INTEGRATING SEDIMENT CLEAN UP AND WATERSHED MANAGEMENT FOR SINCLAIR AND DYES INLETS, WA USA

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ABSTRACT

Integrating contaminated sediment clean up and restoration issues within the larger perspective of watershed management are especially critical in populated coastal and estuarine areas with multiple sources of stress from urbanization and development as well as sediment contaminated from historical sources. Sinclair and Dyes Inlets, located in the Puget Sound WA, have received historical inputs of contamination from military installations, industrial activities, municipal outfalls, and other nonpoint sources. As part of the record of decision to remediate contaminated sediments near the Puget Sound Naval Shipyard in Sinclair Inlet, sediments were dredged from contaminated areas, placed in an adjacent confined aquatic disposal pit, and covered with clean material dredged to deepen the navigational channel and turning basin. Other cleanup activities included restoring shoreline areas to minimize contaminated soil infiltration and improve shoreline habitat, and conducting a comprehensive cleaning, inspection, and repair of the Shipyard's storm water system. Concurrently, the City of Bremerton, also located in the Inlets, has made significant improvements to its combined sewer and storm water system nearly eliminating combined sewer overflows and achieving a marked improvement in the water quality of the Inlets. Historical trends of contamination in the Inlets obtained from age-dated sediment cores show contamination levels peaking between 1940 and 1960 followed by an obvious decease in contaminant loads in the most recent deposits. During the interval between 1997-8 and 2003 (following clean up activities) the sediments in Sinclair Inlet and Dyes Inlet changed significantly in texture by becoming, on average, nearly a full phi size coarser (from medium to coarse silt). Currently, models are being developed to simulate contaminant runoff and loading from the watershed and the fate and transport of contaminants in Sinclair and Dyes Inlets to calculate Total Maximum Daily Loads and establish the technical and scientific basis to better protect and improve the health of the watershed.

INTEGRATING SEDIMENT CLEAN UP AND WATERSHED MANAGEMENT FOR SINCLAIR/DYES INLETS, WA USA

- Introduction
- Background
  - Historical Trends
- Controlling Potential Sources of Sediment Contaminant
  - Cleanup and Dredging
  - CSO Reduction Program
- Watershed Dynamics
- Summary

Puget Sound Naval Shipyard & Intermediate Maintenance Facility Project ENVVEST

Navy:

Opportunity to propose cleaner, cheaper, and smarter ways of protecting the environment

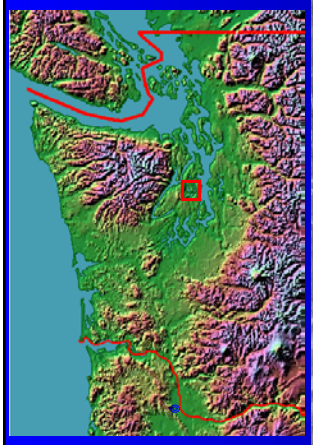
Opportunity to partner with agencies, engage stakeholders, and influence implementation

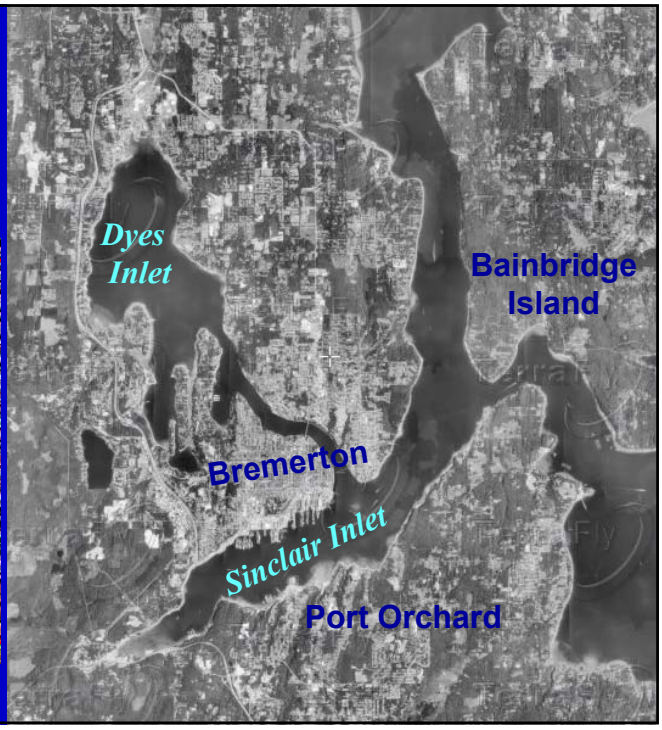
Regulatory Agencies:

More defensible position

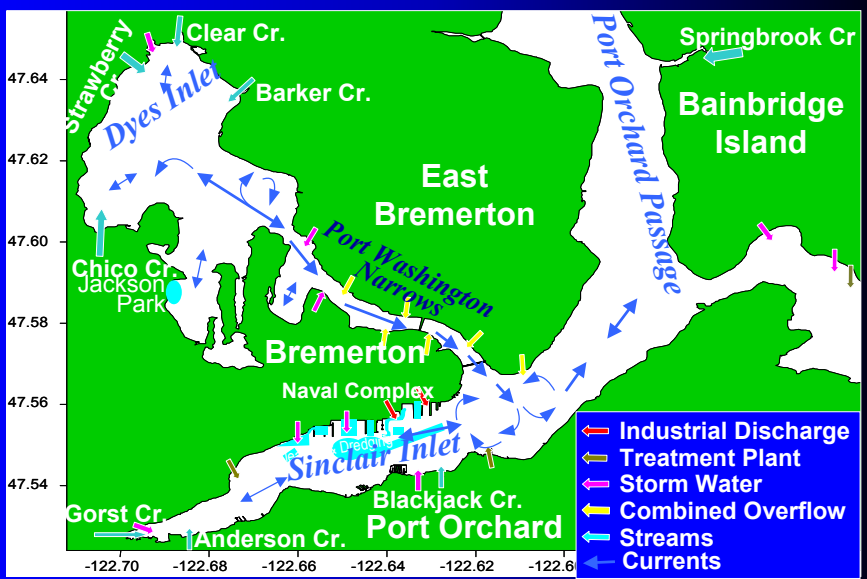
More resources to address problems

Study Area



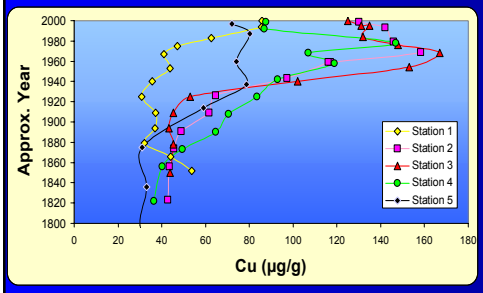


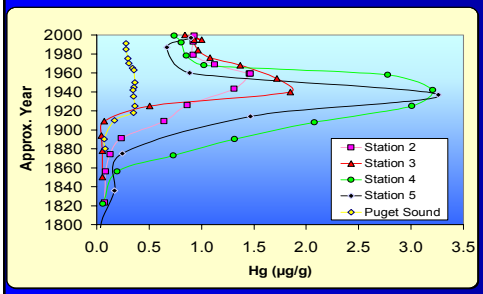
Conceptual Model



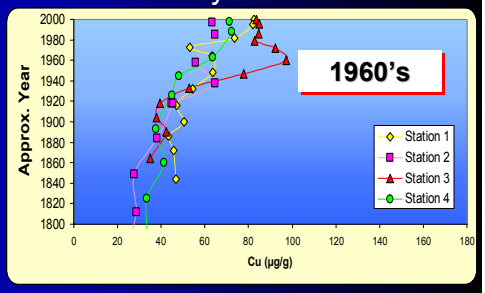
Historical Trends

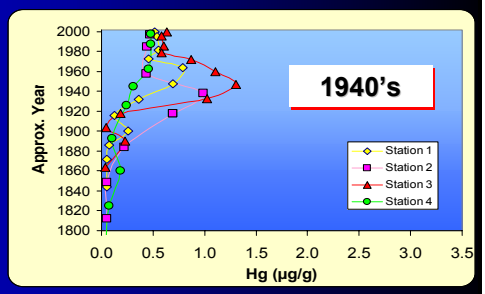
Sinclair Inlet





Dyes Inlet



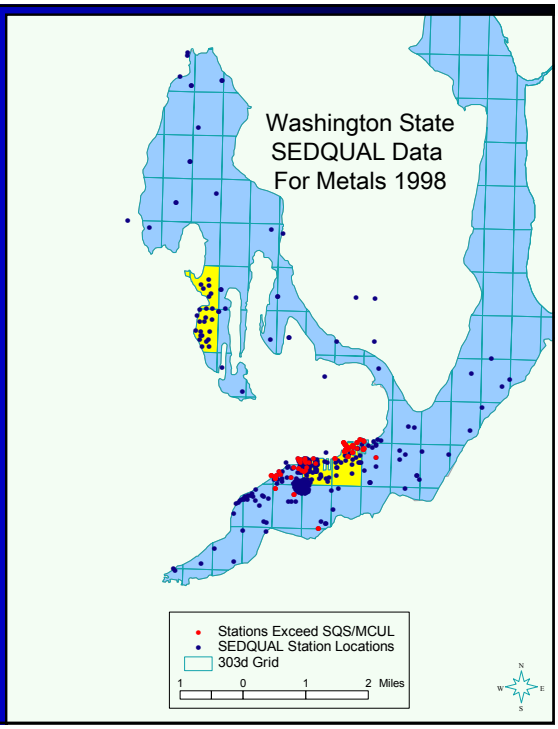


http://www.psat.wa.gov/Publications/03_proceedings/PAPERS/ORAL/6e_crece.pdf

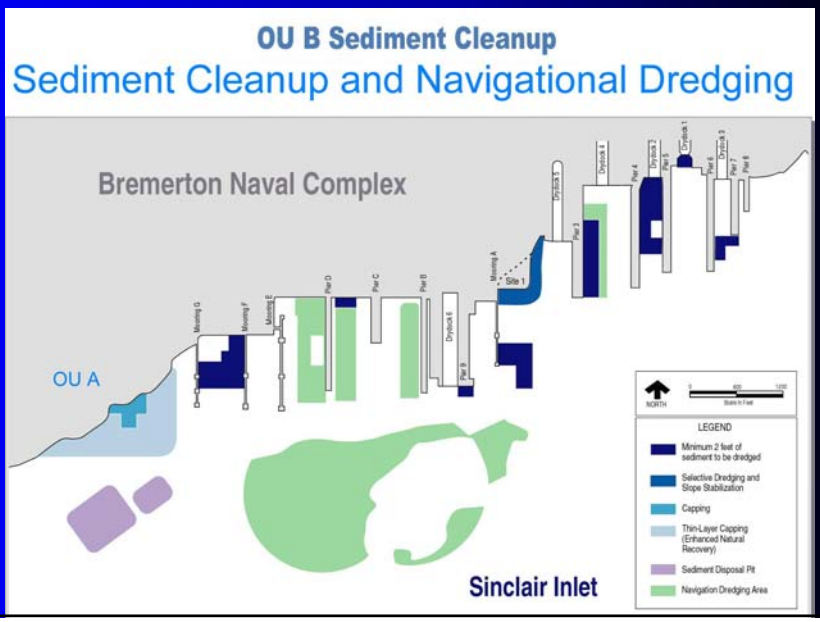
1998 3O3(d) Listings for Sediment

Sinclair Inlet: As, Cu, Pb, Zn, Cd, Hg, PCBs, Phalates,and PAHs

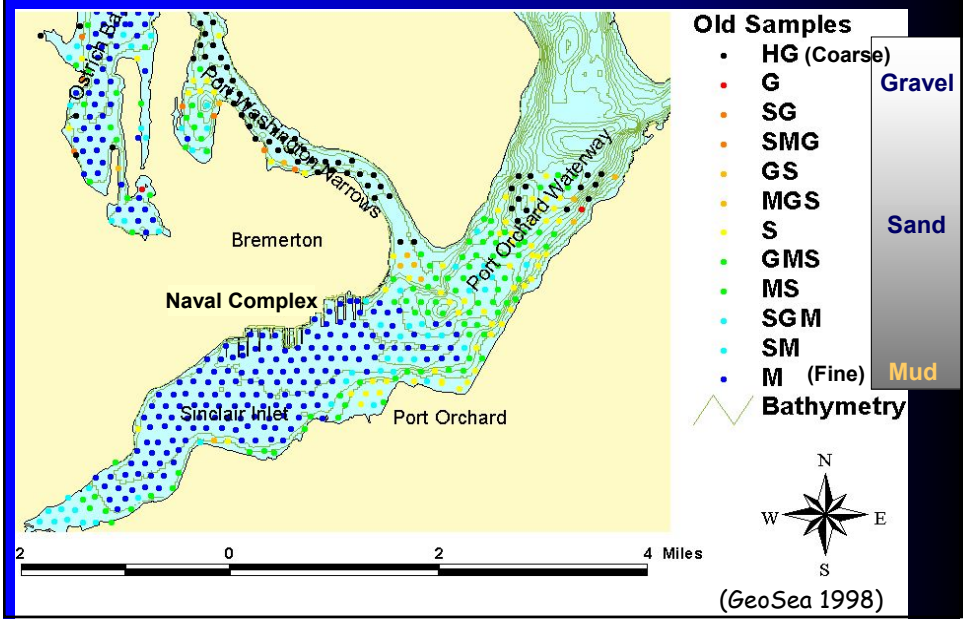
Dyes Inlet: Cd, Ag, Hg, Phenol, Toxicity



Sediment Remediation



Precleanup Sediment Texture

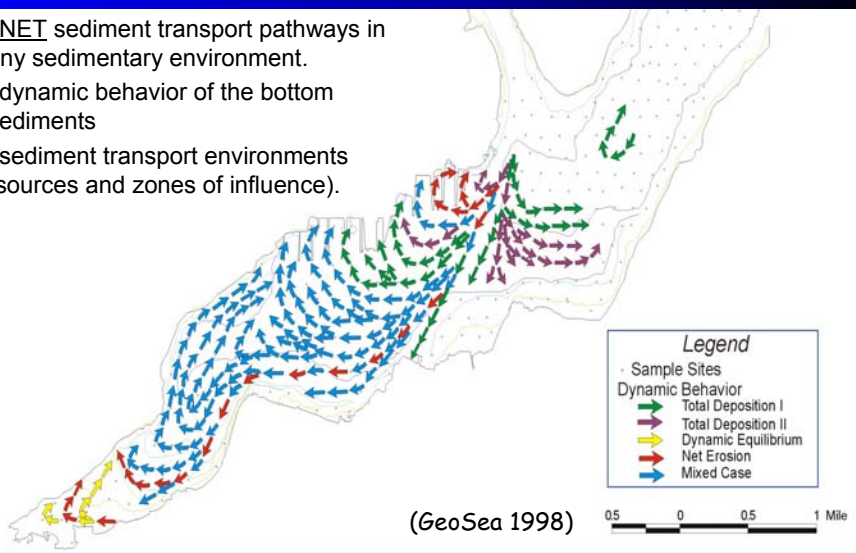


Sediment Trend Analysis for Sinclair Inlet Net Transport for Muds

The NET sediment transport pathways in any sedimentary environment.

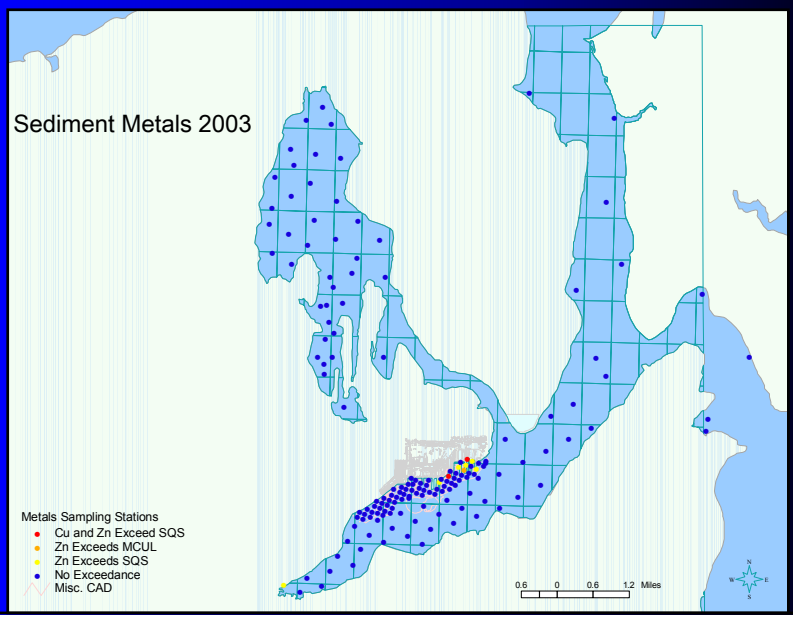
The dynamic behavior of the bottom sediments

The sediment transport environments (sources and zones of influence).



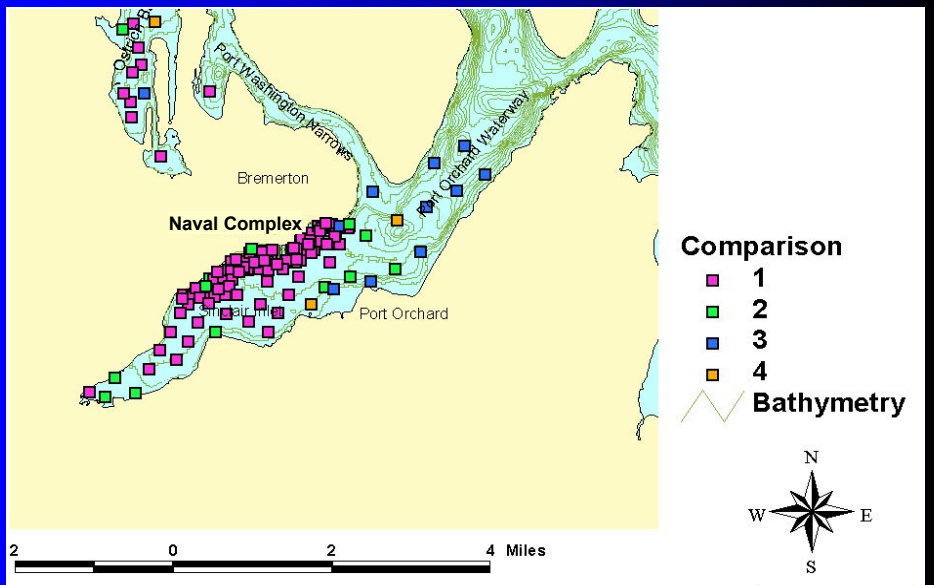
(GeoSea 1998)

Post Cleanup Sediment Metals



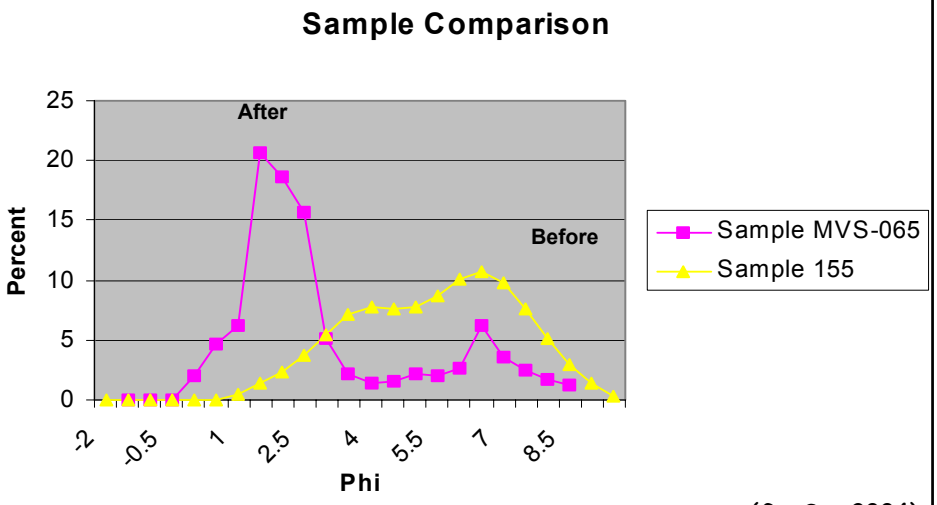
Post Cleanup Sediment Texture

Sediments became coarser



(GeoSea 2004)

The sediments became coarser (from medium to coarse silt).



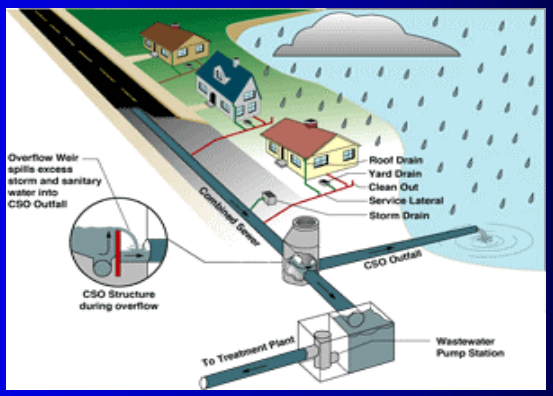
(GeoSea 2004)

Why Coarser Texture?

- Addition of a courser sediment to a pre-existing finer sediment.
- Coarser sediments are assumed to be available from the regional glacial deposits bordering the coasts and underlying the bottom sediments.
  - Greater than usual storm activity between samplings.
  - The fast ferry eroding the coasts of Port Orchard.
  - Dredging in Sinclair Inlet introducing underlying coarser sediments into the water column.

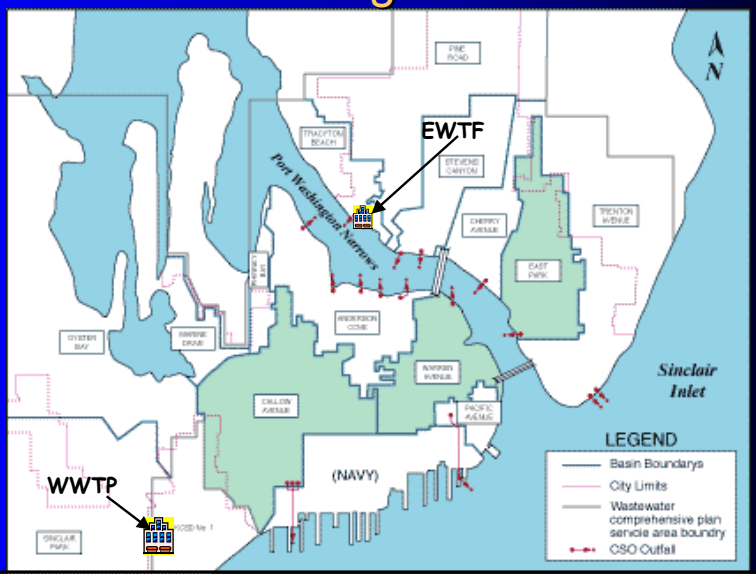
(GeoSea 2004)

Combined Sewer Overflows

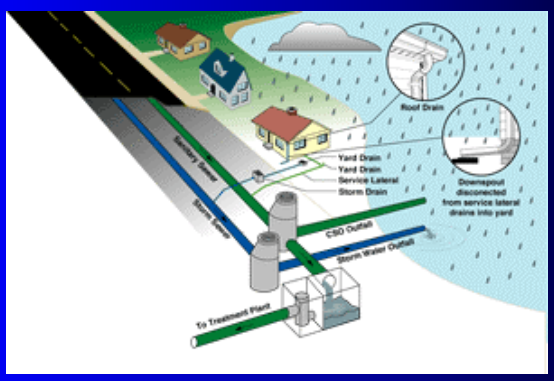


City of Bremerton, 2004. CSO Reduction.
http://www.cityofbremerton.com/content/csoreduction.html

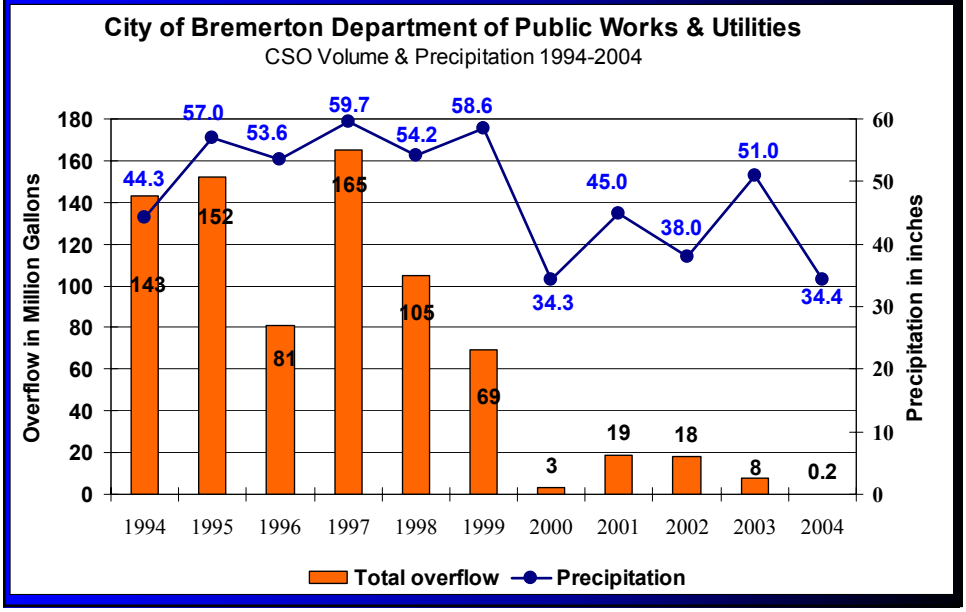
City of Bremerton CSO Reduction Program



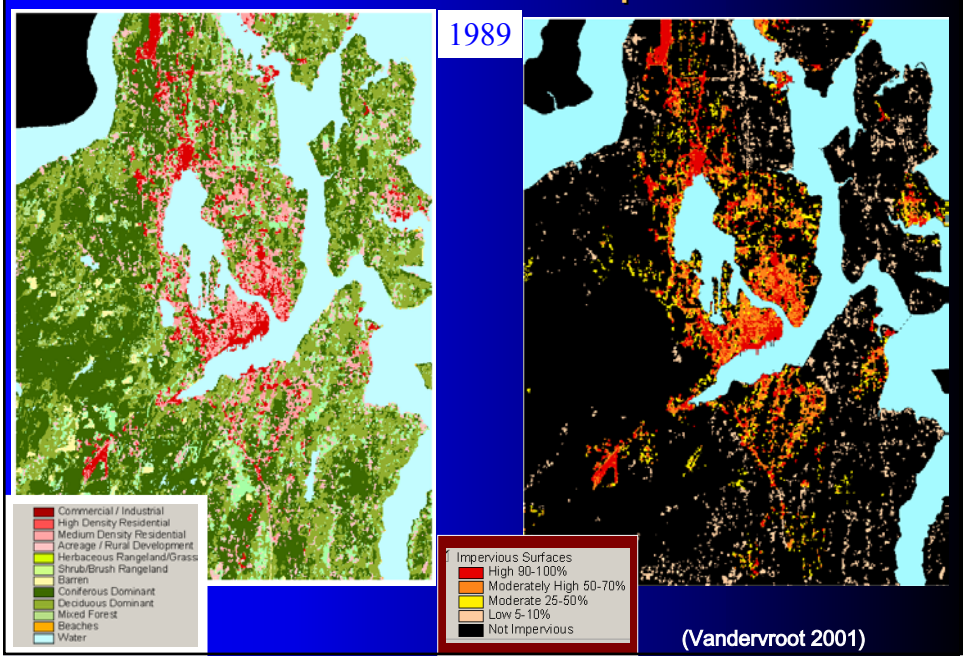
Separation of Sanitary and Storm Water



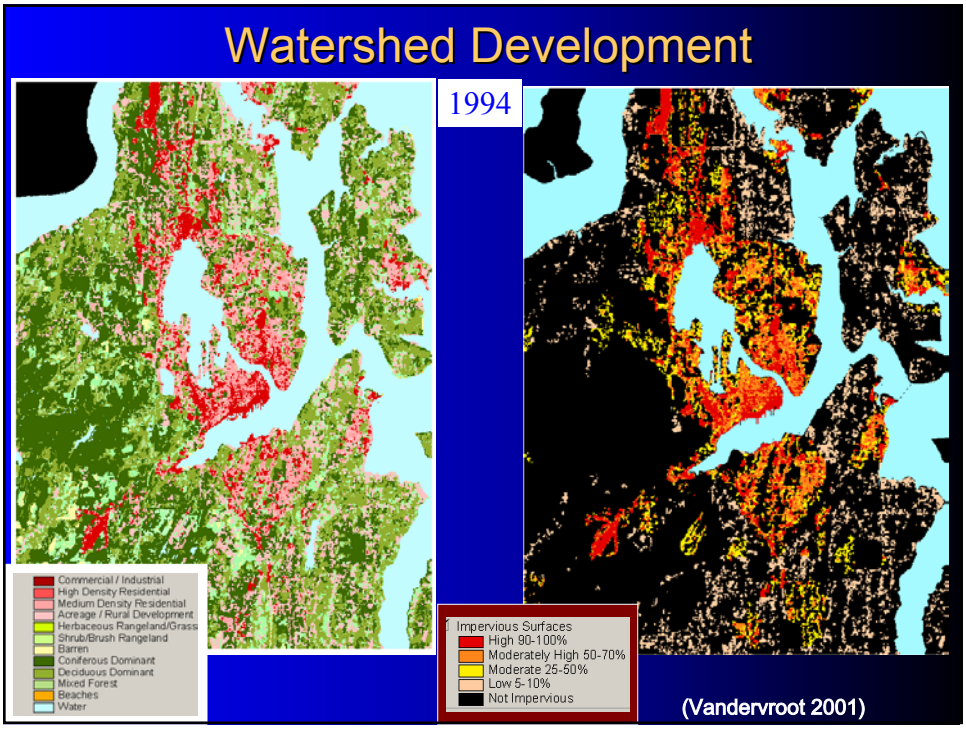
CSO Reduction Program



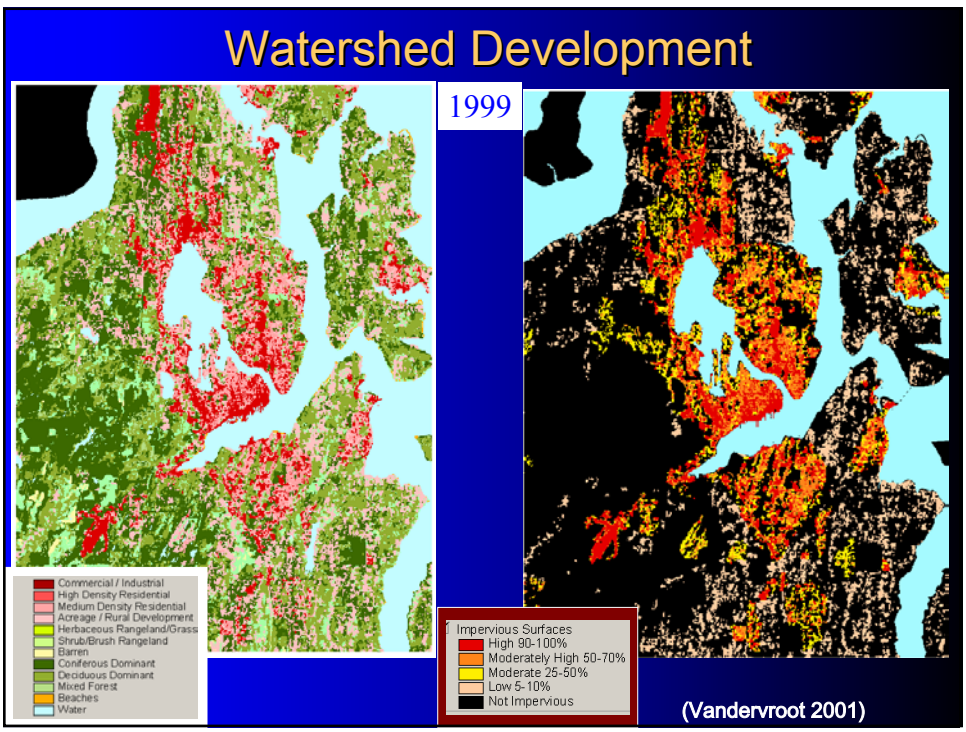
Watershed Development



Watershed Development

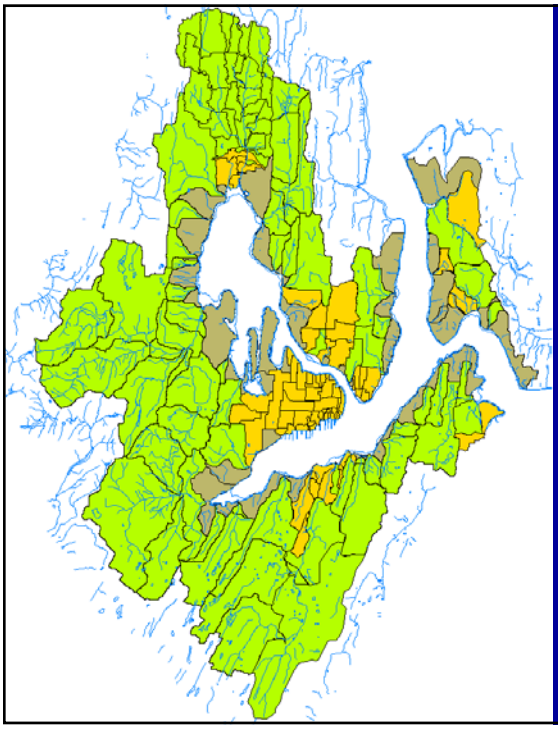


Watershed Development



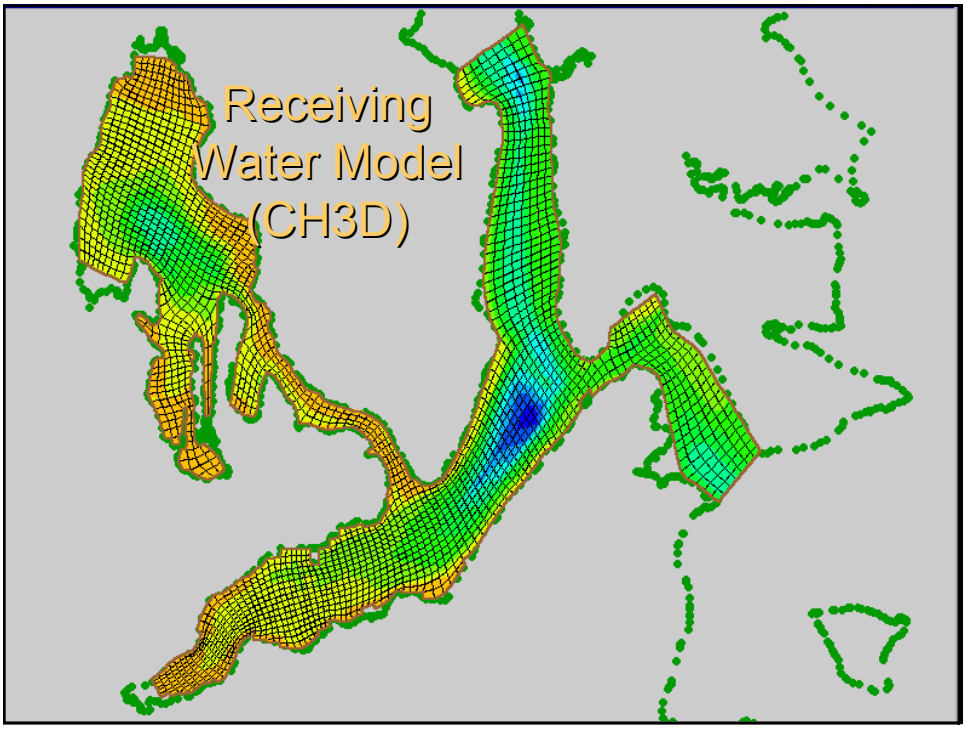
Cooperative Storm Event Monitoring

- Sample representative storm events
- Collecting data on hydrology and water quality parameters
- Relate landuse to environmental quality
- Quantify loading from the watershed into the receiving waters of the Inlet
- Support TMDLs



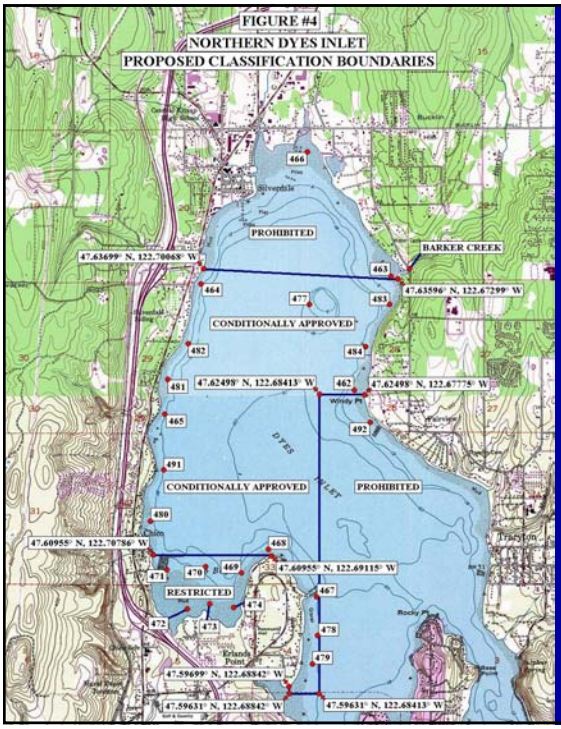
Watershed Model – HSPF

Open channel (stream)
Piped channel (storm water)
Beach (sheet flow)



Modeling Studies

- Developed models for simulating runoff and loading from the watershed
- Bremerton's elimination CSOs and the ability to simulate FC fate and transport in the Inlets resulted in the re-opening of **1500 acres** of shellfish beds in Dyes Inlet
- The integrated watershed-receiving water model is being verified so that the models can be used to simulate waste load allocation (WLA) and load allocation (LA) targets needed for the TMDL



Northern Dyes Inlet

1500 acres reclassified for shellfish harvesting

Animation of Stream Discharge and CSO Event

Click here to load animation of stream discharge.
http://www.psmem.org/models/graphics/Streamtoscn0.gif

Click here to load animation of stream discharge and CSO event.
http://www.psmem.org/models/graphics/Streamtoscn0.gif

Summary

- Pool resources and data to get a better product.
- Watershed approach facilitates partnering.
- Much better chance for successful implementation.
- Compliance with Clean Water Act will cost less and do more.

Project ENVVEST Technical Working Group Clambake featuring manila clams harvested from Dyes Inlet provided courtesy of the Suquamish Tribe.

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