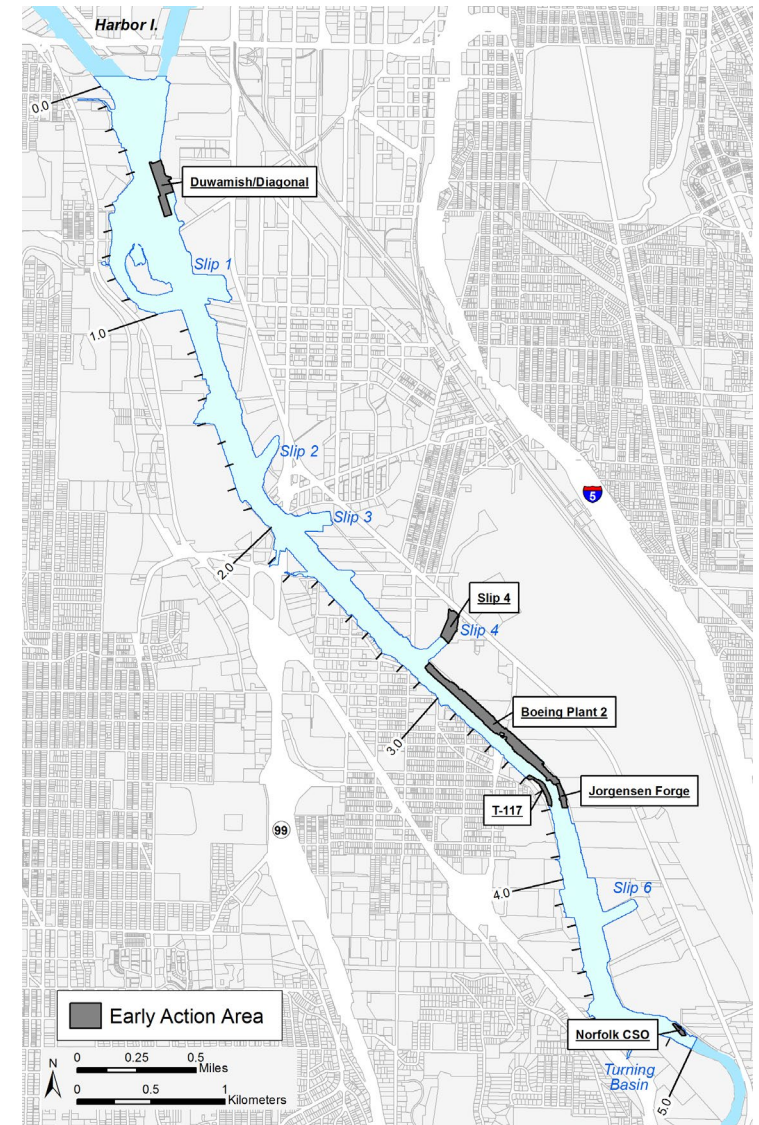


Source control is ongoing...

Sediment Remedy Effectiveness Retrospective Workshop

# Summary of Remedy

- Duwamish/Diagonal: 2005, 6.7 ac, \$10.1 million
- Slip 4: 2012, 3.8 ac, \$8.1 million
- Boeing Plant 2: 2015, 17.5 ac, \$100+ million
- Jorgensen Forge: 2015, 1.4 ac, \$7 million
- Terminal 117: 2015, 1.7 ac, \$26 million
- Norfolk CSO: 1999, 0.6 ac, \$2.3 million



# Significant Remedy Scope or Schedule Deviations

- In 2000, initial discussions envisioned a streamlined CERCLA process with early actions followed by adaptive management
- In 2001, CERCLA AOC for standard process signed by four parties
- Early actions took longer than anticipated
- In 2013 (just before the ROD), State sediment regulations changed adding new concepts

# When Were External Sources Characterized and Addressed?

- USEPA is lead agency for the sediment remedy and Ecology is lead for source control
- Source control efforts began in the early 2000s and involved many analyses and actions
- Source control for Early Actions involved targeted assessments, source tracing, and stormwater system retrofits
- Early actions went forward after source control was deemed sufficient to minimize likelihood of sediment recontamination above remedial action levels
- Ecology is focusing on priority sources and will make sufficiency recommendations as phased remedial design progresses from upstream to downstream

# Primary Pre- and Post-Remedy Effectiveness Monitoring Elements

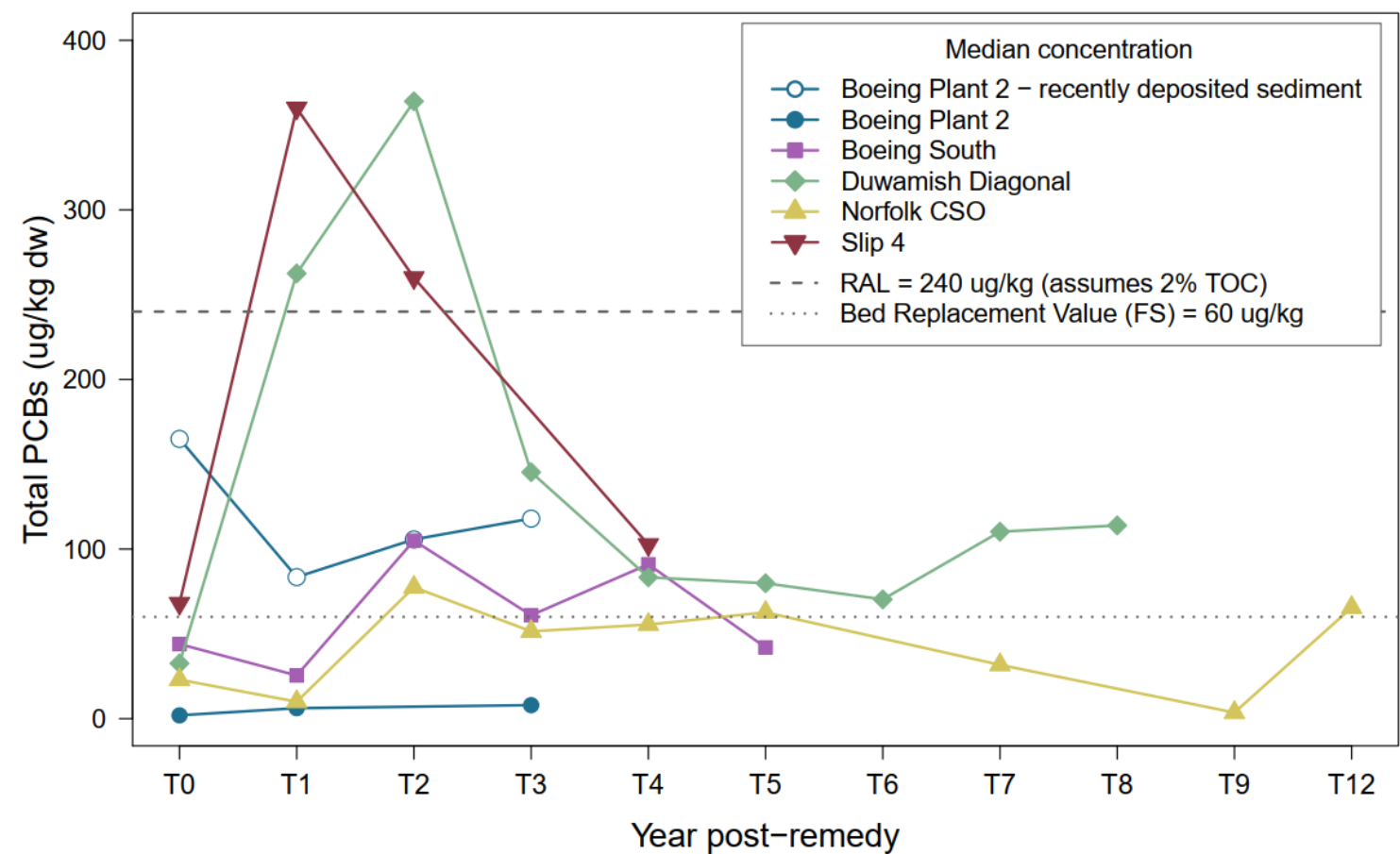
- Early Action Areas
  - Post-construction compliance sediment sampling
  - Long-term sediment recontamination monitoring ( $\geq 5$  years) and off-site residuals monitoring at three areas
- Full sediment remedy
  - Baseline sampling of sediment, surface water, and tissue (fish, clams, crabs) in 2017/2018
  - Post-construction sampling
  - Long-term sediment, surface water, and tissue monitoring for remedial effectiveness and achievement of cleanup objectives

# Did the Remedy Achieve Short- and/or Long-Term Remediation Objectives for Surface Sediment?

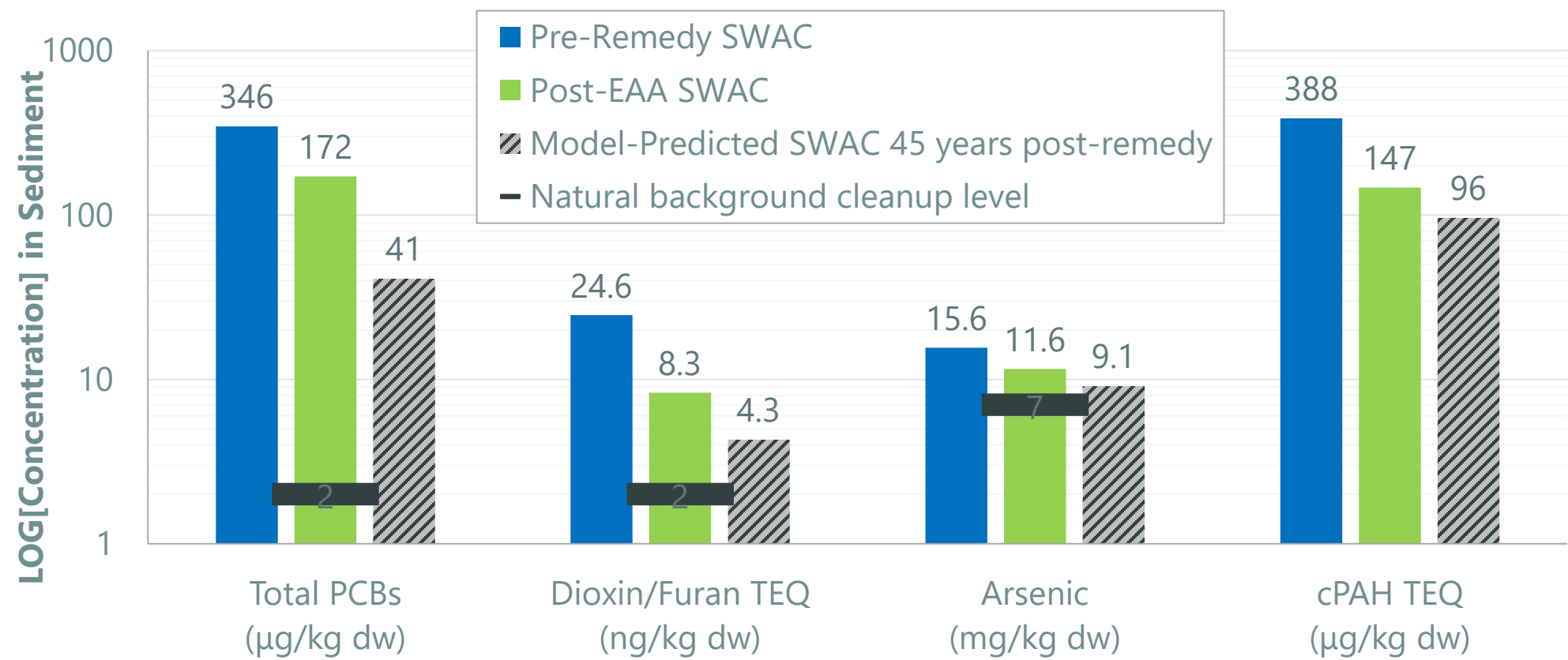
- Generally met objectives for Early Action Areas after 1 to 2 years
- Full sediment remedy has not yet begun (scheduled to begin in 2024)
  - Meeting model sediment predictions after early actions (50% reduction in PCB SWAC)
  - Model predicts that long-term PCB remediation objectives (2 µg/kg dw, based on Puget Sound natural background) will not be met in sediment
    - Once the remedy is complete and concentrations have reached a steady state, next steps will be determined based on a process outlined in the ROD
    - Cleanup levels may also be revised in the interim to incorporate regional background



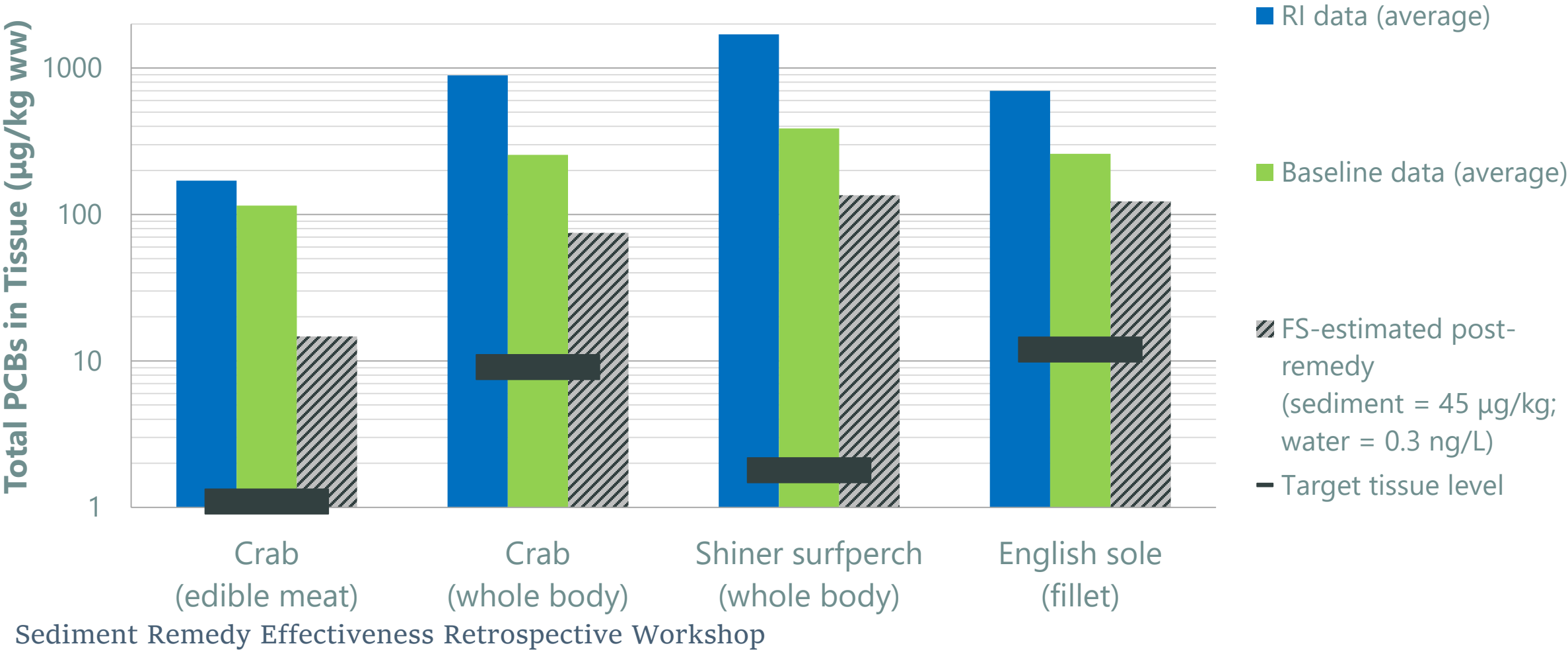
# Post-Early Action Area Sediment Monitoring



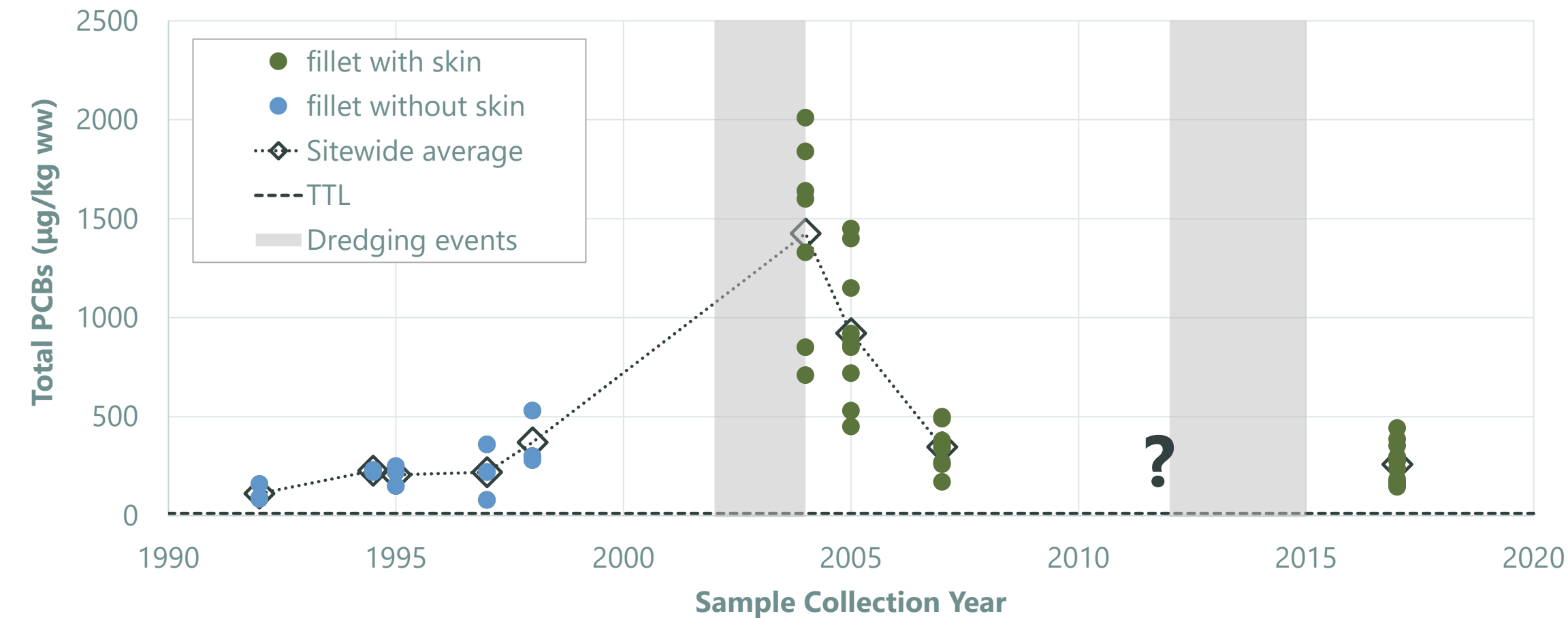
# Waterway-Wide Sediment SWACs Before and After Early Actions



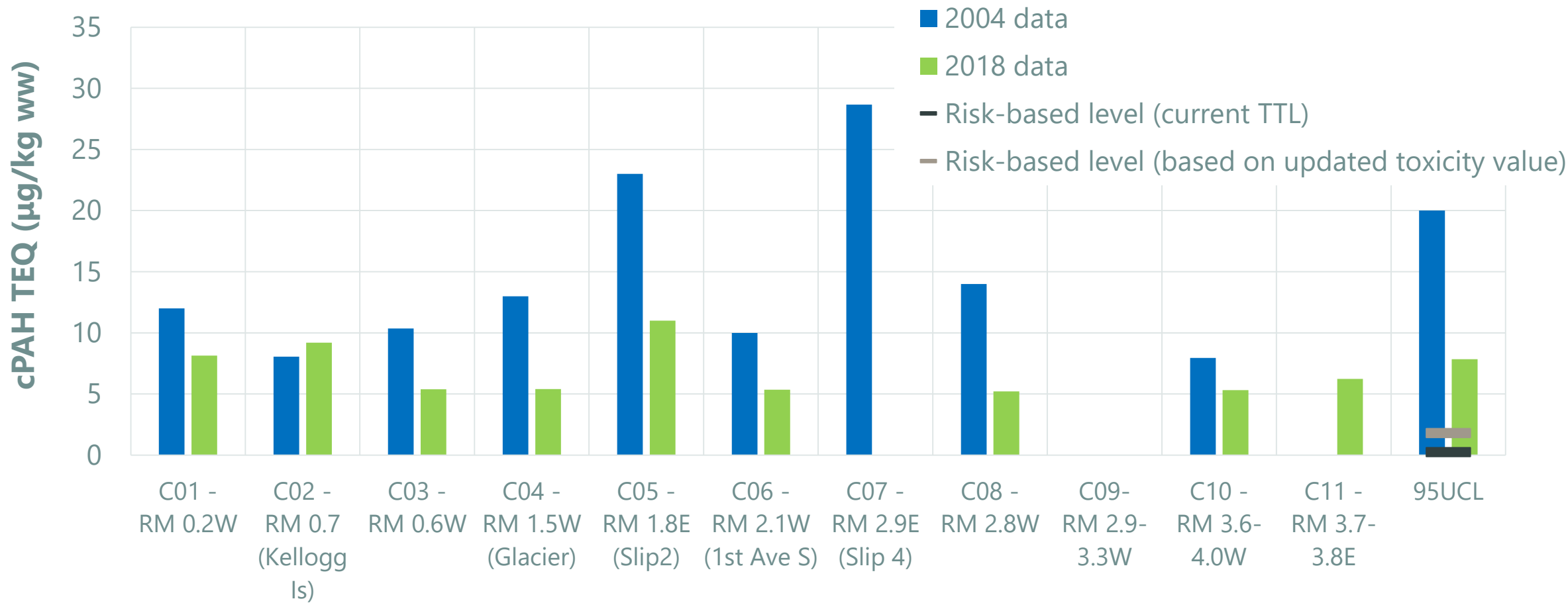
# Is the Remedy on Track to Achieve Long-Term Targets for Biota?



# PCB Concentrations in English Sole Fillet Tissue

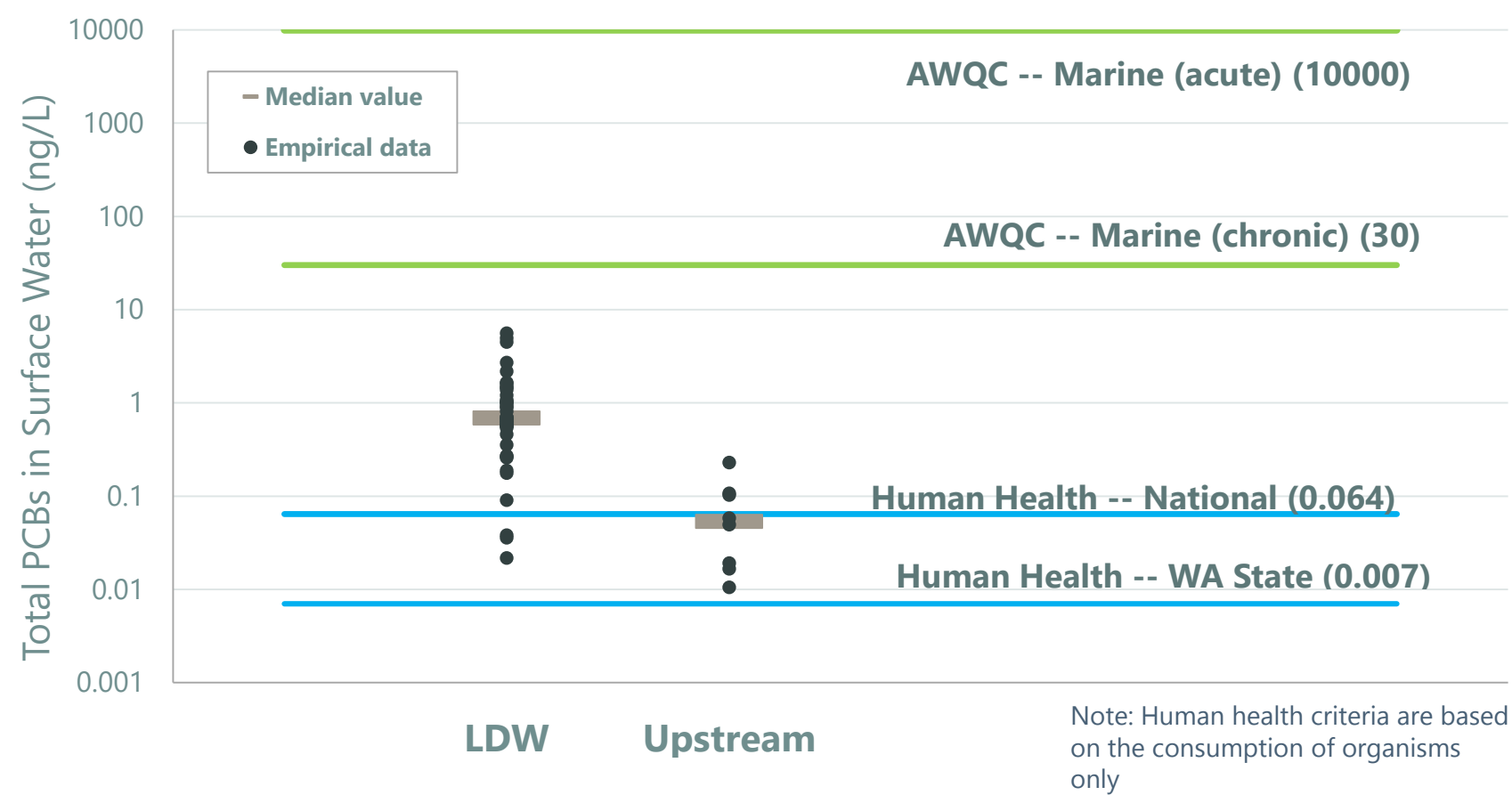


# cPAHs TEQs in Clam Composite Tissues



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# Is the Remedy on Track to Achieve PCB ARARs in Surface Water?



# Key Take-Home Messages

- Early actions were effective in significant reduction in sediment concentrations (on track); no significant reduction in fish/crab seafood consumption risk (yet)
- Having sediment management standards helps establish consistent action levels – for early action and cleanup
- Robust baseline data and monitoring is important to document risk reduction and what cleanup accomplished; compositing and statistical designs are important
- Source control is resource intensive, time consuming, complex, and critical
- USEPA and PRPs need to work together in these complex urban sites to speed up the CERCLA process and set realistic expectations
- For more information, visit: [LDWG.org](https://LDWG.org)