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Infrastructure, environment, facilities

Tacoma

Thea Foss Waterway Remediation Project

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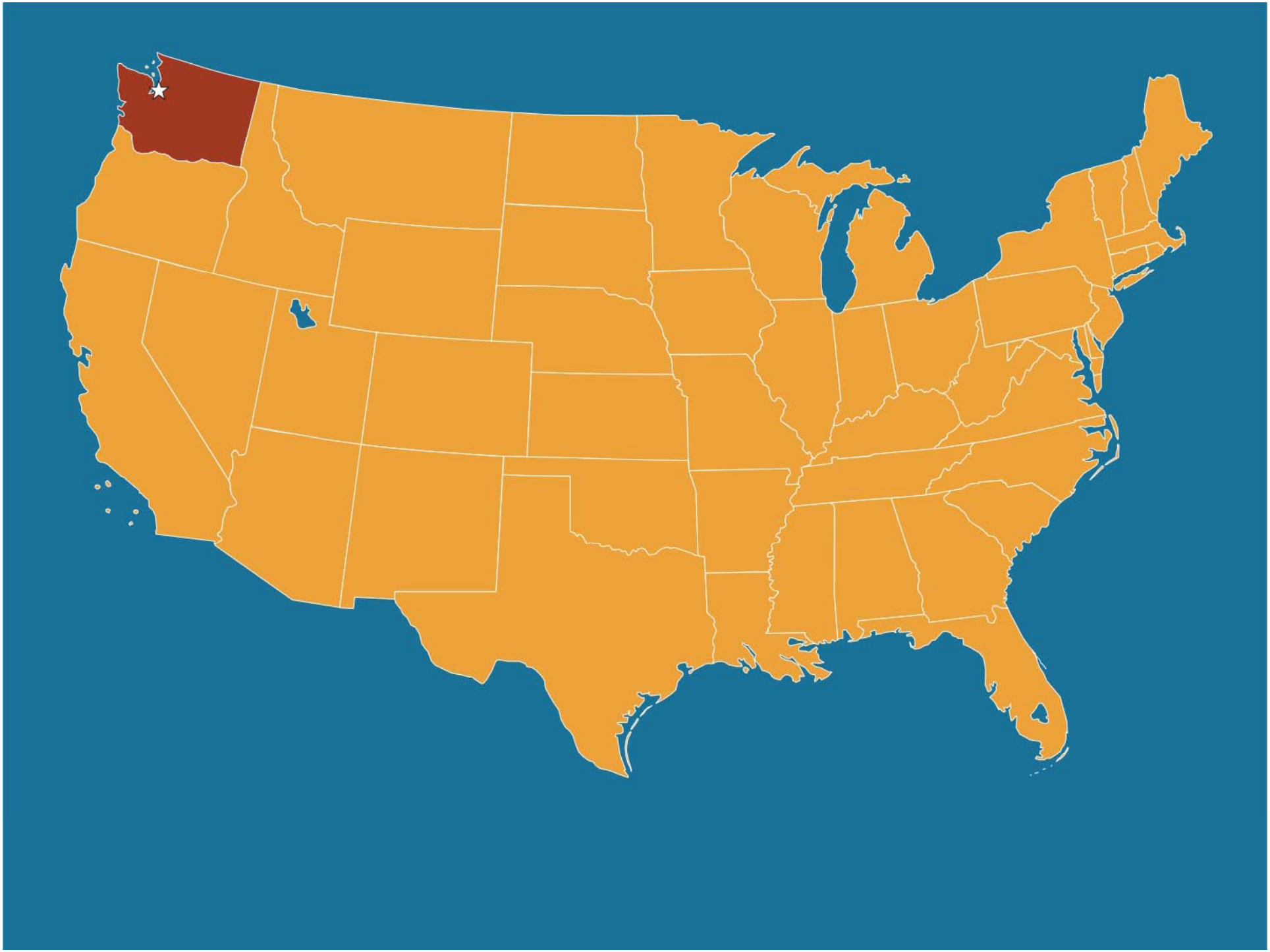
Thea Foss Waterway, Washington, USA

- Waterway received storm drainage and direct discharges: oils, tars, PAHs, phthalates, PCBs
- Multi-user waterway with Extensive redevelopment underway
- Extensive industrial and recreational use
- Risk-based remedial design incorporated source controls, natural recovery, capping, dredging, confined disposal, and habitat mitigation



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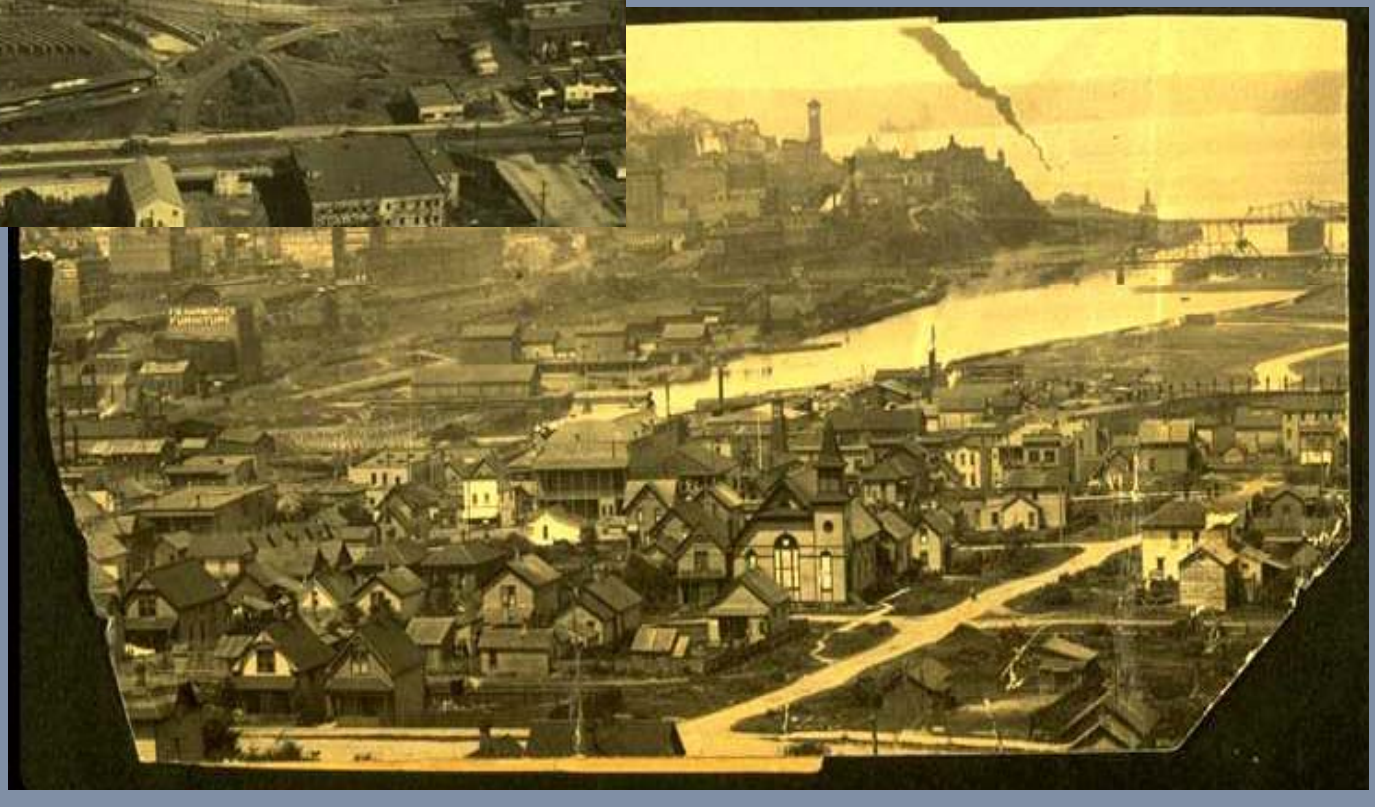
100 Years of Use (and abuse)



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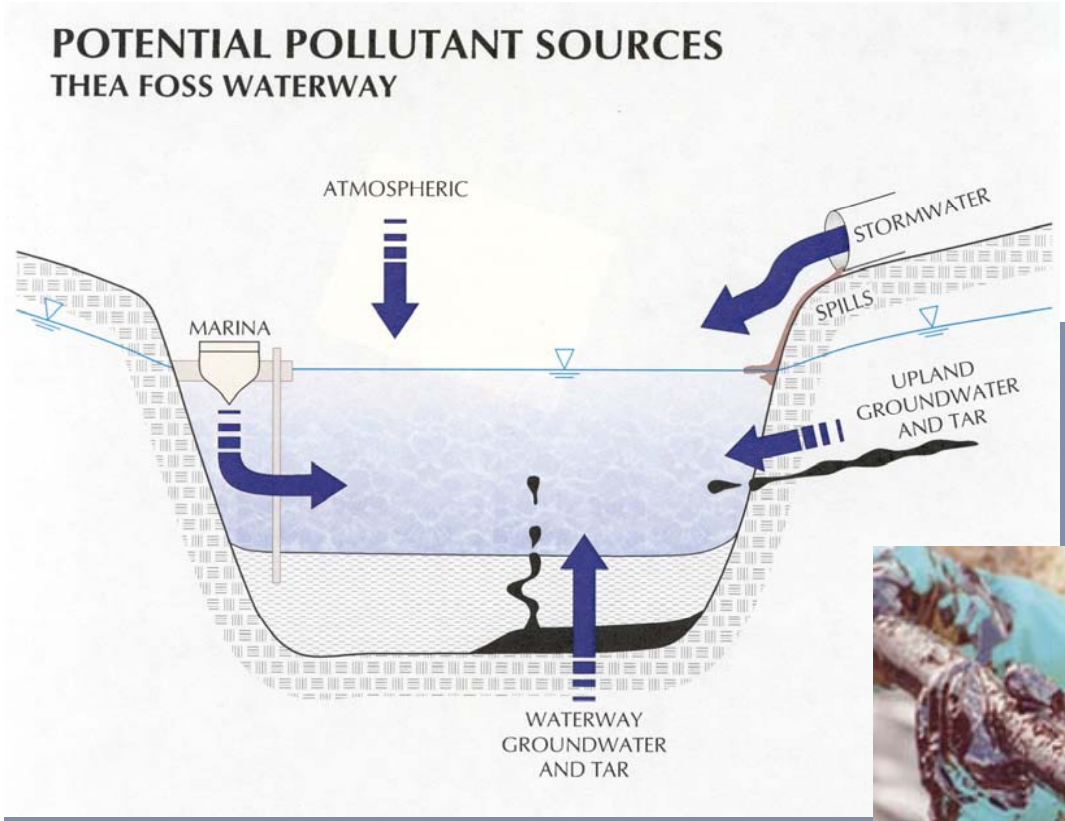

What are we dealing with?

- PAHs
- PCBs
- Metals
- Phthalates
- Pesticides
- Phenols

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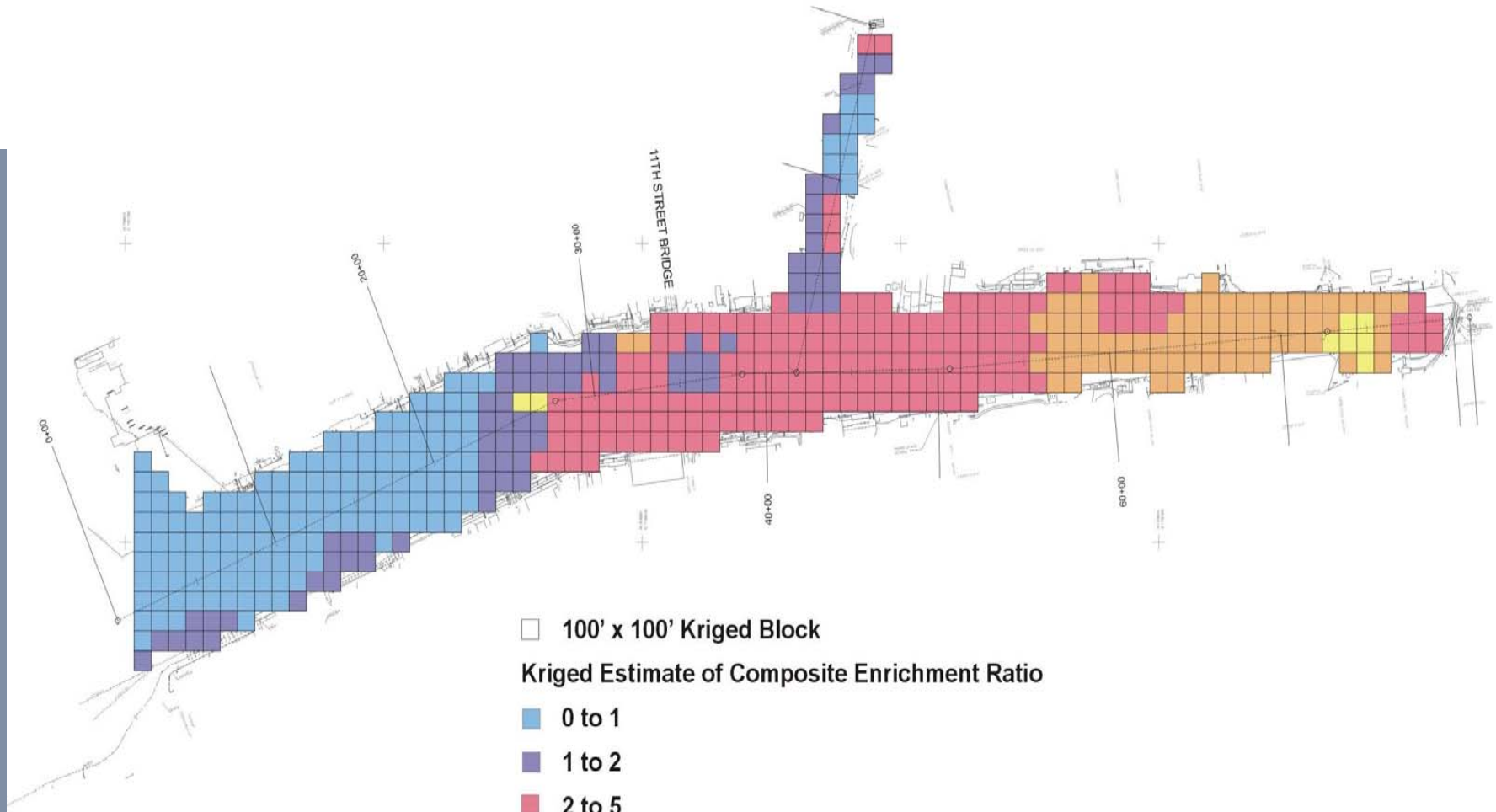
Lifecycle of the Site – 54 years

- National Priorities List (NPL) – 1981
- Declared Superfund site – 1983
- Remedial Investigation/Feasibility Study (RI/FS) – 1985
- Record of Decision (ROD) – 1989
- City of Tacoma takes the lead – 1994
- Administrative Order on Consent (AOC) – 1994
- AOC Required Deliverables – 1995 to 2002
- Explanation of Significant Differences (ESD) – 2000
- Final Design Analysis Report – April 25, 2002
- Construction Contractor Selection – November 2002
- Begin Construction – August 2003
- Complete Construction – March 2003
- Complete Monitoring - 2035

Who is involved – Legal (and Technical) Fragmentation and Complexity

- EPA
- Corps of Engineers
- NOAA
- Washington Department of Ecology
- Washington Department of Fish and Wildlife
- Washington Department of Natural Resources
- Over 50 responsible parties
- Dozens of property owners
- Citizens for a Healthy Bay
- About 20 technical consultants
- Attorneys for each party


11TH STREET BRIDGE
0+00
20+00
30+00
40+00
60+00
100' x 100' Kriged Block
Kriged Estimate of Composite Enrichment Ratio
0 to 1
1 to 2
2 to 5
5 to 10
>10
* Maximum enrichment ratio of pyrene, phenanthrene, bis(2-ethylhexyl) phthalate, mercury, and PCBs (key Constituents)

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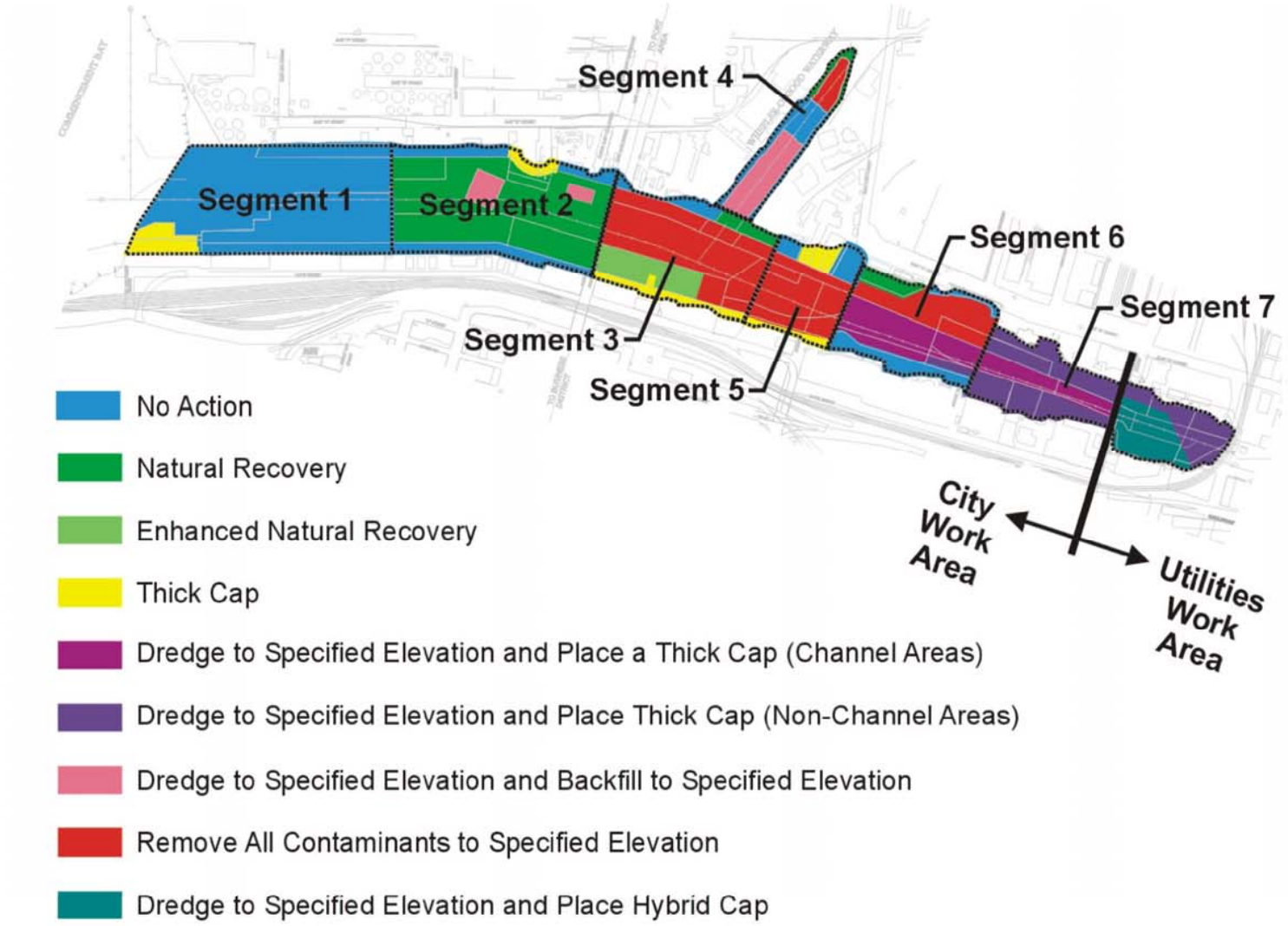
Final Remedy and Disposal Site(s)

- Sequential Risk Management applied to the Thea Foss Waterway –
  - dredging,
  - capping,
  - enhanced natural attenuation,
  - natural attenuation, and
  - no action
- Two Disposal Options – the St. Paul Waterway Nearshore Confined Disposal Facility (CDF) and Upland Disposal


Segment 4
Segment 1
Segment 2
Segment 6
Segment 7
Segment 3
Segment 5
City Work Area
Utilities Work Area
No Action
Natural Recovery
Enhanced Natural Recovery
Thick Cap
Dredge to Specified Elevation and Place a Thick Cap (Channel Areas)
Dredge to Specified Elevation and Place Thick Cap (Non-Channel Areas)
Dredge to Specified Elevation and Backfill to Specified Elevation
Remove All Contaminants to Specified Elevation
Dredge to Specified Elevation and Place Hybrid Cap

Final Design Remedy

- No Action (37 acres)
- Natural Attenuation (21 acres) and Enhanced Natural Attenuation (4 acres)
- Dredging (47 acres – 525,000 cubic yards)
- Capping (30 acres – 225,000 cubic yards)
- Capping of active tar seep

Design Challenges in the Thea Foss Waterway

- Proximity of residential property and consequent concern about noise, odor, and other aesthetic issues
- Construction Impacts on waterfront structures and marinas
- Coordinating with State-led Cleanup and Development Projects – Foss Development and the Esplanade Project
- Outreach to property owners

Cleaning up the Waterway

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Construction Overview

- St. Paul Waterway Confined Disposal Facility (CDF)
- Simpson facilities
- Marinas
- Remedial actions
- Habitat creation and enhancement

St. Paul Waterway CDF

- 12-acre waterway owned by Simpson
- Original depth to -20 ft. MLLW
- Dredged to -60 ft. MLLW for a capacity of 520,000 CY
- Construction of containment & offset berms
- Capped with 9-13 feet of clean material

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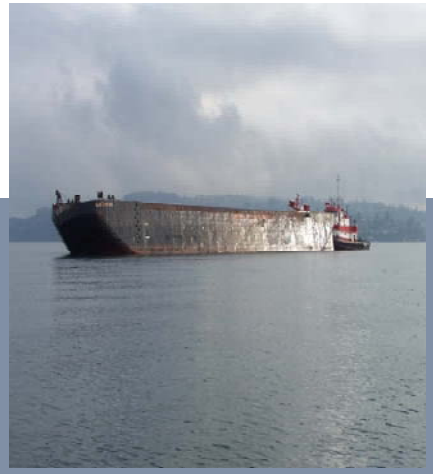
St. Paul CDF



Marinas

- Construction of a new marina
- Removal and replacement of 5 private marinas
- Orchestrated over 850 commercial and recreational boat moves

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Remedial Actions

- 24 separate Remediation Areas (RAs)
- 60 acres of contaminated sediments
- 7 types of remedial actions
  - Dredge to clean
  - Channel dredging and capping
  - Slope dredging and capping
  - Dredge and backfill
  - Enhanced natural recovery
  - Grout mat capping
  - Debris and pile removal

Dredging

Conventional Capping

Grout Mat Capping

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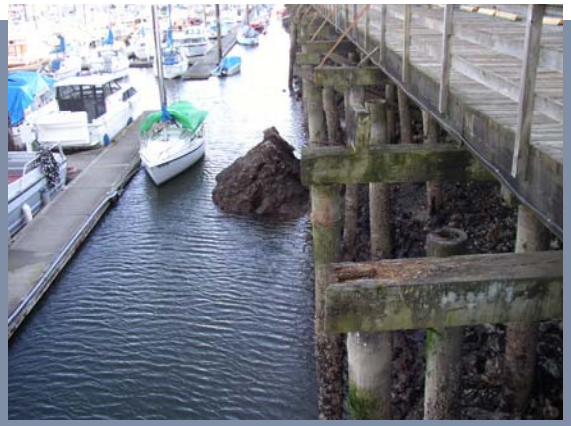
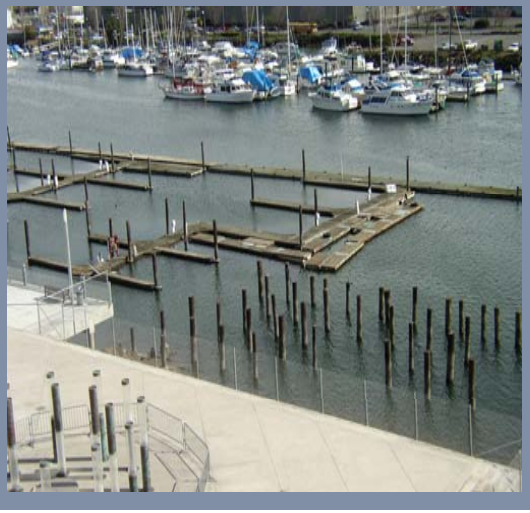
Telebelt Capping

Debris and Pile Removal



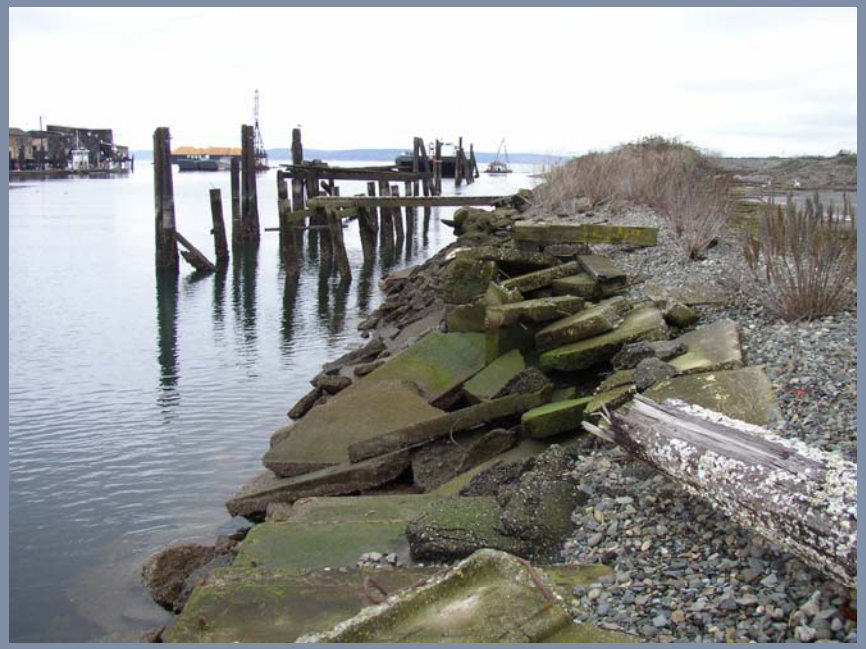


Habitat Creation and Enhancement

- Objectives
  - Actively remediate contaminated waterway sediments
  - Fully mitigate loss of St. Paul Waterway habitat
  - Contribute to the recovery of threatened and endangered species present in the Commencement Bay ecosystem
- Four new major habitat areas
- Enhancement where possible in waterway

North Beach Habitat

Middle Waterway Tideflat Habitat



Puyallup River Side Channel

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Other Mitigation Actions

- Creation of pocket habitat areas
- Removal of creosote treated piling and structures
- Removal of over-water structures

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Esplanade Development, Upland Cleanup

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Paying For It

Cleanup cost: US$105 million

- **City of Tacoma:** $59.5 million
- **Other responsible parties:** $20.3 million
- **State grants:** $21.5 million
- **Other:** $3.7 million

Early Results

Environmental leadership makes economic sense

- 8-fold increase in property values
- $200+ million initial investment
- Museum of Glass, Albers Mill, Thea's Landing, Bridge of Glass, public esplanade
- More developments planned

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What Lessons are We Learning?

- There is no silver bullet in sediment remediation. A risk-based tool box is required
- Remember the obvious: institutional control, source control, resuspension, mass balance, and monitoring
- Specify performance, not method
- Acknowledge the complexity early and often
- Give more weight to good science and engineering
- Beware of solutions that rely on selective use of data
- Appreciate the other players
- Know the game and play it well

Imagine the result