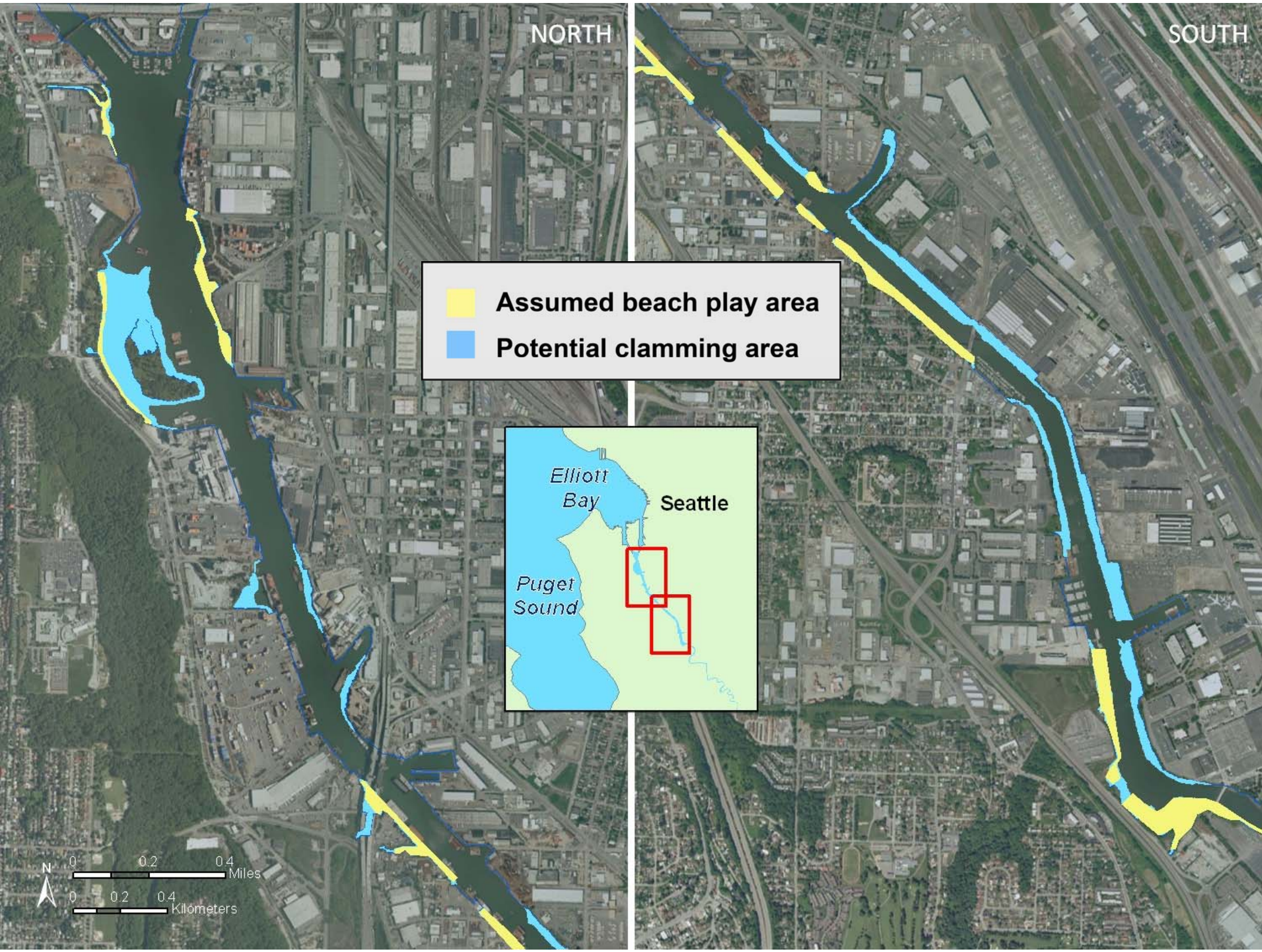
An Overview of Risks, Background, and Other Challenges at the Lower Duwamish Waterway Superfund Site

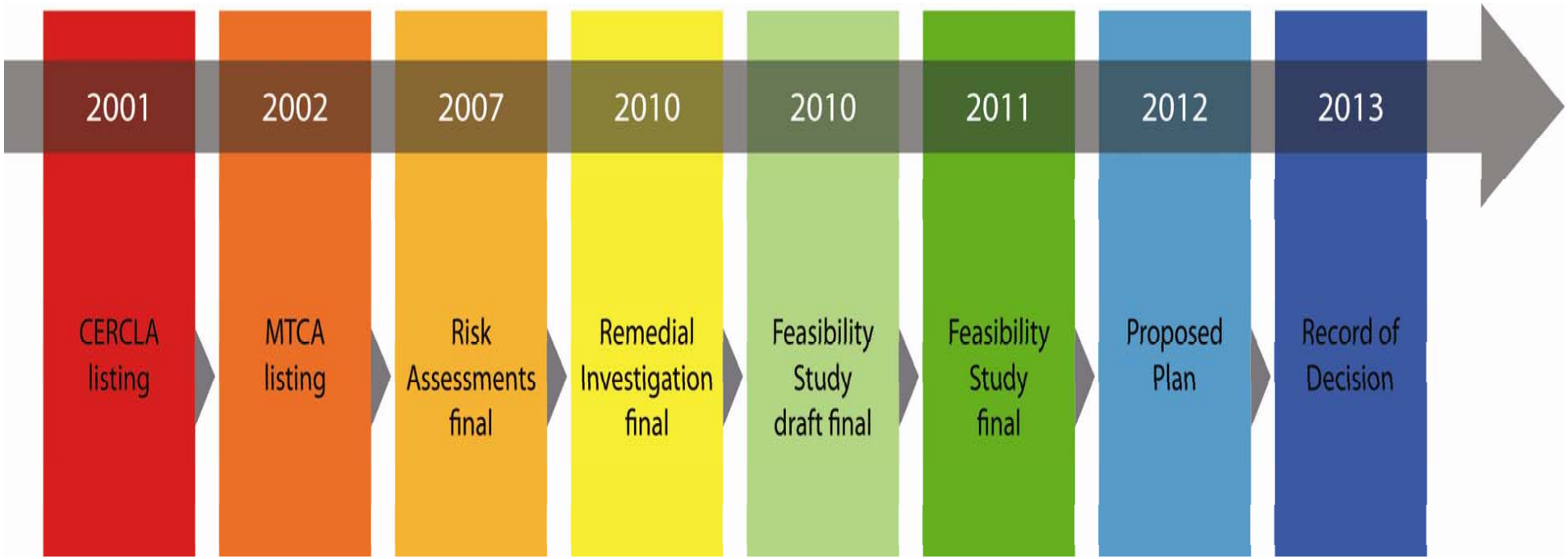
K Godtfredsen, D Hotchkiss, S Fox,
D Schuchardt, J Goldberg, J Stern,
D Williston, L McCrone, M Johns, and T Deshler

Overview

- Location and estuarine setting
- Regulatory history and current status
- Risk drivers for human health
- Risk drivers for ecological receptors
- Risk-based threshold concentrations (RBTCs)
- Comparison of RBTCs with background
- Challenges


NORTH
SOUTH
Assumed beach play area
Potential clamming area
Elliott Bay
Seattle
Puget Sound
N
0 0.2 0.4 Miles
0 0.2 0.4 Kilometers

Timeline

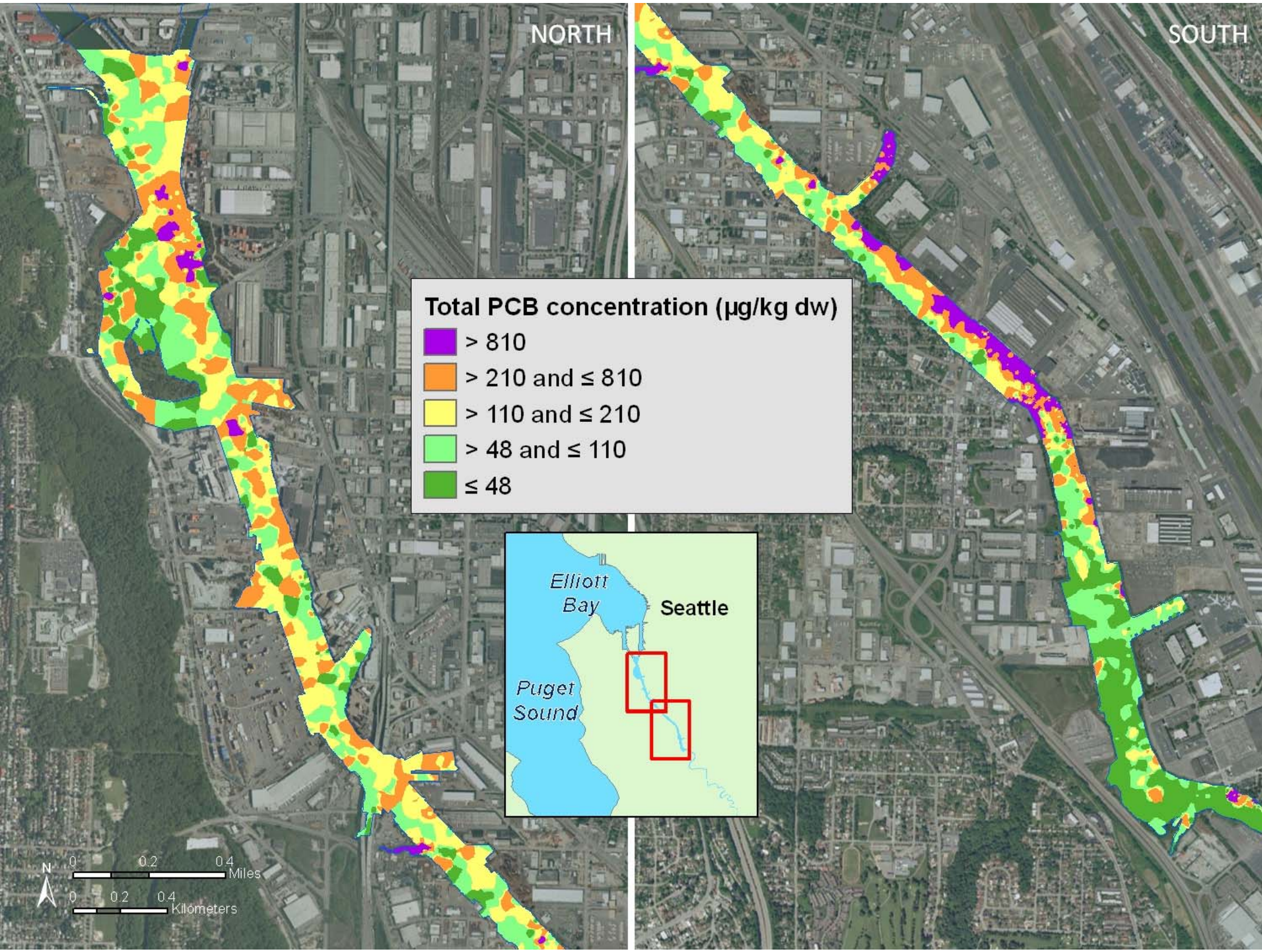

2001
CERCLA listing
2002
MTCA listing
2007
Risk Assessments final
2010
Remedial Investigation final
2010
Feasibility Study draft final
2011
Feasibility Study final
2012
Proposed Plan
2013
Record of Decision

EPA and Department of Ecology Co-Lead

Program	Human Health Excess Cancer Risk Target	Background Definitions	Benthic Invertebrates
CERCLA	10^{-4} to 10^{-6} (cumulative)	Anthropogenic	Risk assessment
Washington State Model Toxics Control Act (MTCA) and Sediment Management Standards (SMS)	10^{-6} (individual chemicals) 10^{-5} (cumulative)	Natural and area	Promulgated numeric chemical criteria with toxicity test override

Risk Drivers for Human Health

- Human health scenarios
  - Seafood consumption
  - Direct sediment contact
    - Beach play
    - Clamming
    - Netfishing
- Risk-driver chemicals
  - Polychlorinated biphenyls (PCBs)
  - Dioxins/furans
  - Carcinogenic polycyclic aromatic hydrocarbons (cPAHs)
  - Arsenic

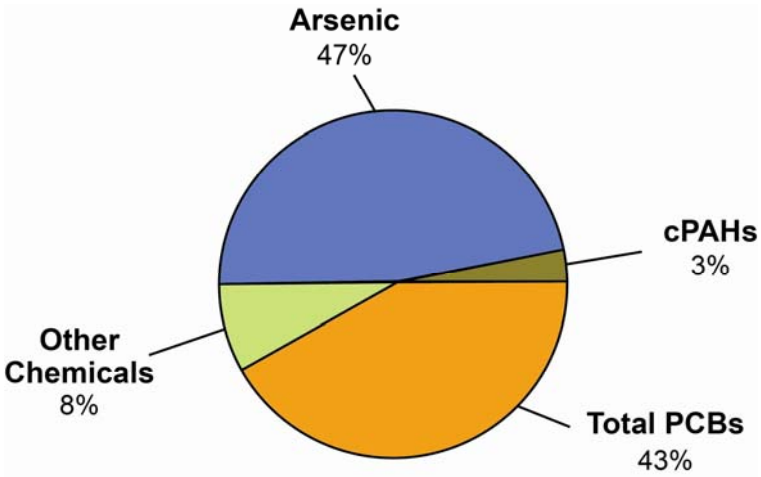

NORTH
SOUTH
Total PCB concentration (µg/kg dw)
> 810
> 210 and ≤ 810
> 110 and ≤ 210
> 48 and ≤ 110
≤ 48
Elliott Bay
Seattle
Puget Sound
N
0 0.2 0.4 Miles
0 0.2 0.4 Kilometers

Human Health Seafood Consumption

Scenario	Key Assumptions	Excess Cancer Risk Estimate	Non-Cancer Hazard Indices
Adult Tribal RME	97.5 g/day for 70 yrs	3×10^{-3}	0.4 to 41
Child Tribal RME	39 g/day for 6 yrs	7×10^{-4}	0.5 to 89
Asian and Pacific Islander RME	51.5 g/day for 30 yrs	1×10^{-3}	0.2 to 30
One meal per month (informational)	7.5 g/day for 30 yrs	3×10^{-5} to 2×10^{-4}	0.006 to 10

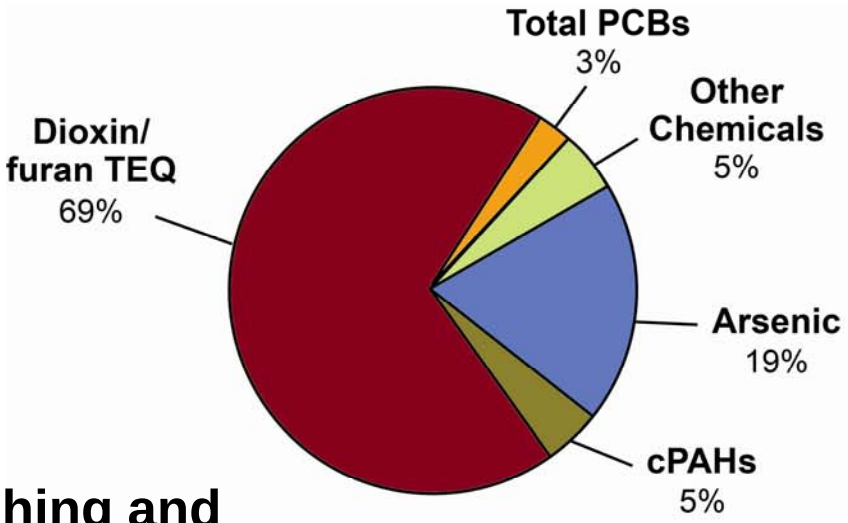
RME – reasonable maximum exposure

Contribution of risk driver chemicals

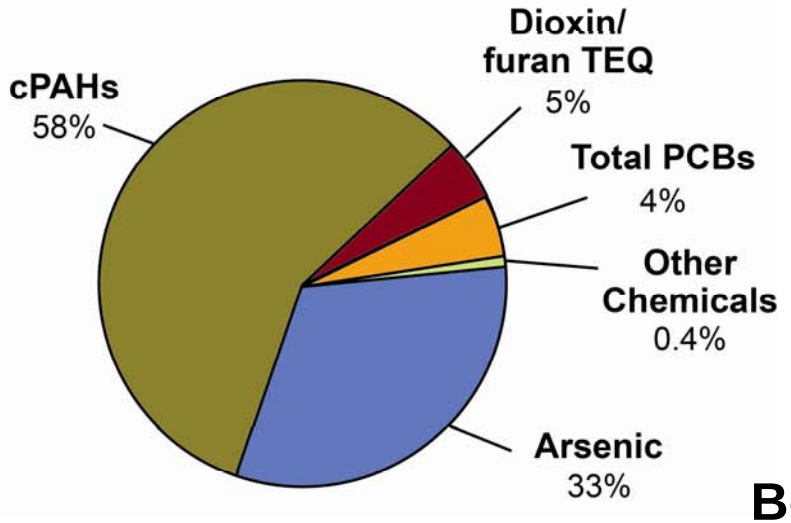


Direct Sediment Contact

Scenario	Key Assumptions	Updated Excess Cancer Risk Estimates	Updated Non-Cancer Hazard Quotients
Beach play RME	65 days/yr for 6 yrs	4×10^{-6} to 6×10^{-4}	< 1 (except one area with HQ of 187 for PCBs)
Tribal clamming RME	120 days/yr for 64 yrs	8×10^{-5}	< 1
Netfishing RME	119 days/yr for 44 yrs	1×10^{-5}	< 1



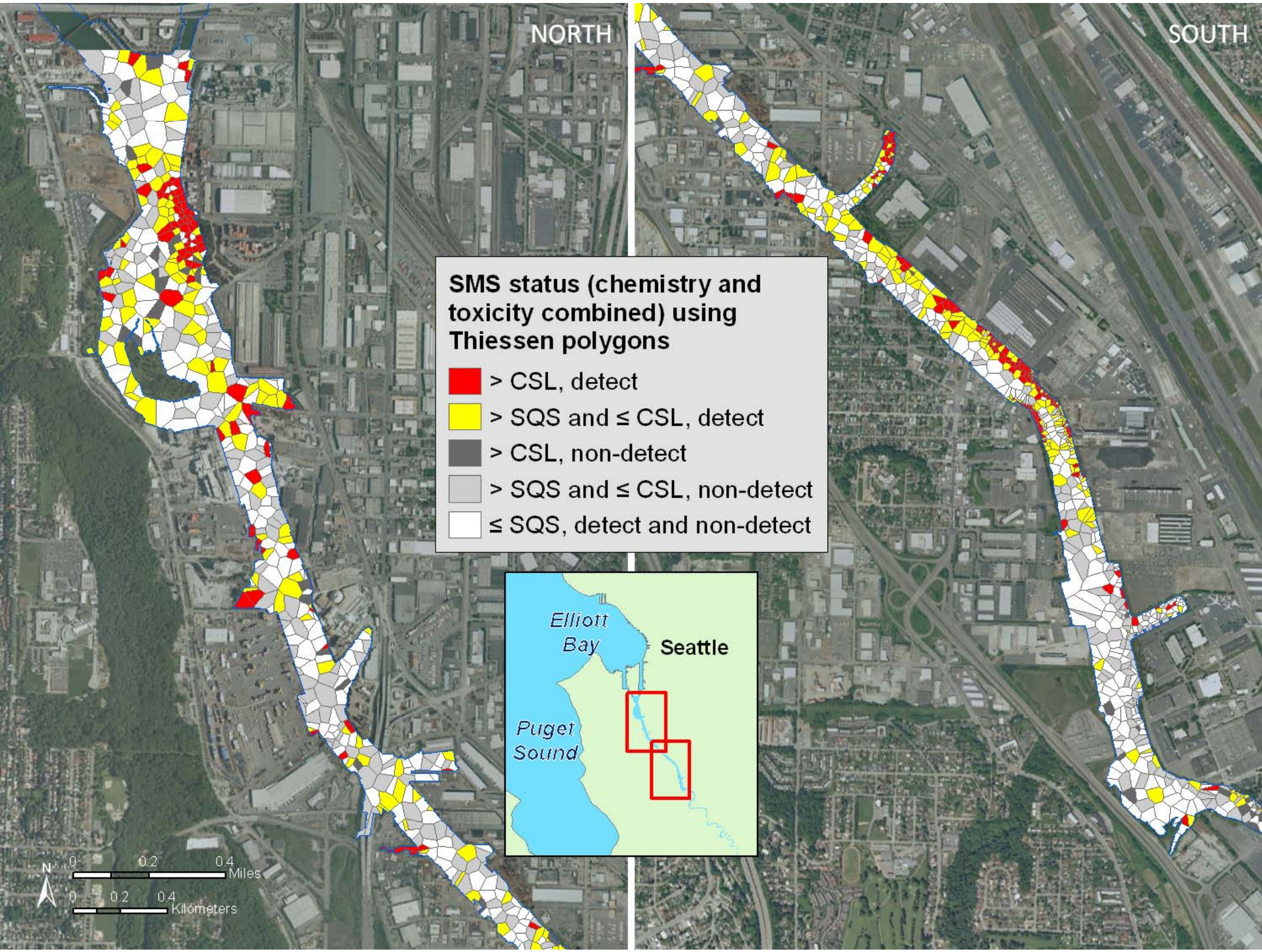
Netfishing and clamming



Beach play

Risk Drivers for Ecological Receptors

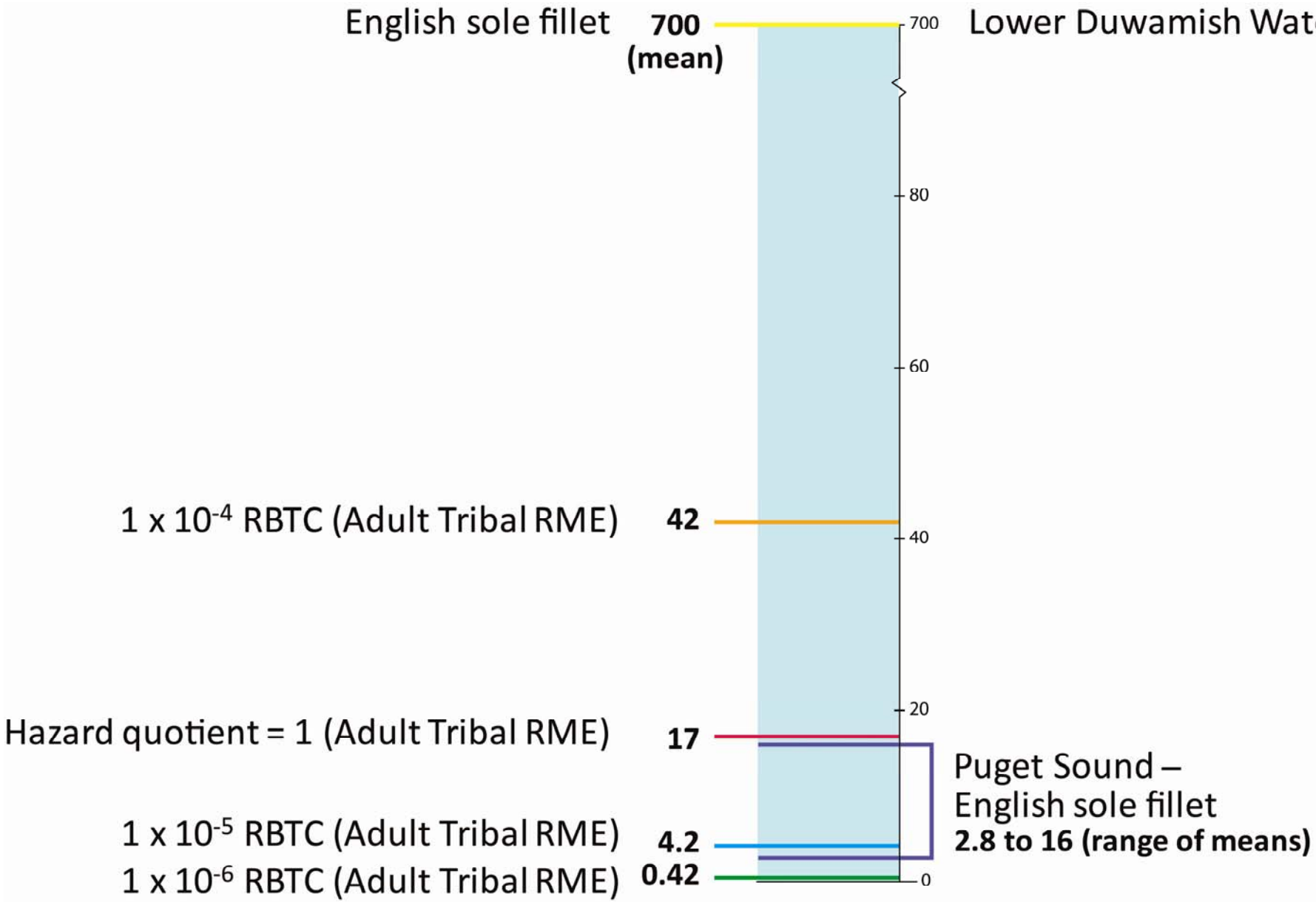
- Risks assessed for:
  - Birds (heron, osprey, sandpiper)
  - Mammals (otter, seal)
  - Fish (sculpin, sole, juvenile salmon)
  - Benthic invertebrates (including gastropods and crabs)
- Risk-driver chemicals
  - PCBs (otter) – lowest-observed-apparent-effects level (LOAEL)-based hazard quotient (HQ) of 2.9
  - 41 chemicals for benthic invertebrates


NORTH
SOUTH
SMS status (chemistry and toxicity combined) using Thiessen polygons
> CSL, detect
> SQS and ≤ CSL, detect
> CSL, non-detect
> SQS and ≤ CSL, non-detect
≤ SQS, detect and non-detect
Elliott Bay
Seattle
Puget Sound
N
0 0.2 0.4 Miles
0 0.2 0.4 Kilometers

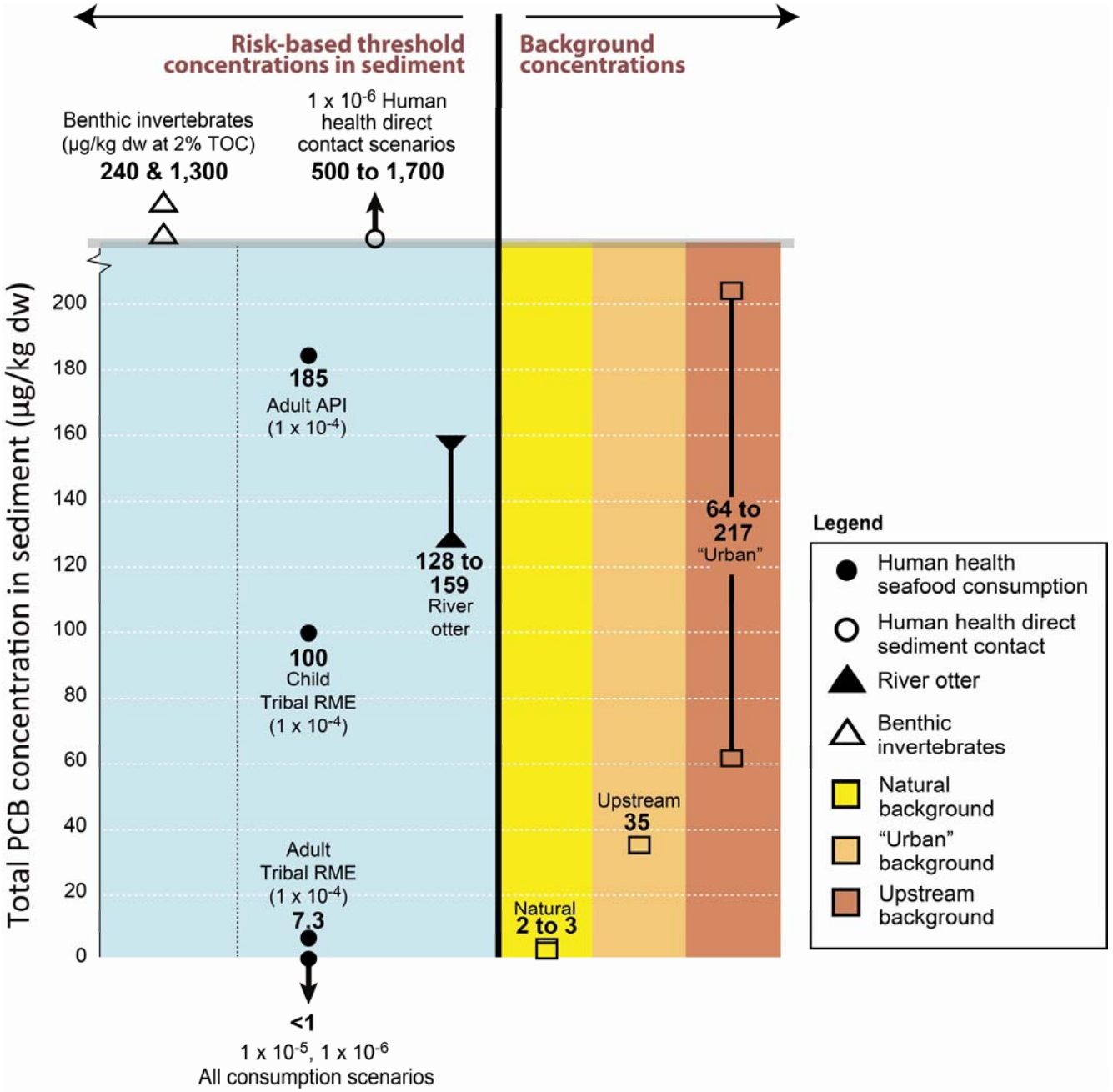
Risk-Based Threshold Concentrations

Risk-Driver Chemical	Tissue RBTCs – Seafood Ingestion	Sediment RBTCs – Seafood Ingestion	Sediment RBTCs – Direct Sediment Contact	Sediment RBTCs – River Otter
PCBs	X	X	X	X
Arsenic	X	Insufficient relationship	X	Not a risk driver
cPAHs	X	Insufficient relationship	X	Not a risk driver
Dioxins and furans	Risks assumed to be unacceptable	Risks assumed to be unacceptable	X	Not a risk driver

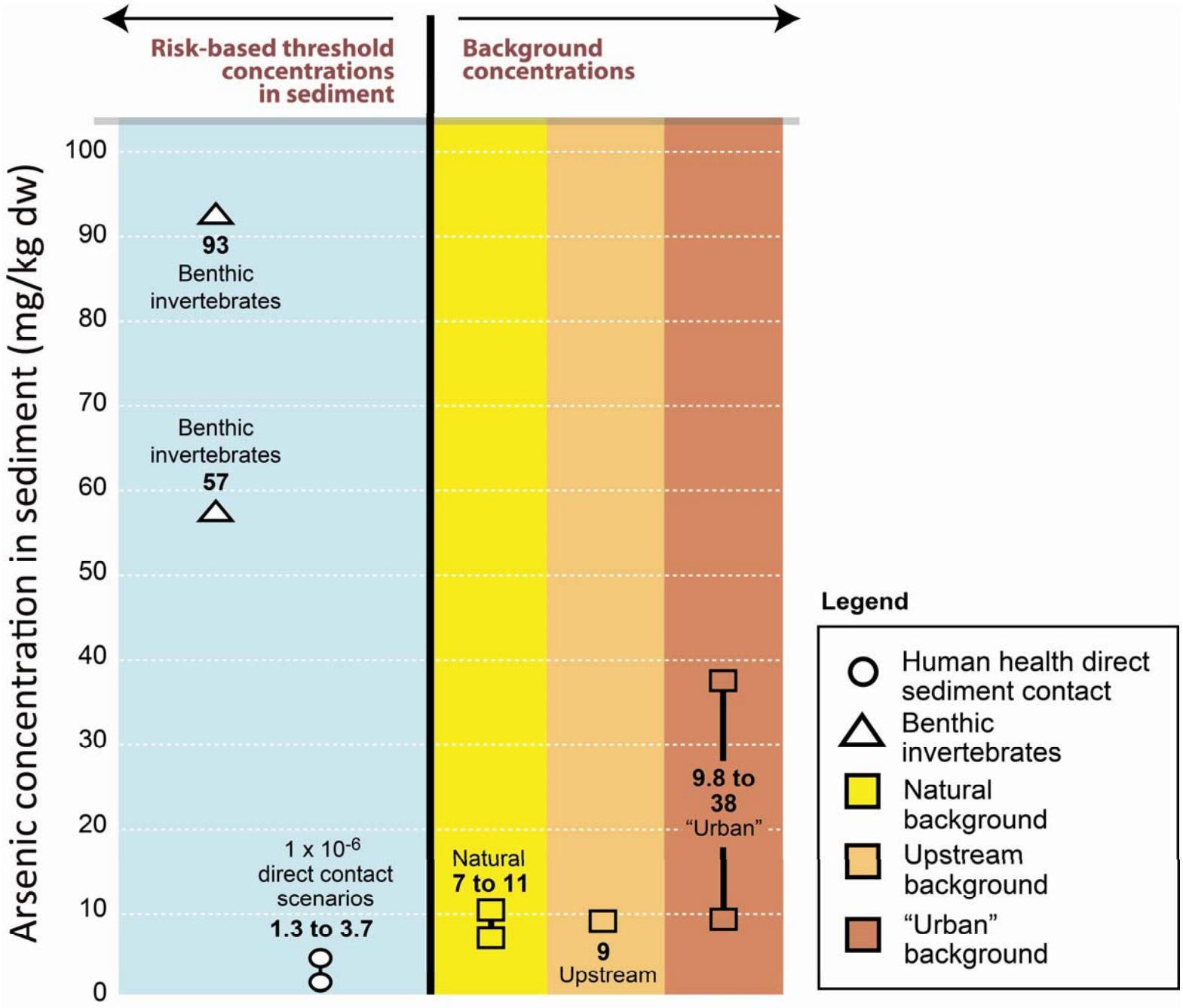
Risk-Based Threshold Concentrations of PCBs in Tissue (µg/kg ww)



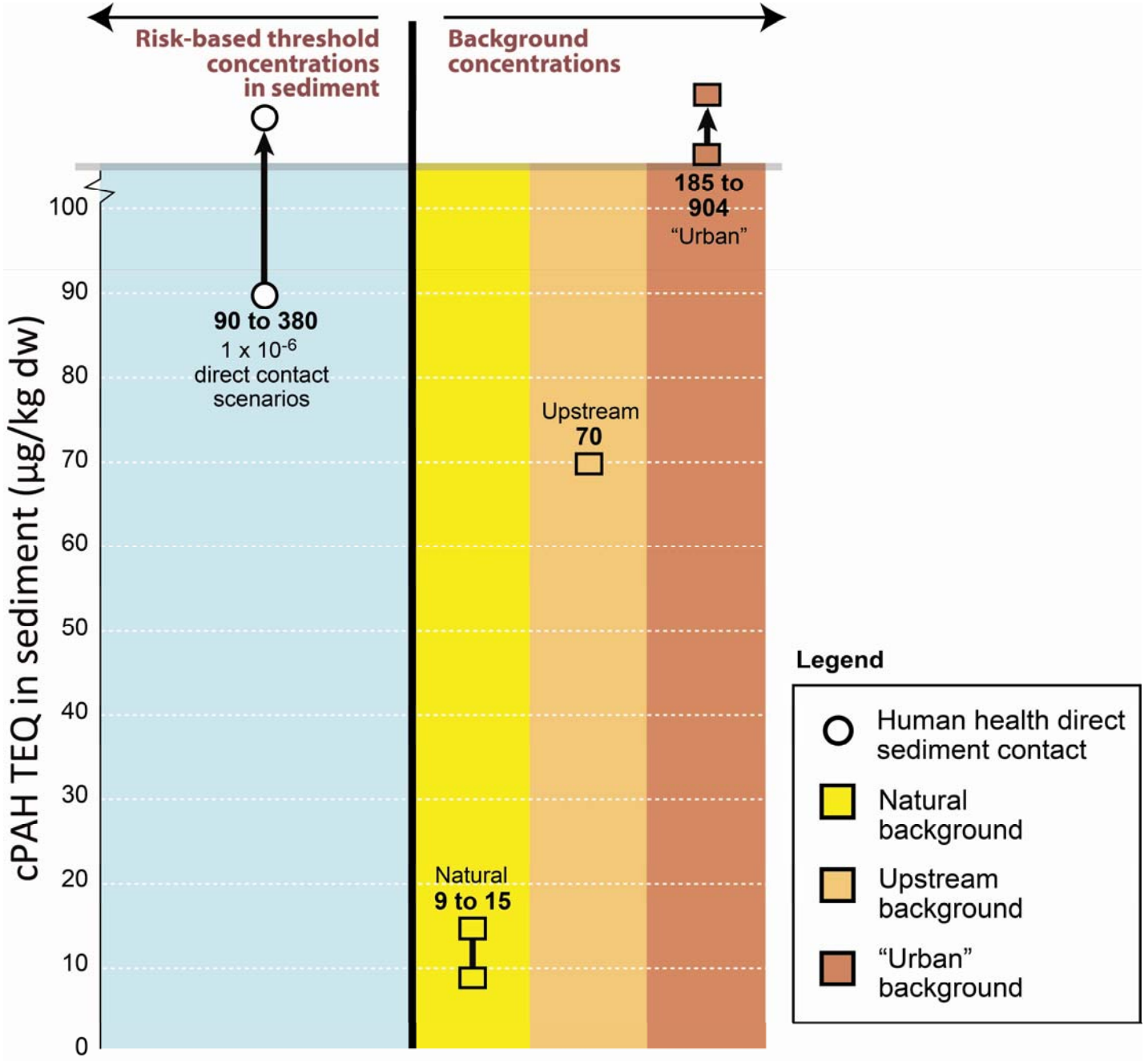
Background and Risk-Based Threshold Concentrations for PCBs in Sediment (µg/kg dw)



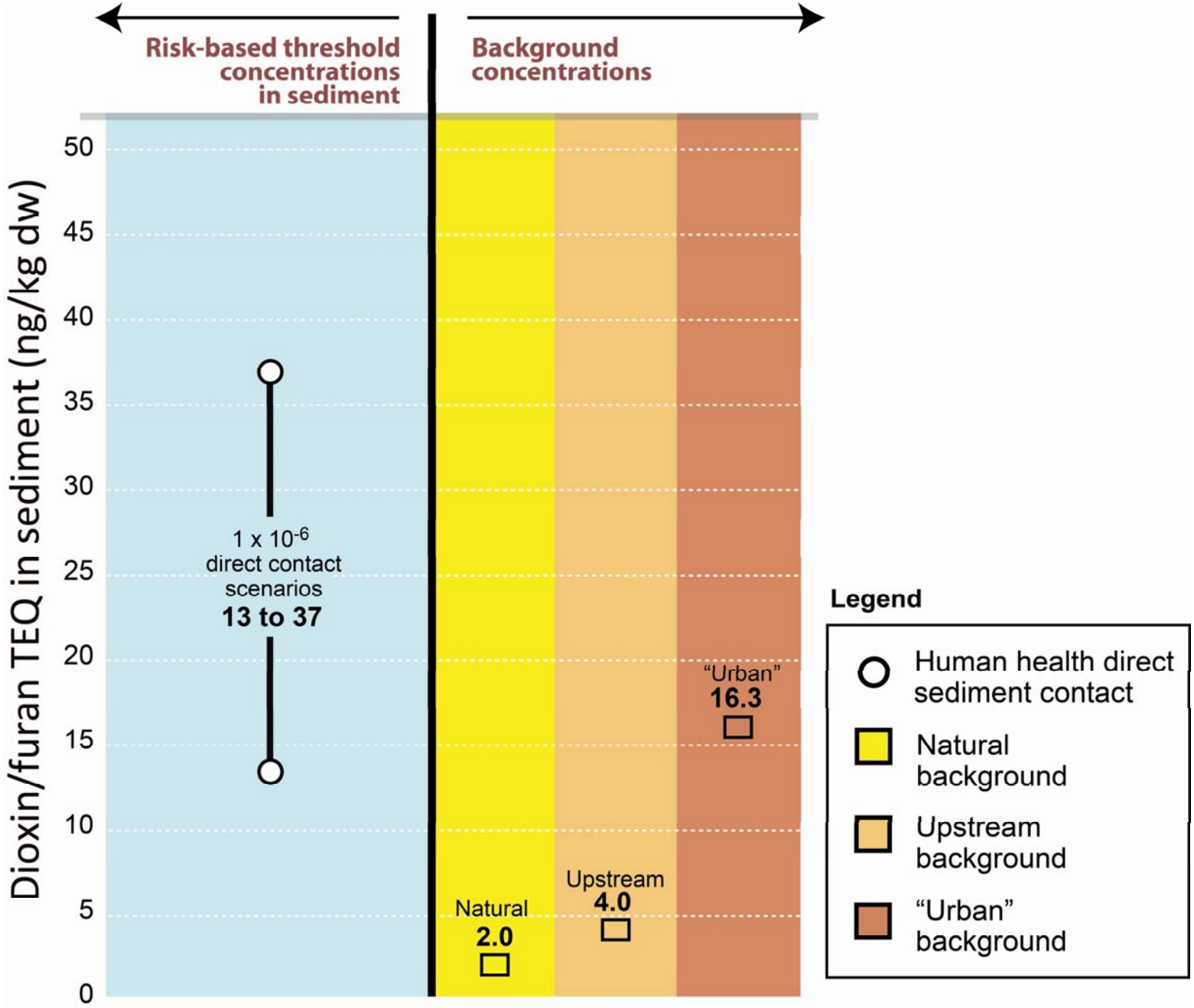
Background and Risk-Based Threshold Concentrations for Arsenic in Sediment (mg/kg dw)



Background and Risk-Based Threshold Concentrations for cPAH TEQ in Sediment (µg/kg dw)



Background and Risk-Based Threshold Concentrations for Dioxin/Furan TEQ in Sediment (ng/kg dw)



Take-home messages

- Urban waterways present many challenges under CERCLA, especially when the site is a co-lead site with the state.
- Key challenges include:
  - Establishing background
  - Assessing sources and recovery and minimizing the potential for recontamination
  - Risk management and communication

Questions?