Quartermaster Harbor Nitrogen Management Study Workshop
LOCATION: Vashon High School Commons (20120 Vashon Highway SW)
AGENDA – October 12, 2011

6:30 – 8:30 pm (Presentation will start at 7:00 pm)

6:30-7:00 **Open House Poster Session / Meet and Greet** –All

7:00-7:05 **1. Getting Started** -Curtis DeGasperi
- a. Introductions
- b. General updates since last meeting

7:05-7:15 **2. Freshwater Monitoring** - Eric Ferguson
- a. Overview of monitoring program
  - o Seasonal variation in stream nitrate levels
  - o Spatial variation in groundwater nitrate levels

7:15-7:30 **3. Marine Monitoring – King County/UWT** - Kim Stark / Cheryl Greengrove
- a. Overview of monitoring program / 303(d) listing
- b. Nitrate, phytoplankton and DO patterns
- c. Relationship to *Alexandrium*

7:30-7:45 **4. Special Studies** - Curtis DeGasperi
- a. Overview of N Sources to Harbor
- b. Mileta Creek N Source Tracking
- c. Nearshore Freshwater N
- d. Benthic Flux Study
- e. Updated loading estimates

7:45-7:55 **5. Harbor Model** - Skip Albertson
- a. Hydrodynamic model
- b. Water quality model status

7:55-8:05 **6. Draft Policy Recommendations and Next Steps** - Larry Stockton
- a. 2012 KC Comp Plan recommendations / schedule
- b. Next steps
  - o N management alternatives analysis spring 2012
  - o Correction activities
  - o Community interest / support will play key role

8:10-8:30 **8. Questions and Answers** - All

Adjourn at 8:30 pm

Quartermaster Harbor Nitrogen Management Study

Public Workshop

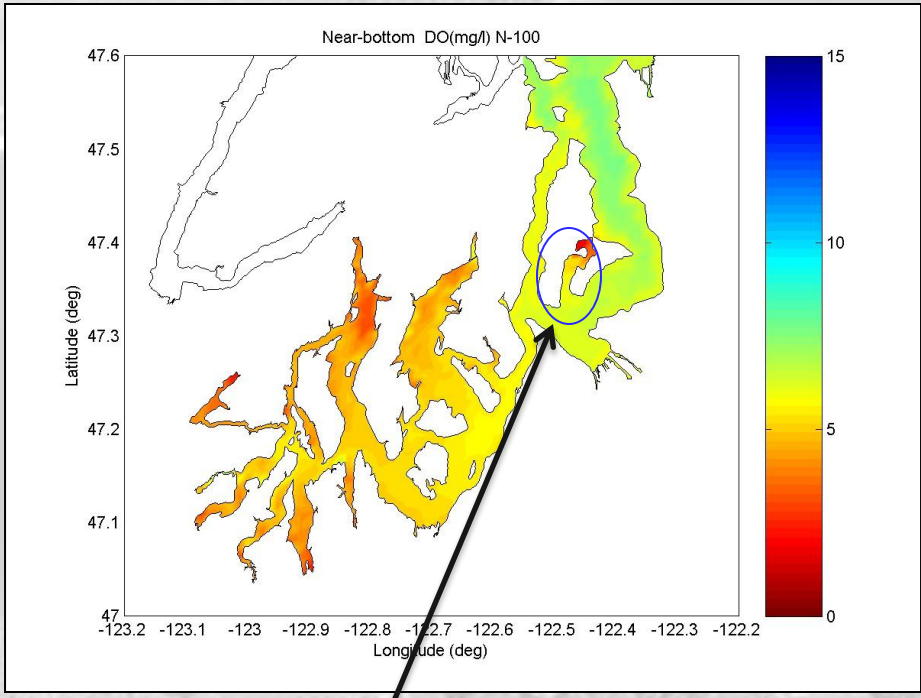
October 12, 2011

Study Team

- Jill Gable – Grant Project Officer, EPA
- Curtis DeGasperi – Project Manager, KC
- Eric Ferguson – Surface/Groundwater monitor, KC
- Kim Stark - Marine monitoring, KC
- Cheryl Greengrove – Environmental Science, UWT
- Julie Masura – Researcher, UWT
- Skip Albertson – Marine Modeler, Ecology
- Larry Stockton – Policy & Public Outreach, KC

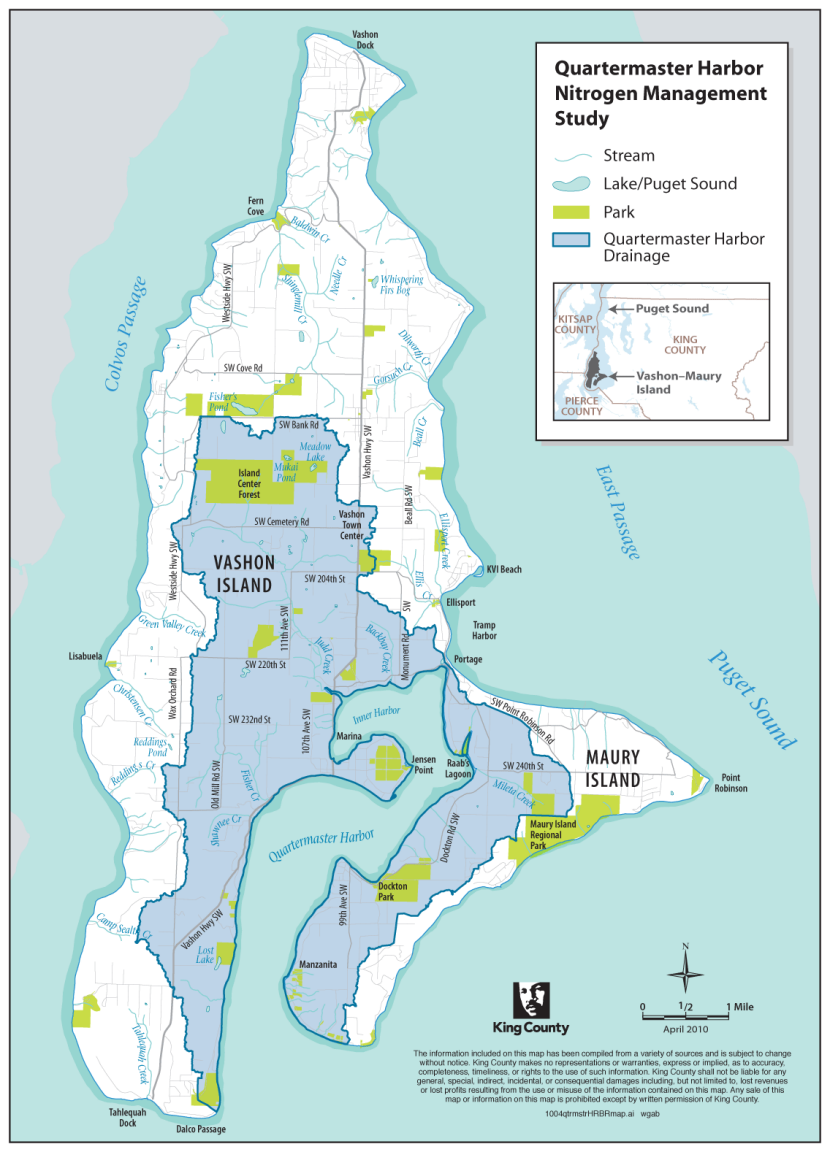
Quartermaster Harbor Nitrogen Management Study

- Problem: Low dissolved oxygen levels observed in harbor
- Low oxygen can be harmful to fish and other aquatic life like in South Puget Sound embayments



Quartermaster Harbor

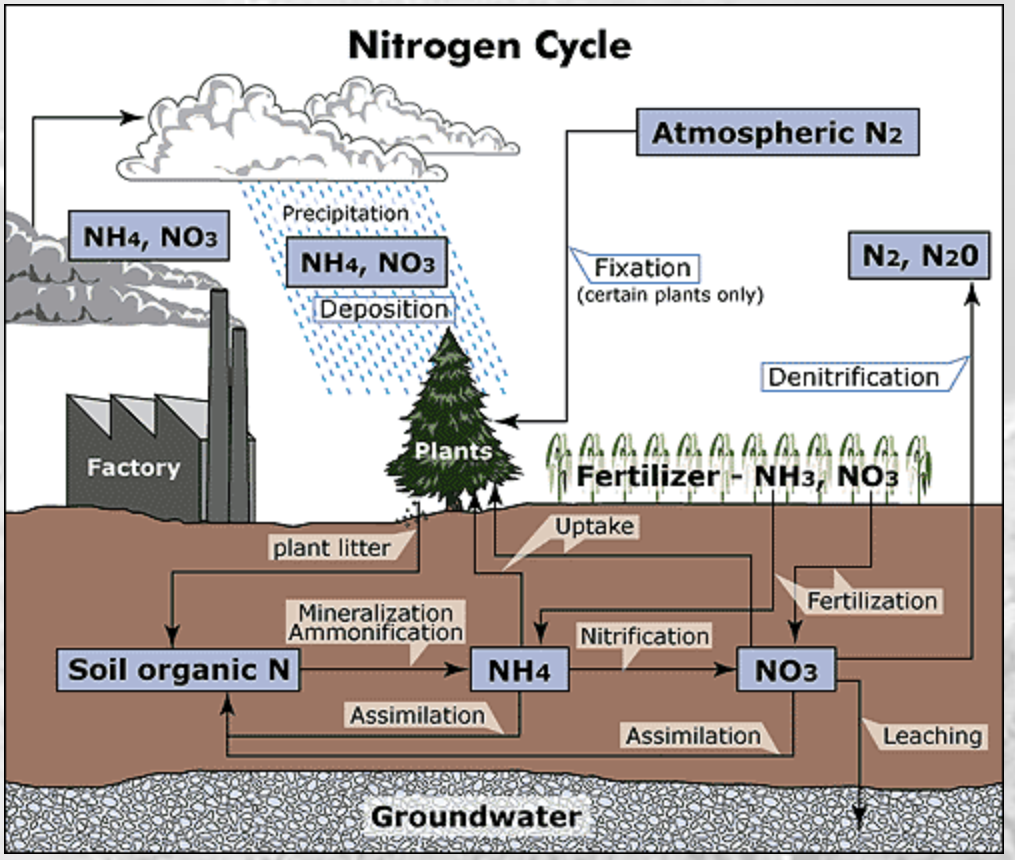
Quartermaster Harbor Nitrogen Management Study



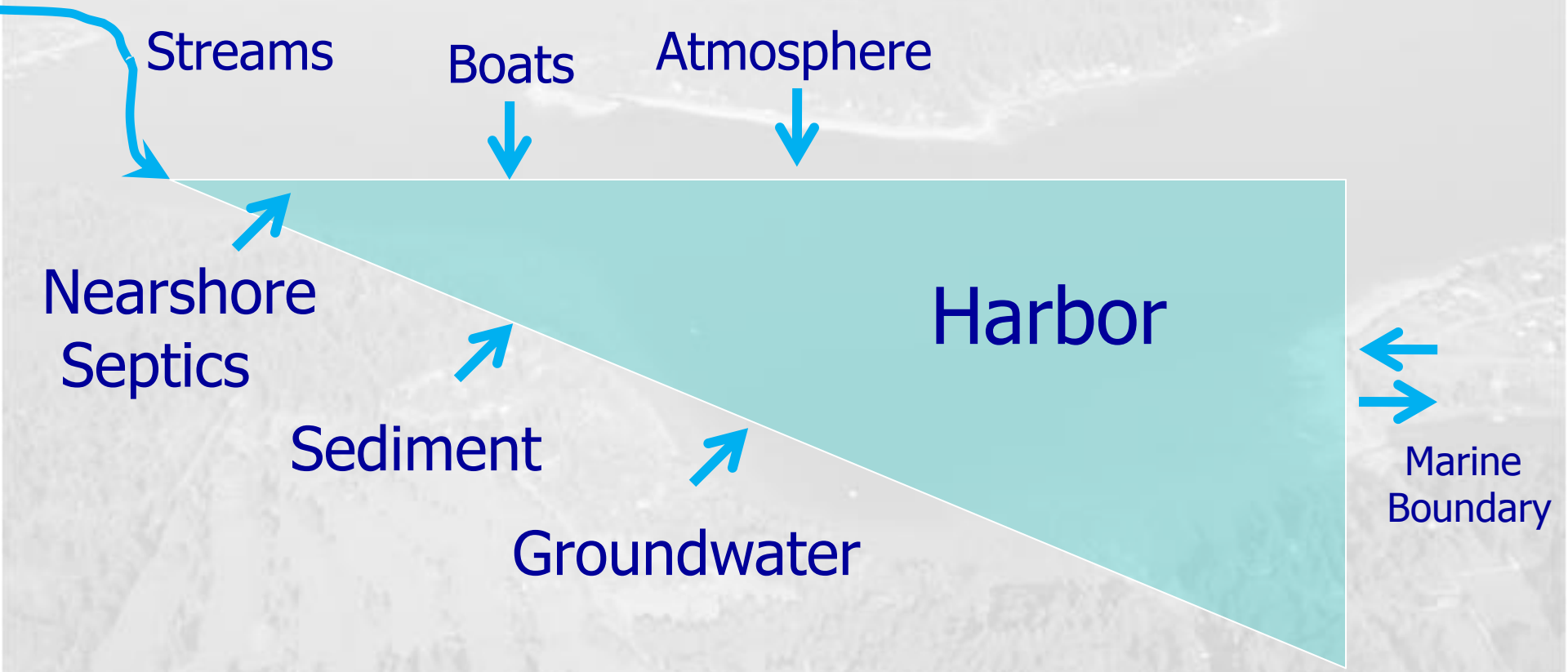
http://www.kingcounty.gov/qmhnitrogenstudy

Sources of Nitrogen on VMI

- Atmosphere
- Septics
- Livestock
- Fertilizer
- Alders



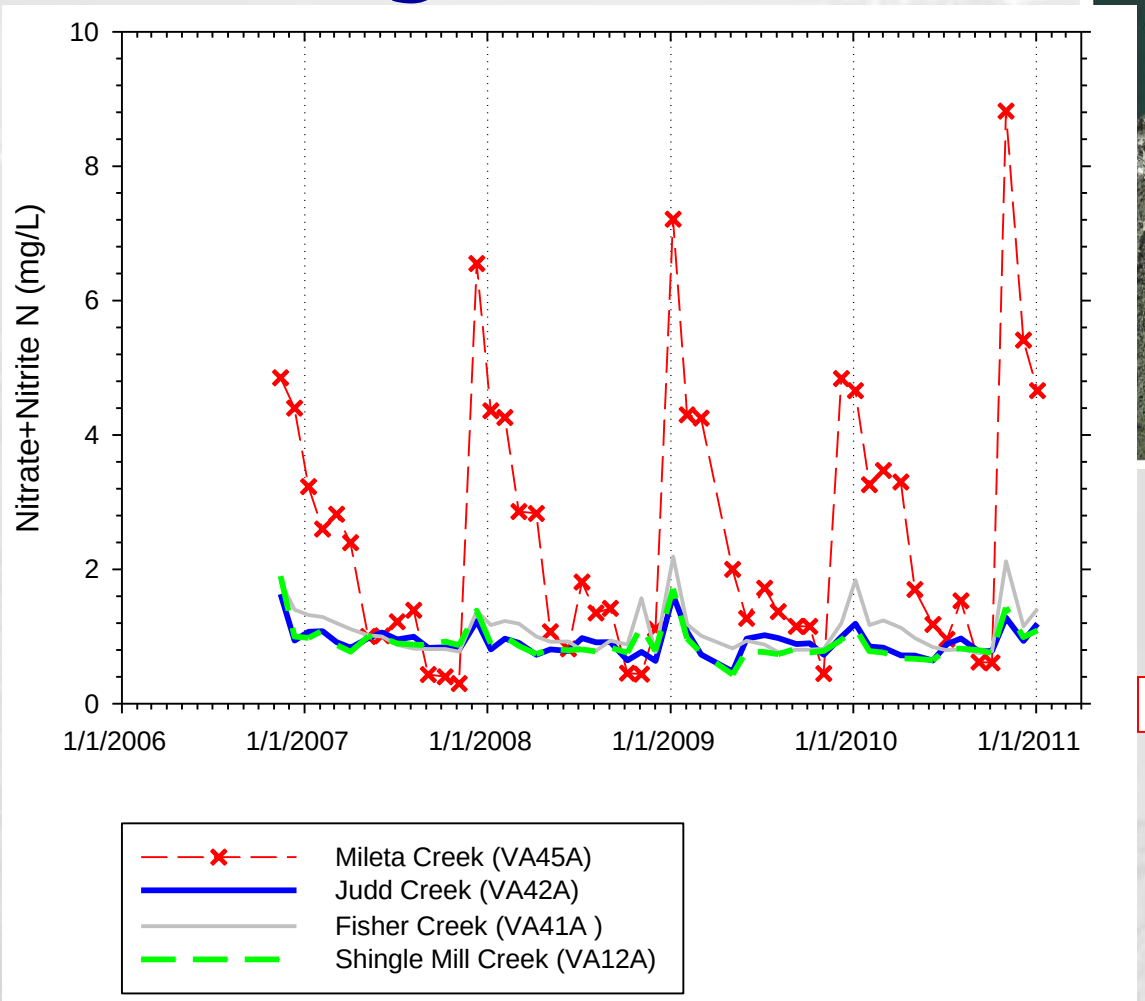
Sources of Nitrogen to Quartermaster Harbor

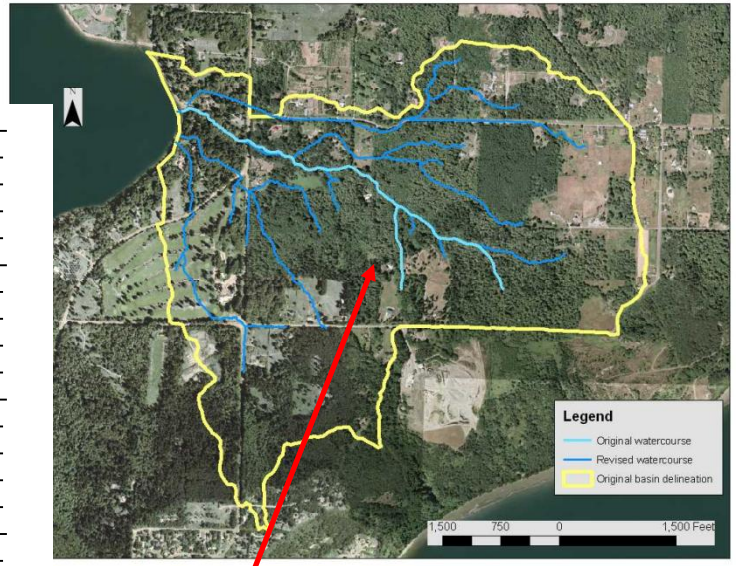


Special Studies

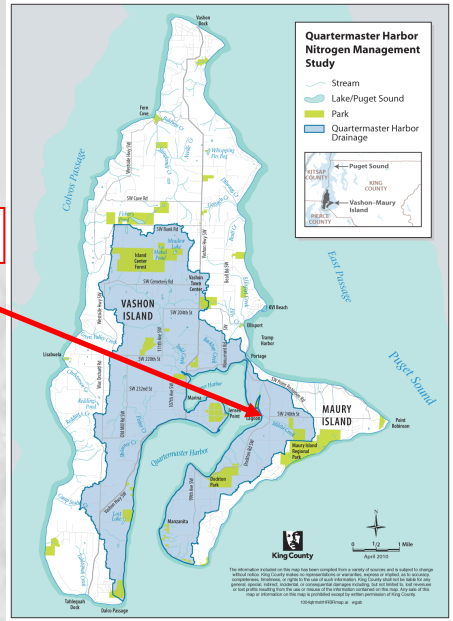
Curtis DeGasperi

Mileta Creek N Source Tracking



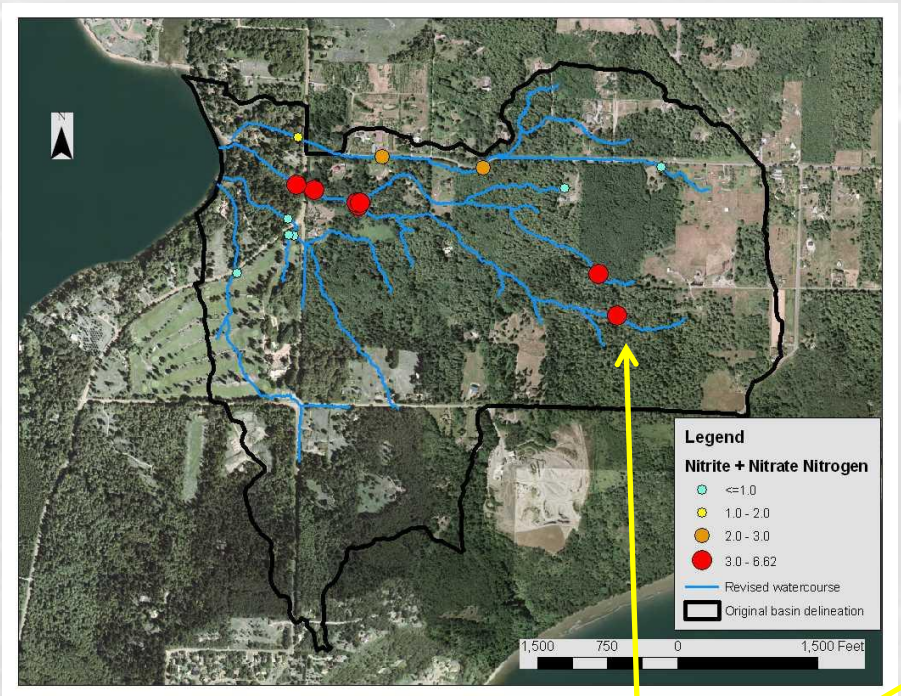


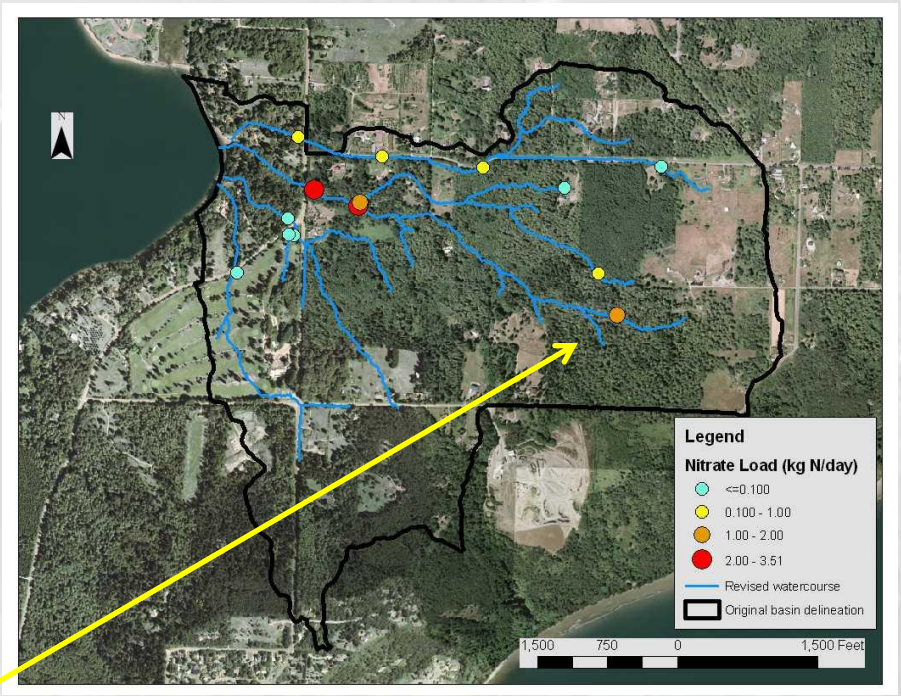
Mileta Creek



Mileta Creek N Source Tracking

November 17, 2010

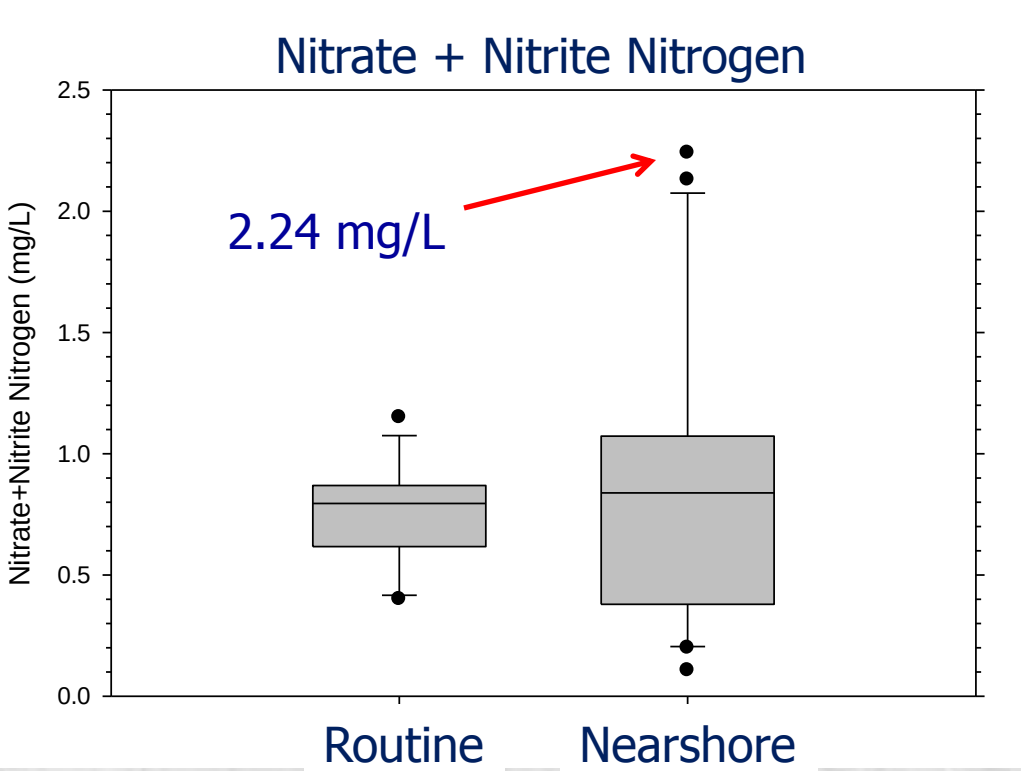




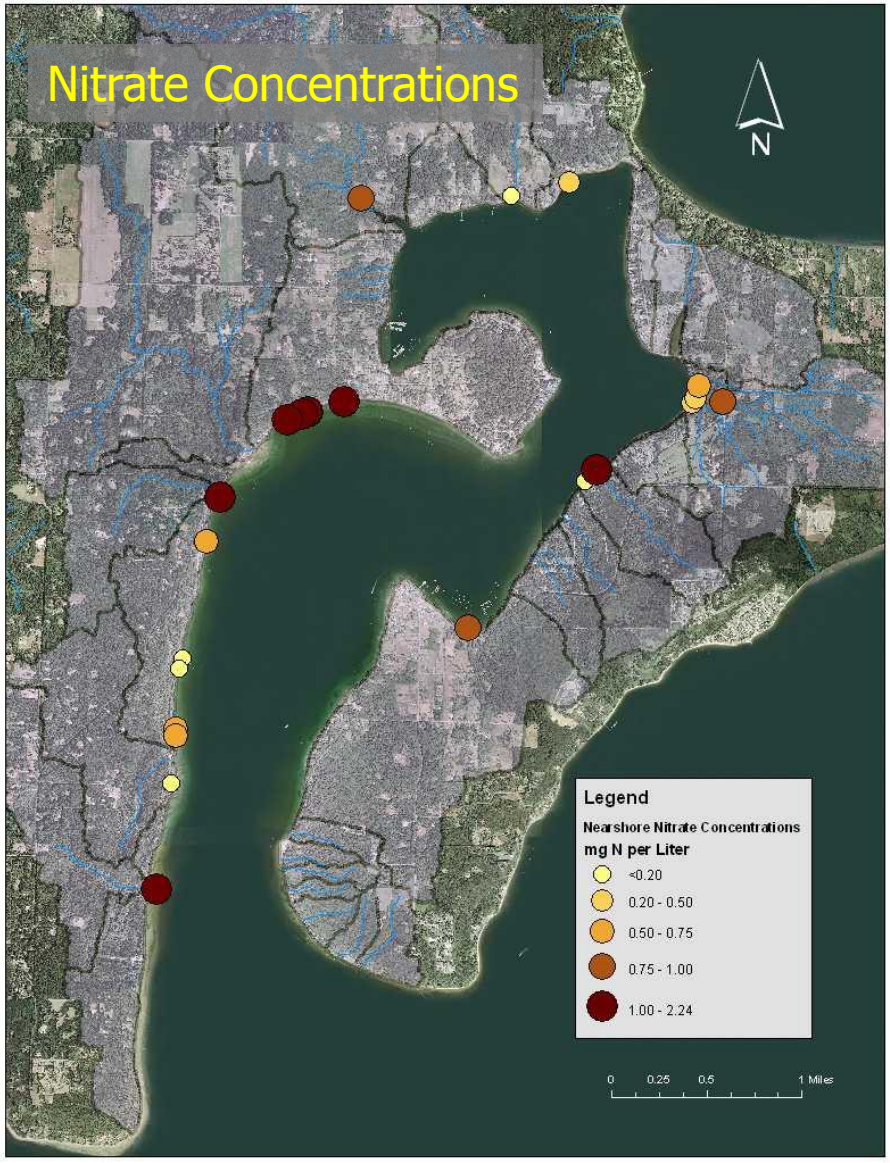
Highest Concentration

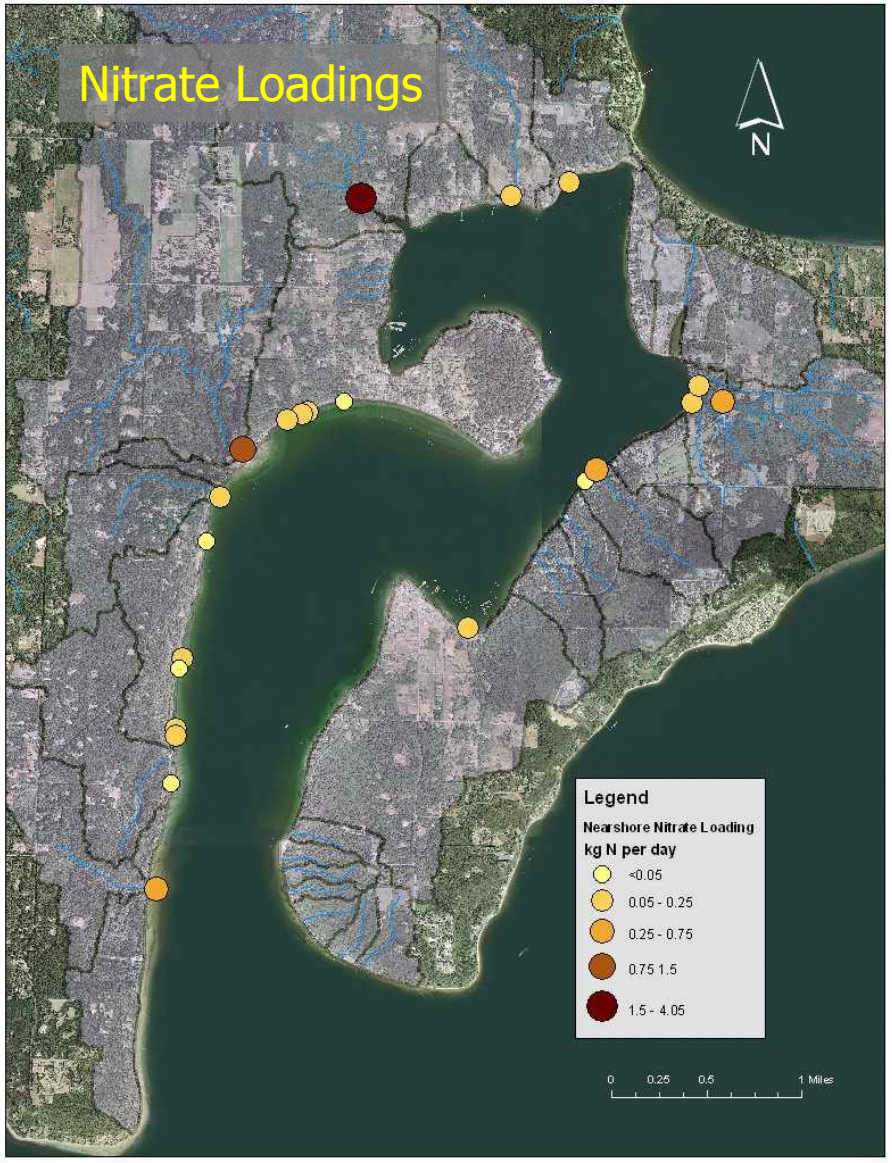
Nearshore Freshwater Inputs

October 6, 2010

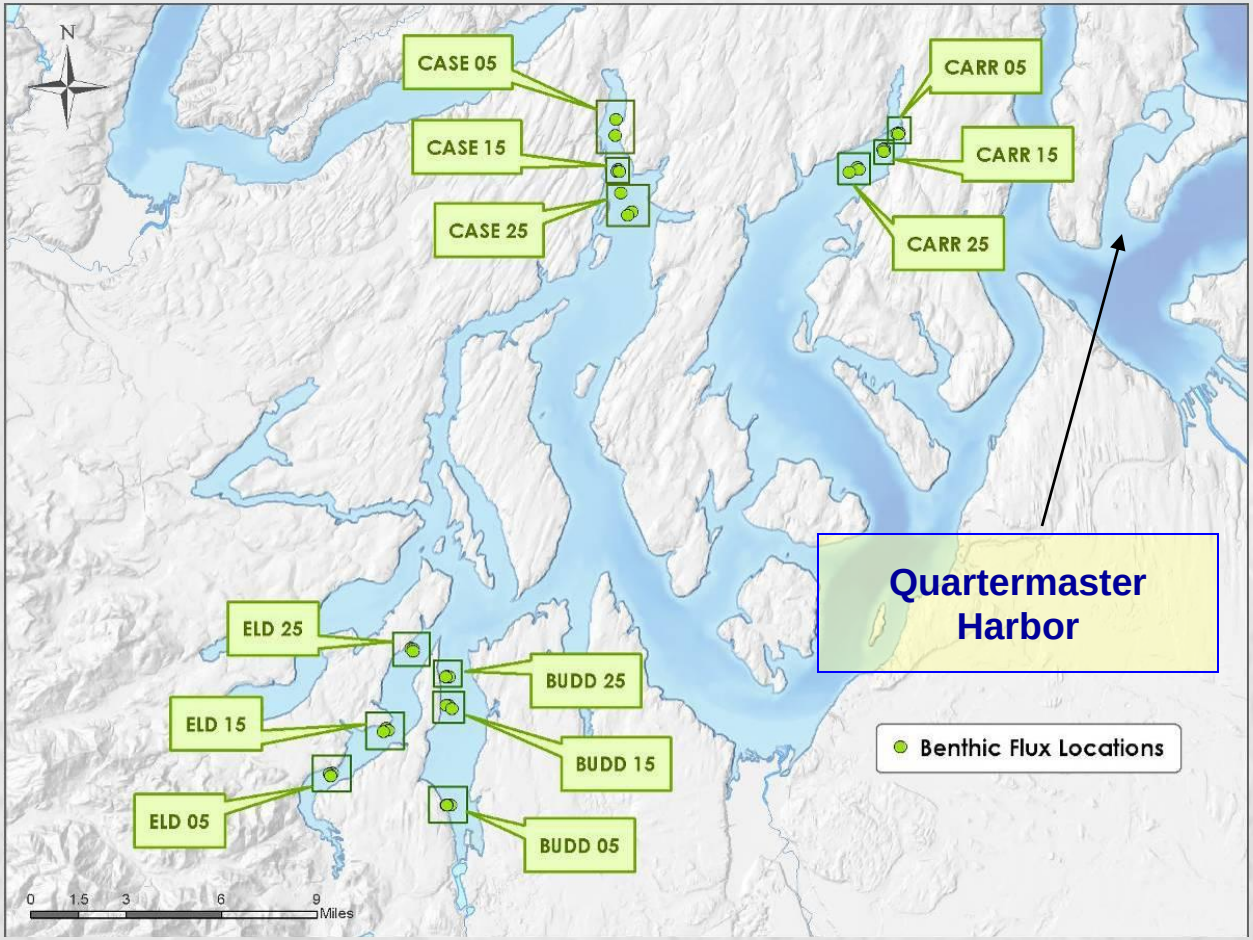


Nearshore Freshwater Inputs



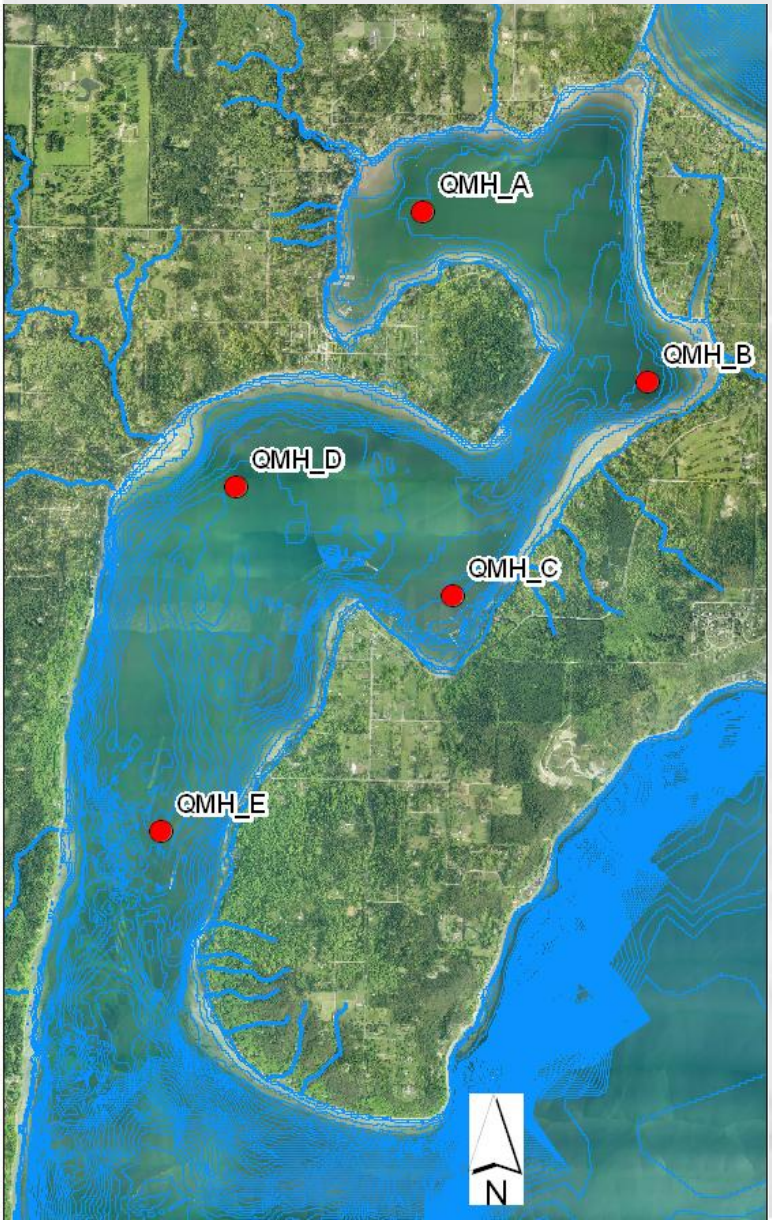


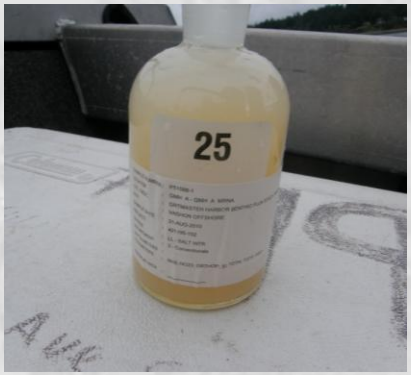
Benthic Flux Study



Benthic Flux Study

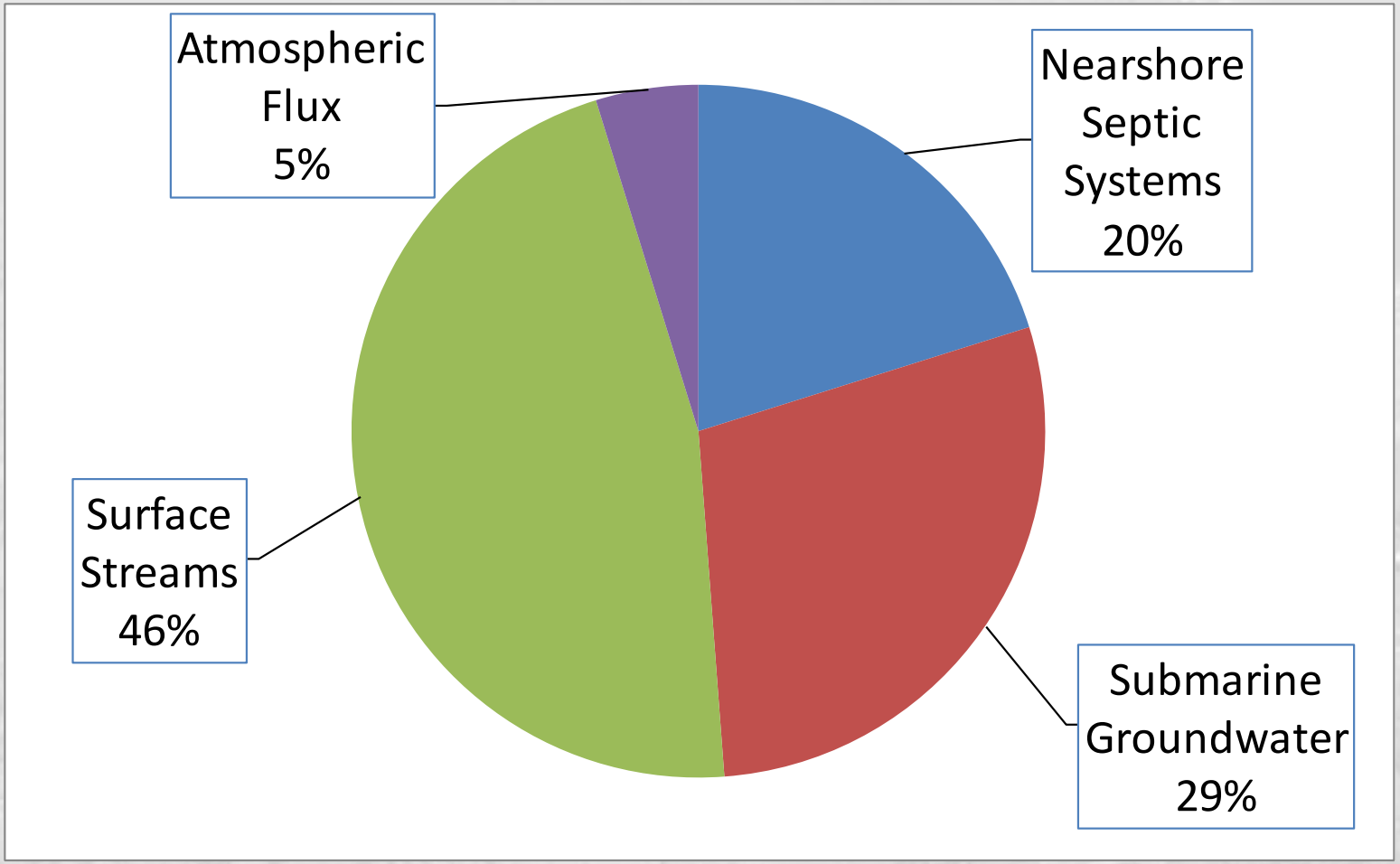
September 1-2, 2010



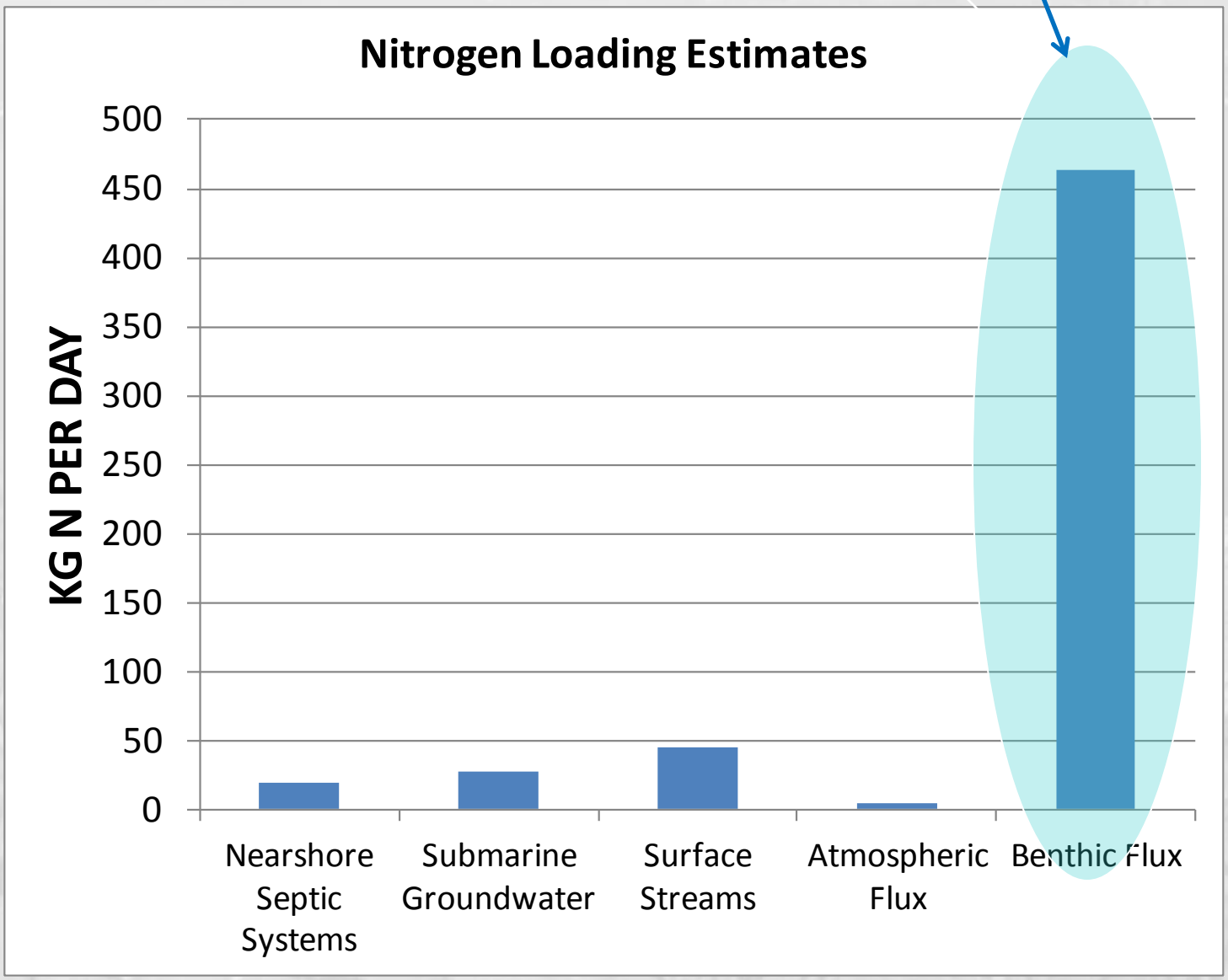


External N inputs assessed

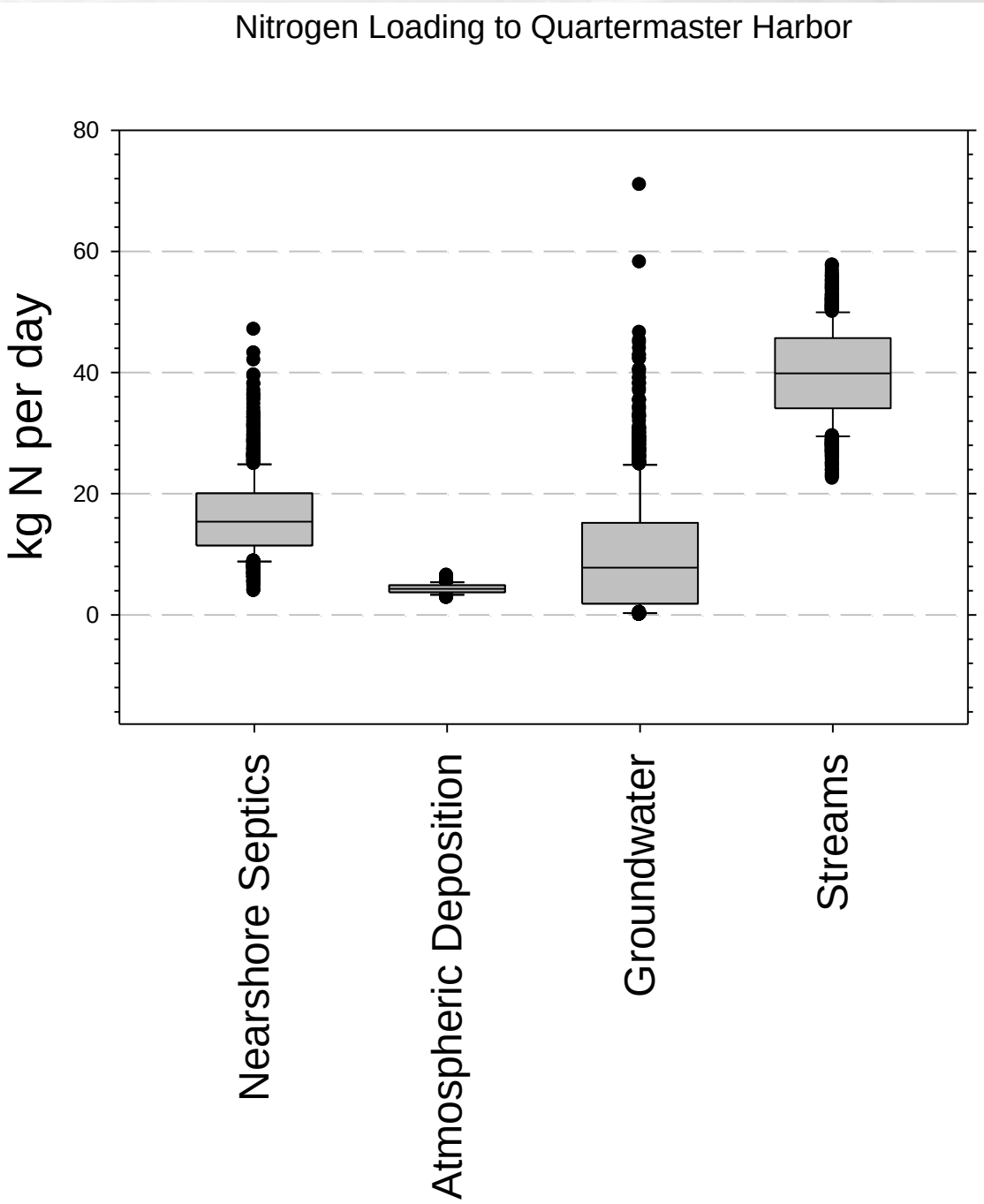
- Atmospheric deposition
- Stream inputs
- Groundwater
- Shoreline septic systems
- Benthic flux



Seasonal Load (late summer)?

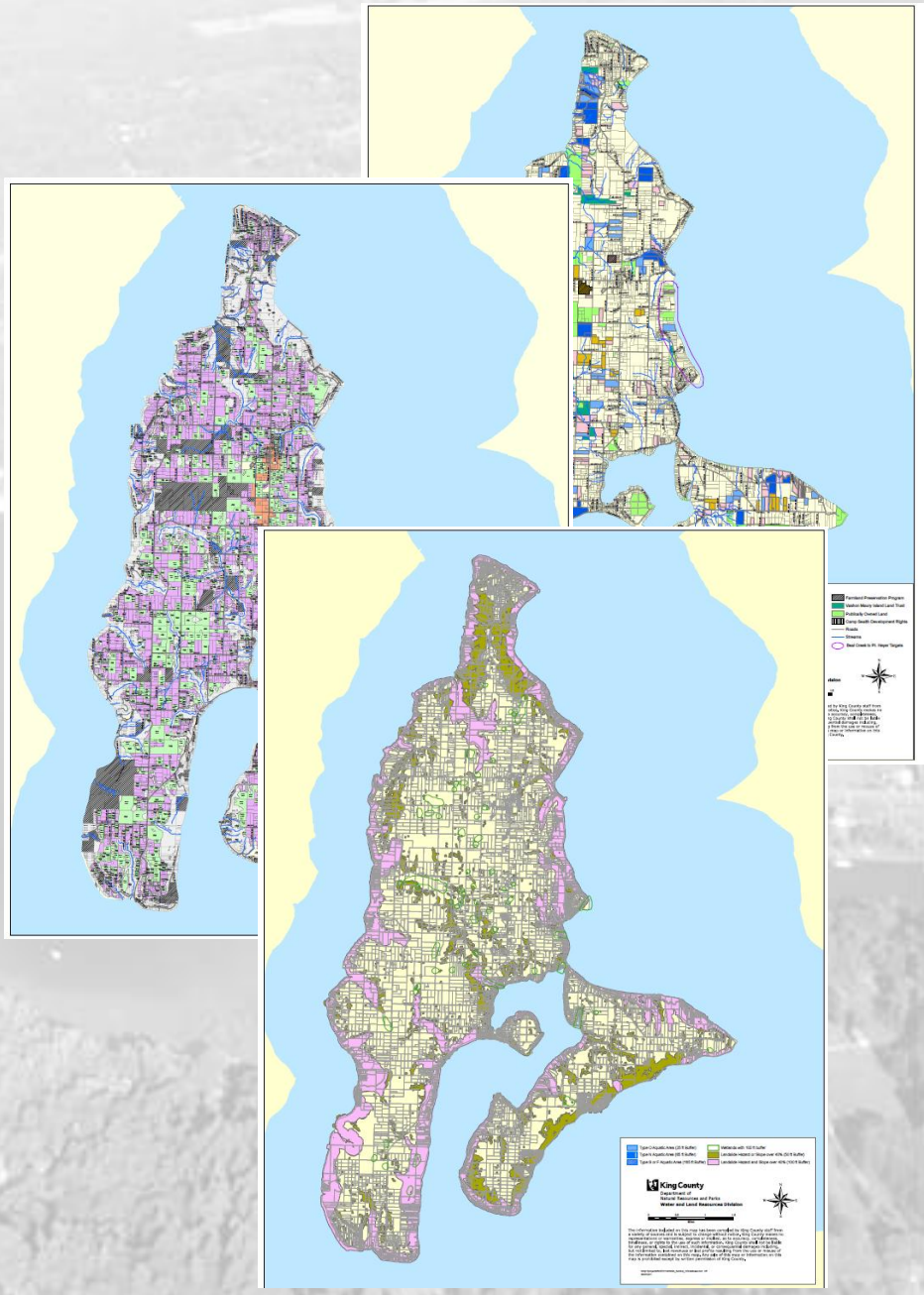


Uncertainty in Nitrogen Loading Estimates



Buildout Analysis

- Identify Buildable Residential Lands
- Exclude
  - Commercial/Industrial
  - Critical Areas
  - Market Reserve



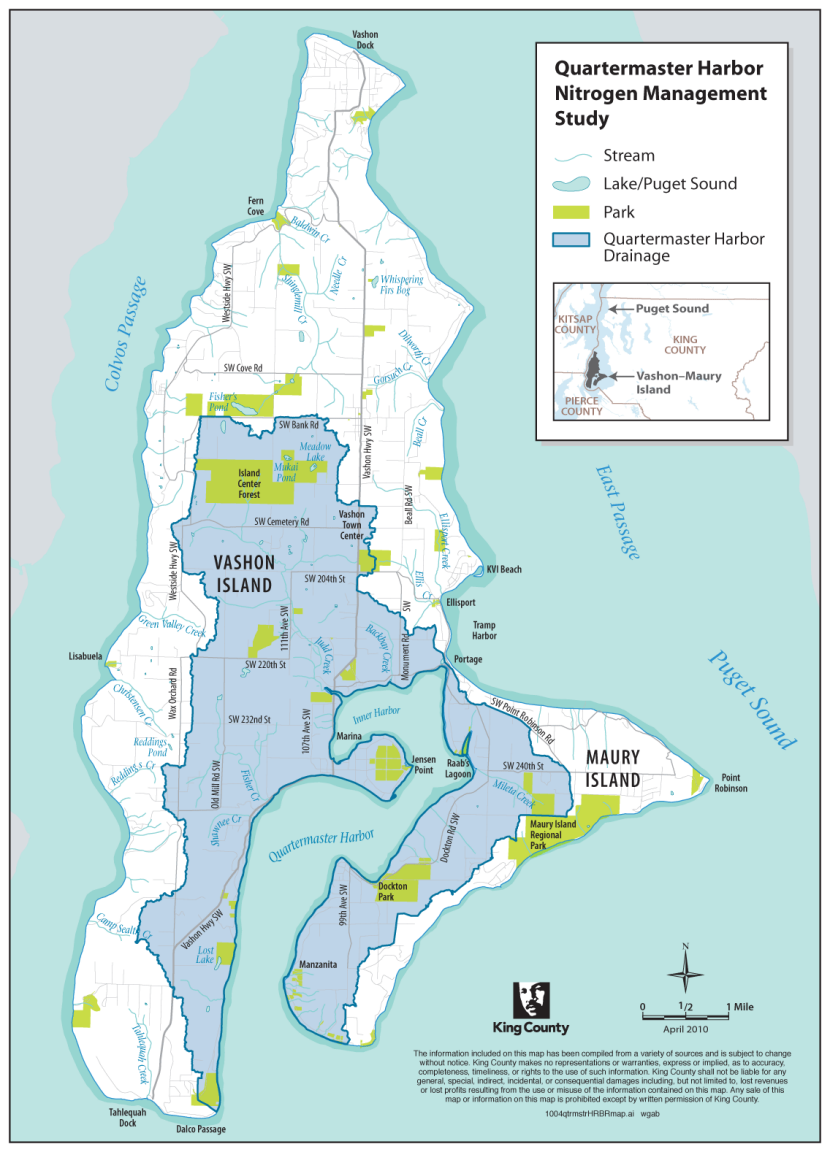
Quartermaster Harbor Nitrogen Management Study

Vashon-Maury Island

Public Workshop

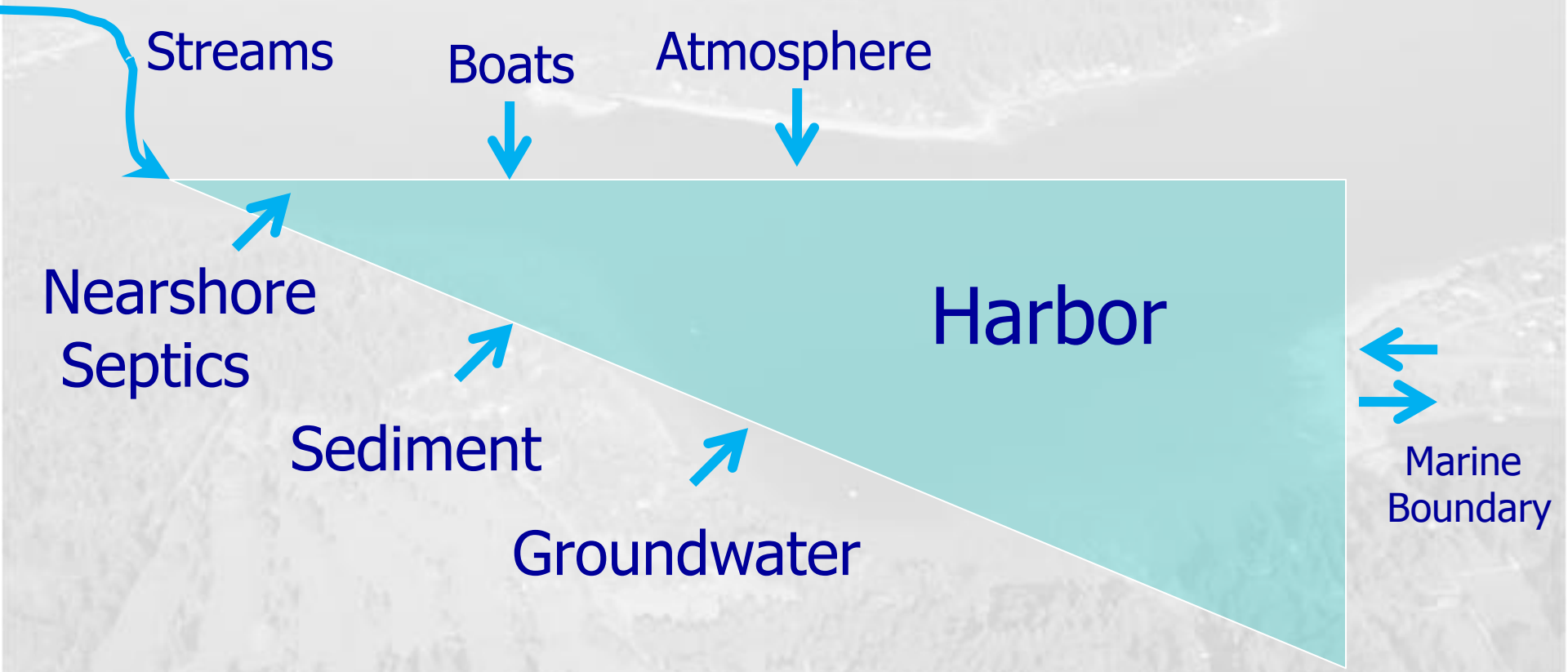
Wednesday, October 12, 2011

Quartermaster Harbor Nitrogen Management Study

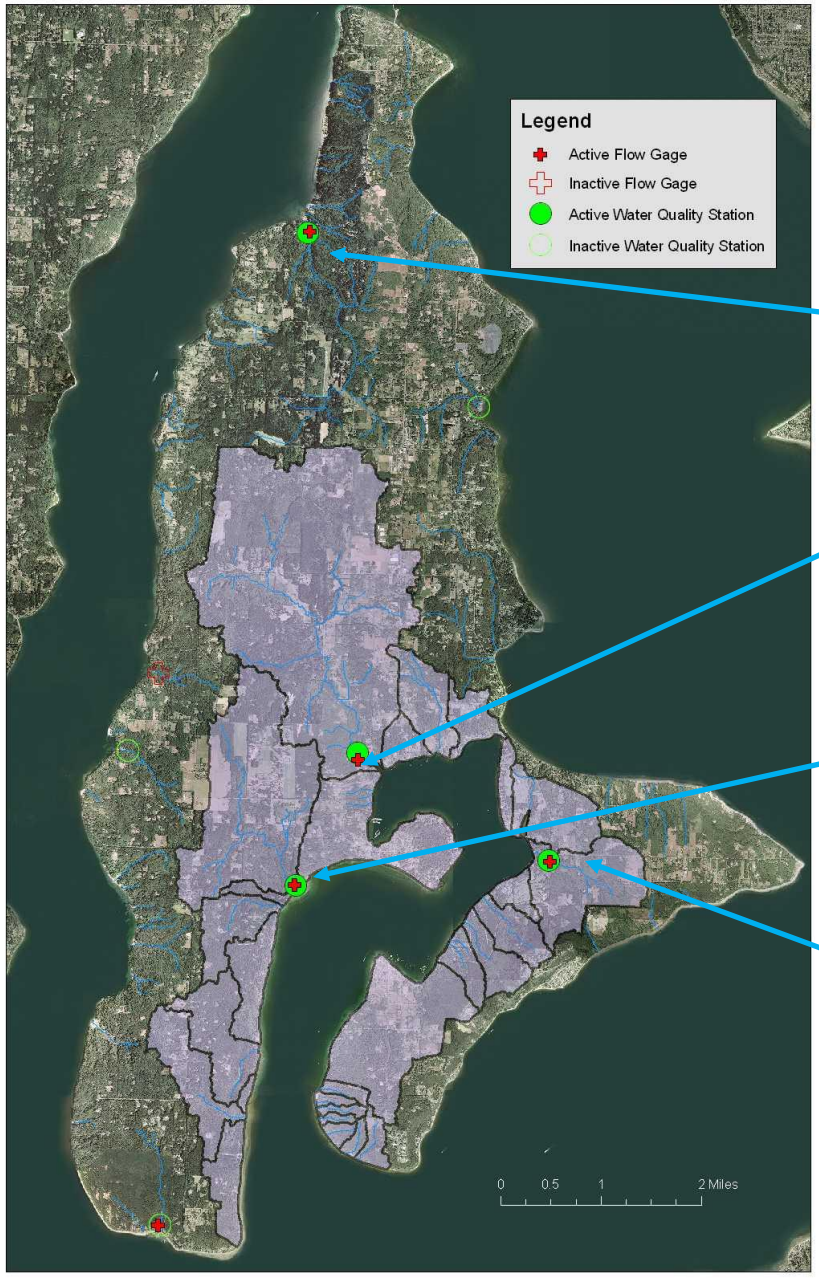


http://www.kingcounty.gov/qmhnitrogenstudy

Sources of Nitrogen to Quartermaster Harbor



Streams Sampling Locations



Shinglemill Creek

Judd Creek

Fisher Creek

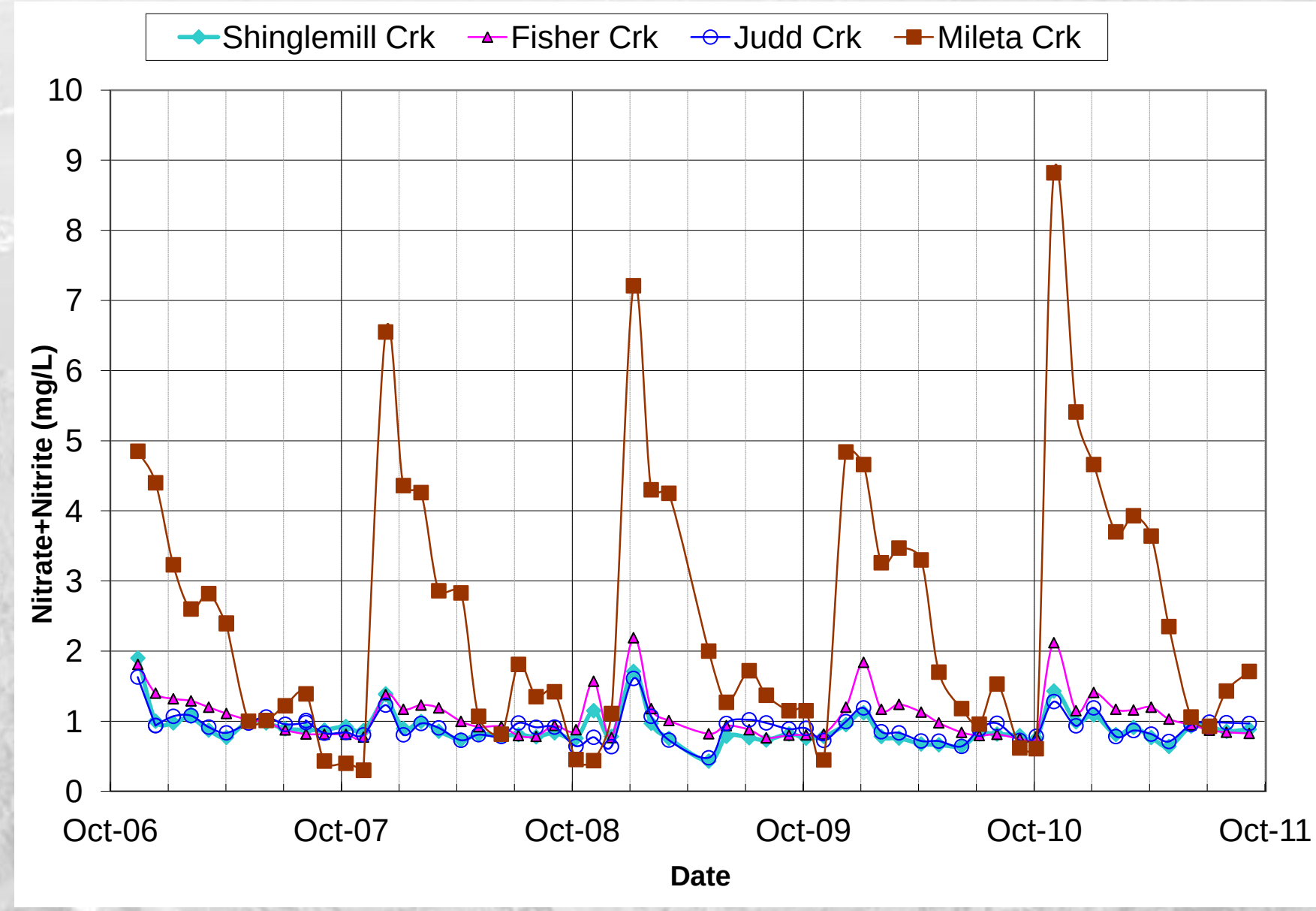
Mileta Creek

4 - Water Quality Sites
- 3 within study area
- sampled monthly

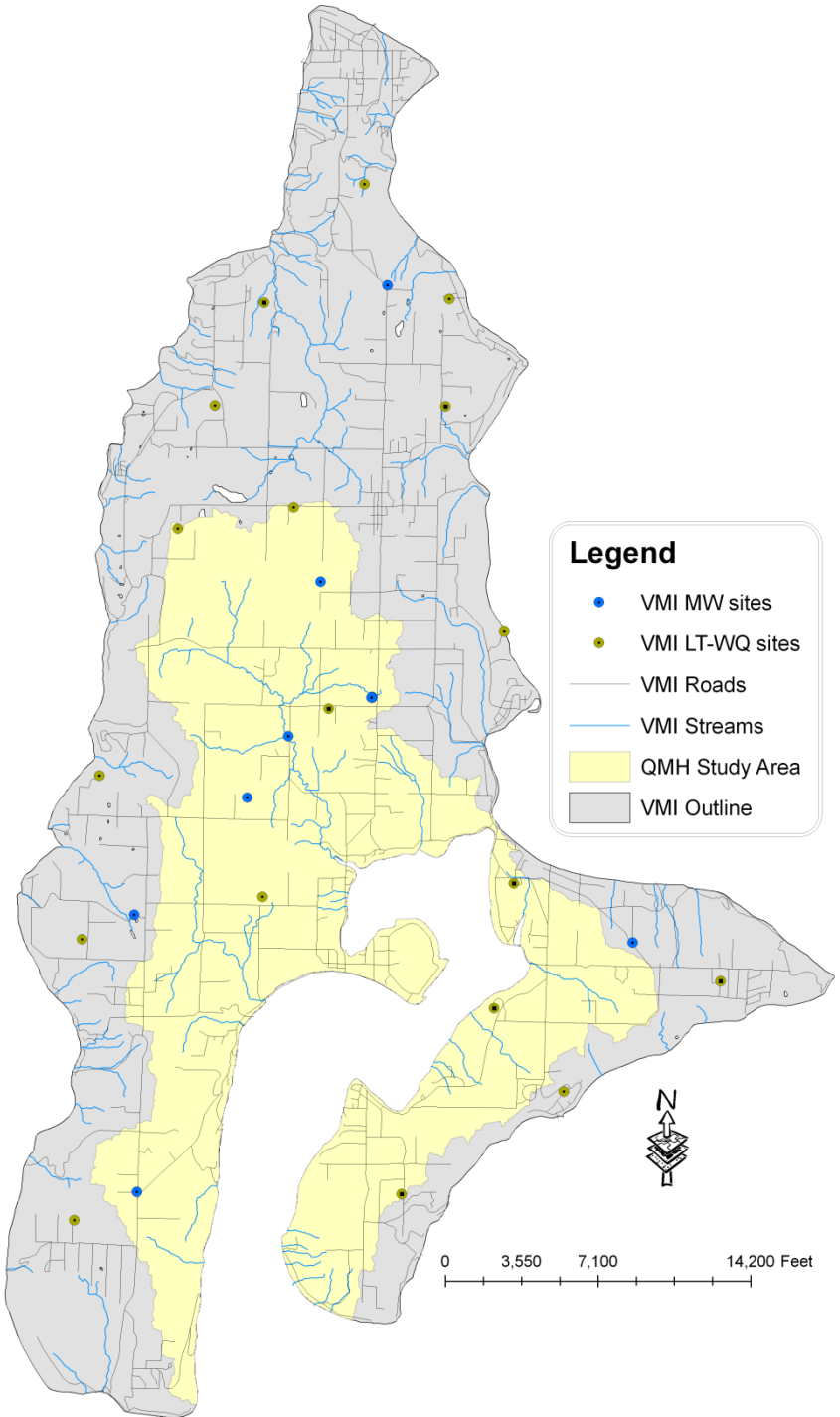
5 – Stream Gauging Sites
- 3 within study area

Additional Freshwater Sampling events
- Oct 2010 - Nearshore
- Nov 2010 – Mileta Creek

Nitrate data from Stream Sites



Groundwater Sampling Locations

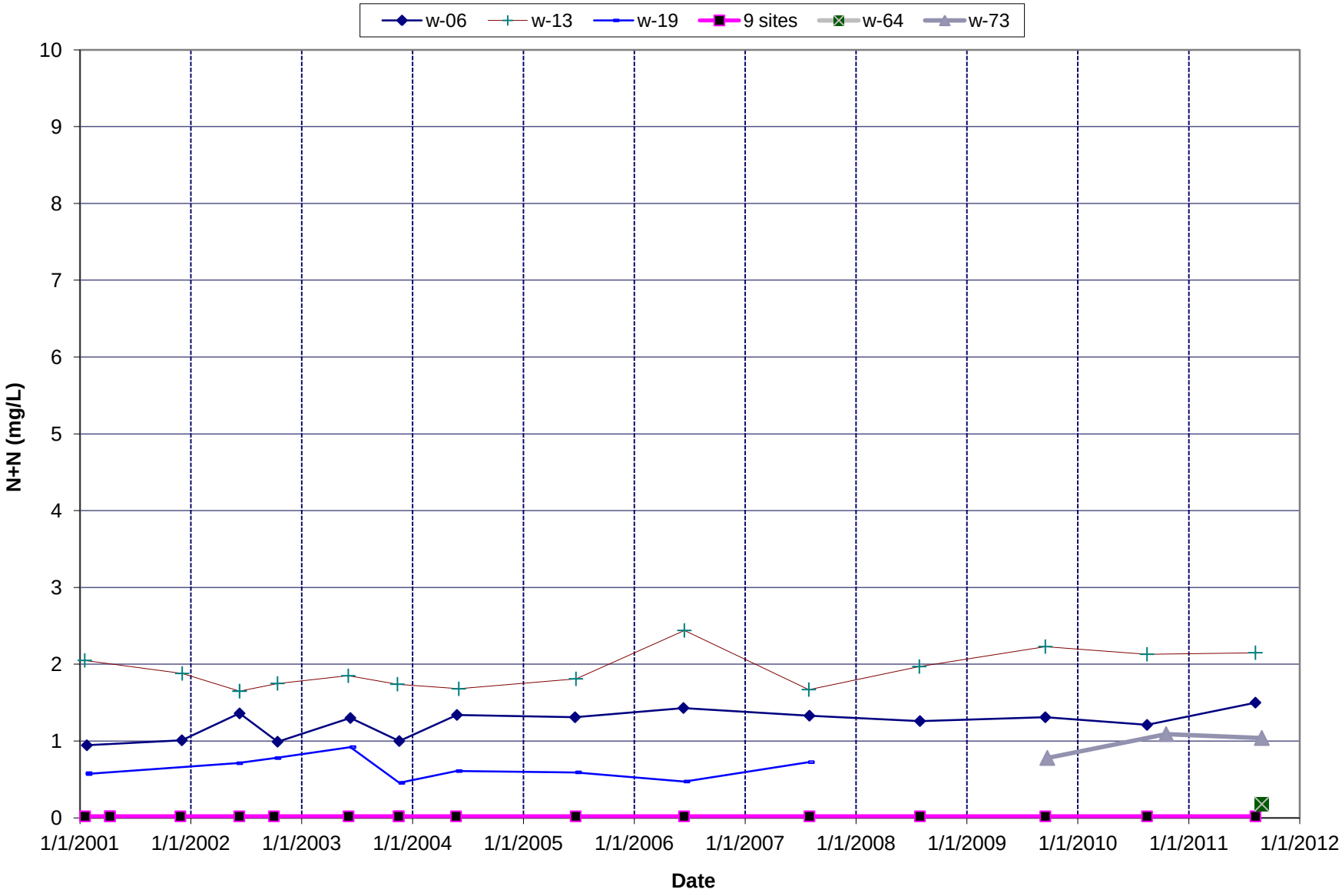


10 Monitoring Wells

18 Long-term Water Quality Sites

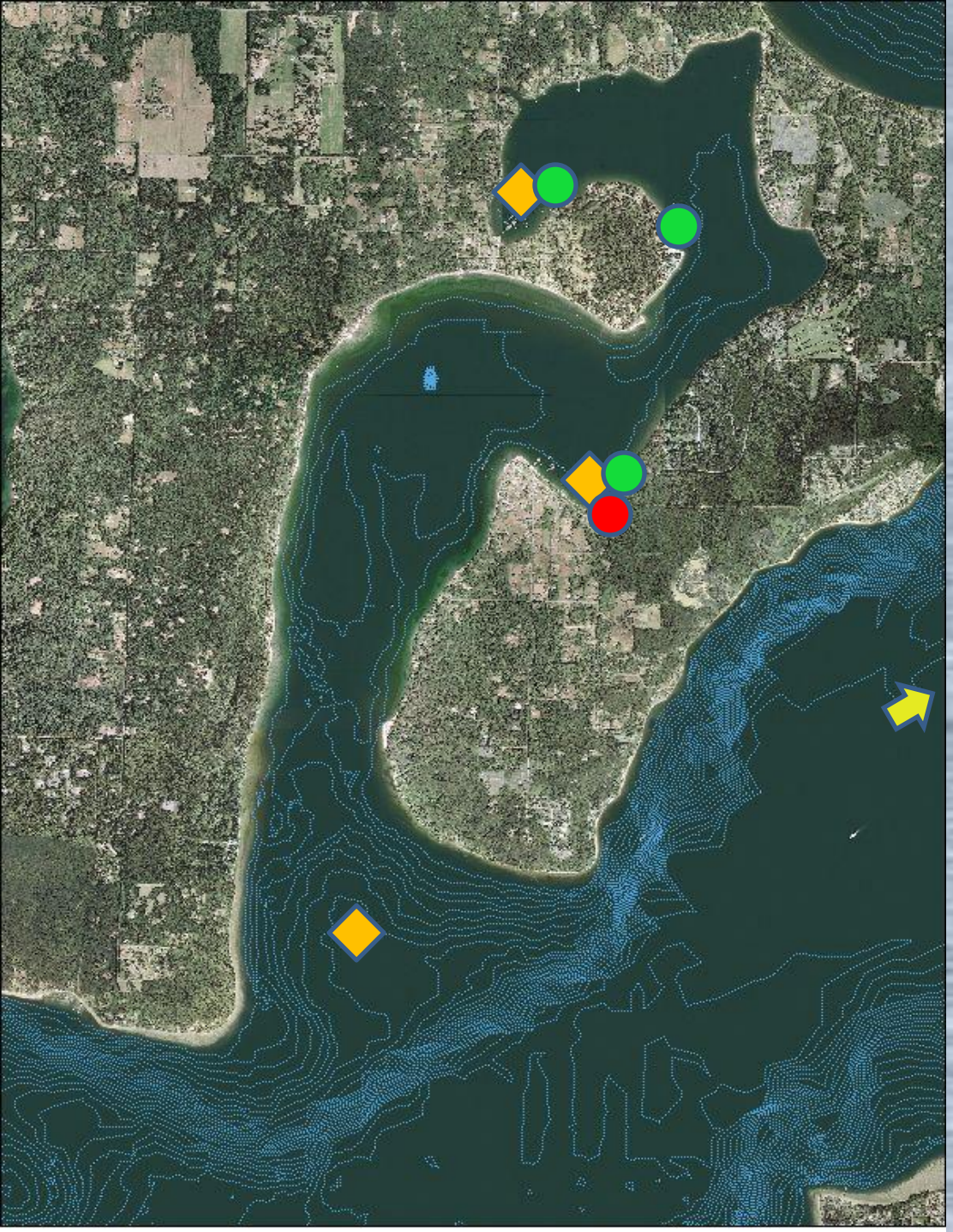
7 of each type of WQ sites are within study area

Nitrate data from QMH Groundwater Sites



On to next segment –

Marine Monitoring



Location

Moorings
continuous

Water
monthly

Phytoplankton
bi-weekly Apr-Oct

What's Sampled

outer harbor

Moorings

fixed depths

salinity, temp, DO, turbidity, chlorophyll, pH

nitrate at outer harbor site

meteorological data at Dockton

Water

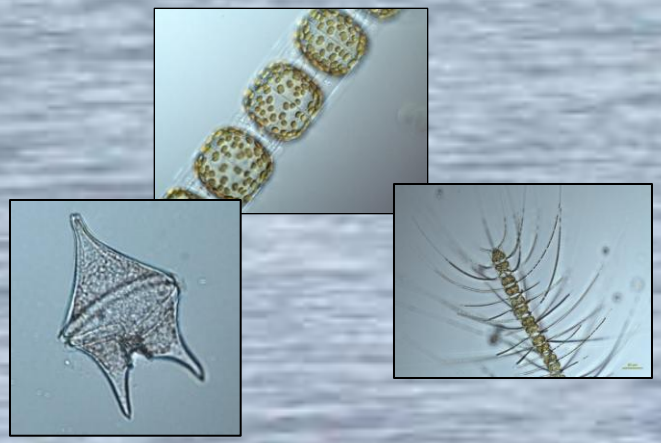
multiple depths

salinity, temp, DO, chlorophyll, nutrients, TSS, bacteria

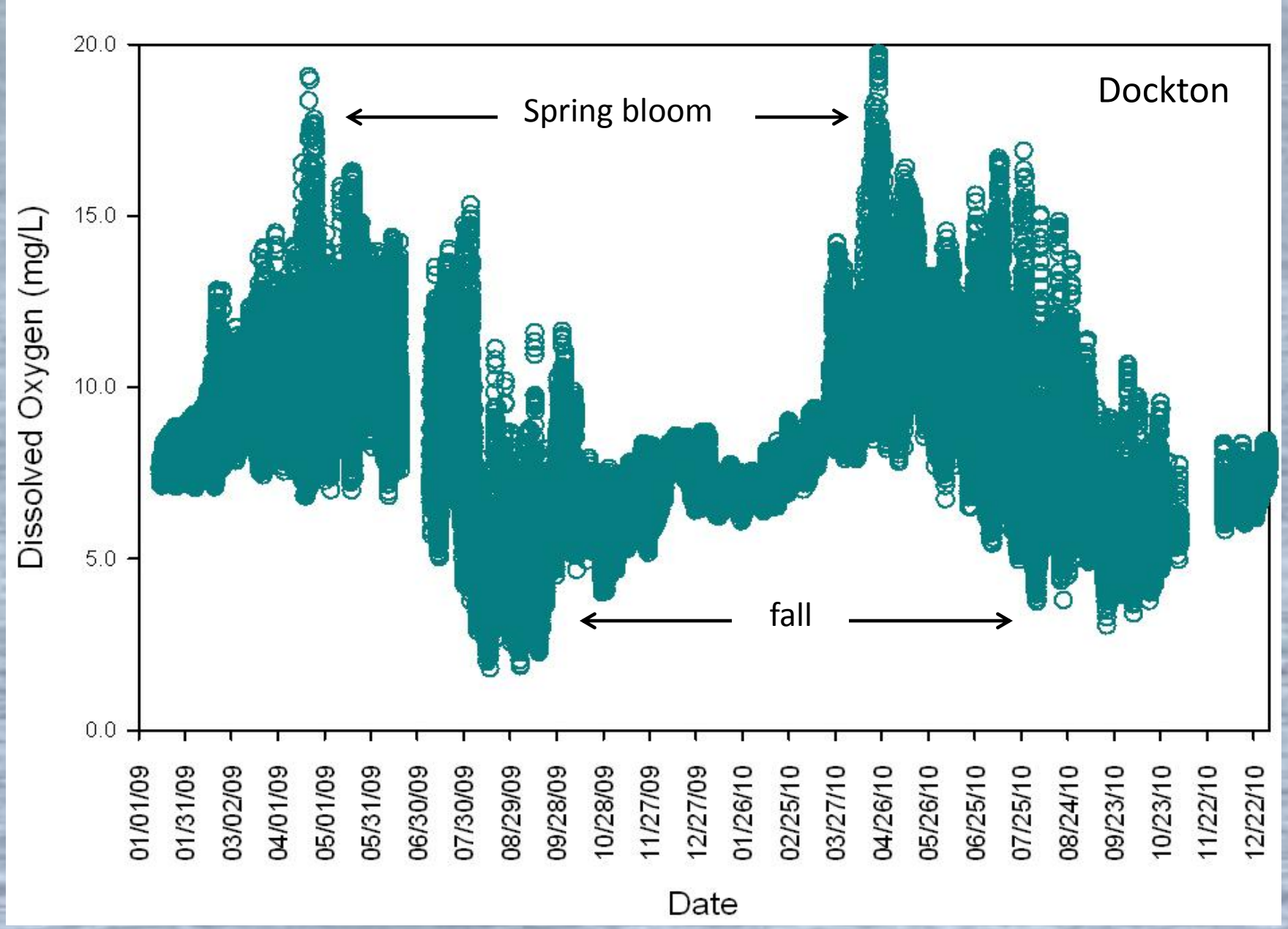
Phytoplankton

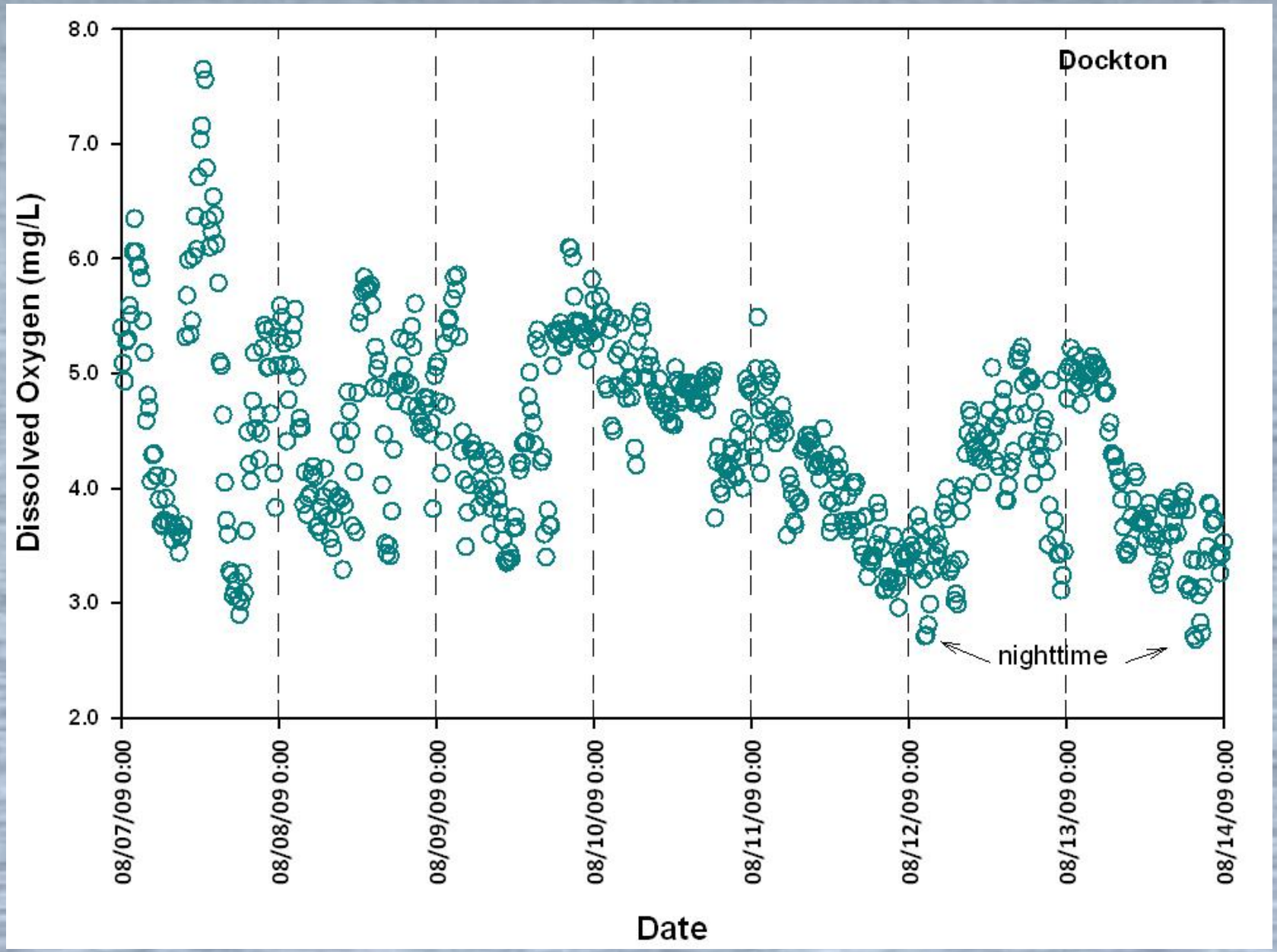
species and relative abundance

Dockton

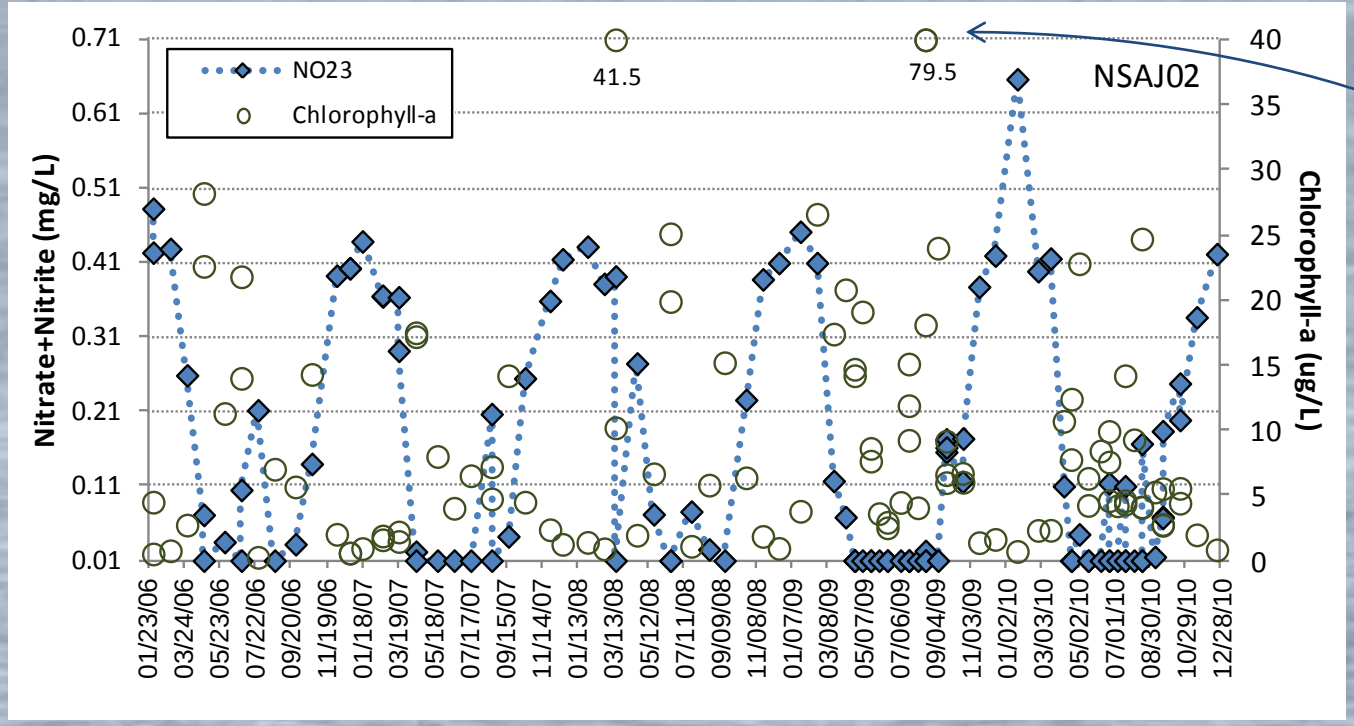


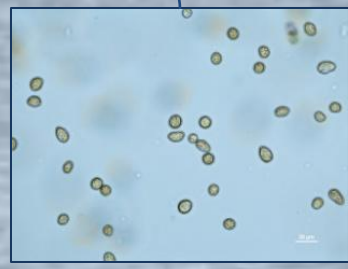
Yacht Club


Dockton
Spring bloom
fall
Dissolved Oxygen (mg/L)
20.0
15.0
10.0
5.0
0.0
01/01/09
01/31/09
03/02/09
04/01/09
05/01/09
05/31/09
06/30/09
07/30/09
08/29/09
09/28/09
10/28/09
11/27/09
12/27/09
01/26/10
02/25/10
03/27/10
04/26/10
05/26/10
06/25/10
07/25/10
08/24/10
09/23/10
10/23/10
11/22/10
12/22/10
Date

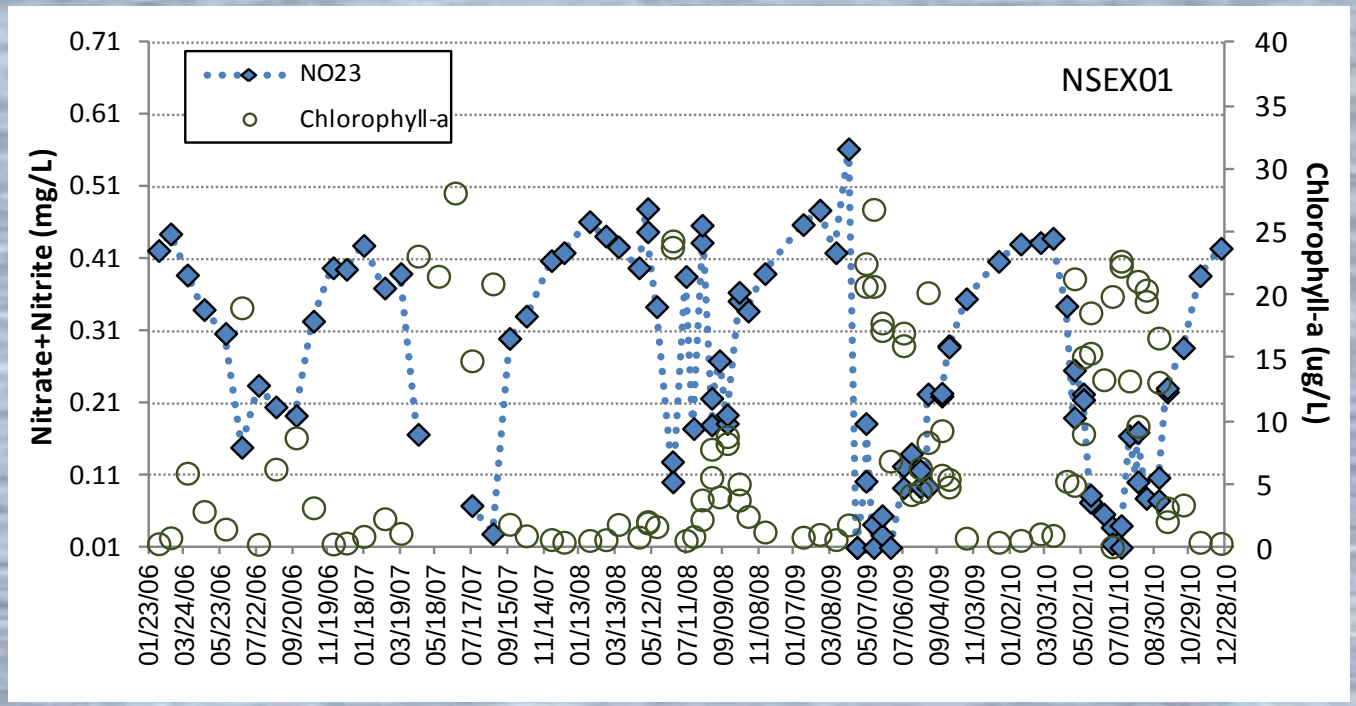

Dockton
Dissolved Oxygen (mg/L)
8.0
7.0
6.0
5.0
4.0
3.0
2.0
nighttime
08/07/09 0:00
08/08/09 0:00
08/09/09 0:00
08/10/09 0:00
08/11/09 0:00
08/12/09 0:00
08/13/09 0:00
08/14/09 0:00
Date

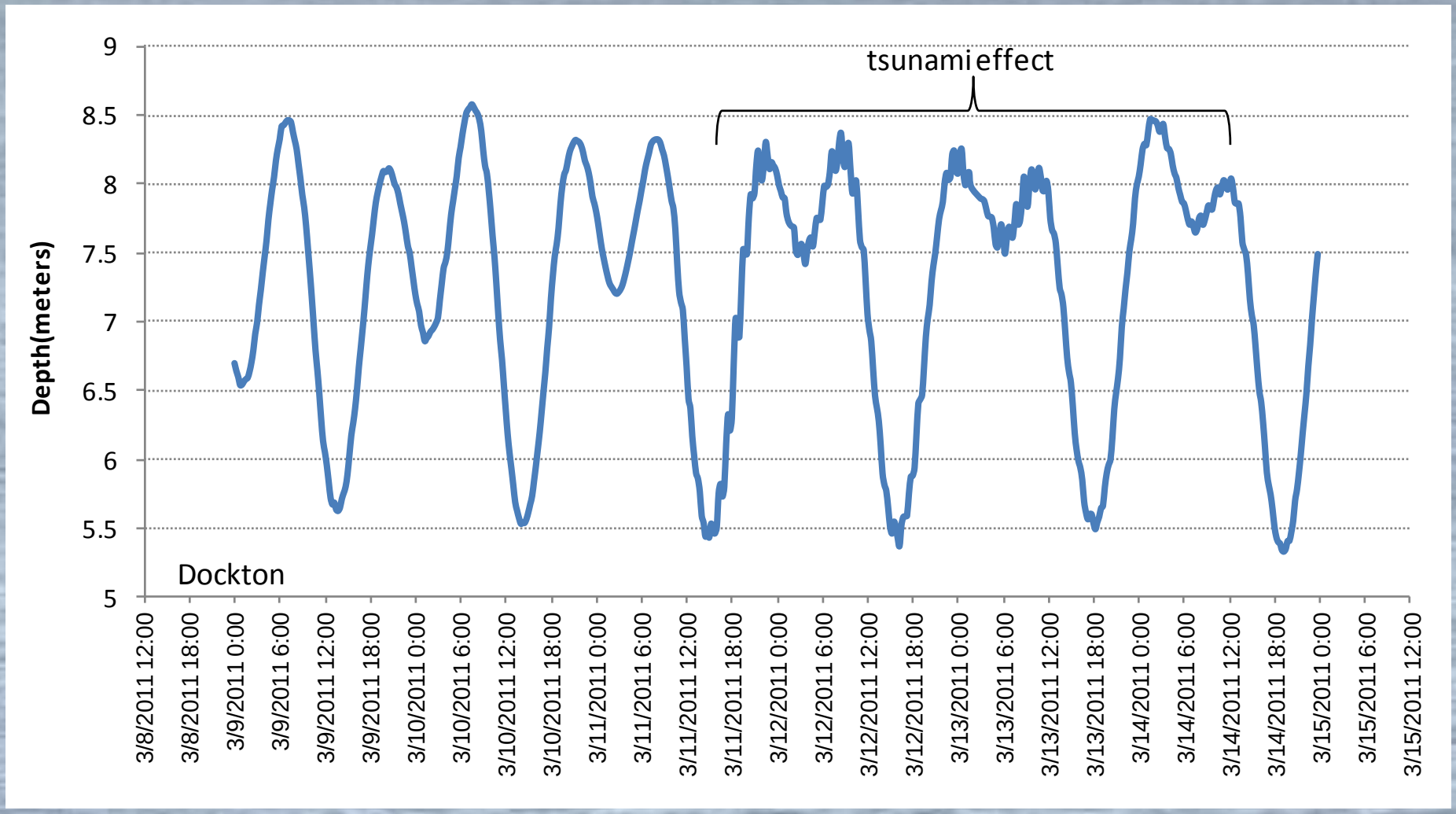
Dockton





East Passage




tsunami effect
Depth(meters)
9
8.5
8
7.5
7
6.5
6
5.5
5
Dockton
3/8/2011 12:00
3/8/2011 18:00
3/9/2011 0:00
3/9/2011 6:00
3/9/2011 12:00
3/9/2011 18:00
3/10/2011 0:00
3/10/2011 6:00
3/10/2011 12:00
3/10/2011 18:00
3/11/2011 0:00
3/11/2011 6:00
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3/12/2011 0:00
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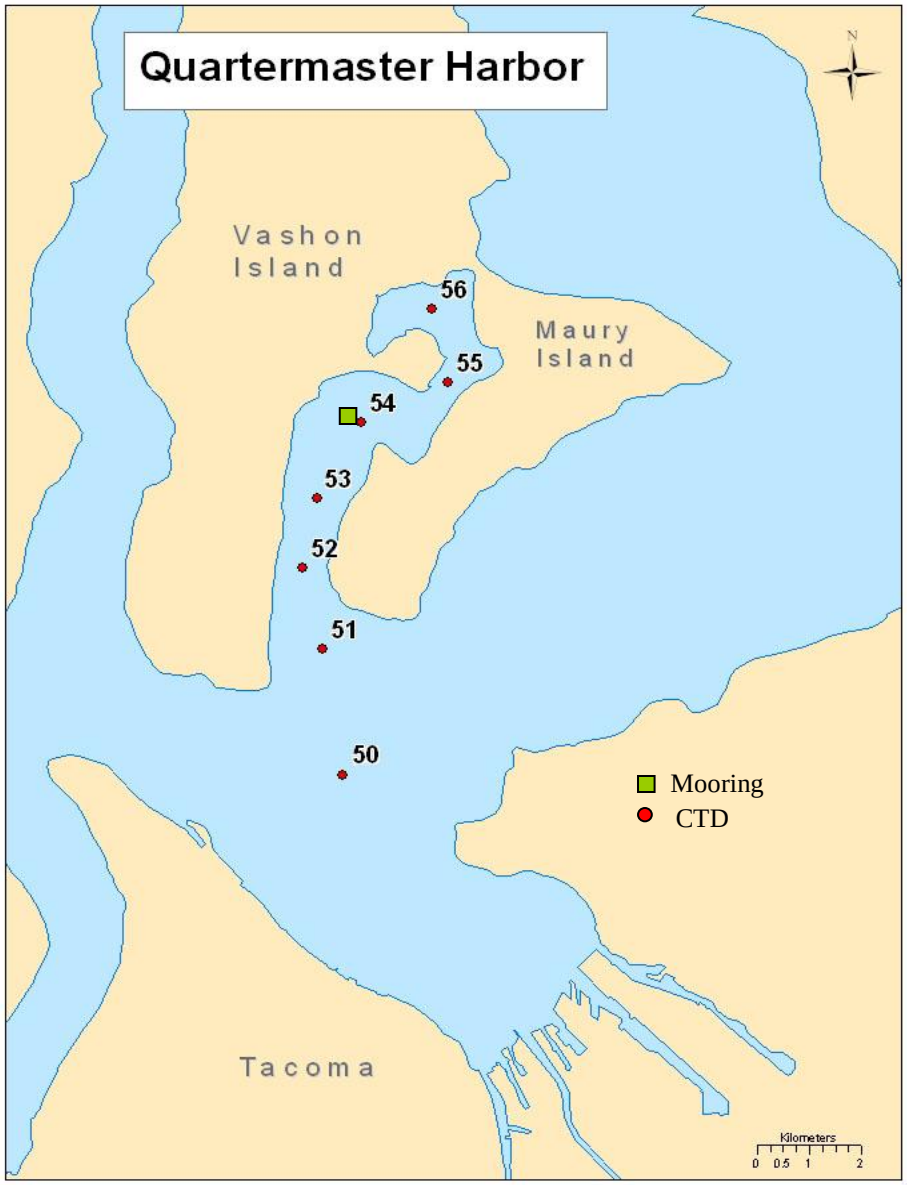
3/12/2011 12:00
3/12/2011 18:00
3/13/2011 0:00
3/13/2011 6:00
3/13/2011 12:00
3/13/2011 18:00
3/14/2011 0:00
3/14/2011 6:00
3/14/2011 12:00
3/14/2011 18:00
3/15/2011 0:00
3/15/2011 6:00
3/15/2011 12:00

Sampling Program

Monthly Sampling
Oct. ’06 – present

Temperature
Salinity
Density
Oxygen
Chlorophyll
Transmissivity
Licor
Nutrients
Plankton



Moored Timeseries

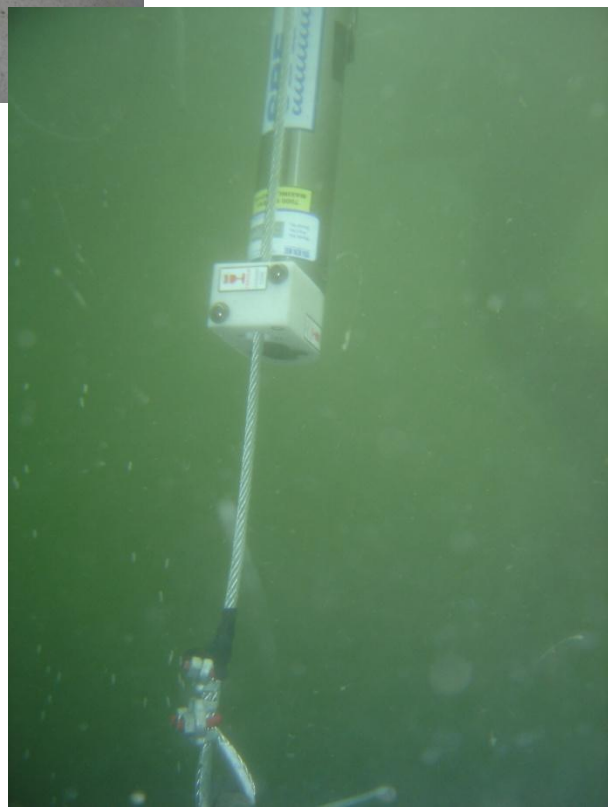
Temperature
Salinity
Density
Oxygen

METHODS

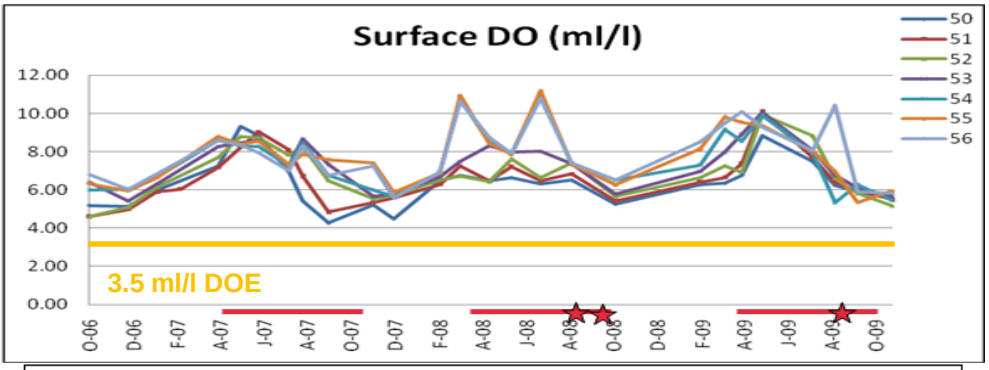
CTD & Water Sampling

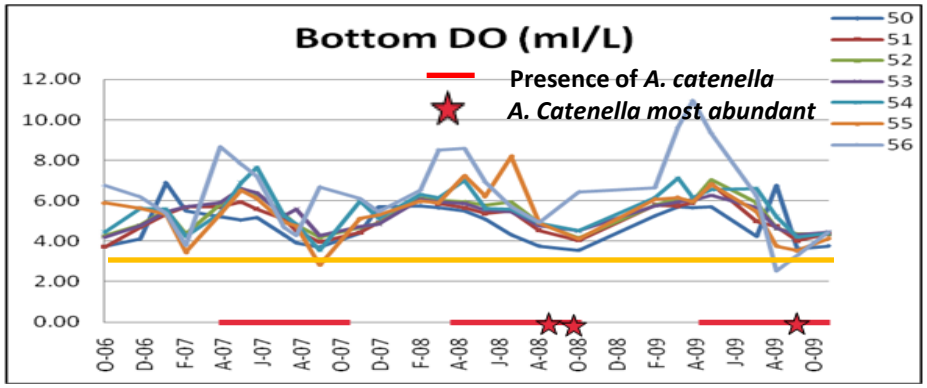
METHODS

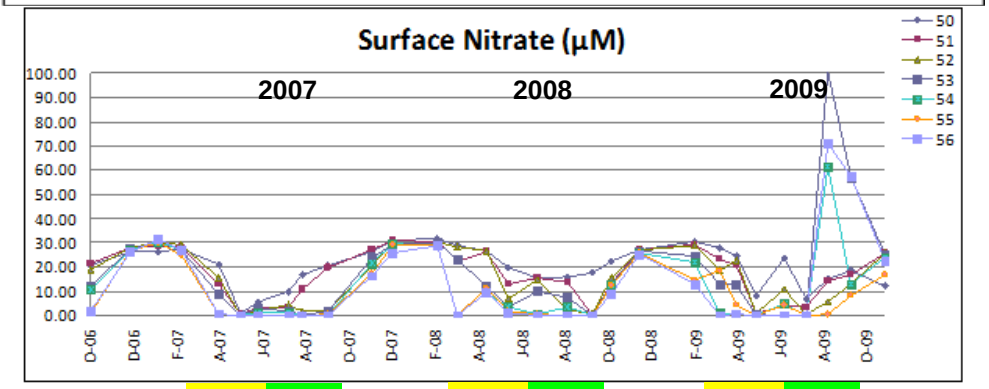
Moored Instrumentation

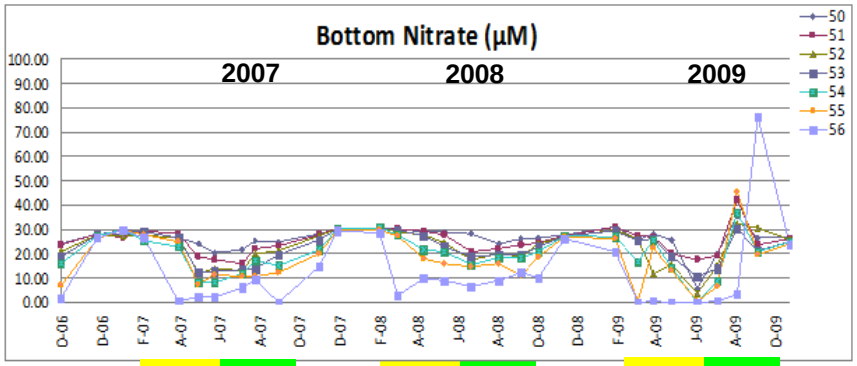


Seasonal Patterns in Nutrients & Phytoplankton









Sp Su Sp Su Sp Su

Sp Su Sp Su Sp Su

Rhizosolenia setigera

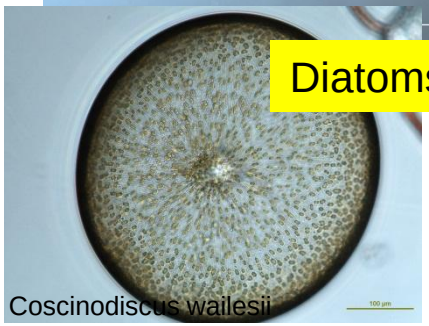
Chaetoceros debilis

Heterosigma akashiwo

All Photos by G. Hannach King County

Diatoms – Spring/Early Summer

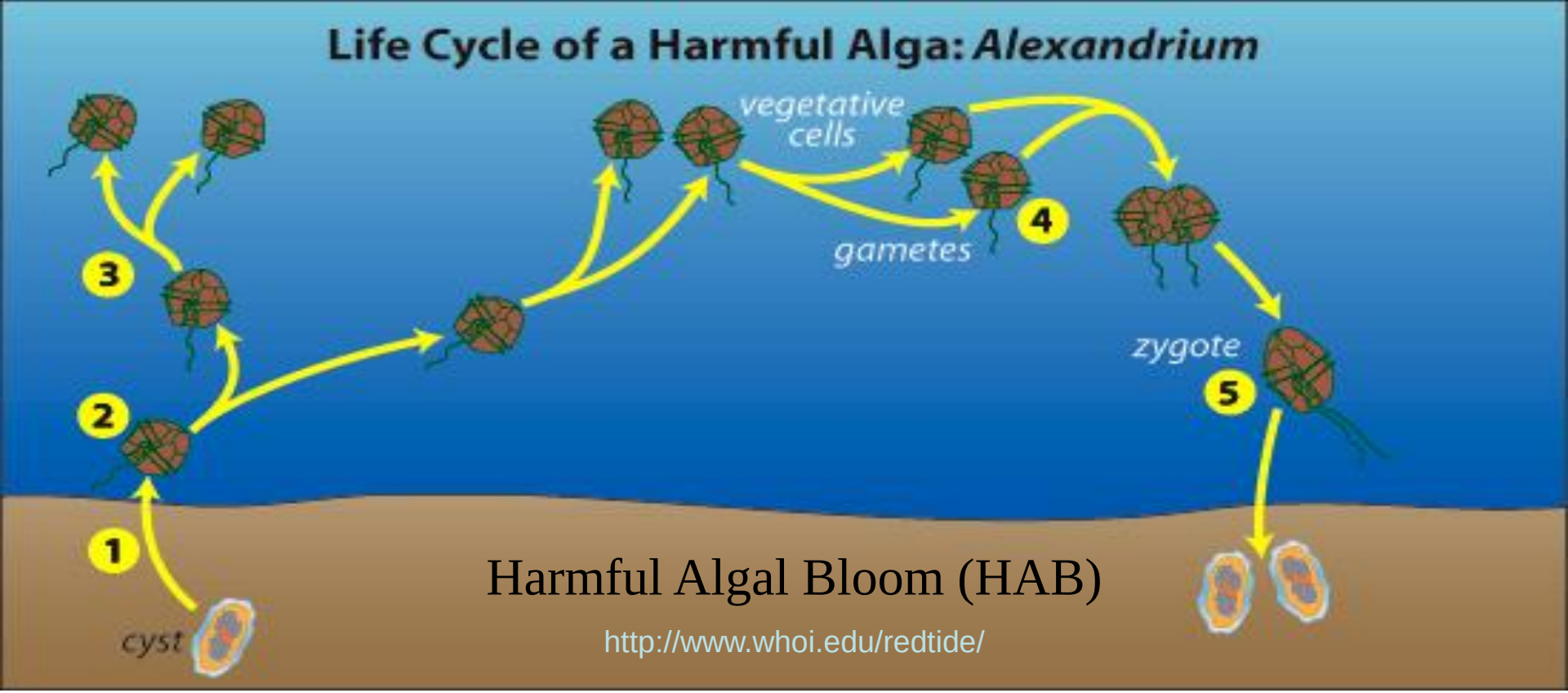
Dinoflagellates – Summer/Early Fall


Coscinodiscus wailesii

Chaetoceros eibenii

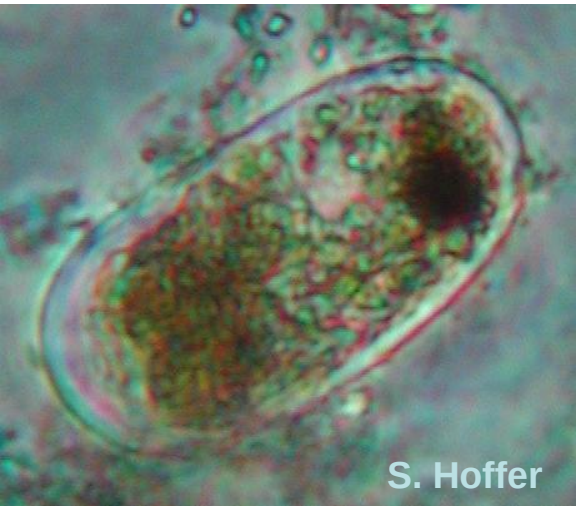
Prorocentrum gracile

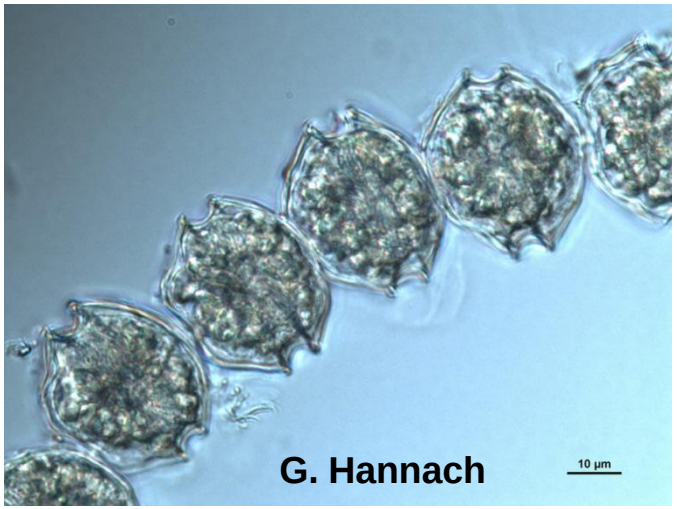
Alexandrium catenella



Harmful Algal Bloom (HAB)

http://www.whoi.edu/redtide/

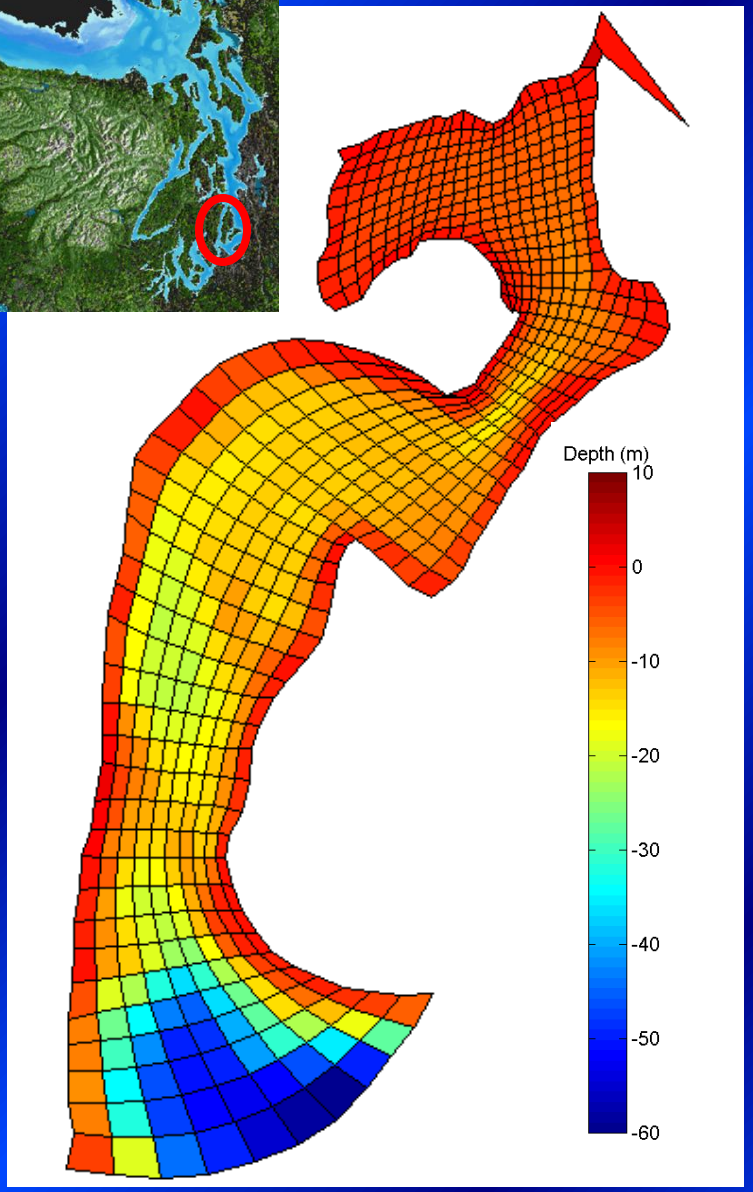




Quartermaster Harbor model

DEPARTMENT OF ECOLOGY
State of Washington

-Skip Albertson
(360) 407-6676



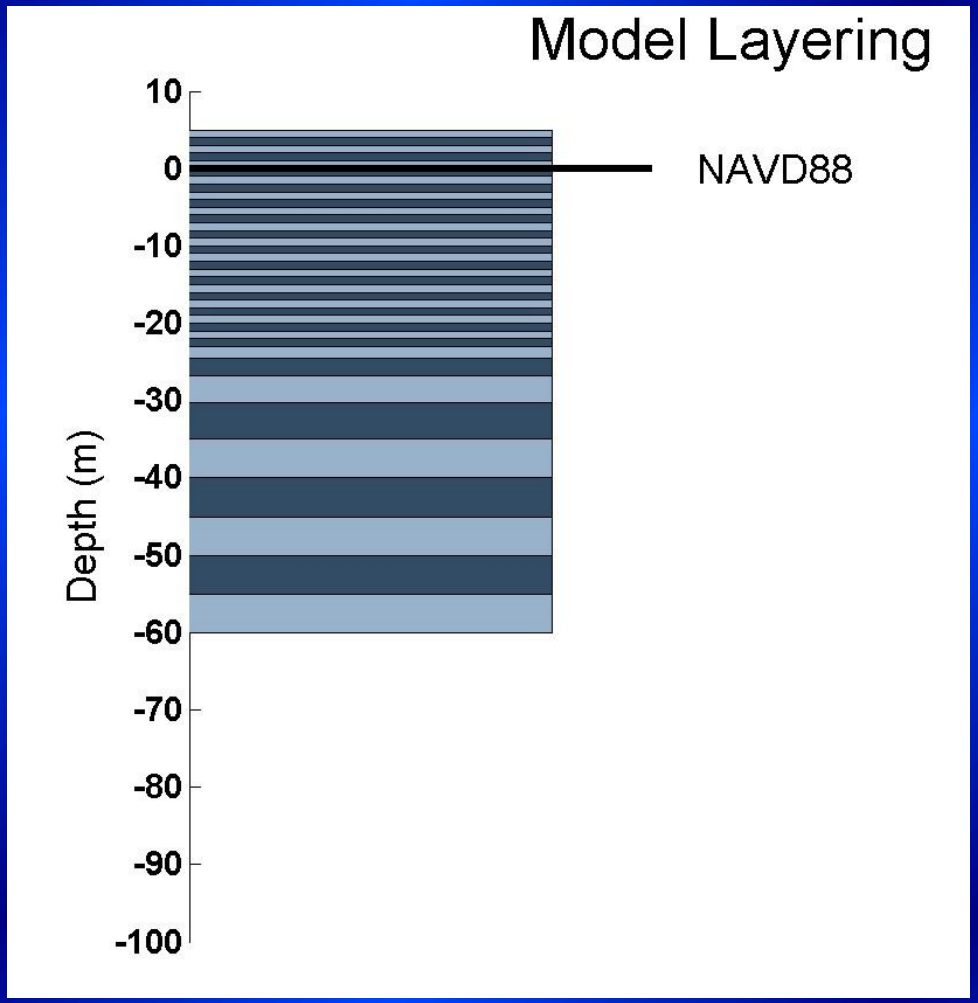
Generalized Environmental Modeling System for Surfacewaters (GEMSS®)

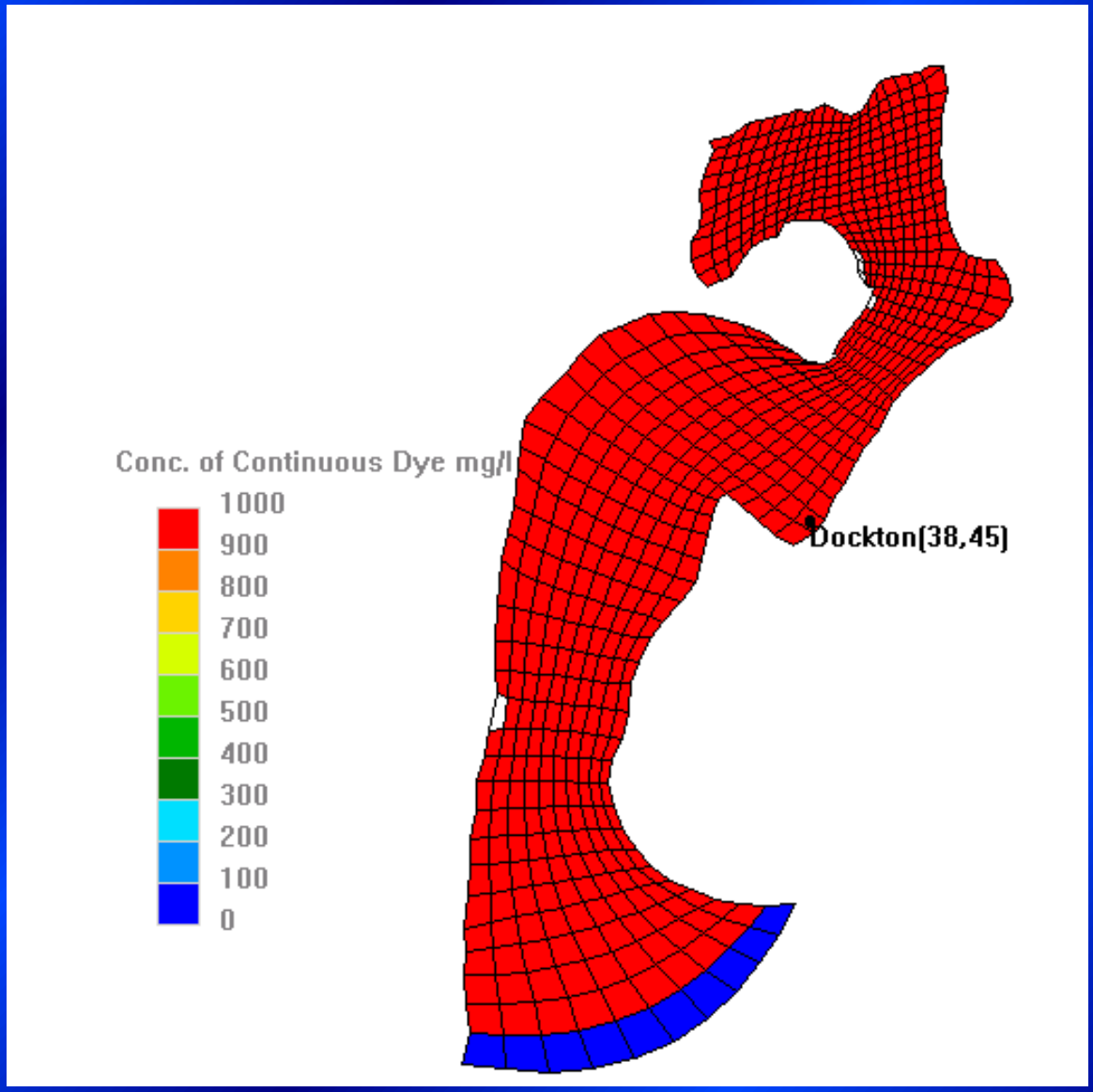
Quartermaster Harbor (QMH) application --

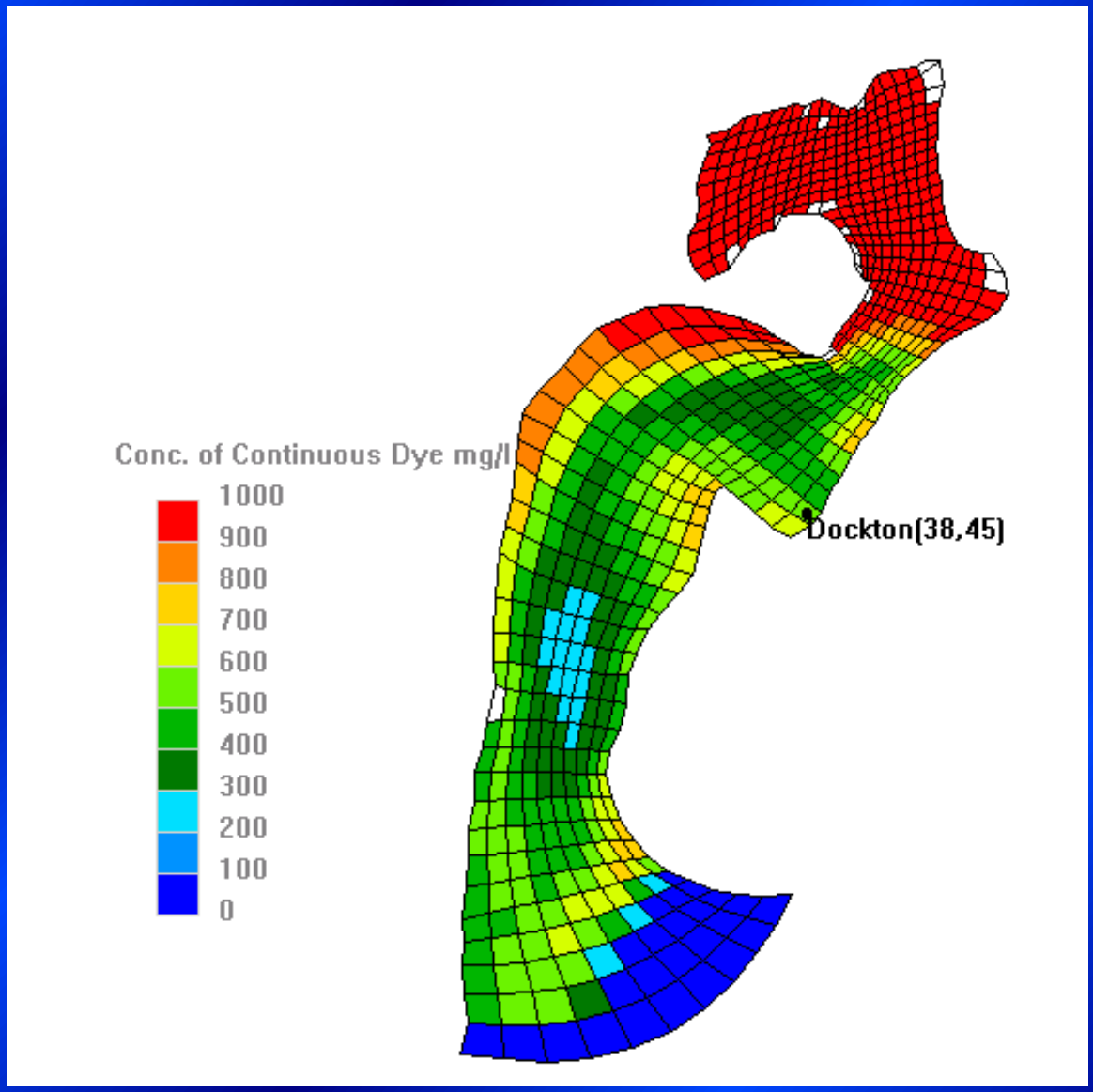
Horizontal grid cells = 799
Vertical layers = 37
Total grid cells = 9798

Vertical layering

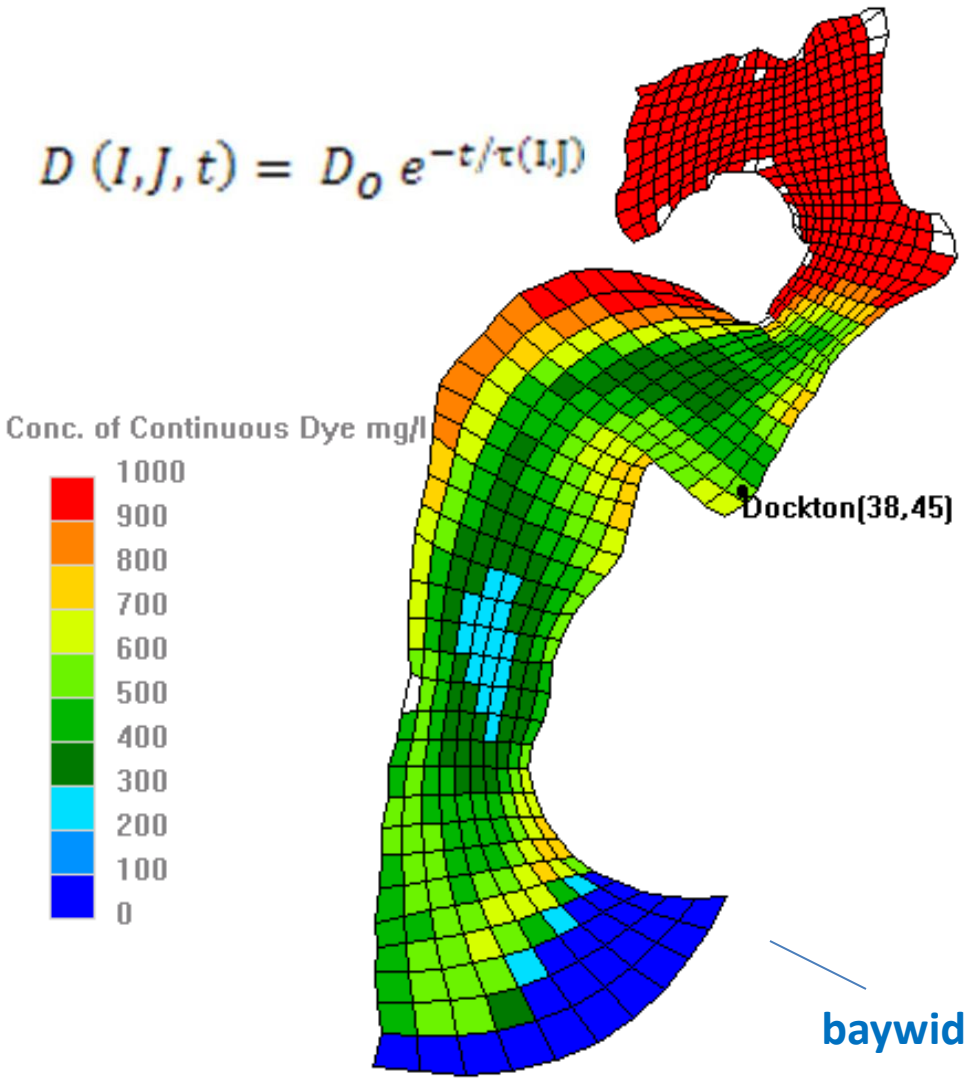
Layer	Thickness (m)	Sum (m)
1	1	4
2	1	3
3	1	2
4	1	1
5	1	0
6	1	-1
7	1	-2
8	1	-3
9	1	-4
10	1	-5
11	1	-6
12	1	-7
13	1	-8
14	1	-9
15	1	-10
16	1	-11
17	1	-12
18	1	-13
19	1	-14
20	1	-15
21	1	-16
22	1	-17
23	1	-18
24	1	-19
25	1	-20
26	1	-21
27	1	-22
28	1	-23
29	1.5	-24.5
30	2.3	-26.8
31	3.4	-30.2
32	4.8	-35
33	5	-40
34	5	-45
35	5	-50
36	5	-55
37	5	-60

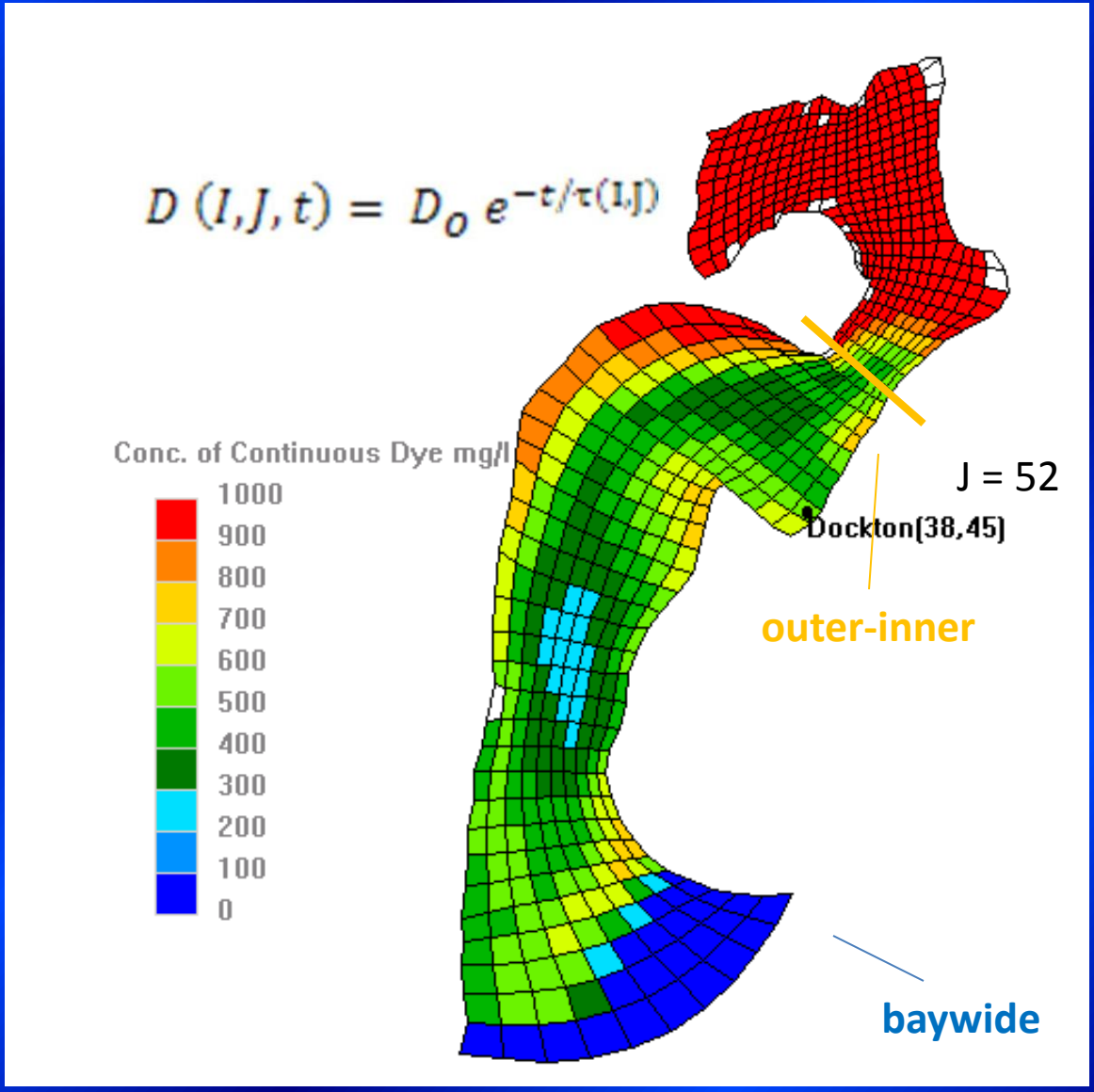


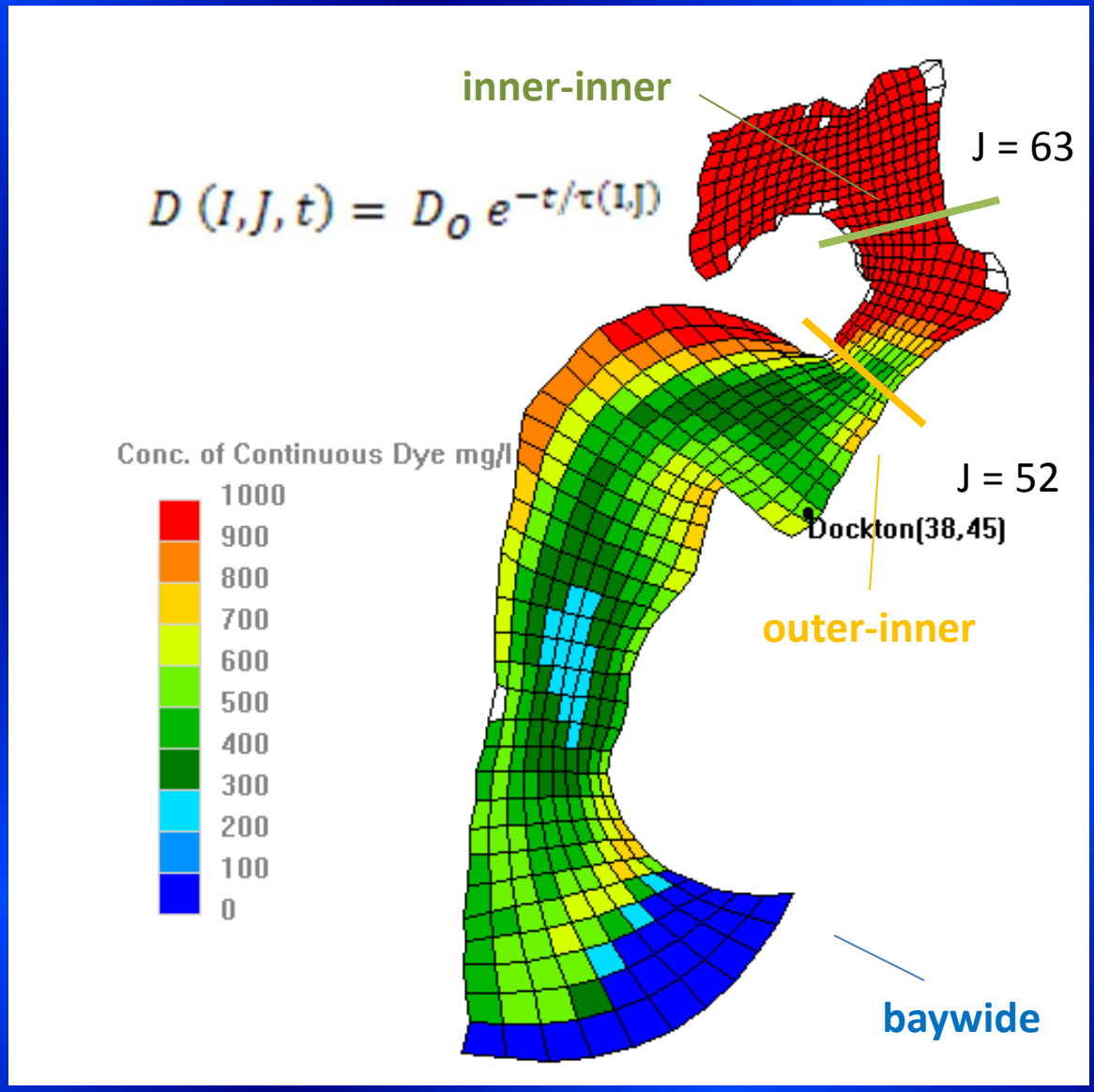

Conc. of Continuous Dye mg/l
1000
900
800
700
600
500
400
300
200
100
0
Dockton(38,45)


Conc. of Continuous Dye mg/l
1000
900
800
700
600
500
400
300
200
100
0
Dockton(38,45)

$$D\,(I,J,t) = D_O\, e^{-t/\tau(I,J)}$$

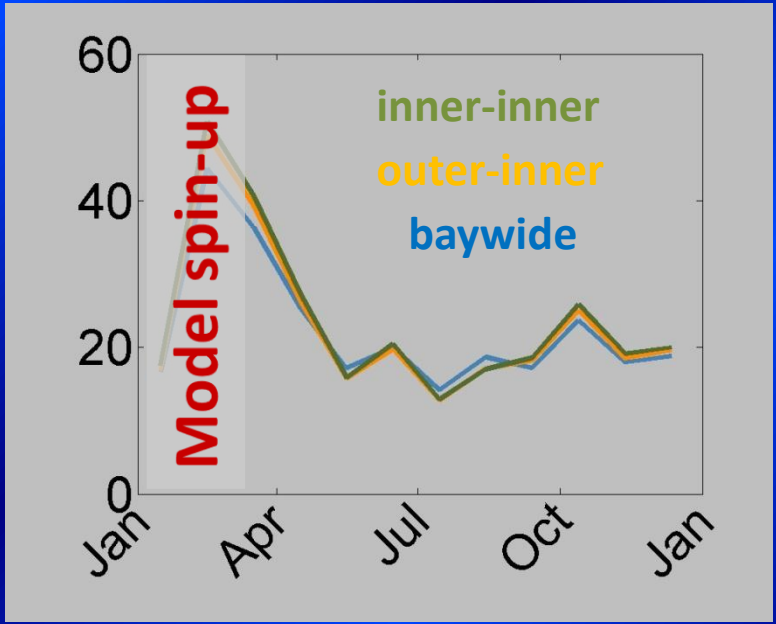



$D(I,J,t) = D_o\, e^{-t/\tau(I,J)}$
Conc. of Continuous Dye mg/l
1000
900
800
700
600
500
400
300
200
100
0
J = 52
Dockton(38,45)
outer-inner
baywide

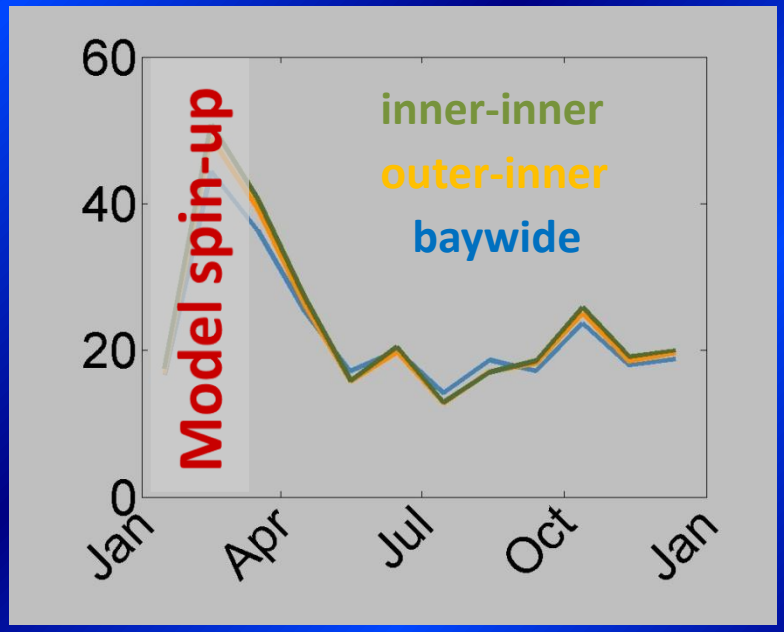

inner-inner
$D(I,J,t) = D_o\, e^{-t/\tau(I,J)}$
J = 63
Conc. of Continuous Dye mg/l
1000
900
800
700
600
500
400
300
200
100
0
J = 52
Dockton(38,45)
outer-inner
baywide

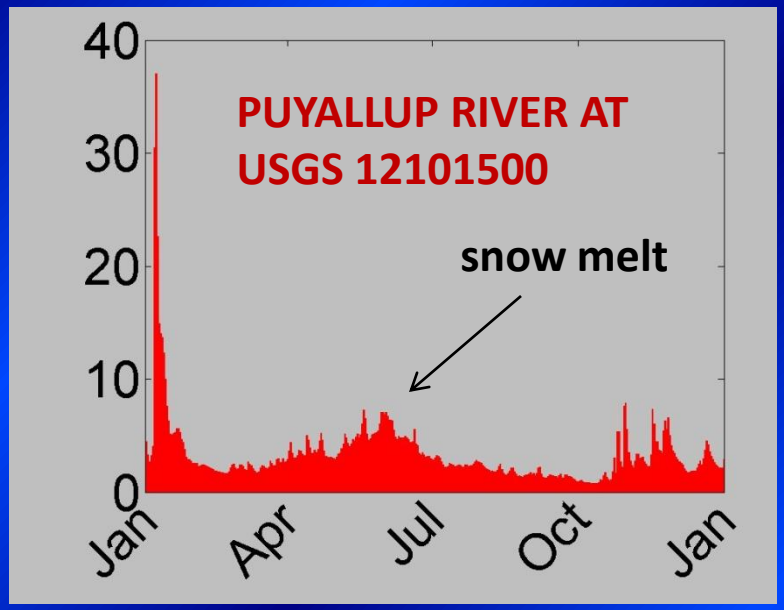
Results

Flushing Time (day)



Results



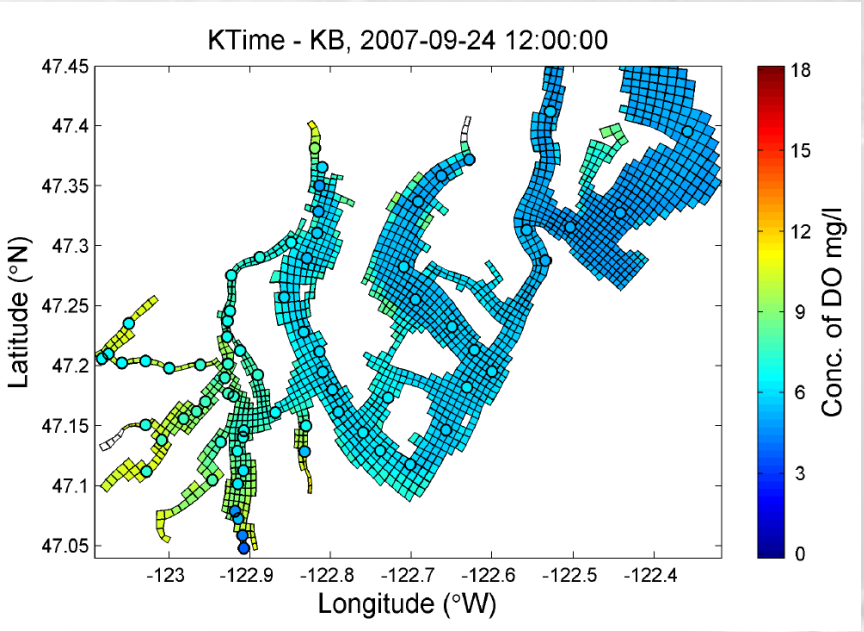


Courtesy: Eyes Over Puget Sound

Summary --

- Flushing time varies by location and is highest in the inner bay
- Flushing time varies seasonally and between years
- Greatest apparent factor controlling flushing time is the Puyallup River
- What events happening during the longer flushing times of May/April affect WQ in August/September?

Parallel Efforts



- South Puget Sound Dissolved Oxygen Study

http://www.ecy.wa.gov/puget_sound/dissolved_oxygen_study.html

"Wicked" Problem

- No silver bullet
- Multiple nitrogen sources
- Puget Sound wide perspective forthcoming
- EPA working on national policy for nutrients

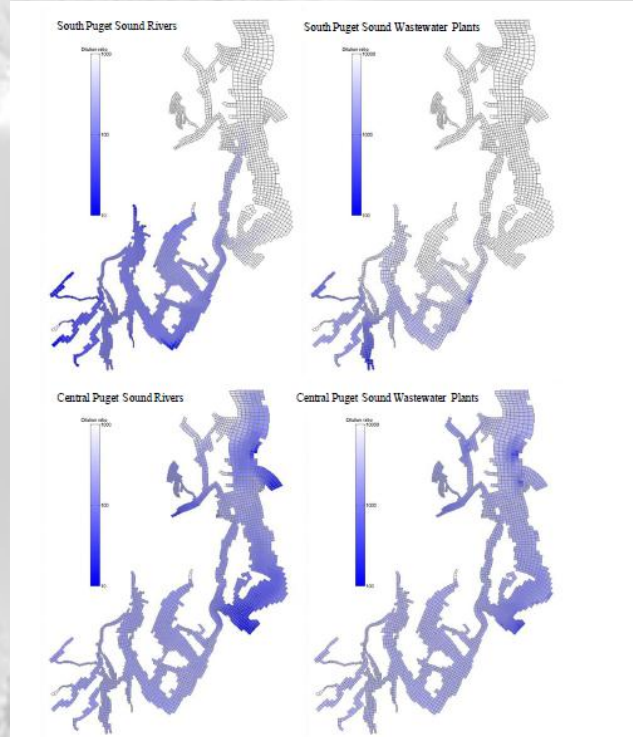
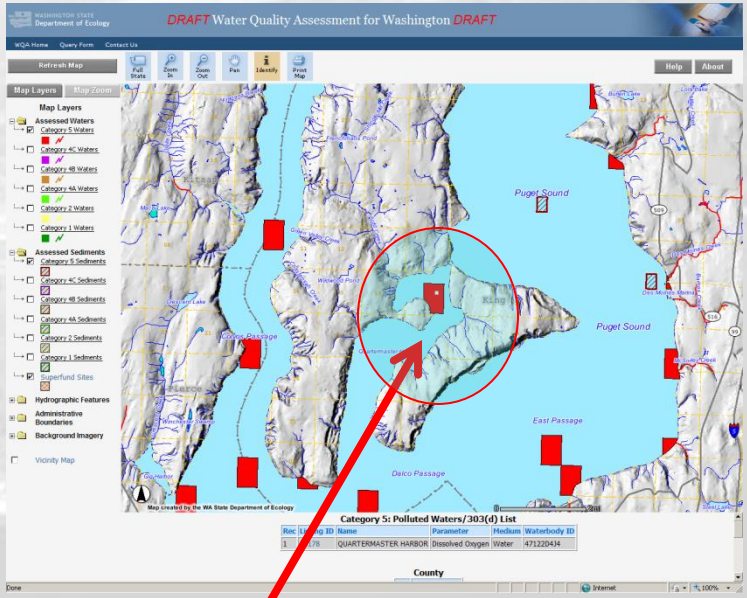


Figure ES-7. Dilution factors calculated from maximum water column dye concentrations for South and Central Puget Sound rivers and wastewater treatment plants for September 2007.

Near Term Strategy Options

- Today education backed with regulations
- Update based on final study outcomes
- Near term outline improved strategies to improve implementation of existing rules
- Longer term limit **T**otal **M**aximum **D**aily **L**oading (TMDL)
- Goal to protect water quality in streams, ground (sole source aquifer) and Harbor

Clean Water Act Section 303(d) List



- Ecology 2010 Draft Assessment of Quartermaster Harbor
  - Category 5: Polluted waters that require a TMDL for Dissolved Oxygen
- Draft Assessment Public Comment Period
  - June 16 – August 16, 2011

http://www.ecy.wa.gov/programs/wq/303d/index.html

Total Maximum Daily (TMDL)

- The Water Quality Improvement Project (TMDL) establishes limits on pollutants that can be discharged to the waterbody and still allow state standards to be met

http://www.ecy.wa.gov/programs/wq/tmdl/

Comprehensive Plan 2012

- Focus existing outreach education and incentives to implement best management practices designed to reduce excessive nutrient and bacterial contaminate loading within the Quartermaster Harbor drainage.
- Seek grants to enhance existing outreach education and incentives when funding opportunities occur.

Comprehensive Plan 2012

- If the final study demonstrates it would significantly reduce future nitrogen loading in the harbor, then consider revising code to require new on-site sewage systems within the drainage area meet nitrogen reduction treatment standard established by DOH, where feasible.

Comprehensive Plan 2012

- If Quartermaster Harbor listed as a Category 5 polluted water body on Water Quality Assessment 303(d) list, request Ecology assistance to develop a Total Maximum Daily Load pollutant limit for point source discharges and guidance to enhance non-regulatory pollution reduction programs for nonpoint sources.

Comprehensive Plan 2012

- Evaluate need and potential sources of funding for an enhanced management program for existing on-site sewage systems on Vashon-Maury Island to ensure they receive routine inspection, maintenance and repair if necessary to protect water quality.

Next Steps…

- Complete/return survey to help inform Co. /State efforts to manage Quartermaster H.
- Review/comment on the draft Comp Plan policies between now and Dec. 23, 2011
- QHN study to compare benefits of nitrogen management reduction options
- Community interest/direction will guide future agency efforts to reduce N loading!

Questions?

Curtis DeGasperi
King County Water and Land Resources
(206) 684-1268
curtis.degasperi@kingcounty.gov

Water Quality Phone Numbers

- KC Stormwater Service Drainage Complaint Line 206-296-1900
- KC Lab Water Quality Trouble/Spills sampling 206-684-2328
- Ecology spill response hotline

1-800-258-5990 -OR- **1-800-OILS-911**