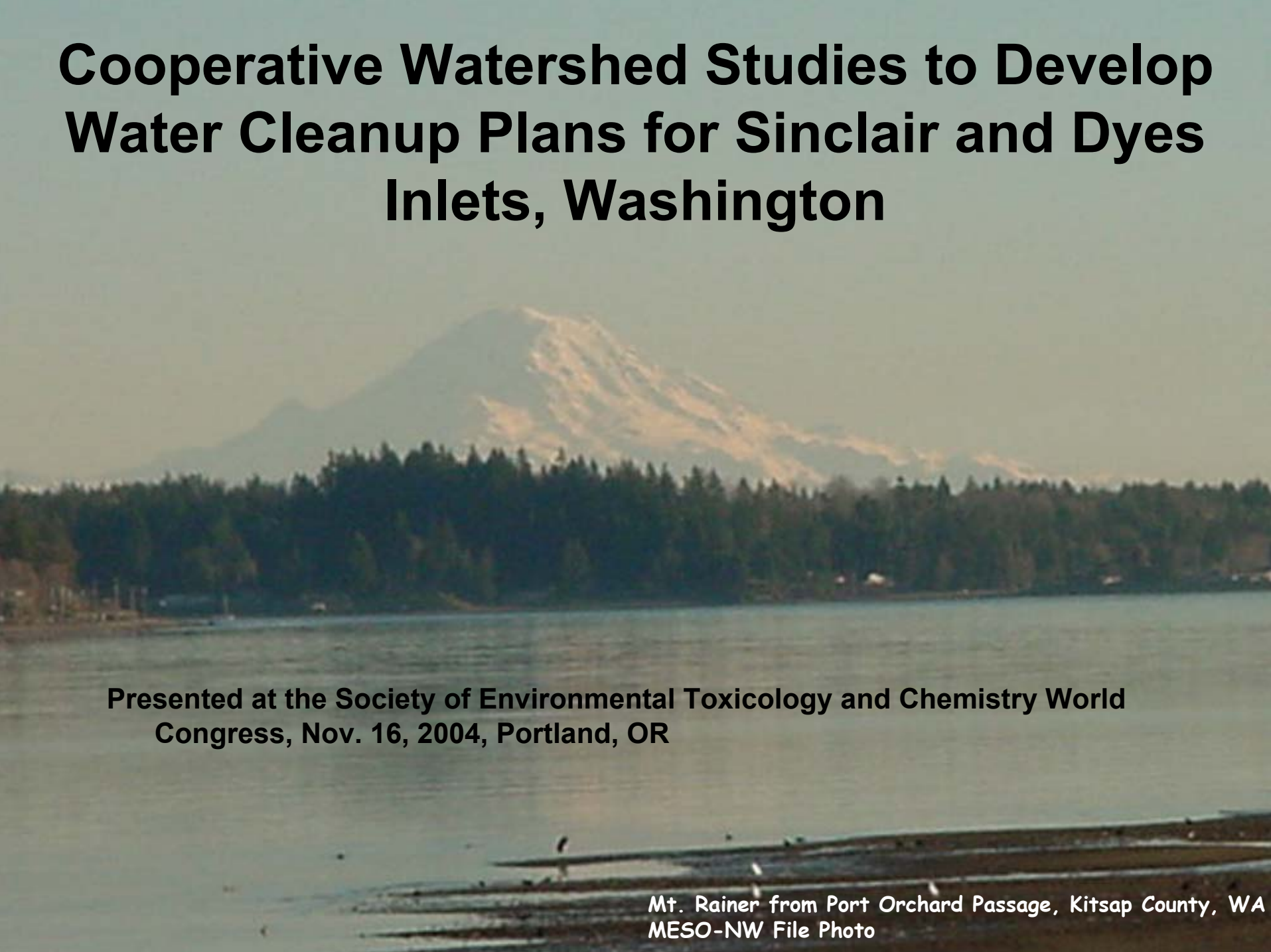
Cooperative Watershed Studies to Develop Water Cleanup Plans for Sinclair and Dyes Inlets, Washington



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Mt. Rainer from Port Orchard Passage, Kitsap County, WA
MESO-NW File Photo

R.K. Johnston*[1], Jerry Sherrell[2], Dwight Leisle[2], Will Kendra[3], Sally Lawrence[3], Michael Rylko[4], Martha Turvey[4], Chris May[5], Martin Miller[5], Ken Richter[1], Tom Ostrom[6], Mike Mecham[7], Dave Tucker[8], and Jim Zimny[9]

[1]Space and Naval Warfare Systems Center

[2]Puget Sound Naval Shipyard & Intermediate Maint. Fac.

[3]Washington Department of Ecology

[4]Environmental Protection Agency Region X

[5]Pacific Northwest National Laboratory

[6]Suquamish Tribe [7]City of Bremerton

[8]Kitsap County Surface and Storm Water Management

[9]Kitsap County Health District

*Author to whom correspondence should be addressed: johnston@spawar.navy.mil

Abstract

Sinclair and Dyes Inlets, Washington were listed on the 1998 303(d) list of impaired waters because of fecal coliform (FC) contamination in the marine waters and metals and organic contaminants in bottom sediments and fish tissues. The Puget Sound Naval Shipyard & Intermediate Maintenance Facility, Department of Ecology, U.S. Environmental Protection Agency and local stakeholders are working together on Project ENVVEST (an acronym for ENVironmental InVESTment) to address contamination issues and develop water cleanup plans for the watershed. Significant progress has been made on the FC Total Maximum Daily Load (TMDL) study for Sinclair and Dyes Inlets, which has benefited from the collaboration and cooperation of many stakeholders within the watershed. Currently, the FC model verification sampling for the TMDL study is being planned and storm water flow monitoring is being initiated for representative storm water outfalls within the study area. Considerable progress has been made on modeling the watershed and receiving waters within the Inlet. The modeling studies have directly contributed to the recent reclassification of Northern Dyes Inlet (about 1500 acres) from prohibited to conditionally approved for shellfishing by the Washington State Department of Health. Further progress has also been achieved for storm event sampling of streams, watershed monitoring, and conducting a sediment metals verification study. Additional studies are being conducted to evaluate contamination accumulation in the food chain of Sinclair and Dyes Inlets by analyzing species of fish and invertebrates from Sinclair Inlet and reference areas in the Puget Sound for metals, polychlorinated biphenyls, and pesticides.

Key words: modeling, water cleanup plan, watershed assessment, ecorisk assessment

Acknowledgements:

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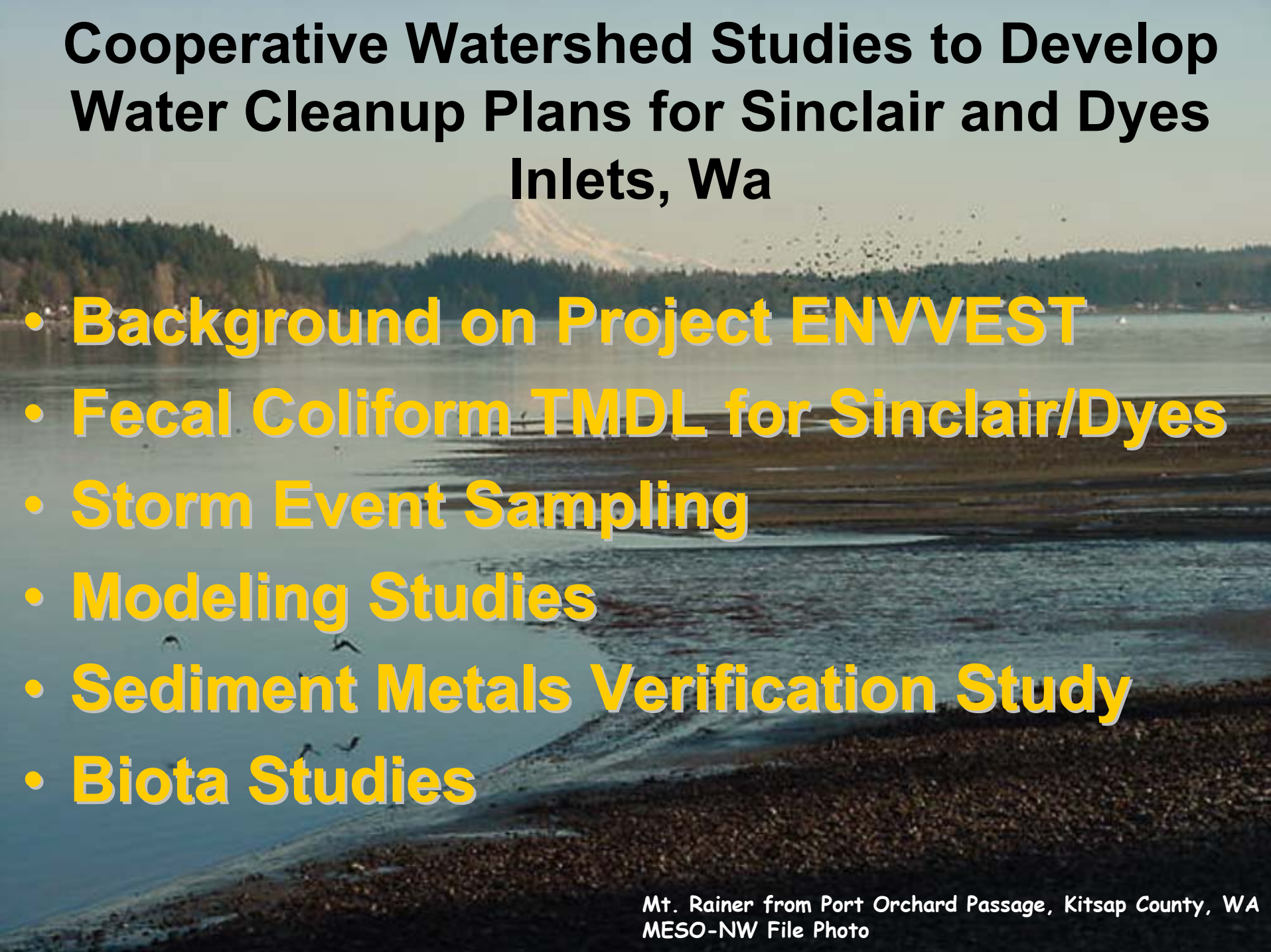
Kitsap County Surface and Storm Water Management
Kitsap County Health District
Suquamish Tribe
Department of Health
Department of Fish and Wildlife
Karcher Creek Sewer District

Cooperative Watershed Studies to Develop Water Cleanup Plans for Sinclair and Dyes Inlets, Wa

- Background on Project ENVVEST
- Fecal Coliform TMDL for Sinclair/Dyes
- Storm Event Sampling
- Modeling Studies
- Sediment Metals Verification Study
- Biota Studies



Mt. Rainer from Port Orchard Passage, Kitsap County, WA
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Puget Sound Naval Shipyard
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

Sinclair Inlet and Bremerton. WA
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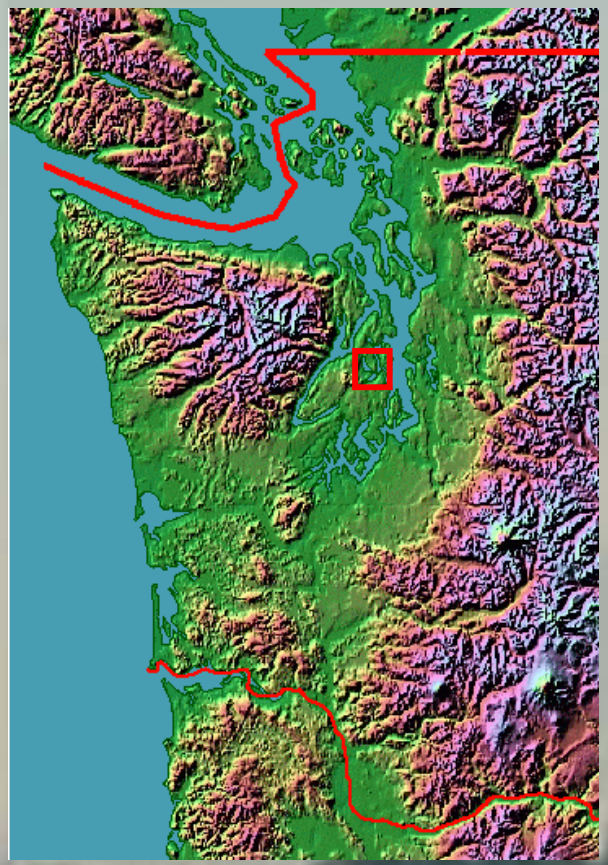
Study Area



Dyes Inlet

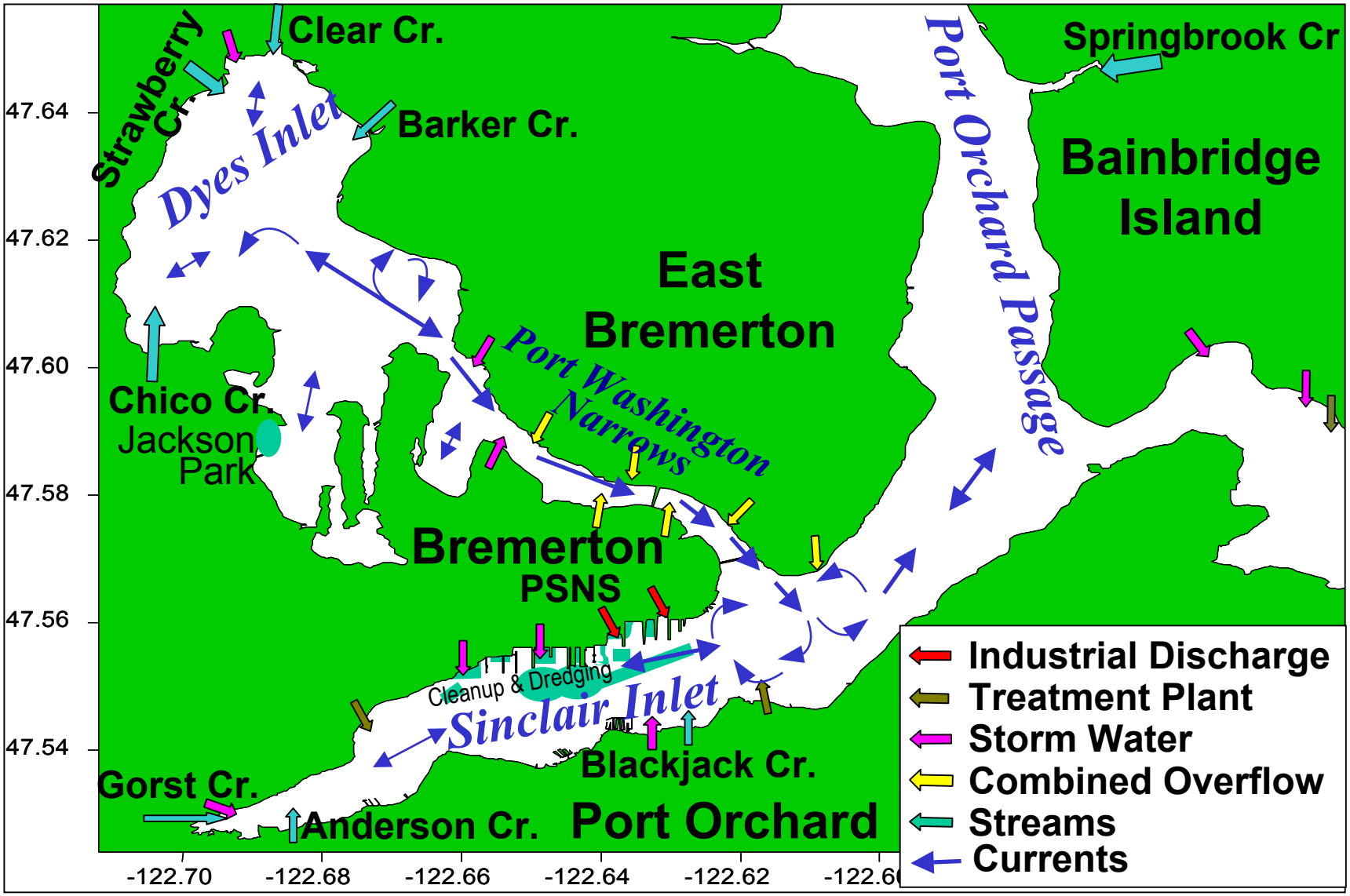
Bainbridge Island

Bremerton

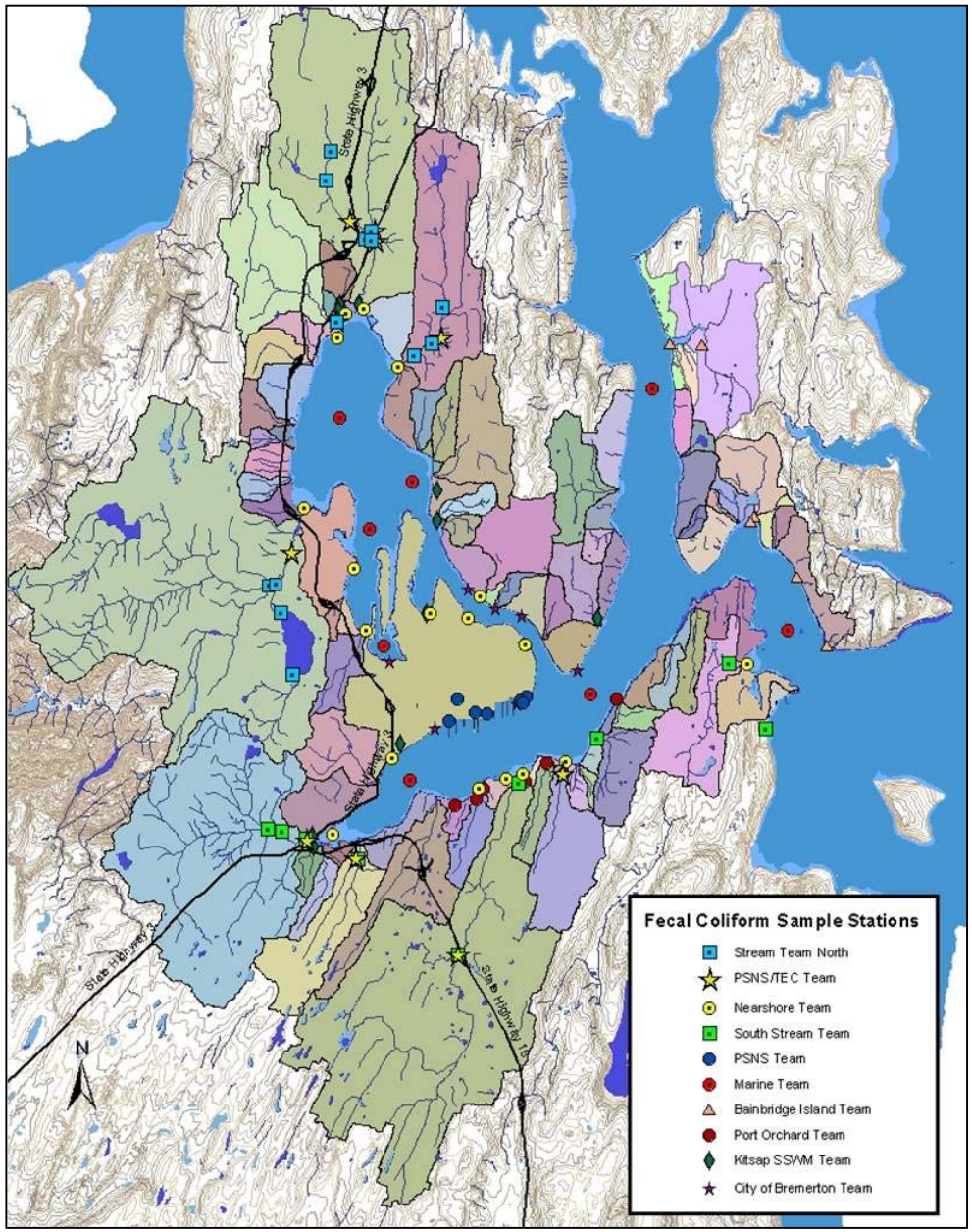
Sinclair Inlet

Port Orchard

Conceptual Model



FC TMDL for Sinclair/Dyes Inlet



- Cooperative study with involved stakeholders
- Collecting critical data needed for TMDL
- Developing consensus on technical approach and implementation needs
- Will lead to water cleanup plan and improved environmental quality for Inlets

http://www.ecy.wa.gov/programs/wq/tmdl/watershed/sinclair-dyes_inlets/index.html

Storm Event Monitoring

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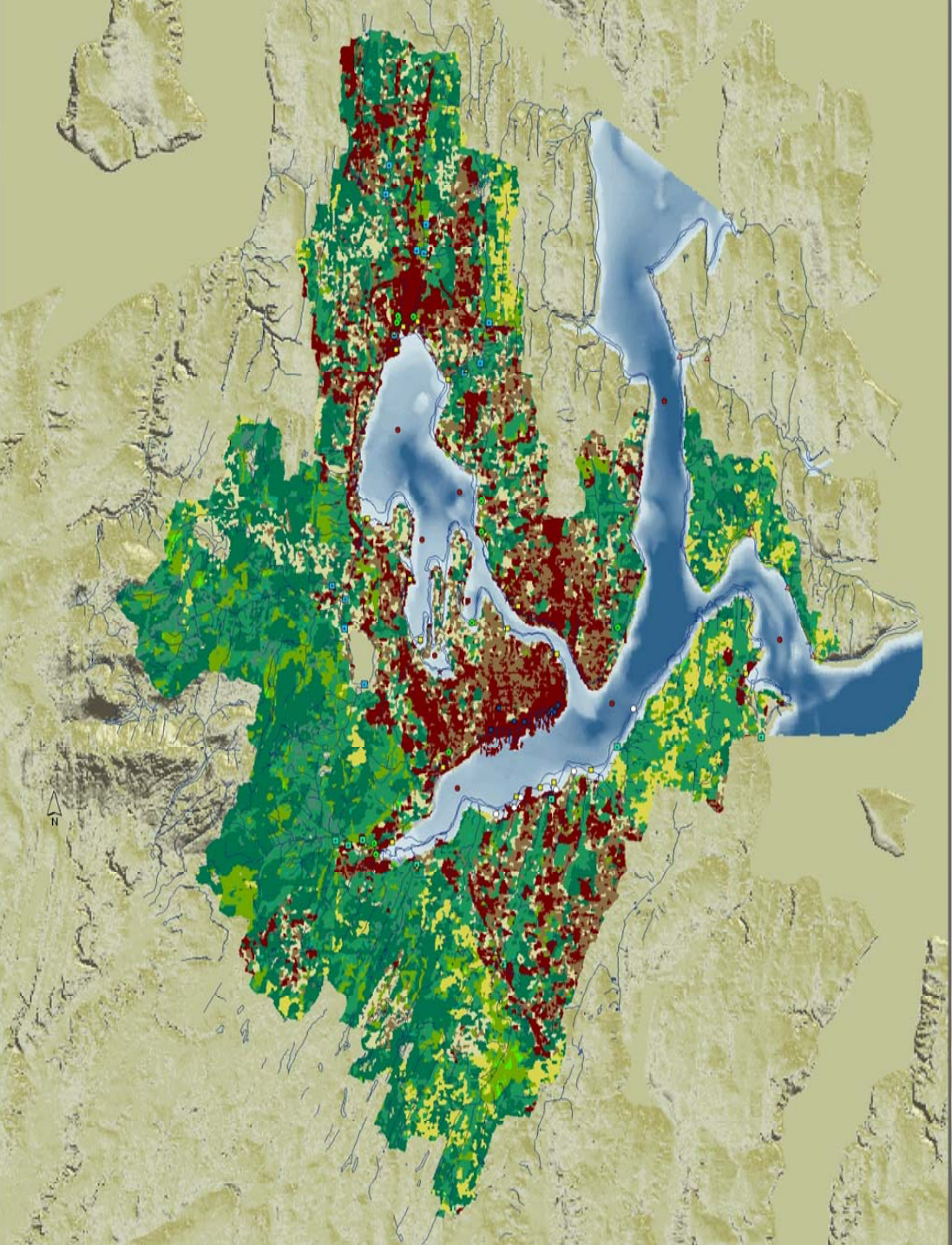
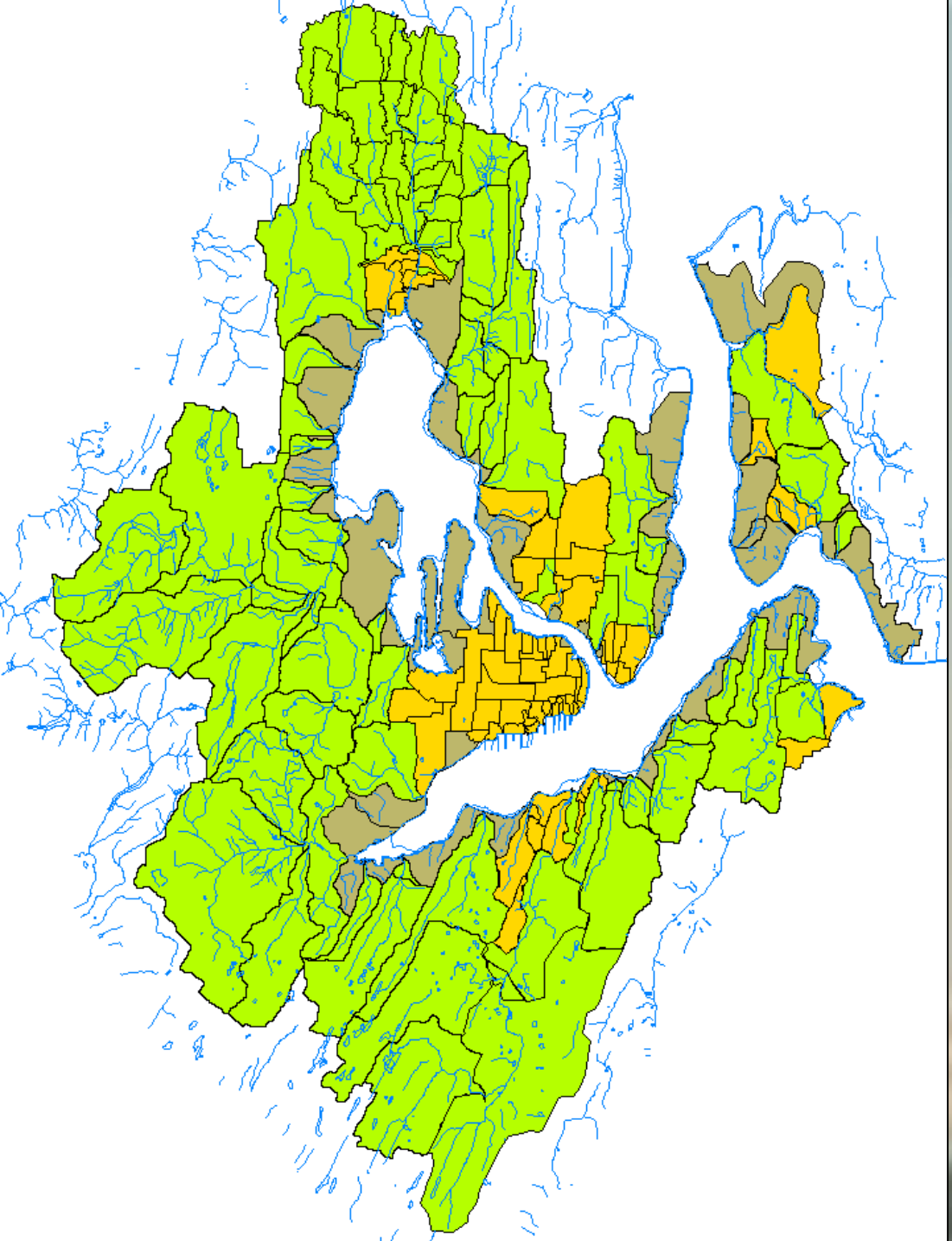
- Sample representative storm events
- Collecting data on hydrology and water quality parameters
- Relate landuse to environmental quality
- Quantify loading from the watershed into the receiving waters of the Inlet
- Support TMDLs
- Cooperation among PSNS & IMF, Cities, and Kitsap County SSWM & Health District

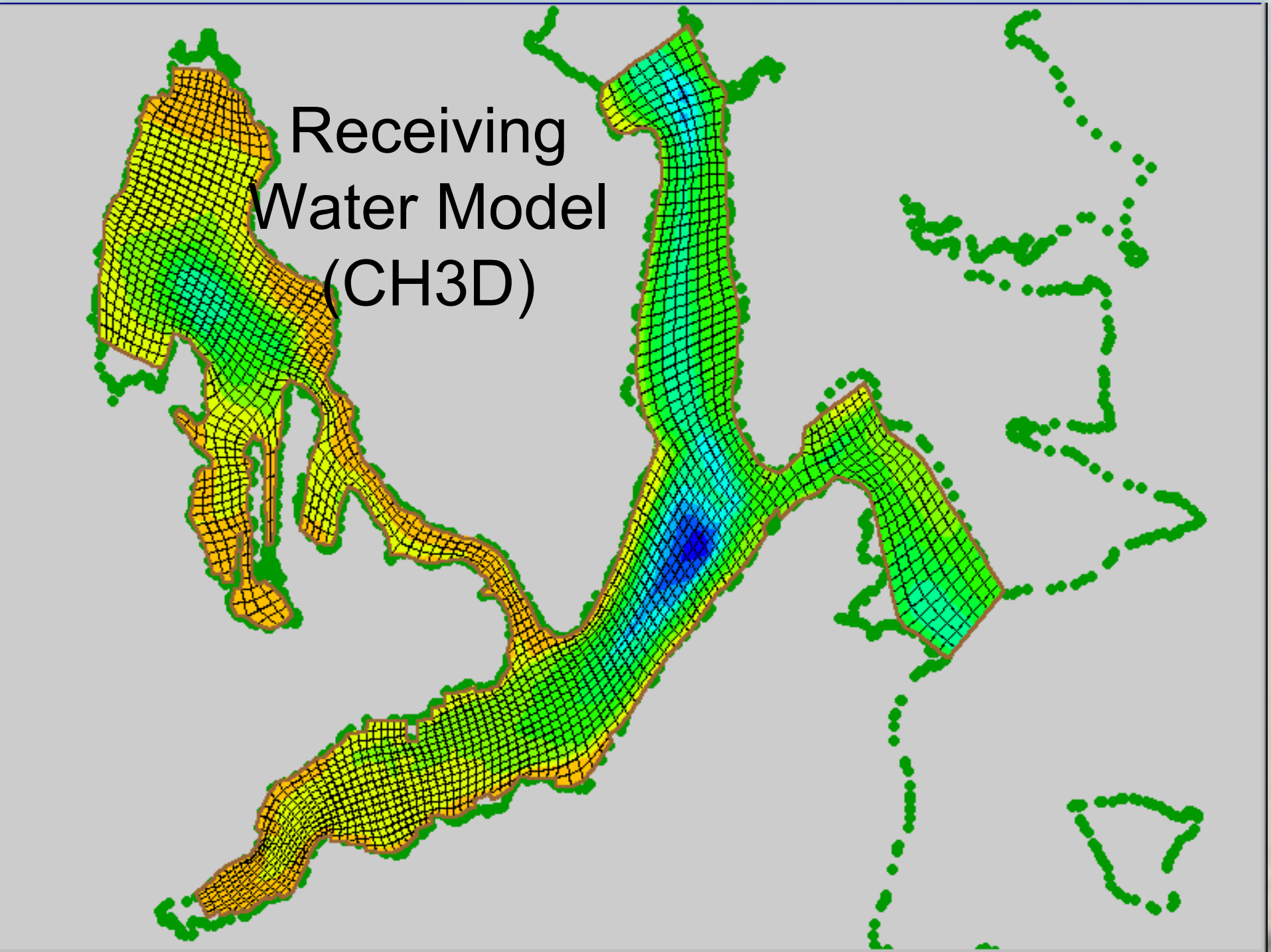
Watershed Model – HSPF



Watershed Model – HSPF

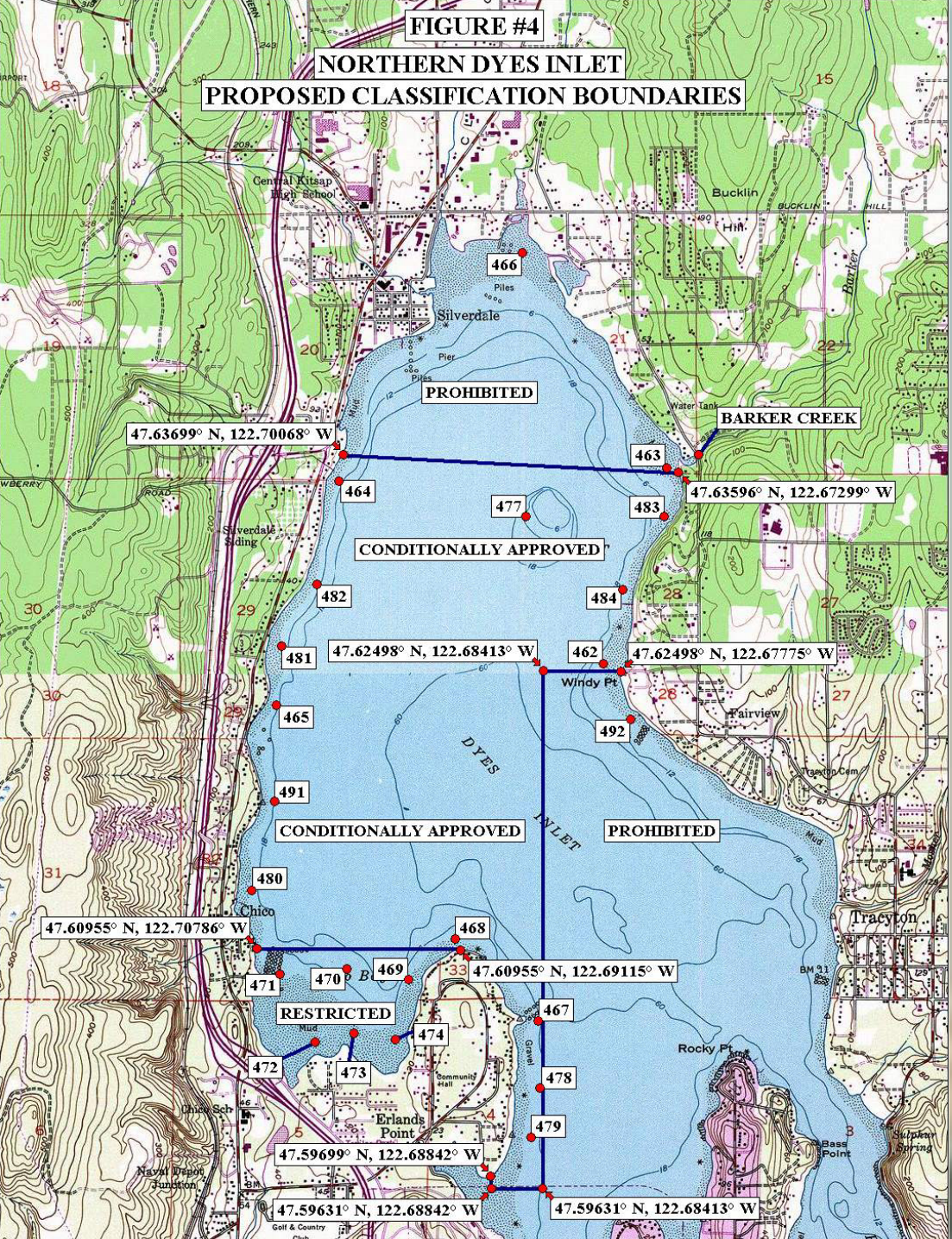


- Open channel (stream)
- Piped channel (storm water)
- Beach (sheet flow)


Receiving
Water Model
(CH3D)

Modeling Studies

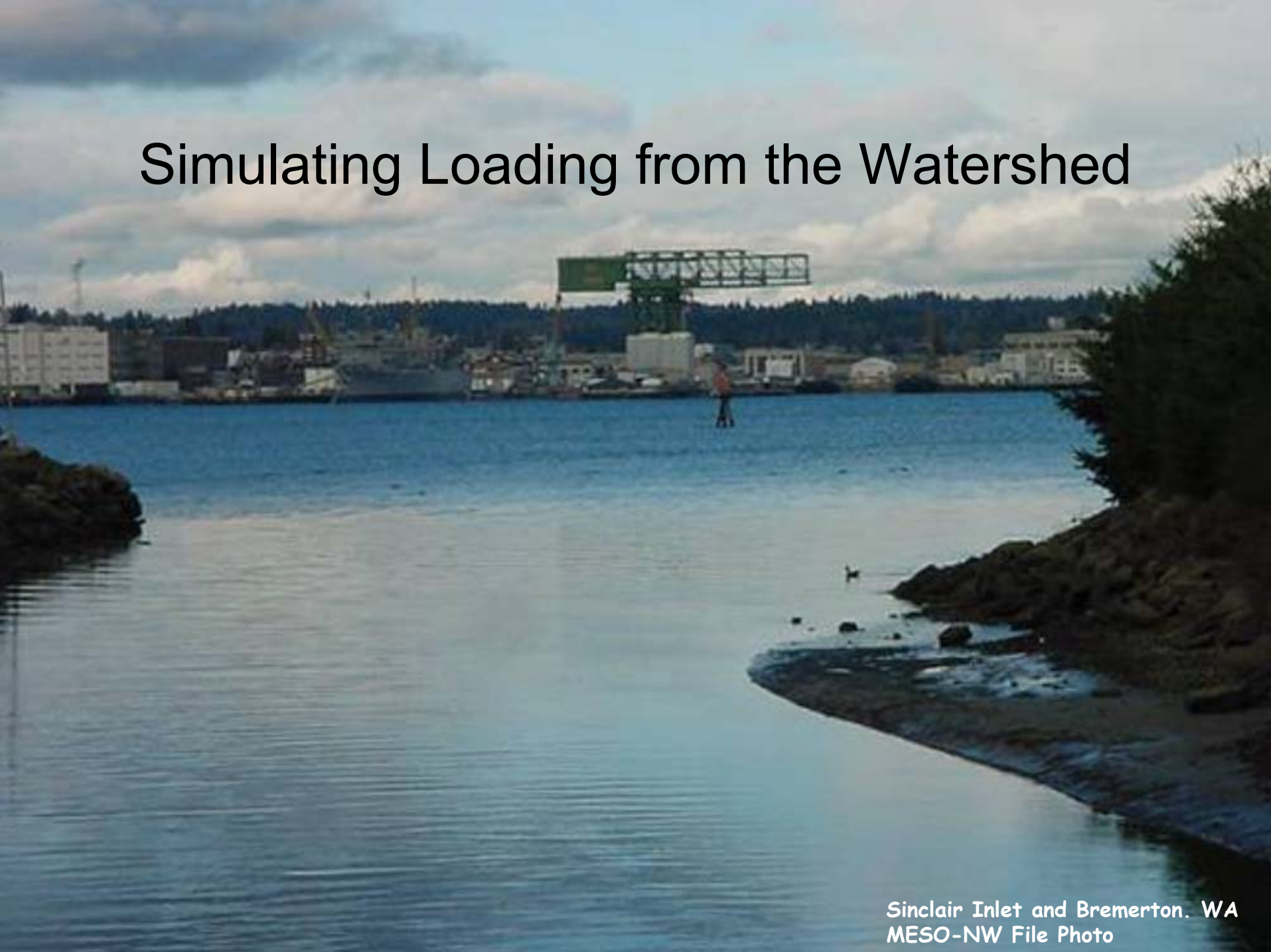
- Developed models for simulating runoff and loading from the watershed
- Bremerton's elimination CSOs and the ability to simulate FC fate and transport in the Inlets resulted in the re-opening of **1500 acres** of shellfish beds in Dyes Inlet
- The integrated watershed-receiving water model is being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



Area of Northern Dyes Inlet Reclassified for Shell fishing

http://www.doh.wa.gov/Publicat/2003_News/03-176.htm

Simulating Loading from the Watershed



Sinclair Inlet and Bremerton. WA
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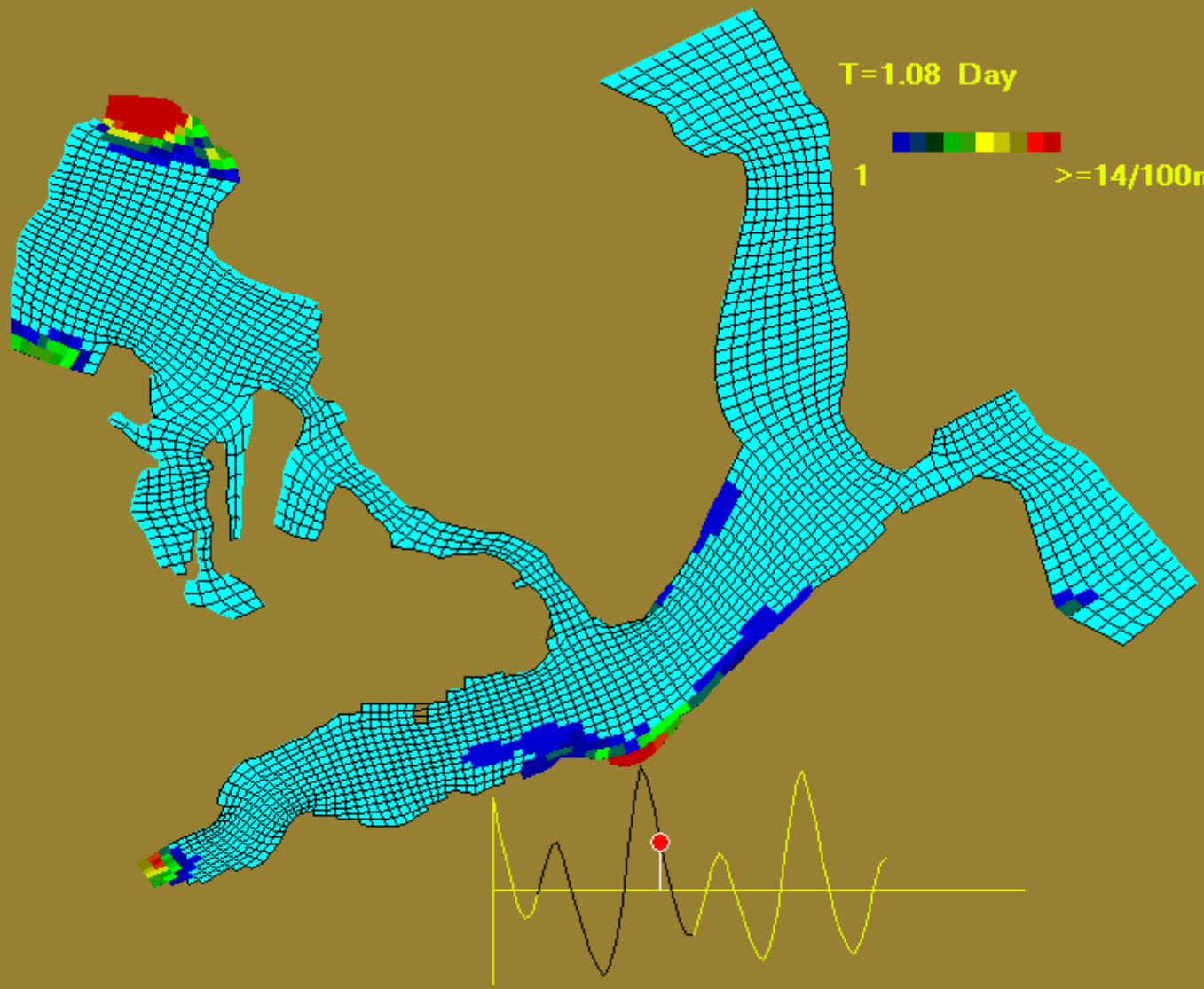
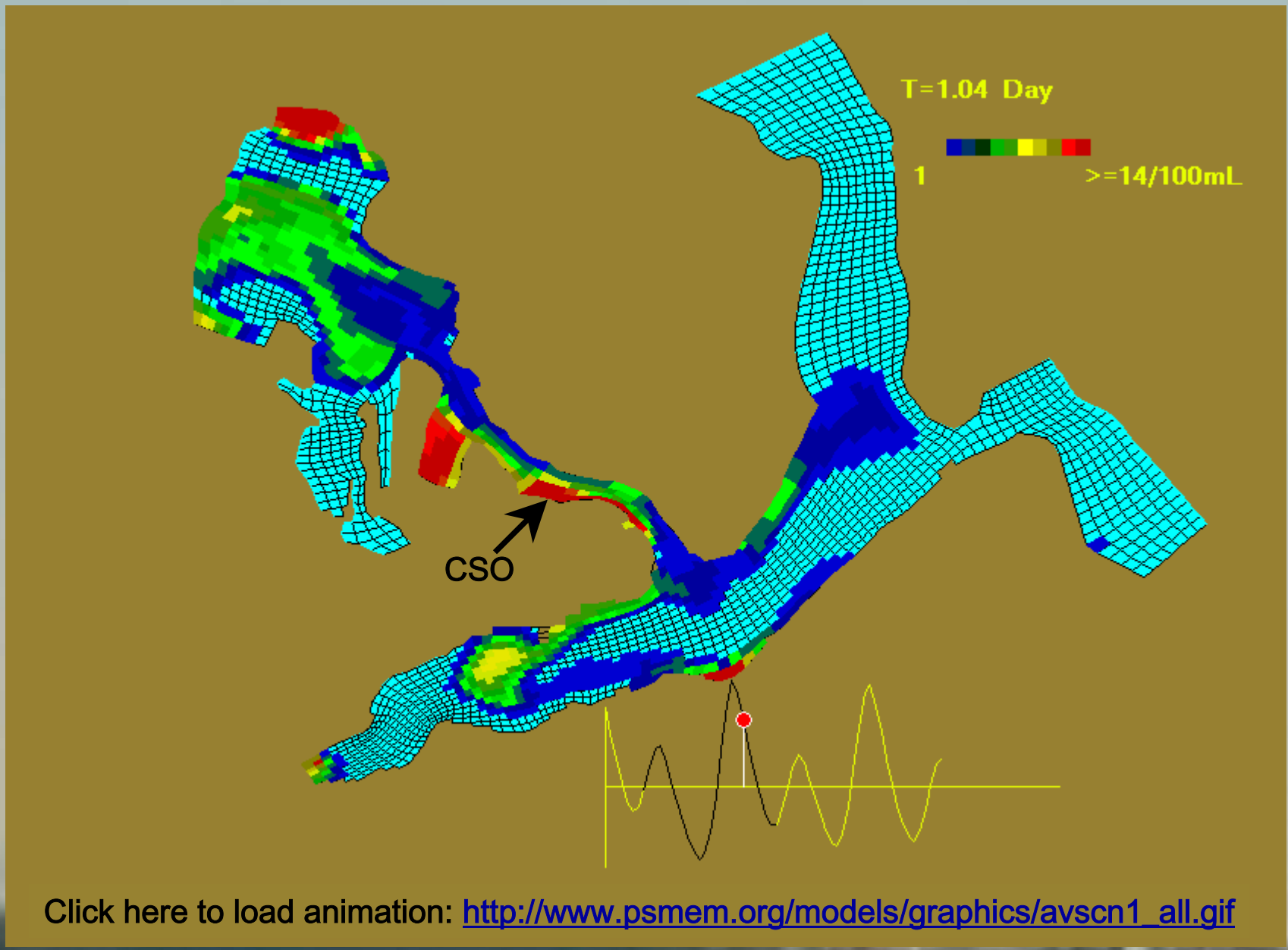
Stream Discharge



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

Stream Discharge and CSO Event



Click here to load animation: http://www.psmem.org/models/graphics/avscn1_all.gif

Sediment Studies

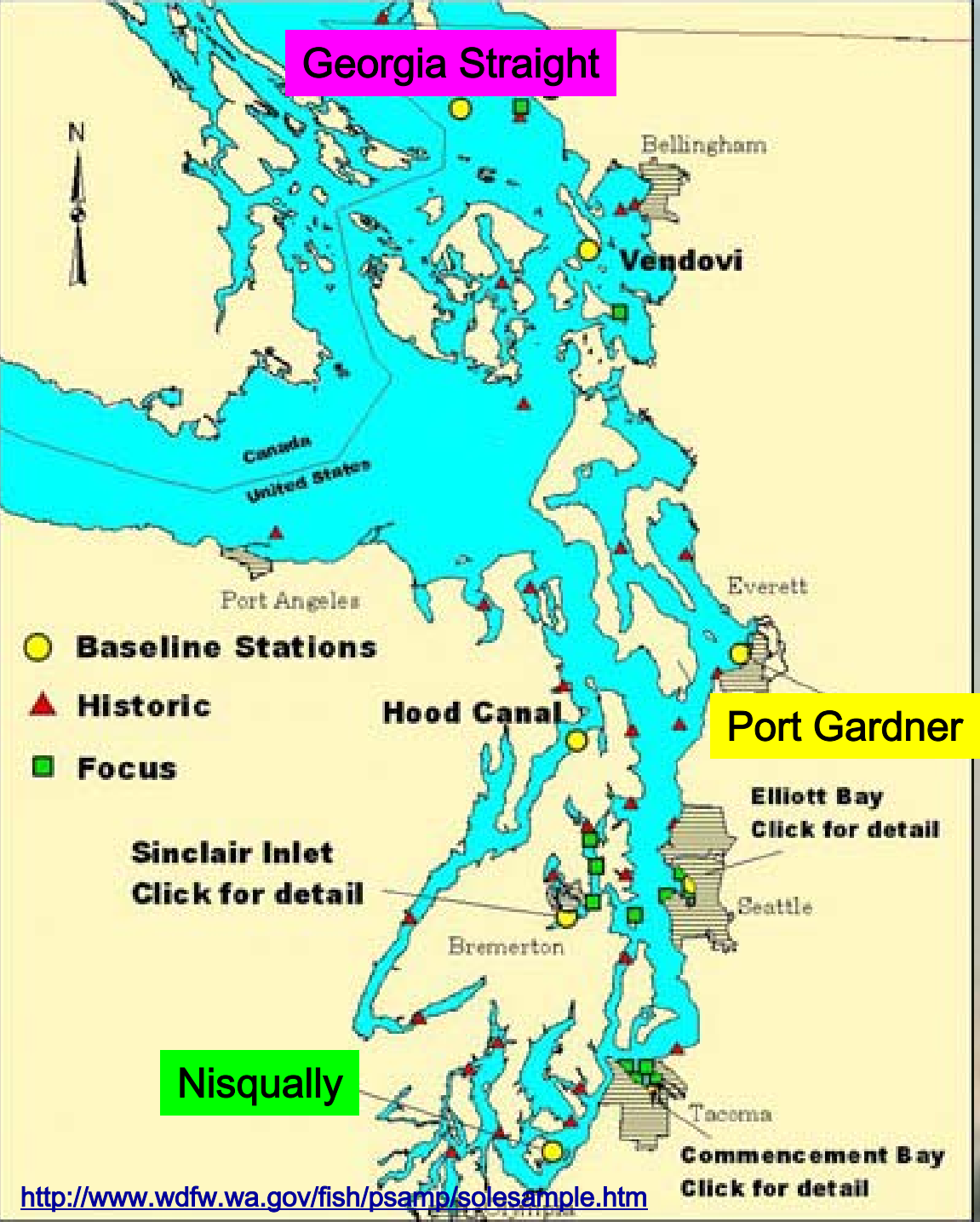
- Metals Verification Study
  - Synoptic sampling of Sinclair and Dyes Inlets.
  - Screening with confirmation
  - Basis for delisting

See Poster (PM148) Sediment Metals Verification Study for Sinclair and Dyes Inlets, Washington. http://abstracts.co.allenpress.com/pweb/setac2004/document/?ID=42802

Biota Studies

- Contaminants in bottom fish and invertebrates
  - 8 species from Sinclair Inlet and reference areas
  - Tissues analyzed for metals, PCBs, and pesticides
- Concentrations compared to reference and Ecological Benchmarks
  - Copper
  - Mercury
  - PCBs

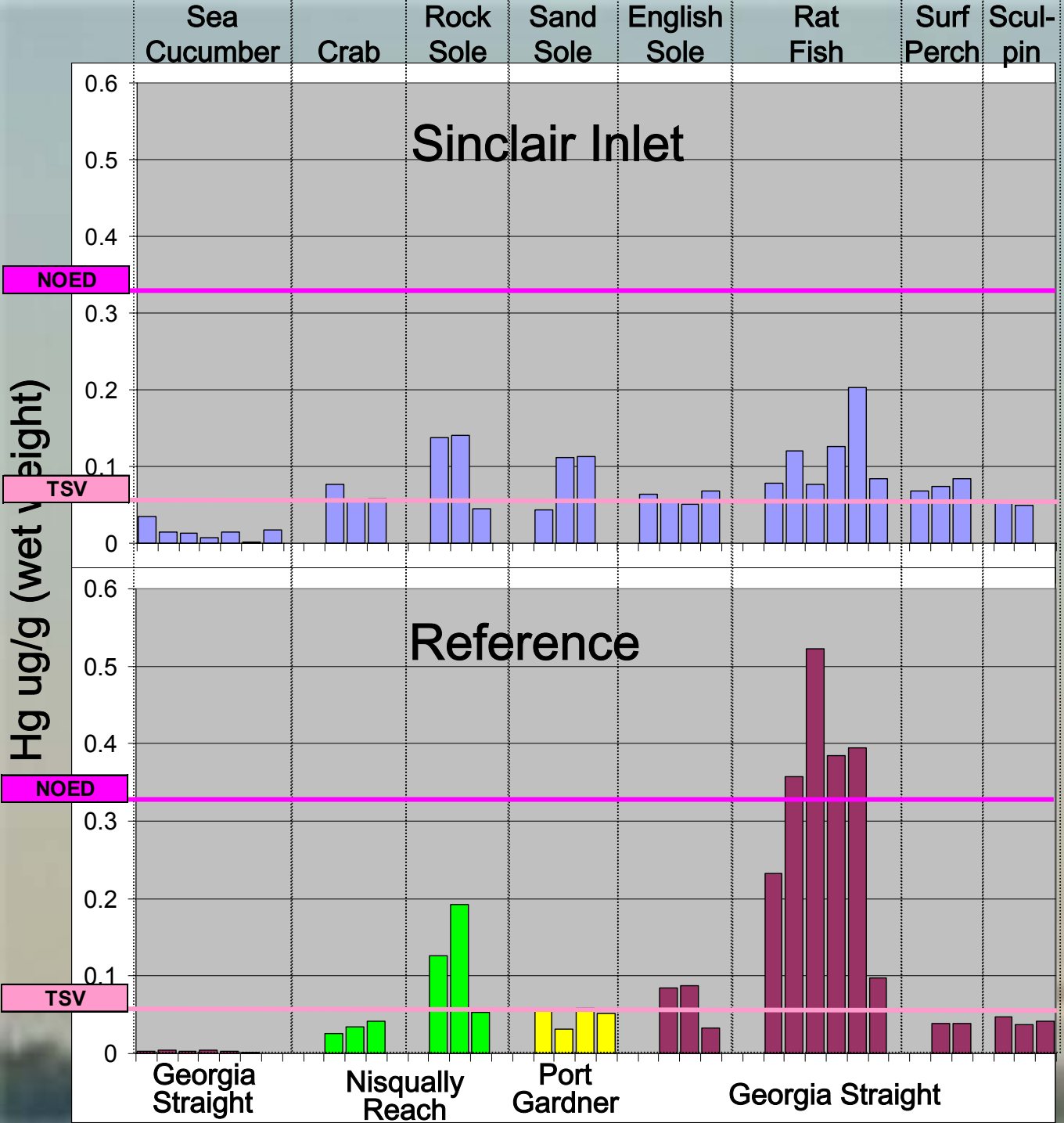
Puget Sound Ambient Monitoring 2003 Demersal Fish Surveys



Summary of Tissue Residue Benchmarks

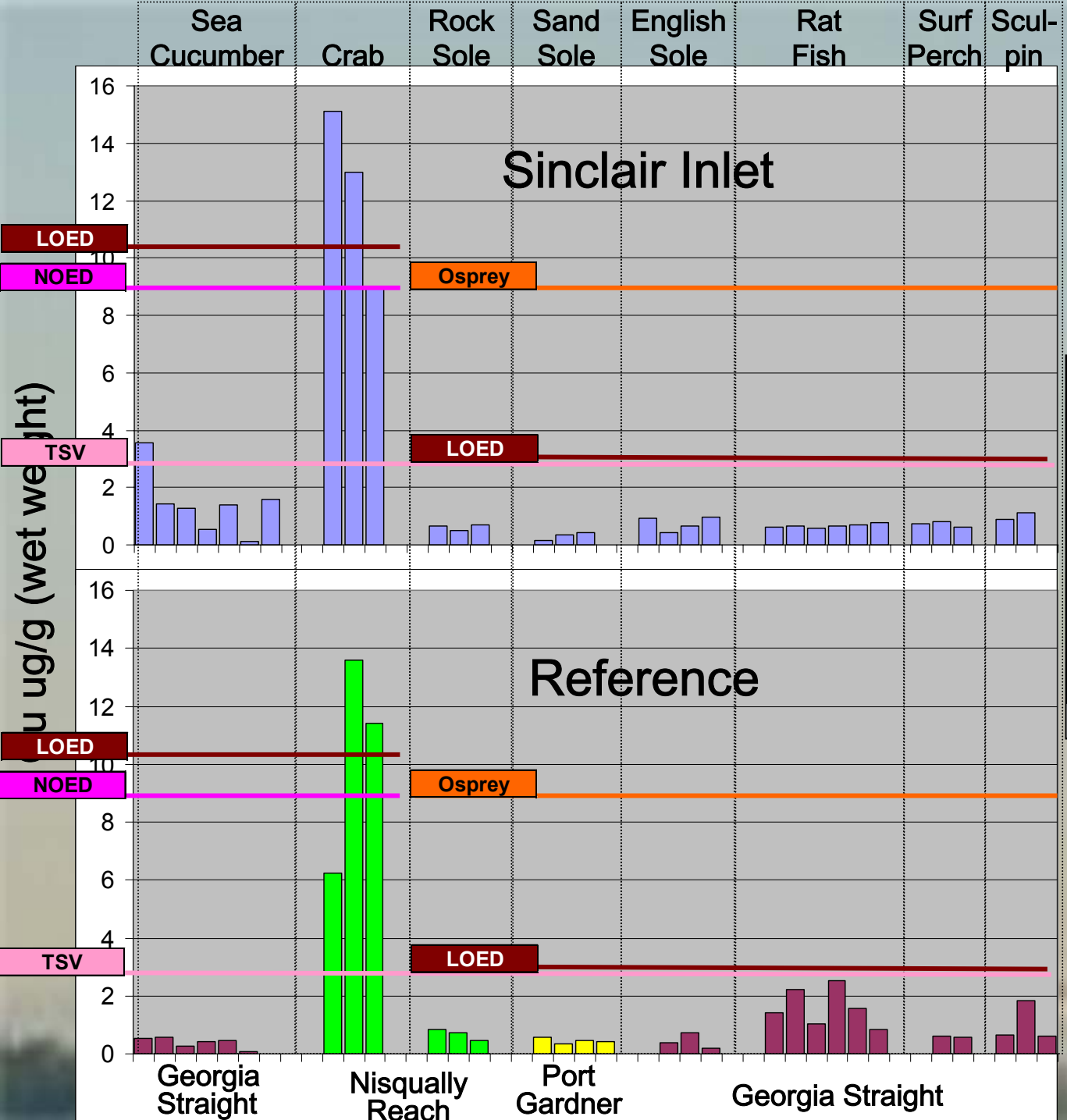
Benchmark	Applicable Endpoints	Comment
TSV	Aquatic Organisms	Very conservative safety factor
B_{CV}	Marine Organisms	Tissue residue above which suggests WQC exceeded
NOED	Demersal Fish Invertebrates	Tissue residue below which effects will probably not occur
LOED	Demersal Fish Invertebrates	Tissue residue above which effects may occur
Dietary	Omnivore – Black Duck Piscivore – Osprey Mammal – Harbor Seal	Concentration in diet below which effects will probably not occur

Total Mercury Tissue Residues



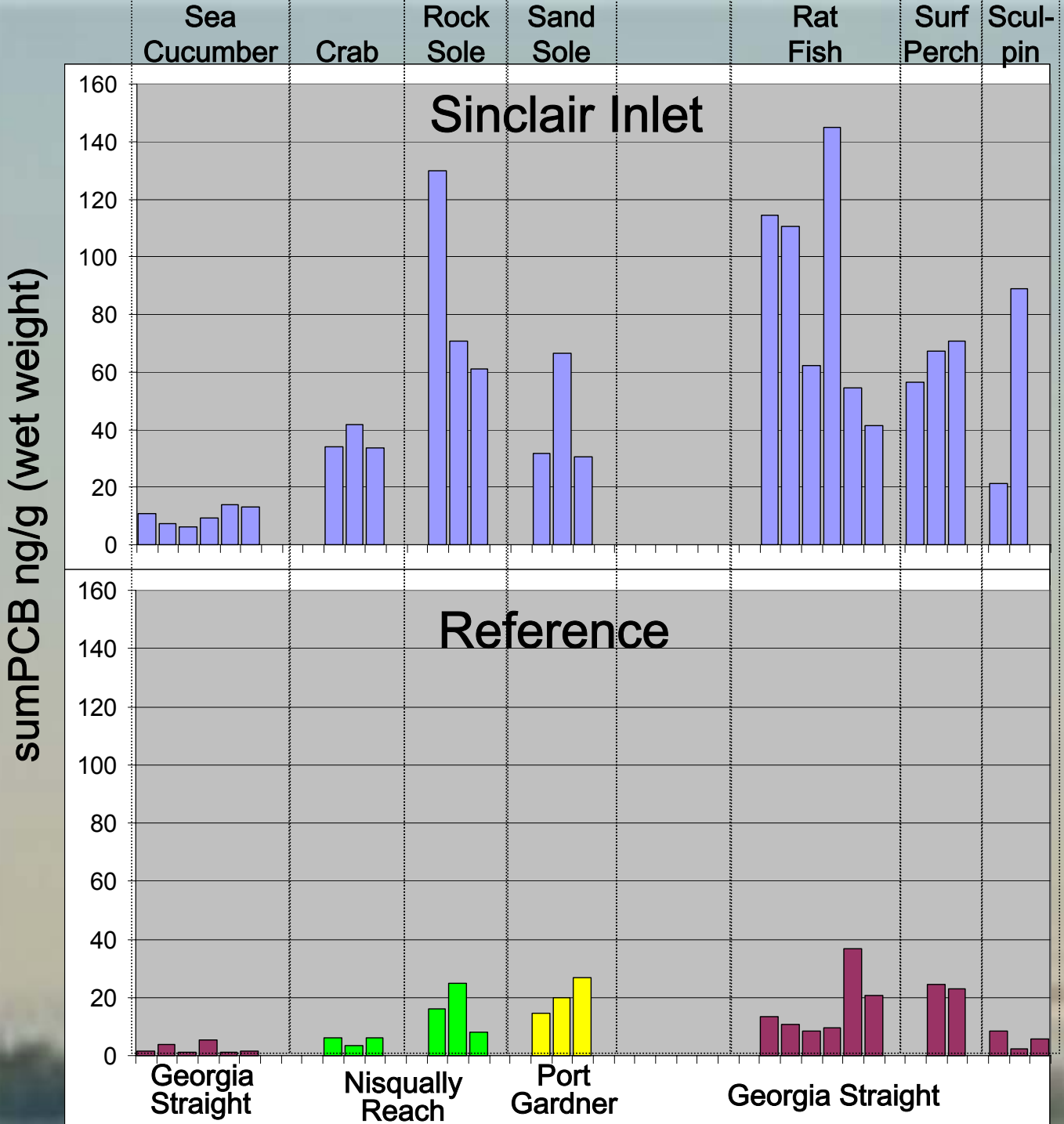
Ecological Benchmarks Total Hg		
	Fish	Invert.
	ug/g wet	ug/g wet
TSV	0.06	0.06
Bcv	4.69	19.65
NOED	0.32	1.64
LOED	1.31	6.00
Harbor Seal	5.83	5.83
Osprey	2.50	na
Black Duck	5.00	5.00

Copper Tissue Residues

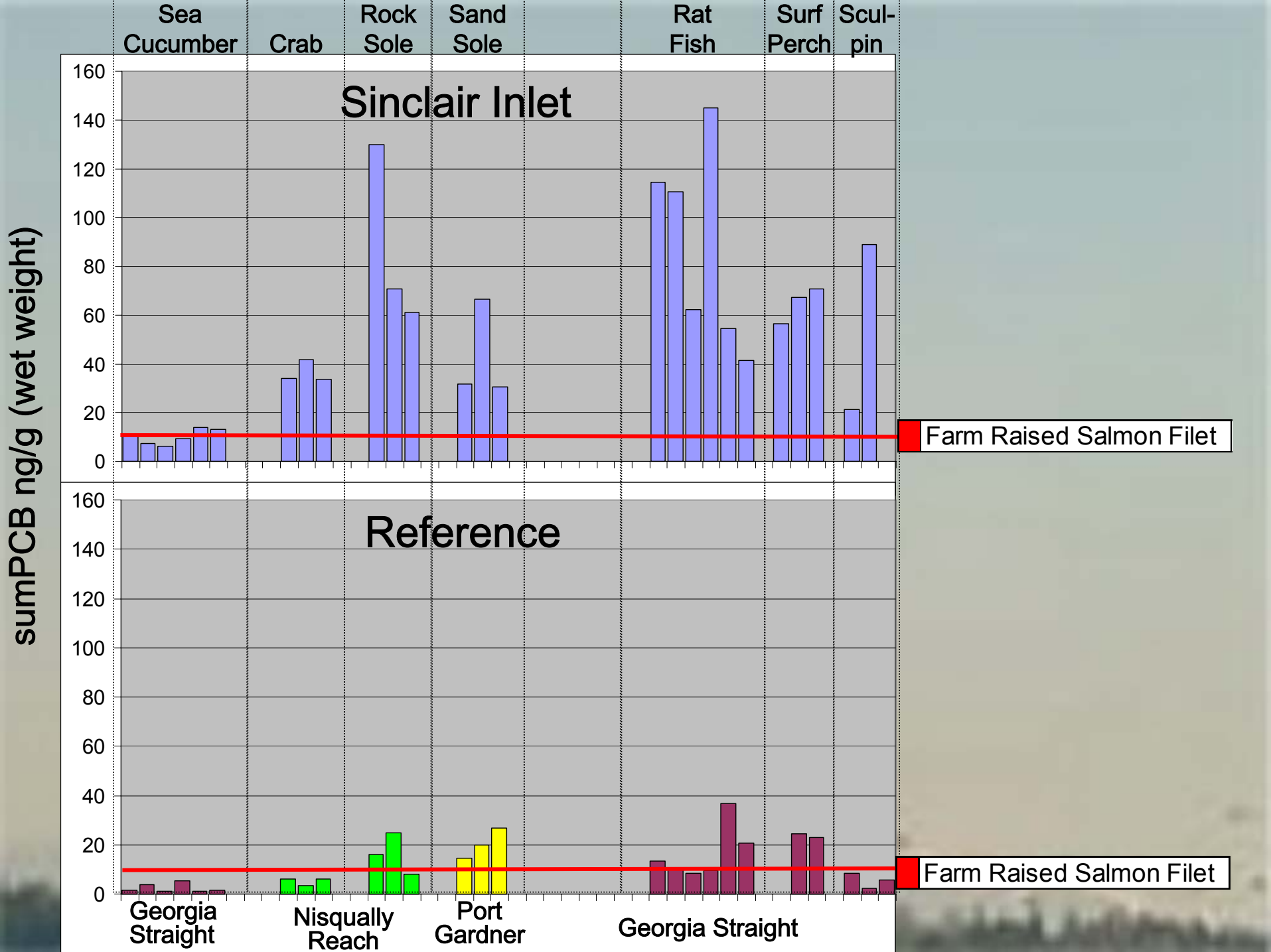


Ecological Benchmarks (Cu)		
	Fish	Invert.
	ug/g wet	ug/g wet
TSV	3.00	3.00
Bcv	0.62	62.00
NOED	0.34*	9.00
LOED	3.40	10.13
Harbor Seal	68.25	68.25
Osprey	9.22	na
Black Duck	18.44	18.44
* NOED = LOED/10		

sumPCB Tissue Residues



Ecological Benchmarks (sumPCB)		
	Fish	Invert.
	ng/g wet	ng/g wet
TSV	218	218
Bcv	3038	468
NOED	750	375
LOED	900	688
Harbor Seal	400	400
Osprey	500	na
Black Duck	1000	1000


Sea Cucumber
Crab
Rock Sole
Sand Sole
Rat Fish
Surf Perch
Scul-pin
Sinclair Inlet
Reference
sumPCB ng/g (wet weight)
0
20
40
60
80
100
120
140
160
Farm Raised Salmon Filet
Farm Raised Salmon Filet
Georgia Straight
Nisqually Reach
Port Gardner
Georgia Straight

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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