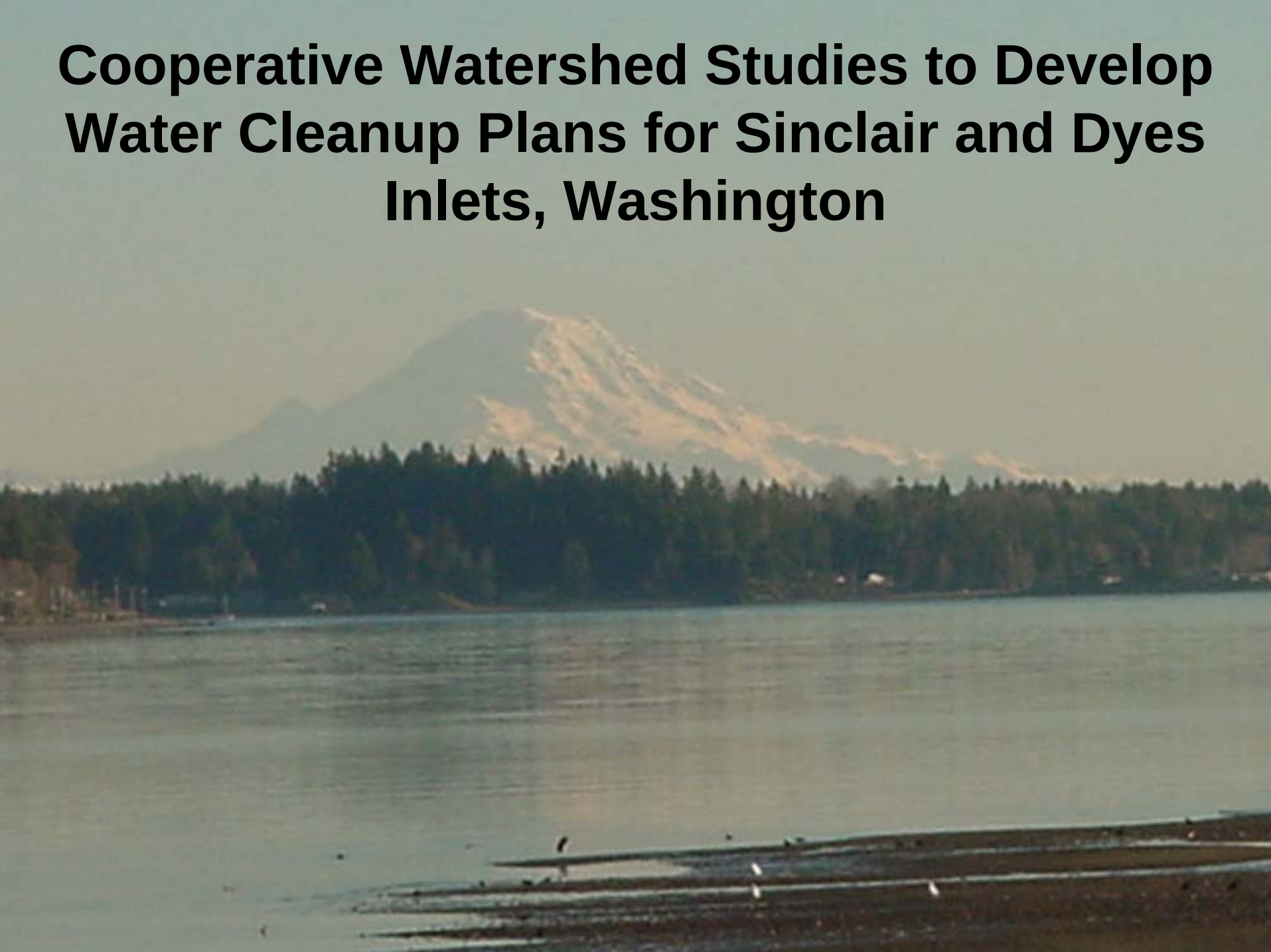
Cooperative Watershed Studies to Develop Water Cleanup Plans for Sinclair and Dyes Inlets, Washington



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[5]Pacific Northwest National Laboratory

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[8]Kitsap County Surface and Storm Water Management

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

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

Primary Motivation

- **Navy:**
  - **Impact on Navy cost, operations, and flexibility**
  - **Opportunity to assure effective and efficient regulations.**
  - **Agencies:**
  - **More defensible position**
  - **More resources to address problems**

Study Area

You are Here

Dyes Inlet

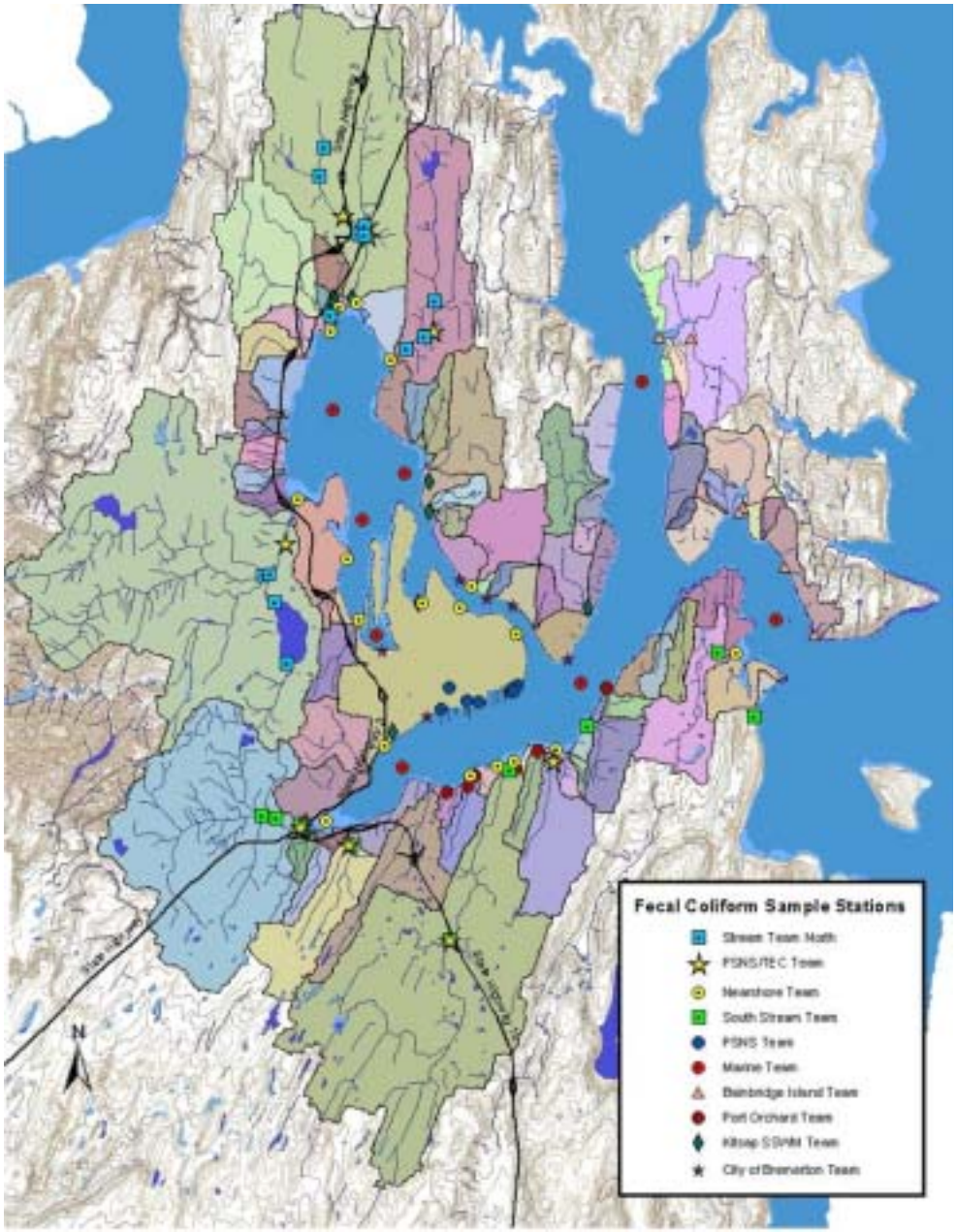
Bainbridge Island

Bremerton

Sinclair Inlet

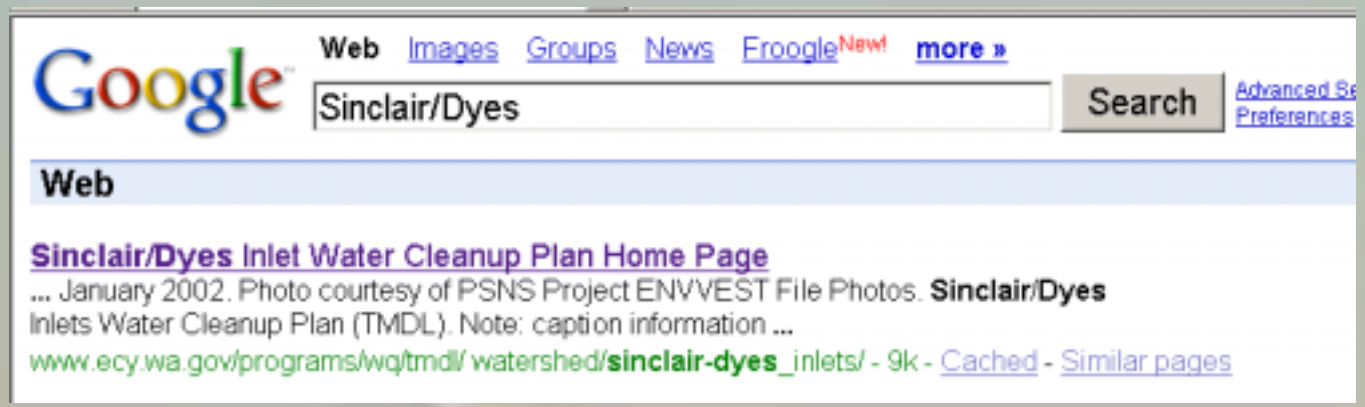
Port Orchard

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



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

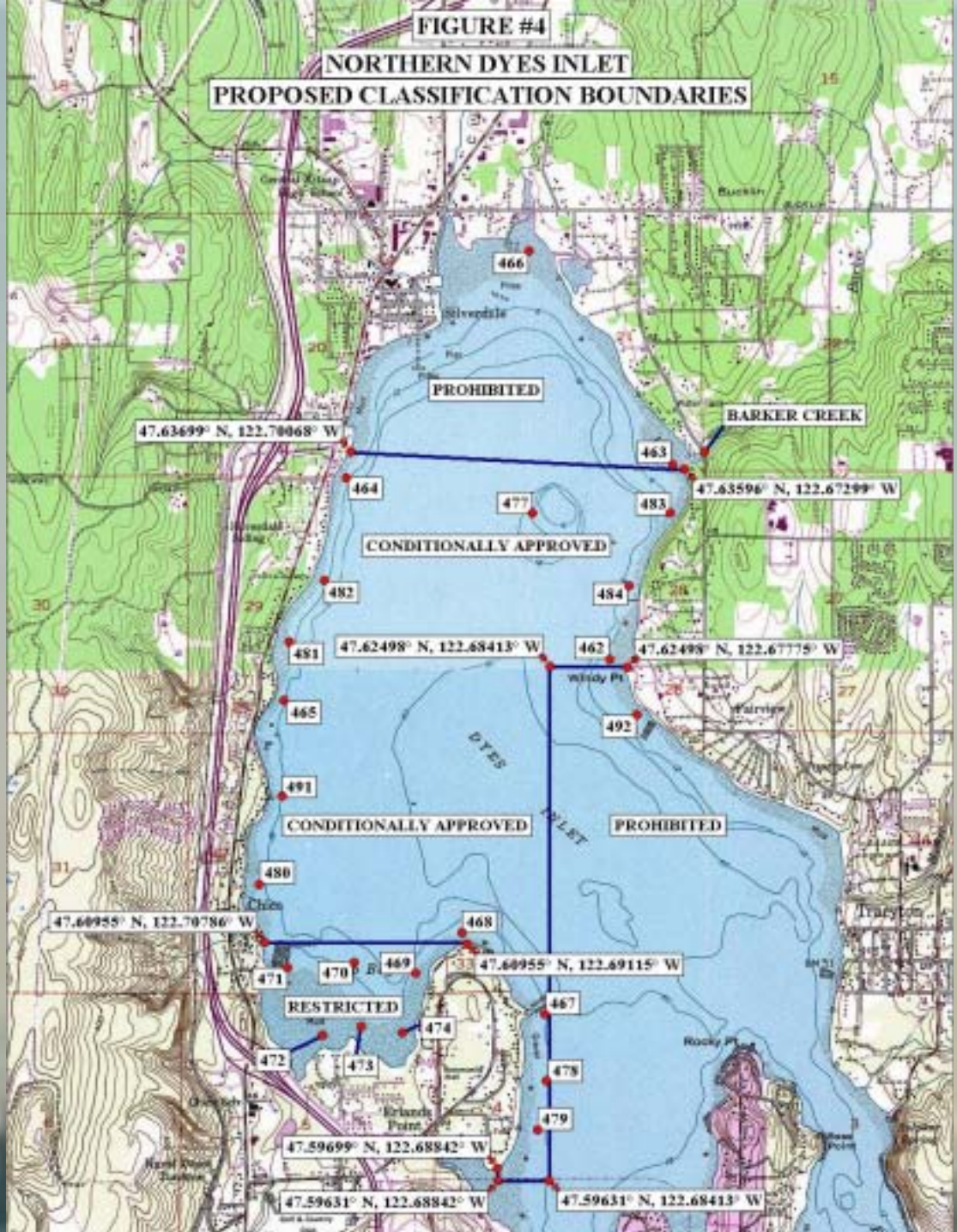
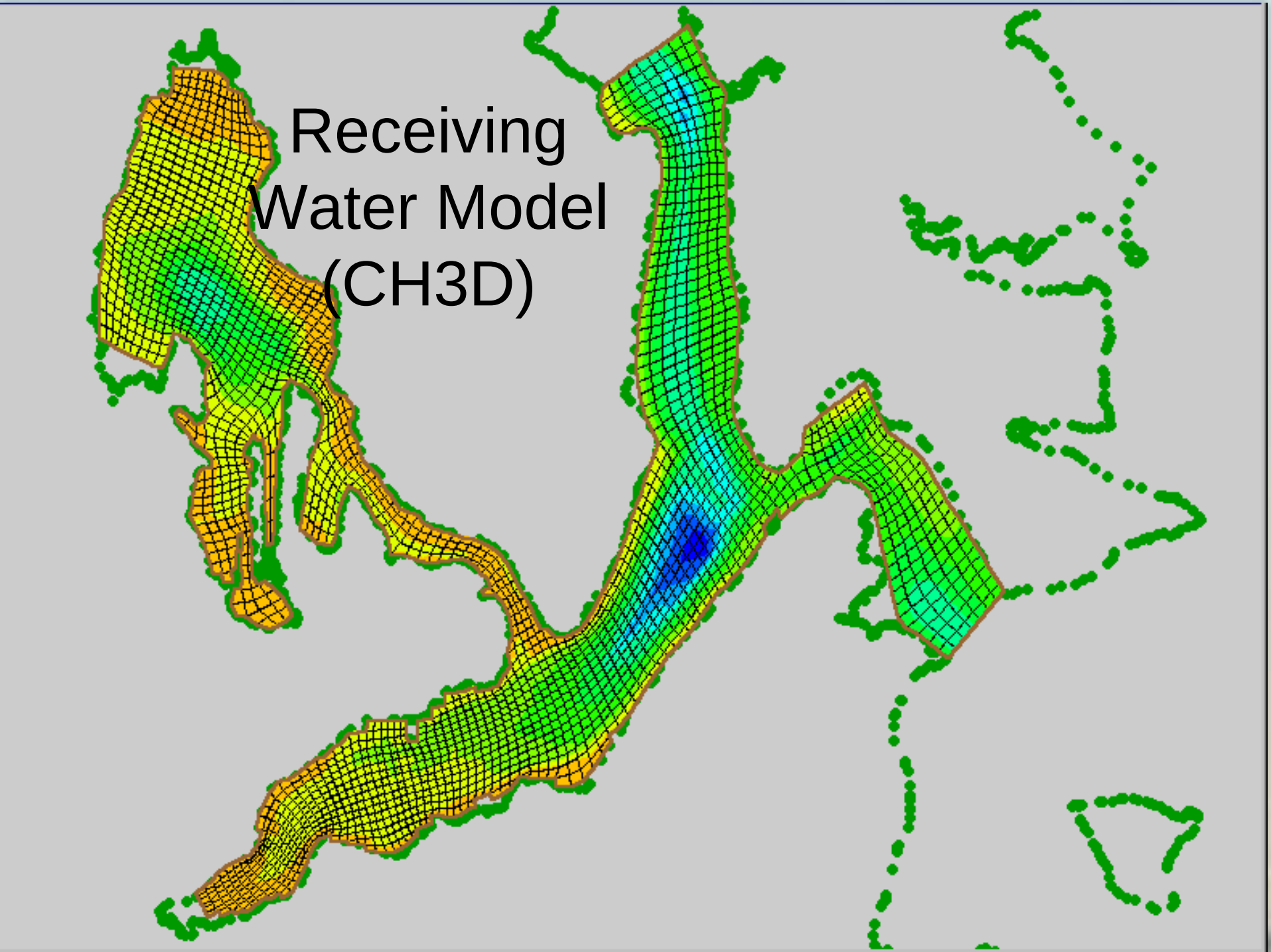
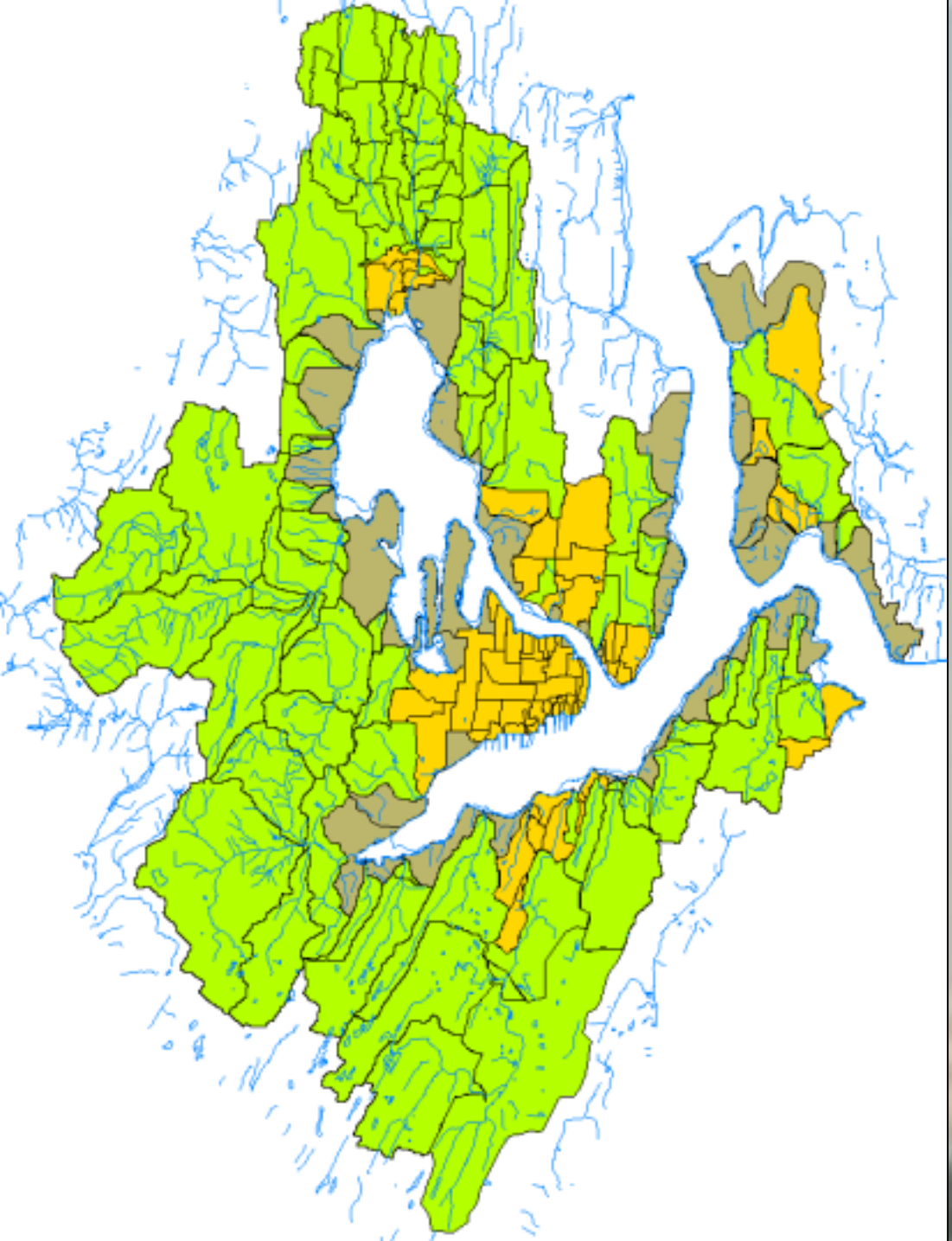


FIGURE #4
NORTHERN DYES INLET
PROPOSED CLASSIFICATION BOUNDARIES
466
PROHIBITED
47.63699° N, 122.70068° W
BARKER CREEK
463
47.63596° N, 122.67299° W
464
477
483
CONDITIONALLY APPROVED
482
484
481
47.62498° N, 122.68413° W
462
47.62498° N, 122.67775° W
Windy Pt
465
492
DYES
INLET
491
CONDITIONALLY APPROVED
PROHIBITED
480
47.60955° N, 122.70786° W
468
471
470
469
47.60955° N, 122.69115° W
RESTRICTED
467
474
472
473
478
479
47.59699° N, 122.68842° W
47.59631° N, 122.68842° W
47.59631° N, 122.68413° W


Receiving
Water Model
(CH3D)

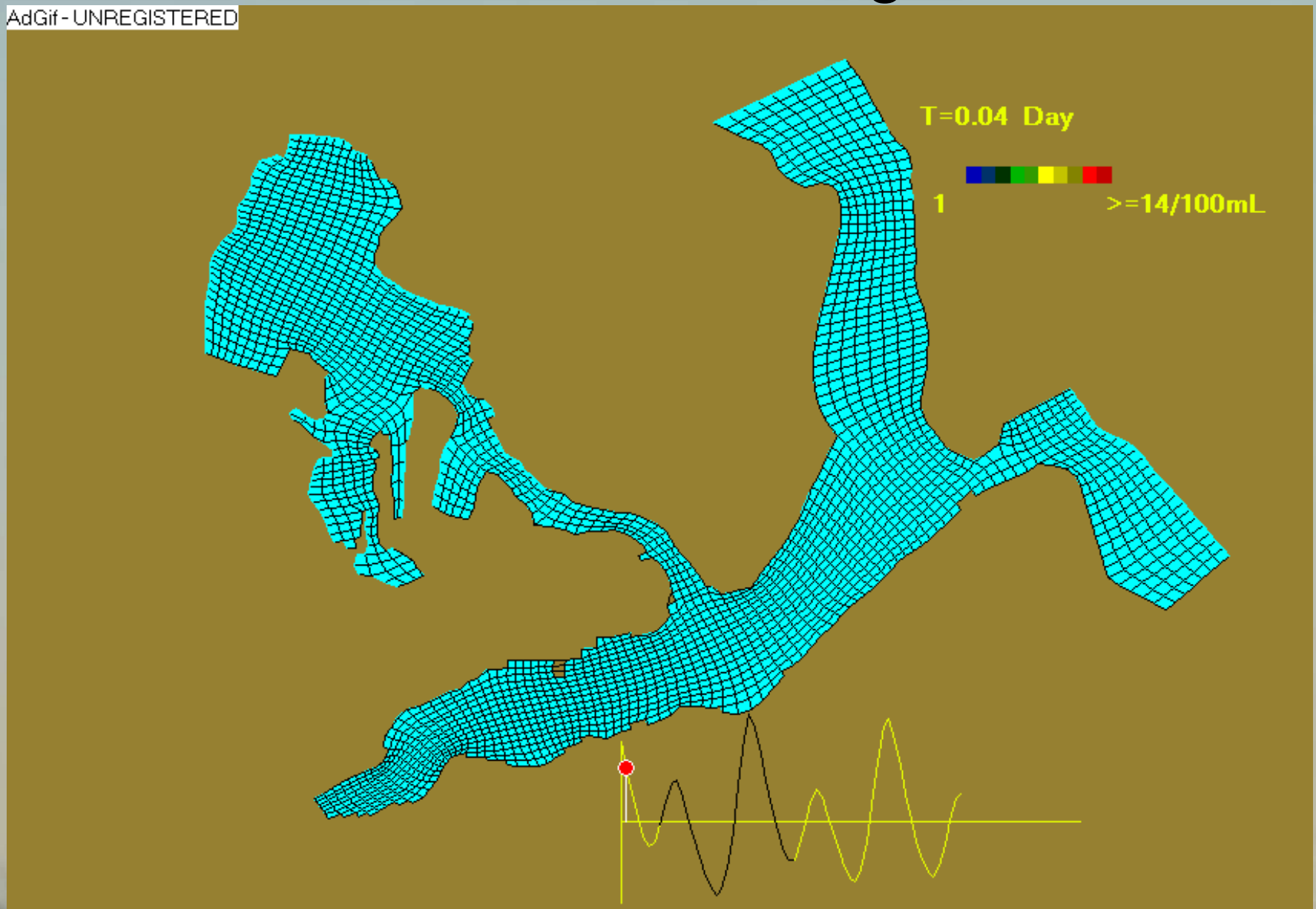


Watershed Model – HSPF

Simulations:

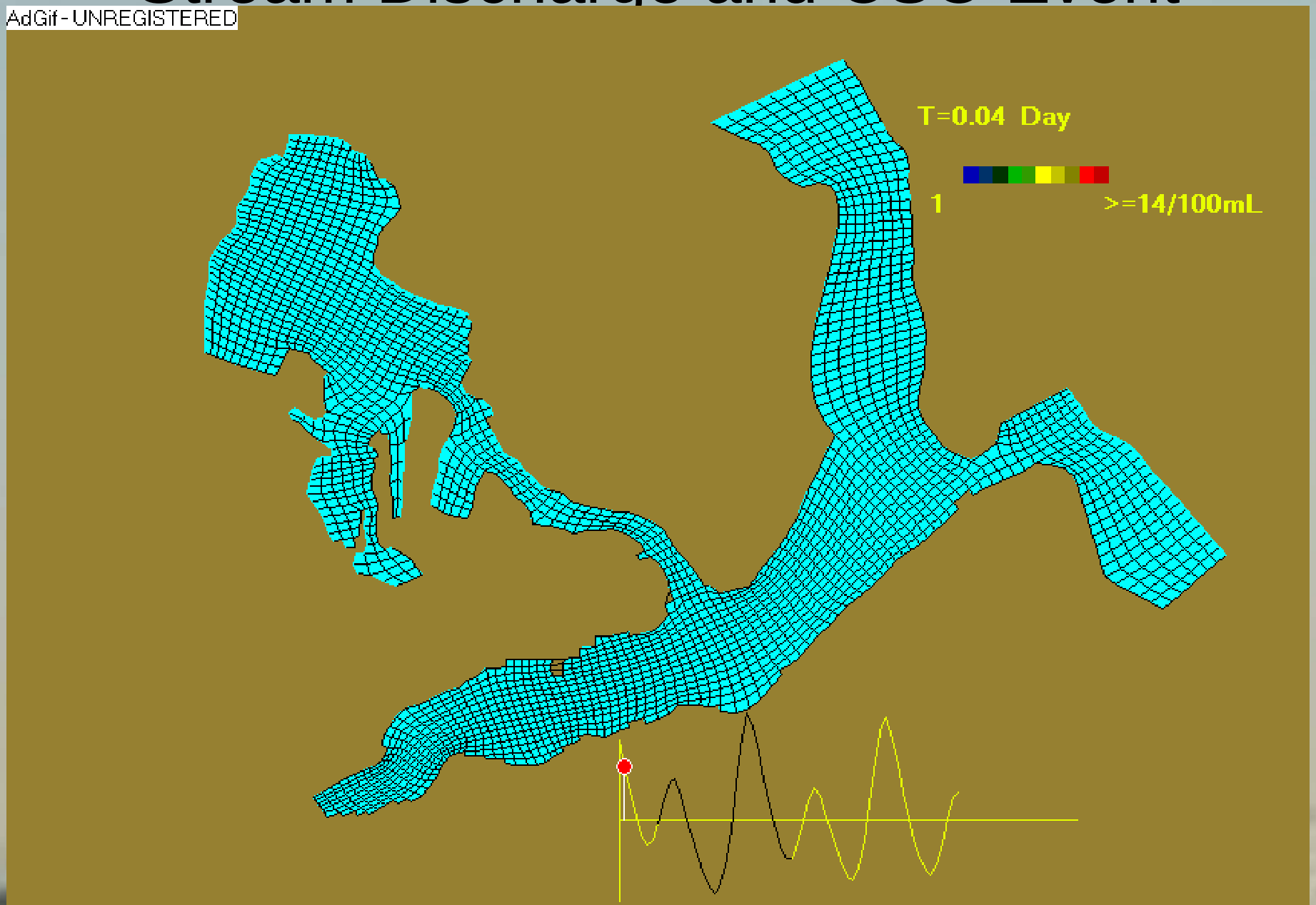
1. FC discharge from 12 major streams during a 2-year storm event (2.7” rain/24hr)
2. + Combined Sewer Overflow

Stream Discharge



http://www.psmem.org/models/graphics/Streamtoscn0.gif

Stream Discharge and CSO Event



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

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

Species and Analytes

Number (No.) of samples to be analyzed							Analyses to be Conducted			
Sinclair Inlet		Nisqually		Strait of Georgia		Port Gardner				
Species	No.	Species	No.	Species	No.	Species	No.	PCB[1]	PAH	Hg[2]	Metals[3]
Sand Sole	3					Sand Sole	3	X		X	X
Rock sole	3	Rock sole	3					X		X	X
Sea cucumber	6			Sea cucumber	6			X		X	X
Staghorn sculpin	2			Staghorn sculpin	3			X		X	X
Shiner surfperch	3	Shiner surfperch	2					X		X	X
Cancer gracilis	3	Cancer gracilis	3					X		X	X
Ratfish	6			Ratfish	6			X		X	X
English sole	3			English sole	3						X
English sole*	5										X

Link to sample photos and station locations

* Carcus and viscera split with WDFW

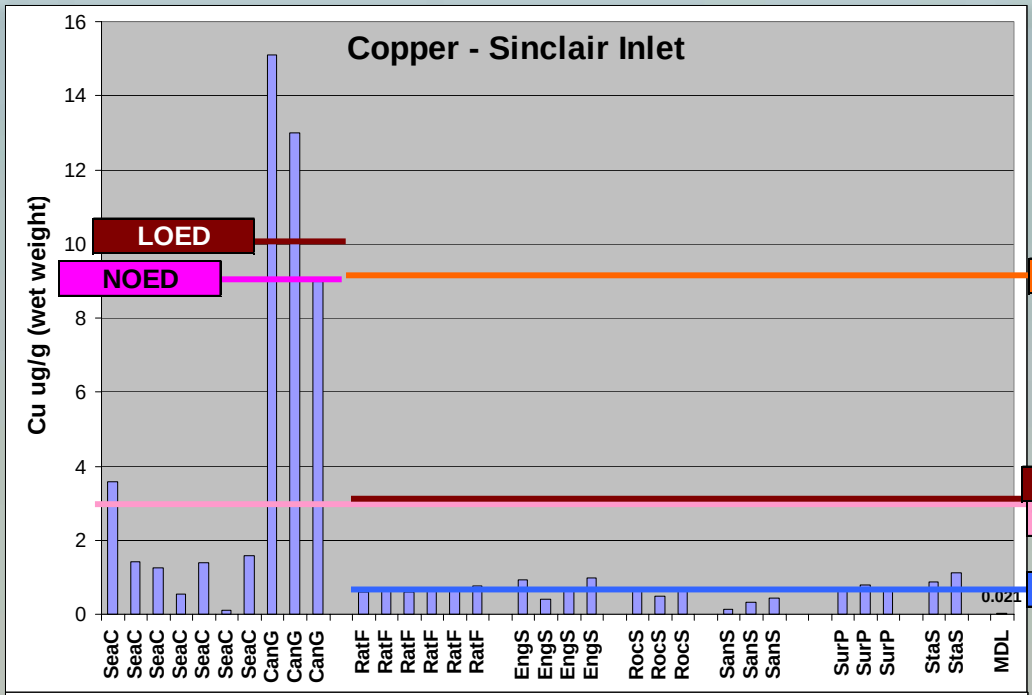
1. NOAA 18 congeners, Dieldrin, and Aldrin
2. Total Hg
3. Ag, As, Cd, Cr, Cu, Fe, Ni, Pb, Zn

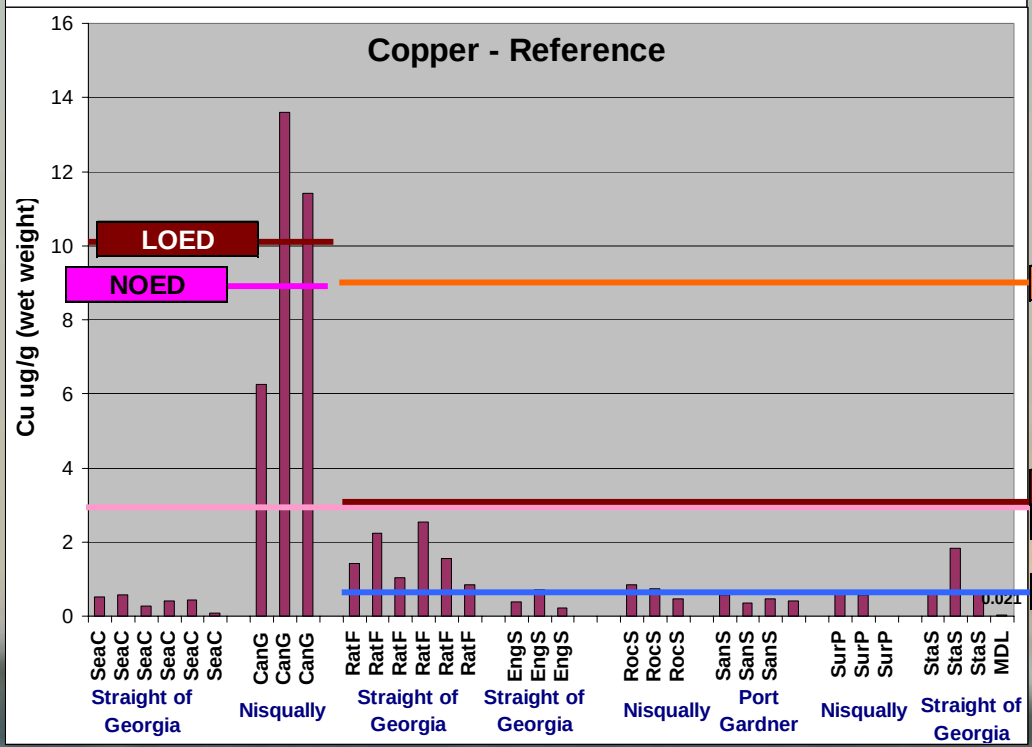
Summary of Tissue Residue Benchmarks

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

Photo by SCDNR

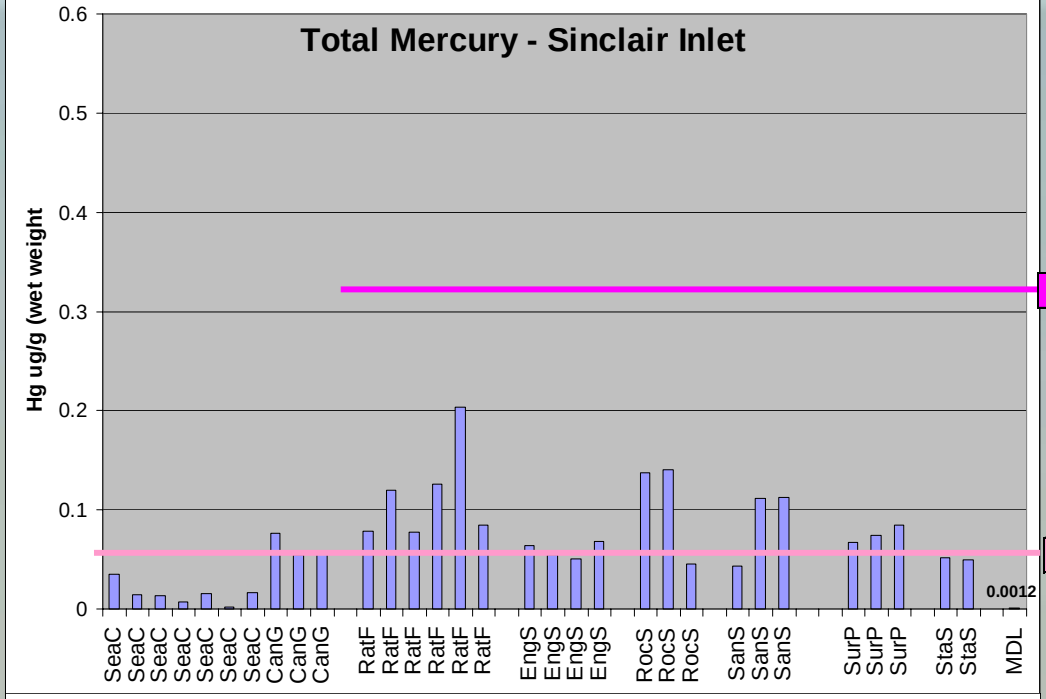
Copper Concentrations

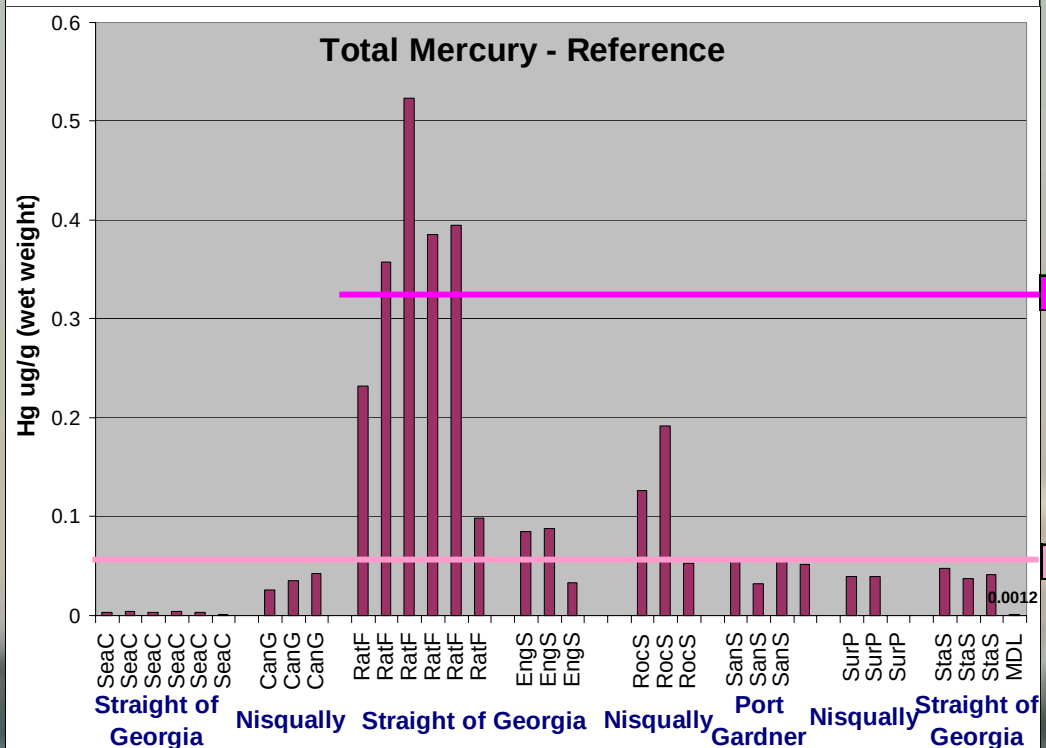




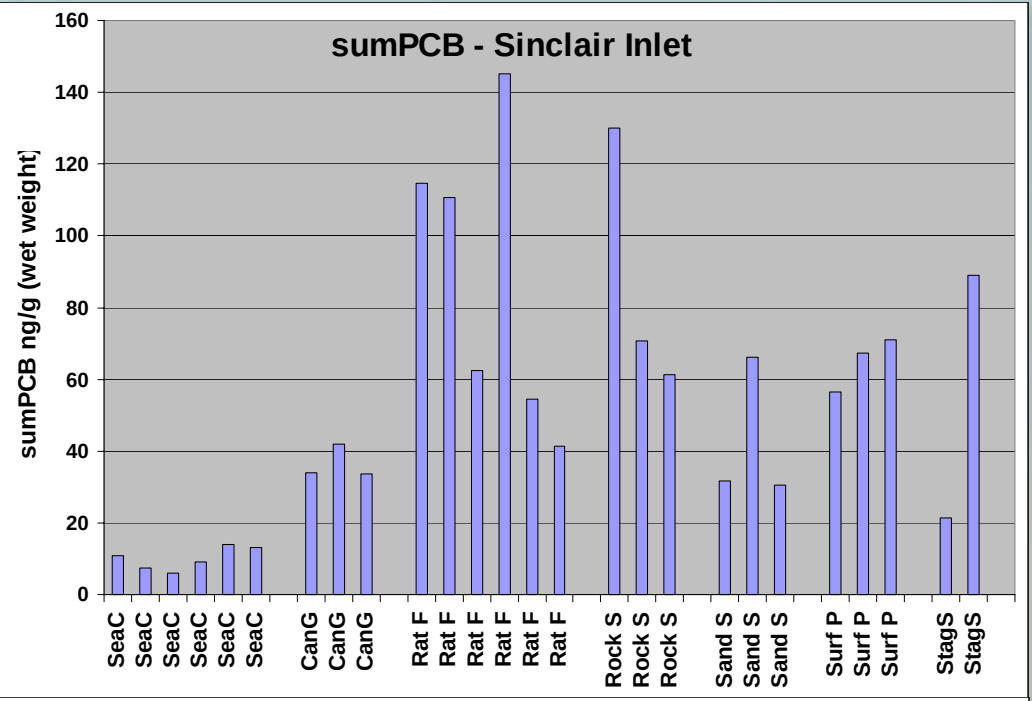
Ecological Benchmarks (Cu)		
	Fish	Invert.
	ug/g wet	ug/g wet
TSV	3.00	3.00
Bcv	0.62	62.00
NOED	0.34*	9.00
LOED	3.40	10.13
Harbor Seal	68.25	68.25
Osprey	9.22	na
Black Duck	18.44	18.44
* NOED = LOED/10		

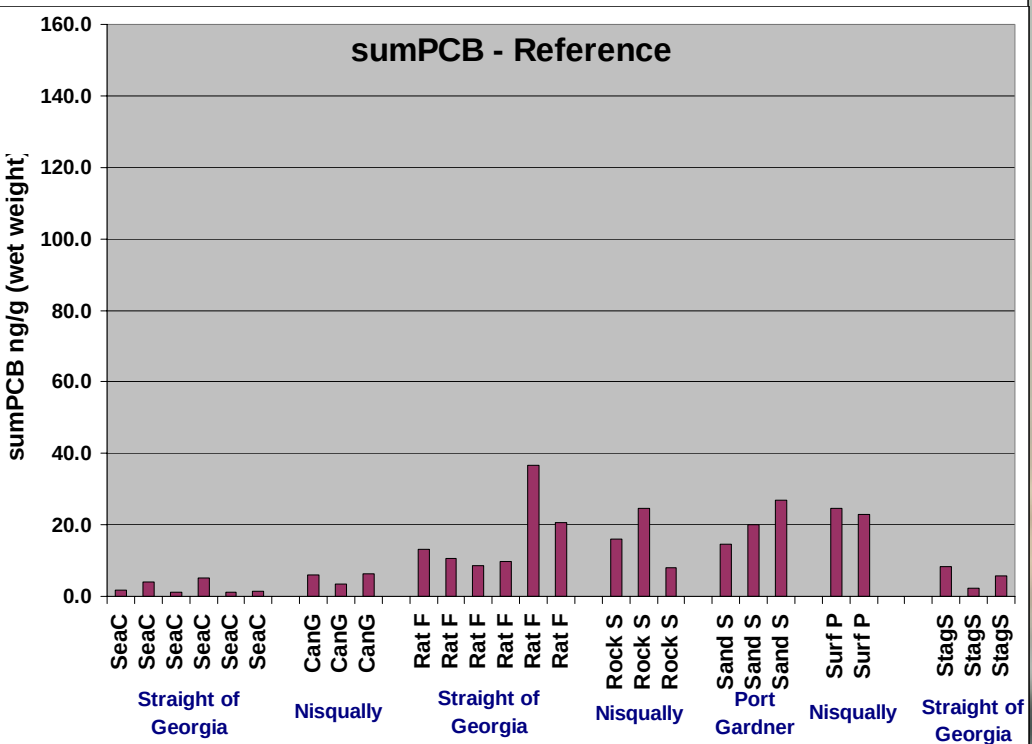
Mercury Tissue Concentrations





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

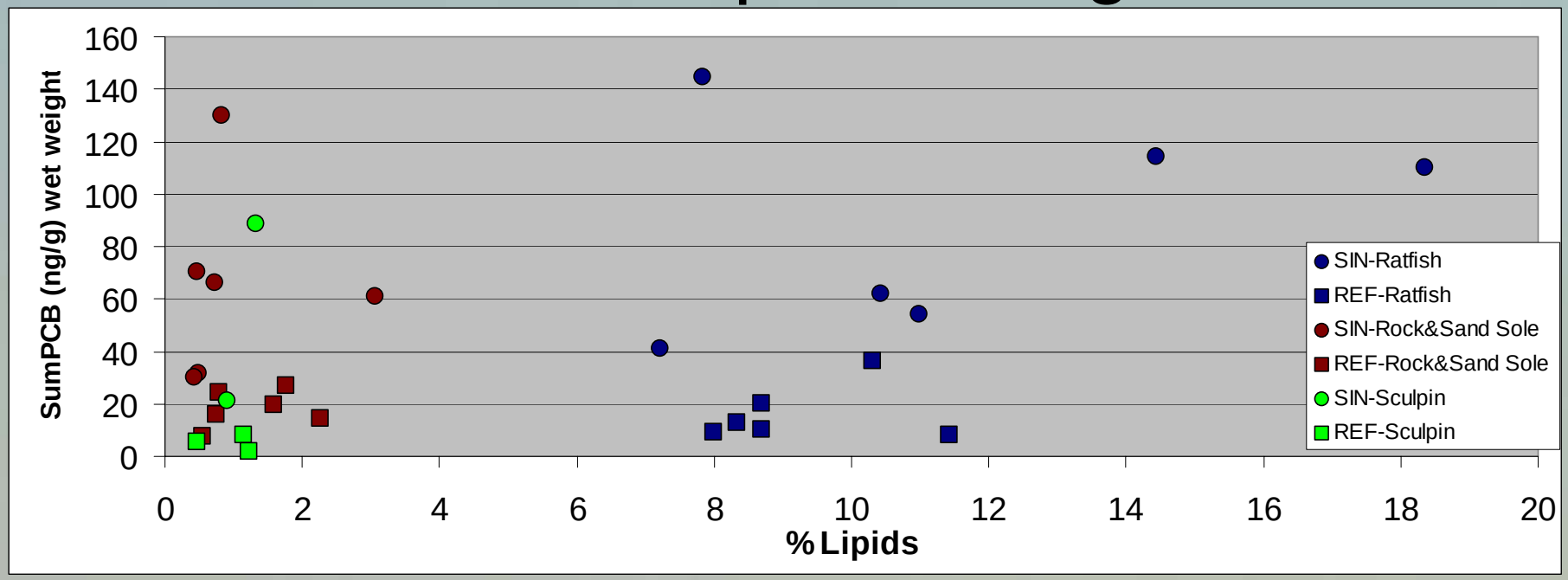


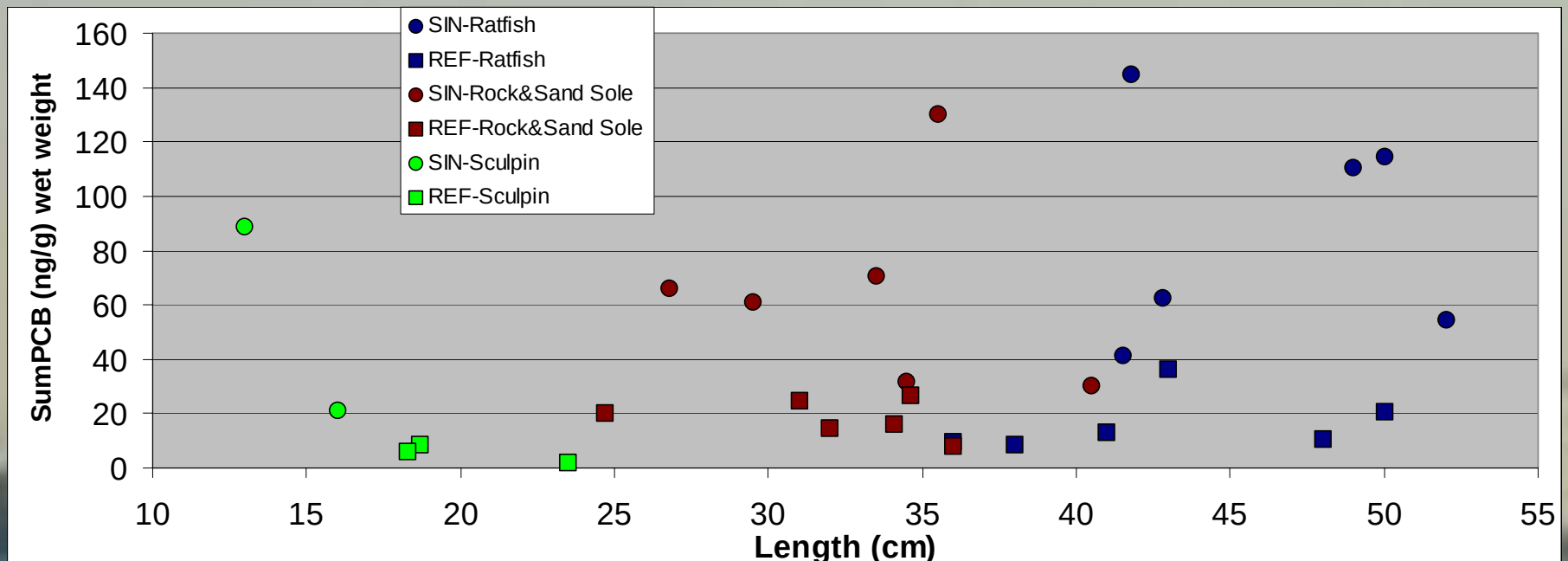


PCB Tissue Concentrations

Ecological Benchmarks (sumPCB)		
	Fish	Invert.
	ug/g wet	ug/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

PCB vs Lipid & Length





PCBs in Salmon Tissue

Global Assessment of Organic Contaminants in Farmed Salmon
Ronald A. Hites, et al. *Science* Jan 9 2004: 226-229.

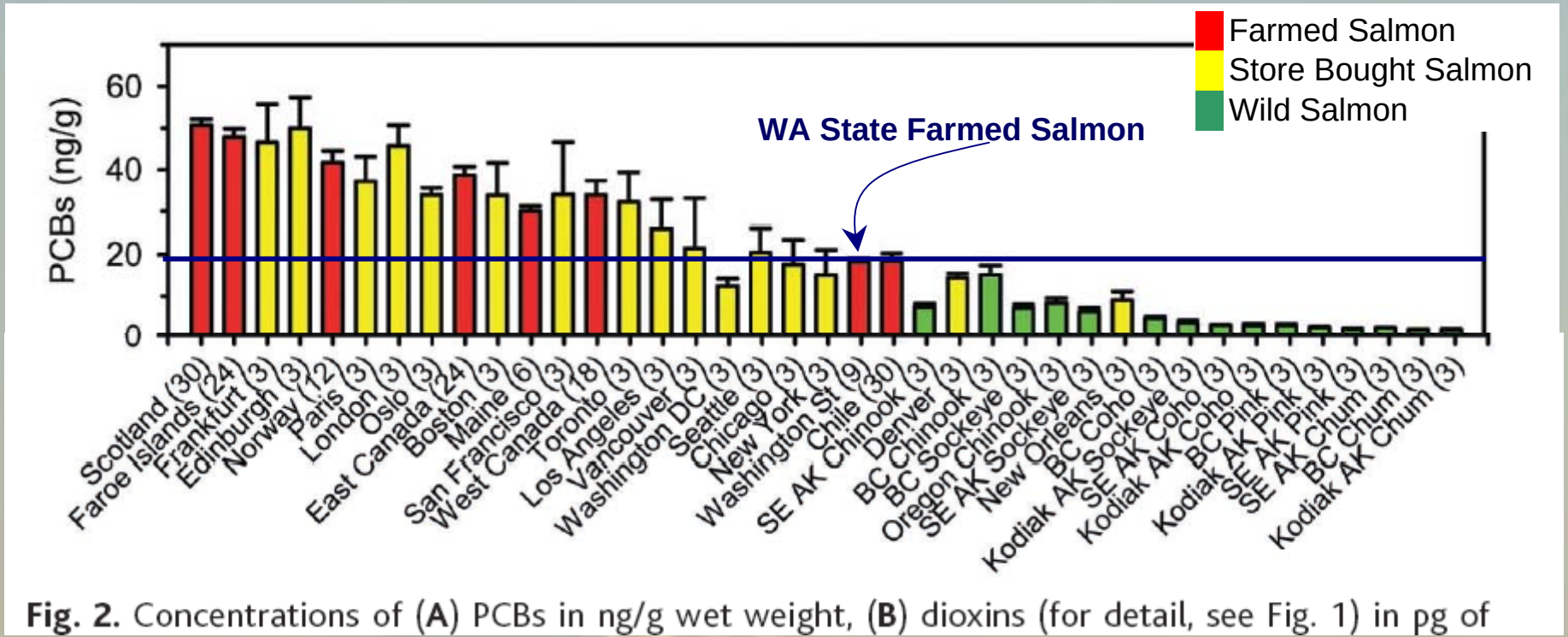
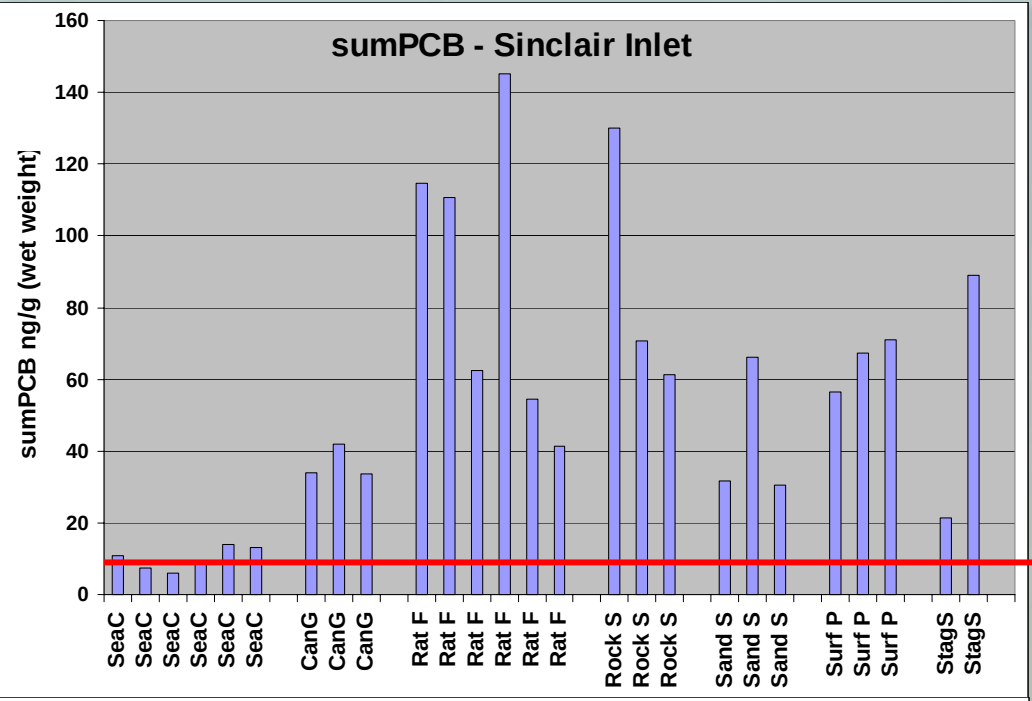
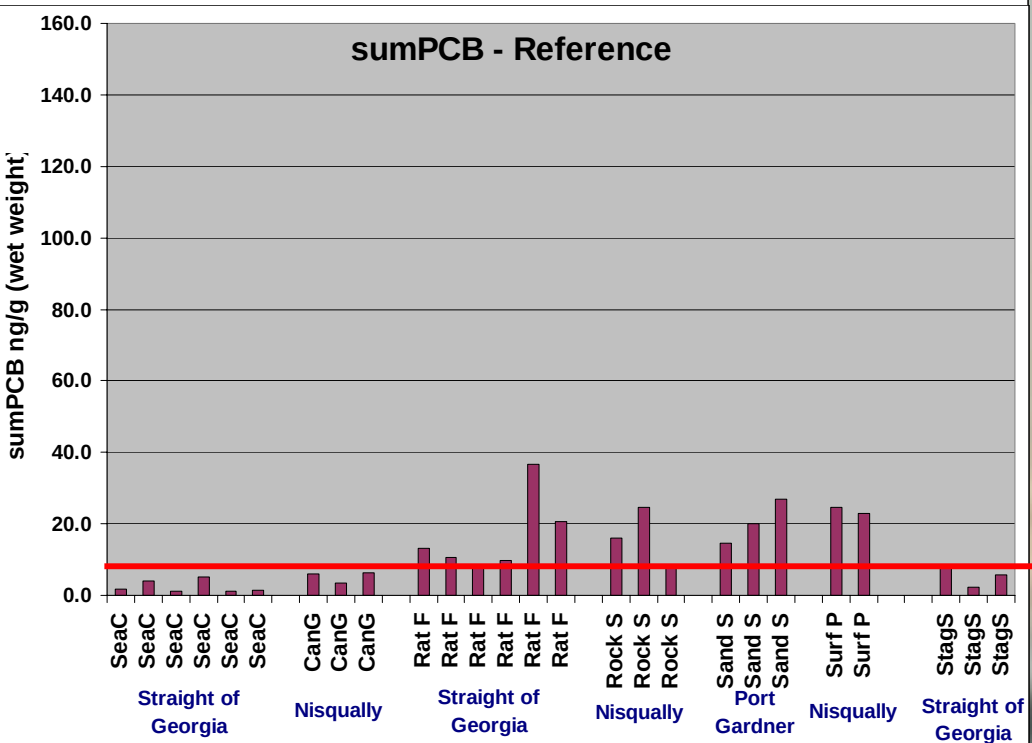


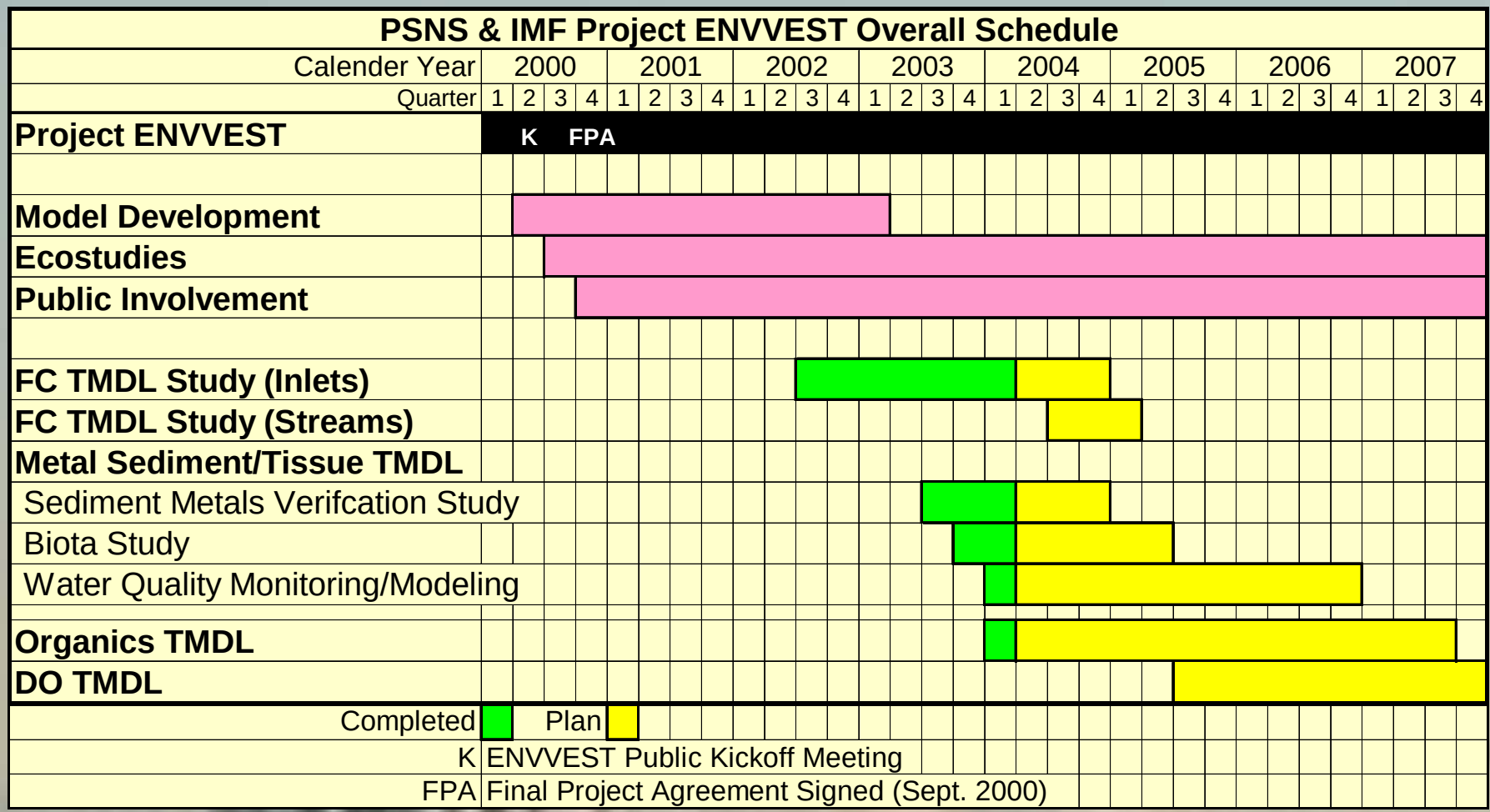
Fig. 2. Concentrations of (**A**) PCBs in ng/g wet weight, (**B**) dioxins (for detail, see Fig. 1) in pg of

Total PCB sum of 209 congeners (Method 1668A)
Filets with skin on


sumPCB - Sinclair Inlet
sumPCB ng/g (wet weight)
160
140
120
100
80
60
40
20
0
SeaC
CanG
Rat F
Rock S
Sand S
Surf P
StagS
Farm Raised Salmon Filet 9.5 ng/g wet


sumPCB - Reference
sumPCB ng/g (wet weight)
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
SeaC
CanG
Rat F
Rock S
Sand S
Surf P
StagS
Straight of Georgia
Nisqually
Straight of Georgia
Nisqually
Port Gardner
Nisqually
Straight of Georgia
Farm Raised Salmon Filet 9.5 ng/g wet

ENVVEST Schedule



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.

Acknowledgements:

PSNS & IMF
Ecology NW Regional Office, Environmental Assessments
EPA Region X
Space and Naval Warfare Systems Center
Battelle Marine Science Lab
Army Corps of Engineers Engineering Research R&D Center
University of Washington
Kitsap Public Utilities District
The Environmental Company
Navy Region NW, Engineering Field Activity NW
Cities of Bremerton, Port Orchard, and Bainbridge Island
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


Thanks for your interest!