Sources, Pathways, and Loadings

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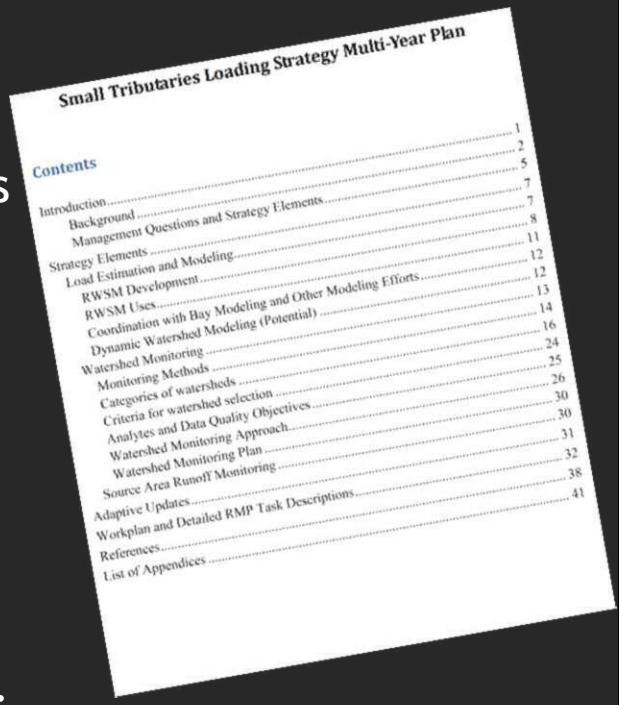
2012 Summary at a glance

- **Small Tributaries Loading Strategy - MYP**
  - **Regional watershed spreadsheet model (RWSM)**
    - Calibration and verification data
    - Input data
    - GIS layer development for Hg and PCB models
  - **Loadings field studies**
    - Marsh Creek near Brentwood
    - San Leandro Creek at San Leandro Blvd.
    - Guadalupe River at Hwy. 101
    - Sunnyvale East Channel at East Ahwanee Ave.



Small Tributaries Loading Strategy Multi-Year Plan

Contents

Introduction 1
Background 2
Management Questions and Strategy Elements 5
Strategy Elements 7
Load Estimation and Modeling 7
RWSM Development 8
RWSM Uses 11
Coordination with Bay Modeling and Other Modeling Efforts 12
Dynamic Watershed Modeling (Potential) 12
Watershed Monitoring 13
Monitoring Methods 14
Categories of watersheds 16
Criteria for watershed selection 24
Analytes and Data Quality Objectives 25
Watershed Monitoring Approach 26
Watershed Monitoring Plan 30
Source Area Runoff Monitoring 30
Adaptive Updates 31
Workplan and Detailed RMP Task Descriptions 32
References 38
List of Appendices 41

2012 Summary at a glance – continued

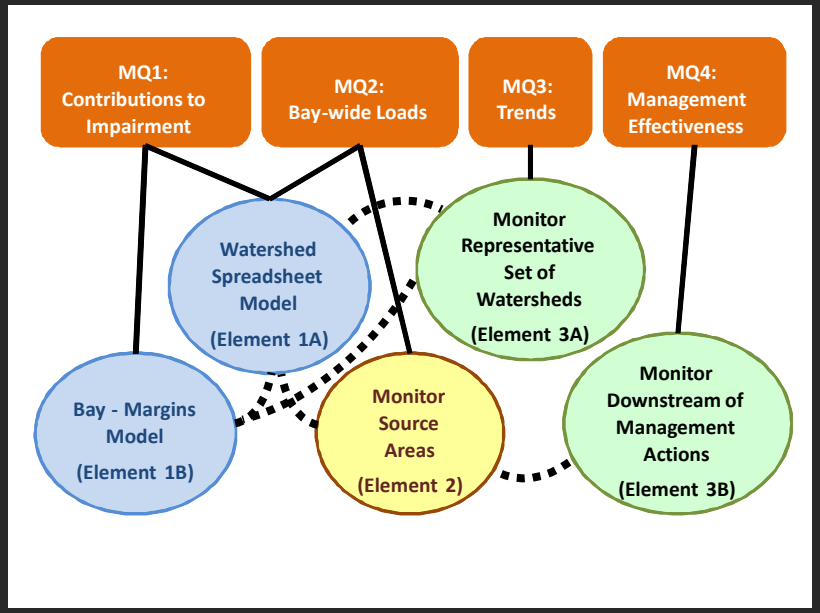
- **Technical reports completed**
  - Pollutants of Concern Loads Monitoring Data Water Year 2011
  - EMC Development for the Regional Watershed Spreadsheet Model
  - RWSM Copper Test Case Model

- **Linkages**
  - **Dioxins strategy – field data** (San Leandro Creek, Sunnyvale East Channel)
  - **Emerging contaminants (Pyrethriods, carbaryl and fipronyl (POC loads stations)**
  - **Nutrient strategy (NO2, TKN, NH4, all POC loads stations)**

- **Other SFEI projects (enhanced by and enhancing the RMP)**
  - **LID projects (El Cerrito, Fremont) (analyte list includes PCBs, Hg, others)**
  - **Richmond pump station (analyte list includes PCBs, Hg and dioxins, others)**
  - **Various geomorphology projects (support for regional sediment loads)**

Small Tributaries Loading Strategy

- **STLS framework document Multi-year plan (MYP) Version "2012" completed**
  - Significant effort led by Arleen Feng/ BASMAA
  - Appendices
    - RWSM construction and calibration
    - Optimizing sampling methods for loads/ trends
    - Exploratory watersheds characterization
    - WY 2011 Watershed Characterization Field Study



Submitted to the Water Board in September 2012

RWSM

- **Objective**
  - **Improve regional average annual estimates of suspended sediment and pollutant loads**
    - Support prioritization and management of “high leverage” watersheds in relation to sensitive areas of the Bay margin
    - Provide input into food web models of the Bay

- **Progress**
  - **2010 - base hydrology model / initial contaminant models - Y1 report**
  - **2011 - improved hydrology model / model documentation - Y2 report**
  - **2012**
    - New and improved user interface
    - Copper model (test case)
    - Development of GIS source layers for PCB and Hg models
    - New “living” report template

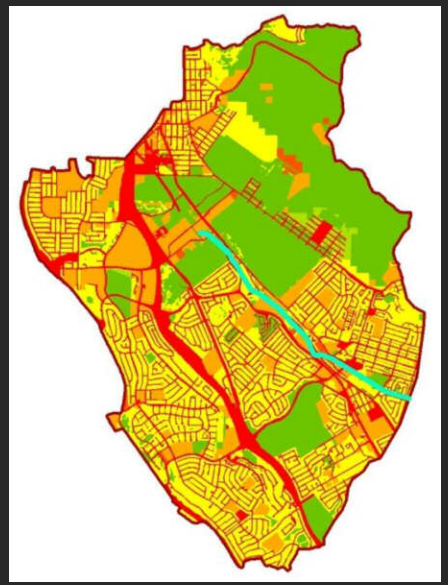
RWSM basic model structure

Objectives

For each watershed, generate average annual:

- Discharge volume
- Sediment load
- POC loads

Runoff volume* x Concentration = Load



*or sediment load

RWSM data needs

Spatial Data Layers

- ✓ Land use (alternatively, imperviousness)
- ✓ Soils
- ✓ Slope
- ✓ Rainfall
- ✓ Watershed boundaries
- • Source areas

Numerical Parameters

- ✓ Runoff coefficients
- • Land use/ source area specific concentrations

Data

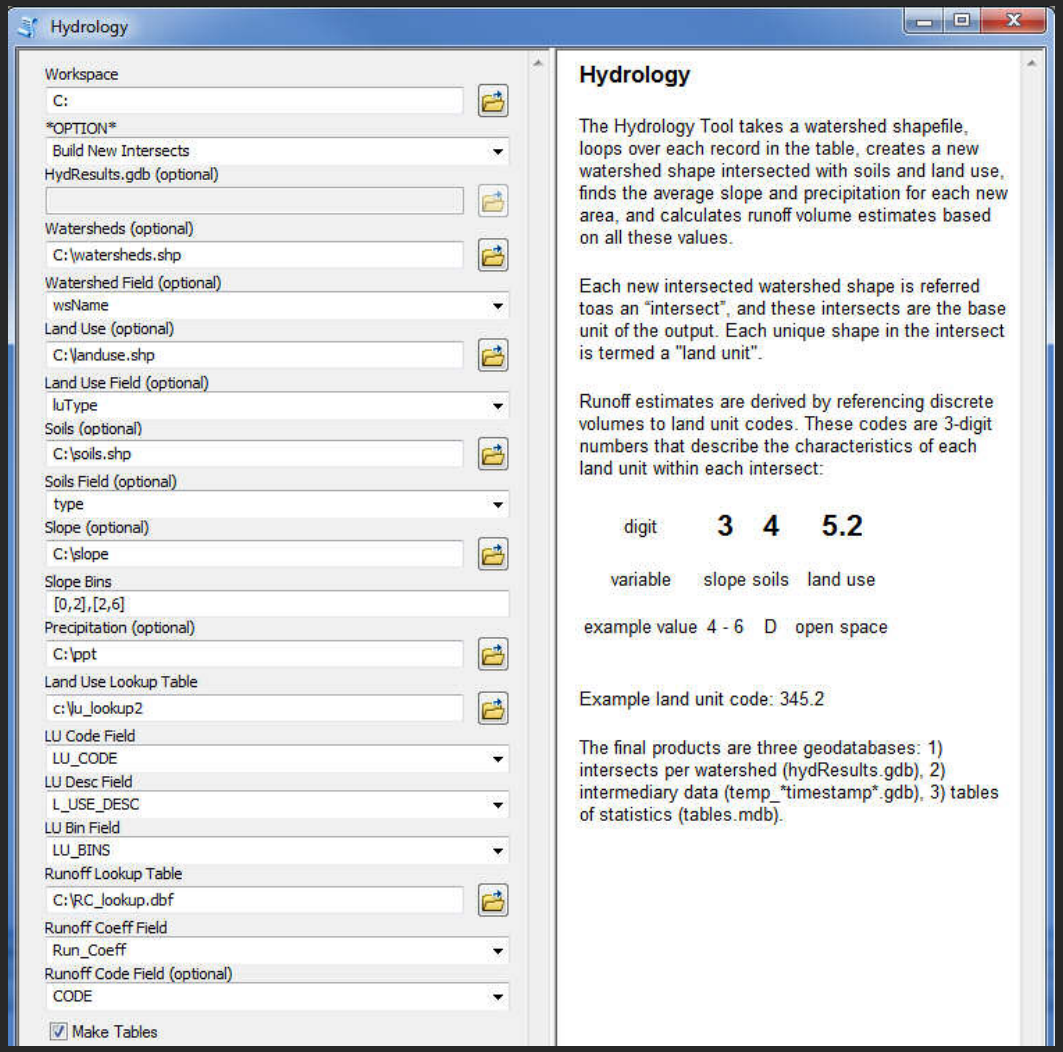
- • Empirical calibration and verification data

RWSM Plan

Hydrology
Sediment
Cu (Test Case)
Hg
PCBs
Selenium
OC Pest
PBDEs

1) Develop fact sheet/methodology
2) Develop GIS layers
3) Collate input data and calibration data
4) Run Version 1 of the model
5) Improve model structure or input data
6) Run Version 2 of the model
7) Complete FINAL input dataset
8) Run Version 3 (FINAL) of the model
9) Complete model packaging and user manual

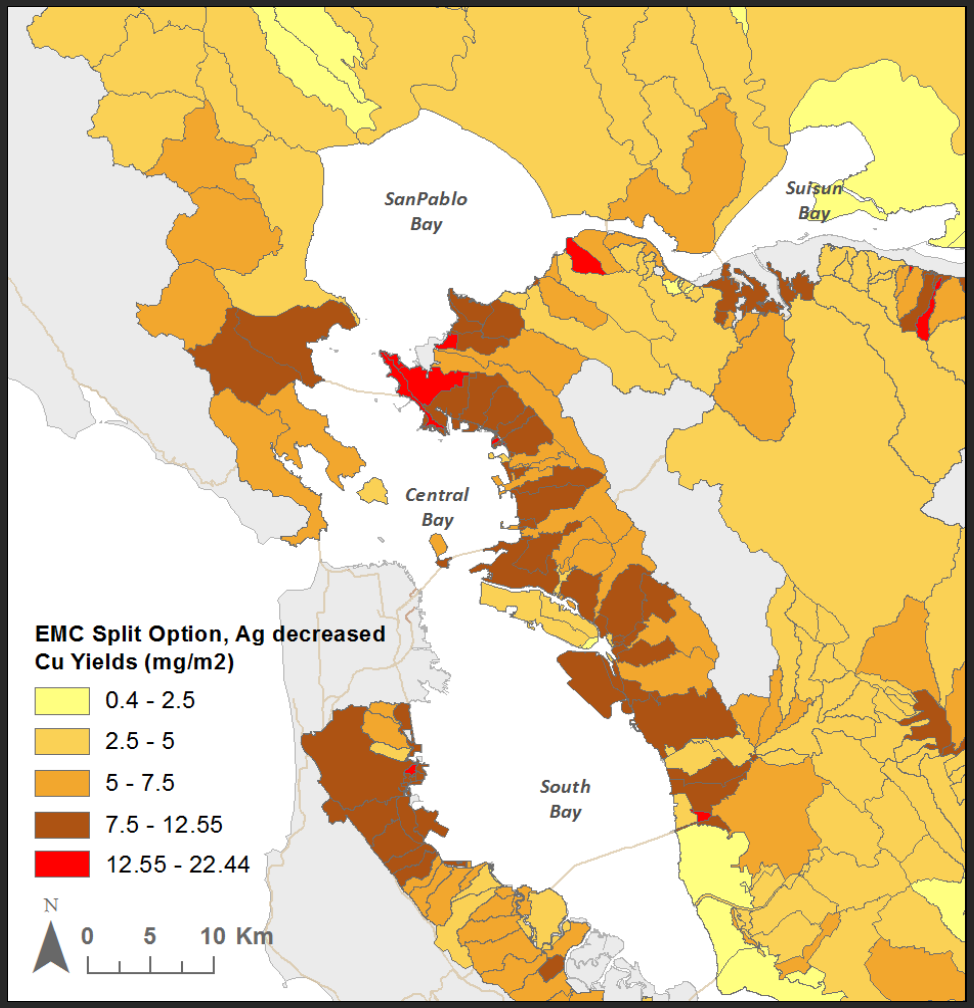
Tool input interface



- ArcGIS standard tool interface
- Advanced GUI behavior
- All parameters have help text

Copper test case model - 10 “Highest” Yielding Watersheds

- Example of output
- Can start to imagine what the PCB and Hg model outcomes will look like



WY 2012 reporting

- ✓ Reporting template has been developed and approved through STLS
- ✓ Two sections complete
  - ✓ EMC data development for RWSM (using back calculations)
  - ✓ Copper model test case
- Other sections in progress
  - GIS layer development
  - PCB and Hg models to follow

Table of contents

Background 3
Work plan summary / framework 3
Pollutant specific model structures 3
Geographic information development to support modeling 3
Use of geoprocessing tools for scientific research 3
Improvements from previous version 3
Overall structure of arcpy code 3
Integration into ArcGIS as ArcToolbox 3
QA process, pitfalls, and solutions 3
Table of geospatial products 3
Metadata specifications 4
Event mean concentration data development 4
Mathematical methods of estimation 4
Land use/source area specific field observations 4
Modeling outcomes 4
Hydrology 4
Suspended sediment 5
Copper ("memo" completed through this year's work) 5
PCBs ("memo" completed through this year's work) 6
Mercury ("memo" completed through this year's work) 6
PBDEs 7
Organochlorine pesticides 7
Other? 7
Year [x] summary and recommendations 8
Literature cited 8

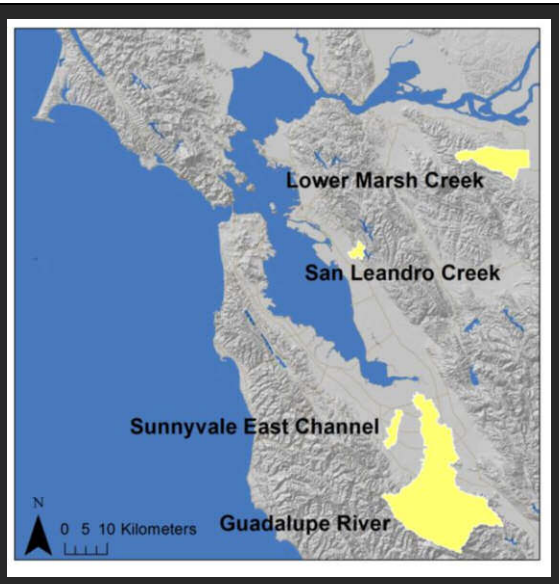
Water Year 2012 POC loads monitoring

- Below average rainfall
- San Jose: Climate Year 2012 was the 7th driest on record

- Completed 69% of sampling plan

Water Year 2012 loads studies

- ✓ 4 watersheds
- ✓ 3 years
- • 4 storms per year per watershed
- • A 1st flush; a large storm, and 2 others
- ✓ Hybrid POC sampling approach
  - ✓ 6712 ISCO - composite and discrete sample collection
  - ✓ D95 - total mercury and total methylmercury
  - ✓ DH84 - total methylmercury wading stage
- ✓ Continuous turbidity and stage measurements
- • Manual discharge measurements



Analytes and collection method

Sample Method	Discrete or Composite	Analysis	Sample Number
Manual ISCO	Discrete	PCBs (40)	18
Manual ISCO	Discrete	PAH	4
Manual ISCO	Discrete	PBDE	4
Manual ISCO	Discrete	SSC (GMA)	17
Manual ISCO	Discrete	TOC	18
Manual ISCO	Discrete	Total Phosphorous	18
Manual ISCO	Discrete	Dissolved phosphorus and Nitrate as N	18
Manual ISCO	Discrete	SSC (GMA)	17
Automated ISCO	Composite	Toxicity – water column	4
Automated ISCO	Composite	Pyrethoids**	6
Automated ISCO	Composite	Carbaryl	6
Automated ISCO	Composite	Fipronil	6
Automated ISCO	Composite	Total Cu and Total Se and Hardness	6
Automated ISCO	Composite	Dissolved Cu and Dissolved Se	6
Automated ISCO	Composite	SSC	6
Manual Grab	Discrete	Total methylmercury	10
Manual Grab	Discrete	Total Mercury	18
Manual Grab	Discrete	SSC	19

- Note – Guadalupe will remain manual
  - Turbidity surrogate / USGS flow
  - D95 / composites completed by staff also (with great effort)

Preliminary mercury and PCB results

Mercury

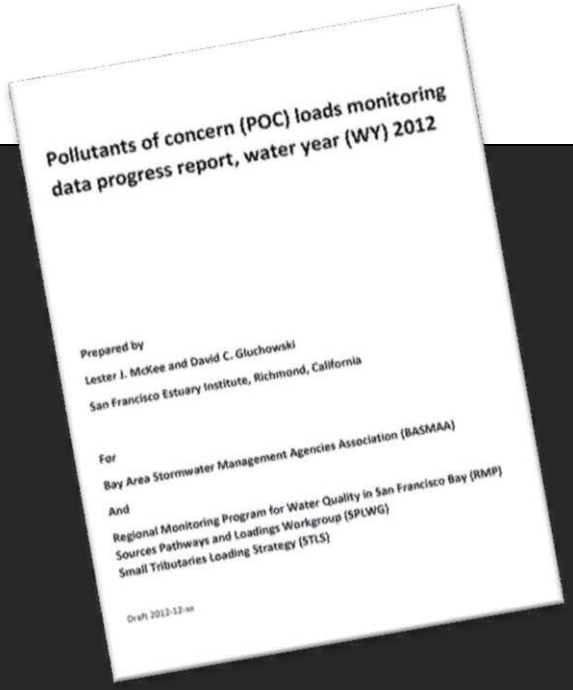
- San Leandro Creek showing high mercury
- Reduced runoff from upper watershed (mining influence) at Lower Marsh Creek and Guadalupe River
- Good relationship between SSC and Mercury

PCBs

- Similar to mercury data – good PCB:SSC relationships
- PCBs in line with reconnaissance findings – higher concentrations in more industrial, less impervious watersheds
- Discrete grab sampling design providing information to answer management questions

WY 2012 reporting

- Reporting template that has been developed and approved through the STLS
- Gaps left in the report for Richmond and Pulgas that came on line in WY 2013
- Report due 12/14/2012 (that's next Friday!)



Pollutants of concern (POC) loads monitoring data progress report, water year (WY) 2012

Prepared by

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San Francisco Estuary Institute, Richmond, California

For

Bay Area Stormwater Management Agencies Association (BASMAA)

And

Regional Monitoring Program for Water Quality in San Francisco Bay (RMP)
Sources Pathways and Loadings Workgroup (SPLWG)
Small Tributaries Loading Strategy (STLS)

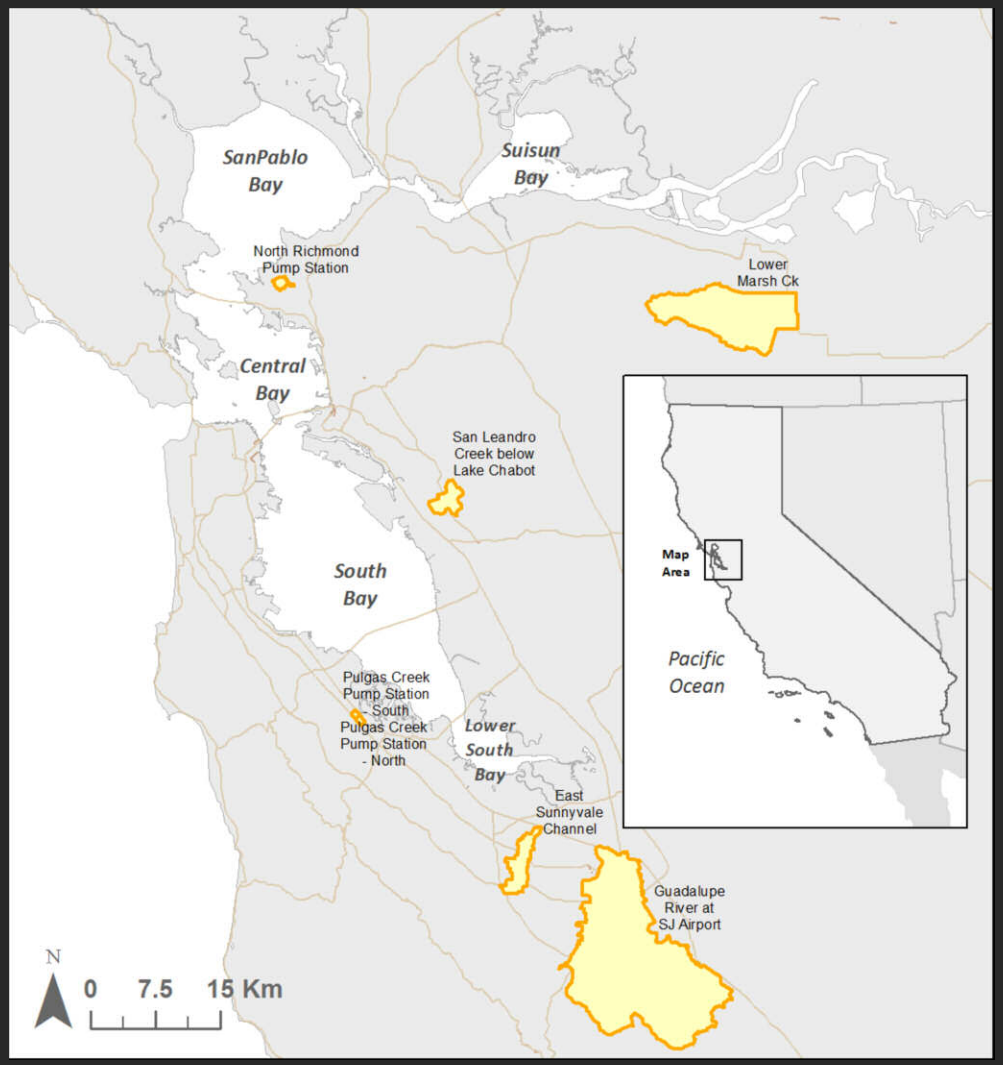
Draft 2012-12-xx

Table of Contents

Acknowledgements 2
1. Introduction 4
2. Watershed physiography and sampling locations 5
3. Sampling methods and laboratory analysis 6
4. Results 8
4.1. Marsh Creek 8
4.2. San Leandro Creek 12
4.4. Sunnyvale East Channel 19
4.5. Richmond Pump Station 21
4.6. Pulgas Creek Pump Station 21
5. Conclusions/lessons learned 21
6. References 22

WY 2013 loads studies ($343,000)

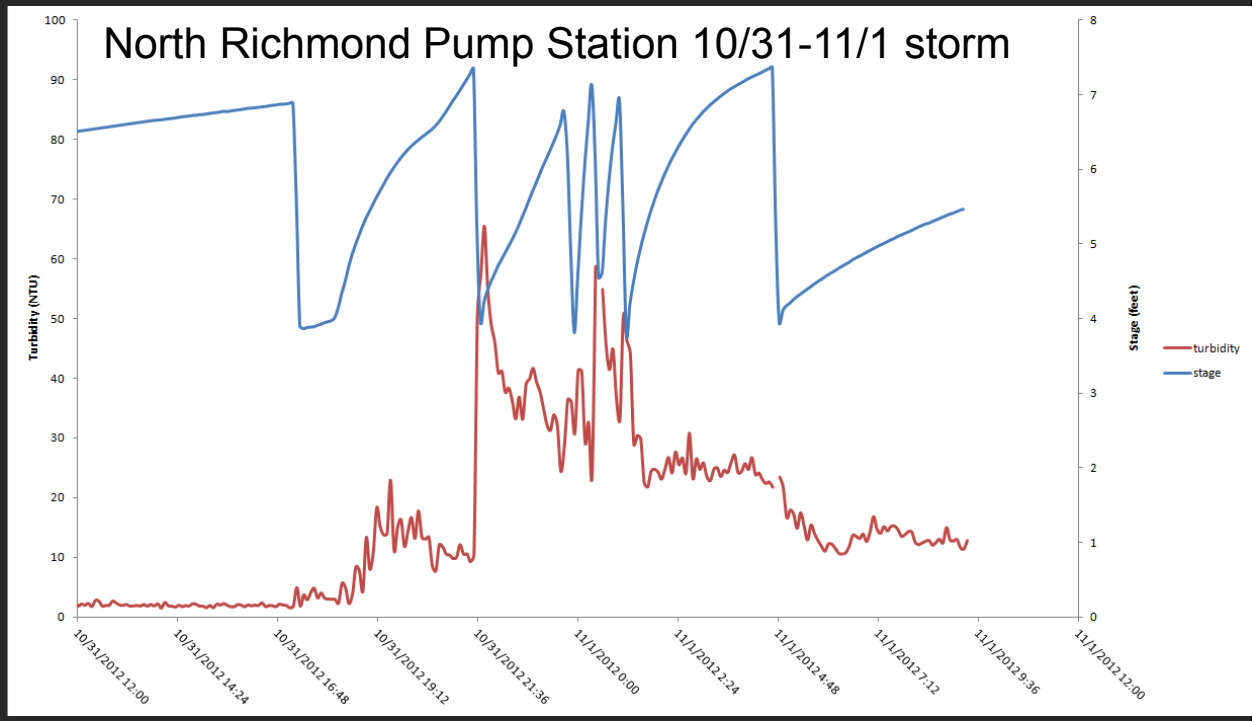
- 6 watersheds (2 with RMP funds)
- 2 more years
- Average of 4 storms per year per watershed
- A 1st flush; a large storm, and 2 others
- Standardized consistent Hybrid POC sampling approach
  - 6712 ISCO – composite and discrete sample collection
  - D95 – total mercury and total methylmercury
  - DH84 – total methylmercury wading stage
- Continuous turbidity and stage measurements
- Manual discharge measurements



WY 2013 loads studies - progress

Storms sampled as of 12/03/2012

- Marsh Creek: 2 of 6
- North Richmond Pump Station: 2 of 4
- San Leandro Creek: 2 of 4
- Guadalupe River: 1 of 5
- Sunnyvale East Channel: 2 of 6
- Pulgas Creek Pump Station: 0 of 4



2013 Spreadsheet model / EMC development

EMC development: $80k; RWSM: $25k + BASMAA funding

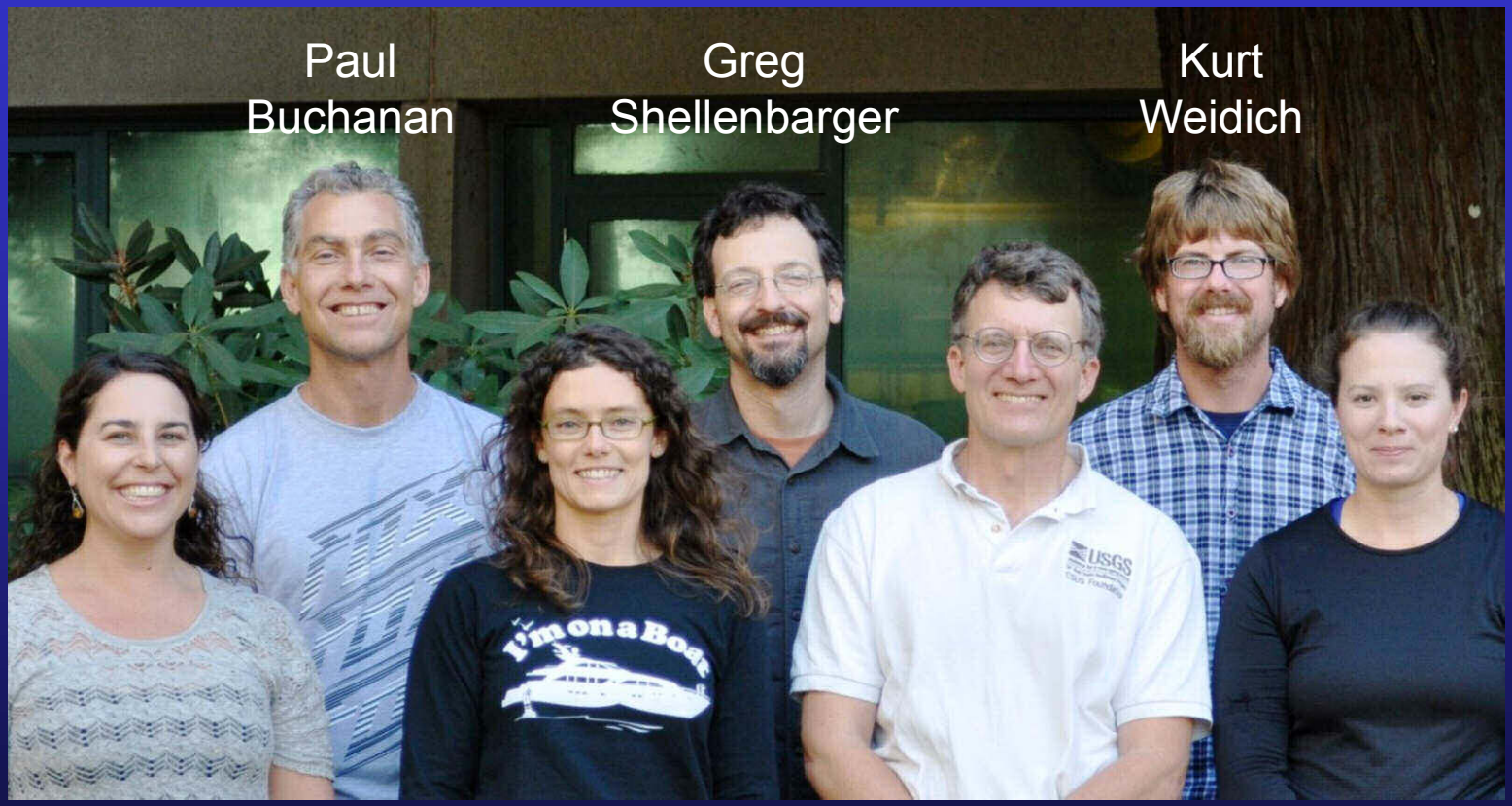
- **Planned products/ report sections:**
  - **GIS layer development and report section draft complete (January 15th) (RMP 2012 funding)**
  - **PCB and Hg RWSM(s) v2 complete (RMP 2012 funding)**
    - EMC field program designed and implemented? (RMP 2013 funding)
  - **PCB RWSM v3 complete (RMP 2013 funding)**
  - **Hg RWSM v3 complete (RMP 2013 funding)**
  - **Regional sediment loads updated (2013 BASMAA funding)**
  - **PBDE/OC Pest contaminant "fact sheets" (2013 BASMAA funding)**
  - **Further reporting (RMP 2013 funding)**

  - **Planning for WY 2014 wet season (July – September):**
    - POC loads monitoring (RMP 2014 funding)
    - EMC field monitoring? (RMP 2013 funding)

2013 STLS management support ($20K)

- Small Tributaries Loading Strategy (STLS) team plans and coordinates loading related projects
  - Water Board staff
  - BASMAA staff
  - RMP staff
  - BASMAA consultants (ADH, Balance Hydrologics, KLI)
- Monthly phone conferences
  - Heads up discussion of progress and product development
  - "Real-time input" rather than review at the end
- Quarterly face-to-face meetings to
  - Discuss progress and get input
  - Collaborate and coordinate on bigger issues and decisions

San Francisco Estuary Sediment Transport Research Project



Tara Morgan-King

Maureen Downing-Kunz

David Schoellhamer

Amber Powell

in class: Chris Silva

USGS

Outline

- Suspended-sediment concentration (SSC), salinity, and dissolved oxygen (DO) continuous monitoring station updates
- Golden Gate suspended-sediment flux analysis

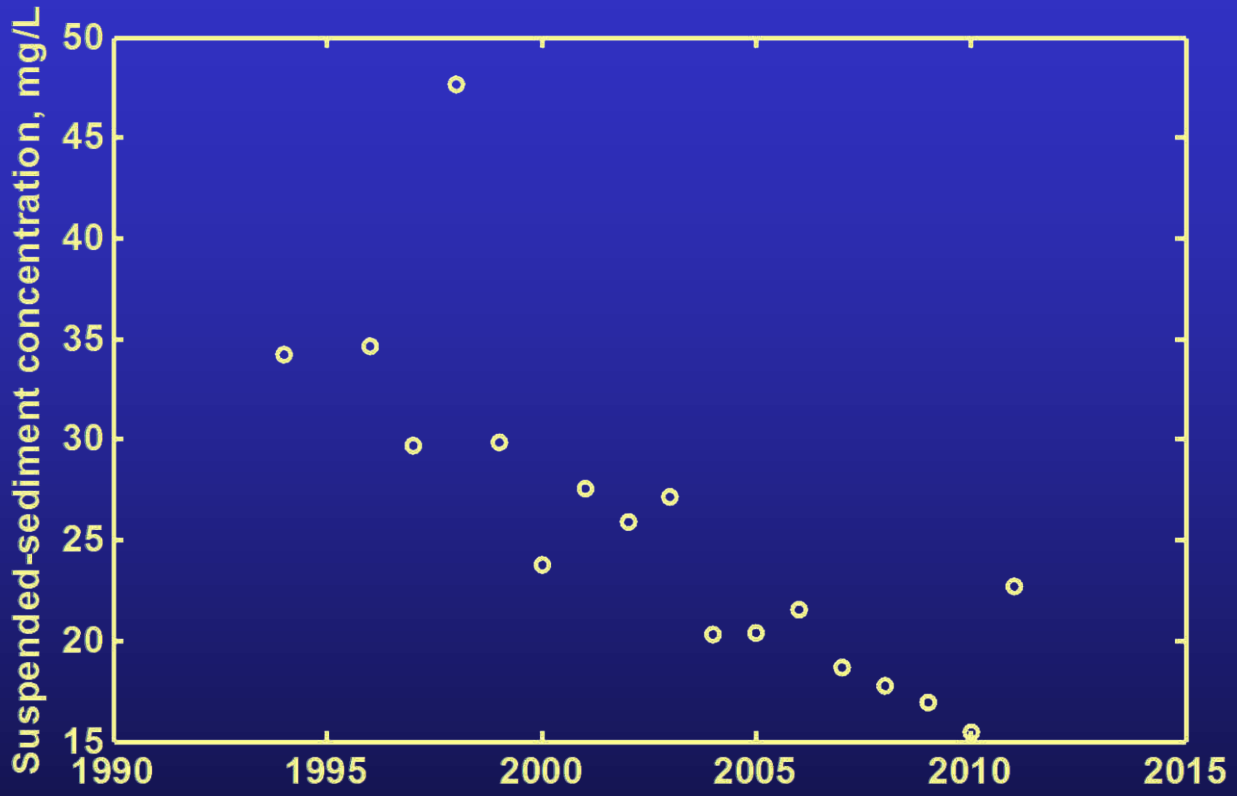
USGS

SSC station update:

- Continued operation of Mallard Island, Benicia, Richmond Bridge, and Alcatraz stations.
- Dumbarton moved from vehicle to railroad bridge for bridge retrofit.
- Hamilton disposal station discontinued, replaced with Golden Gate analysis in 2012, deep Central Bay station in 2013.
- RSM stations: Corte Madera Creek and Alviso Slough
- Planning sensor deployment with Emily Novick and David Senn

USGS

Clearing trend continuing despite wet 2011: Near-surface SSC at Mallard Island, September-October mean values, 1994-2011



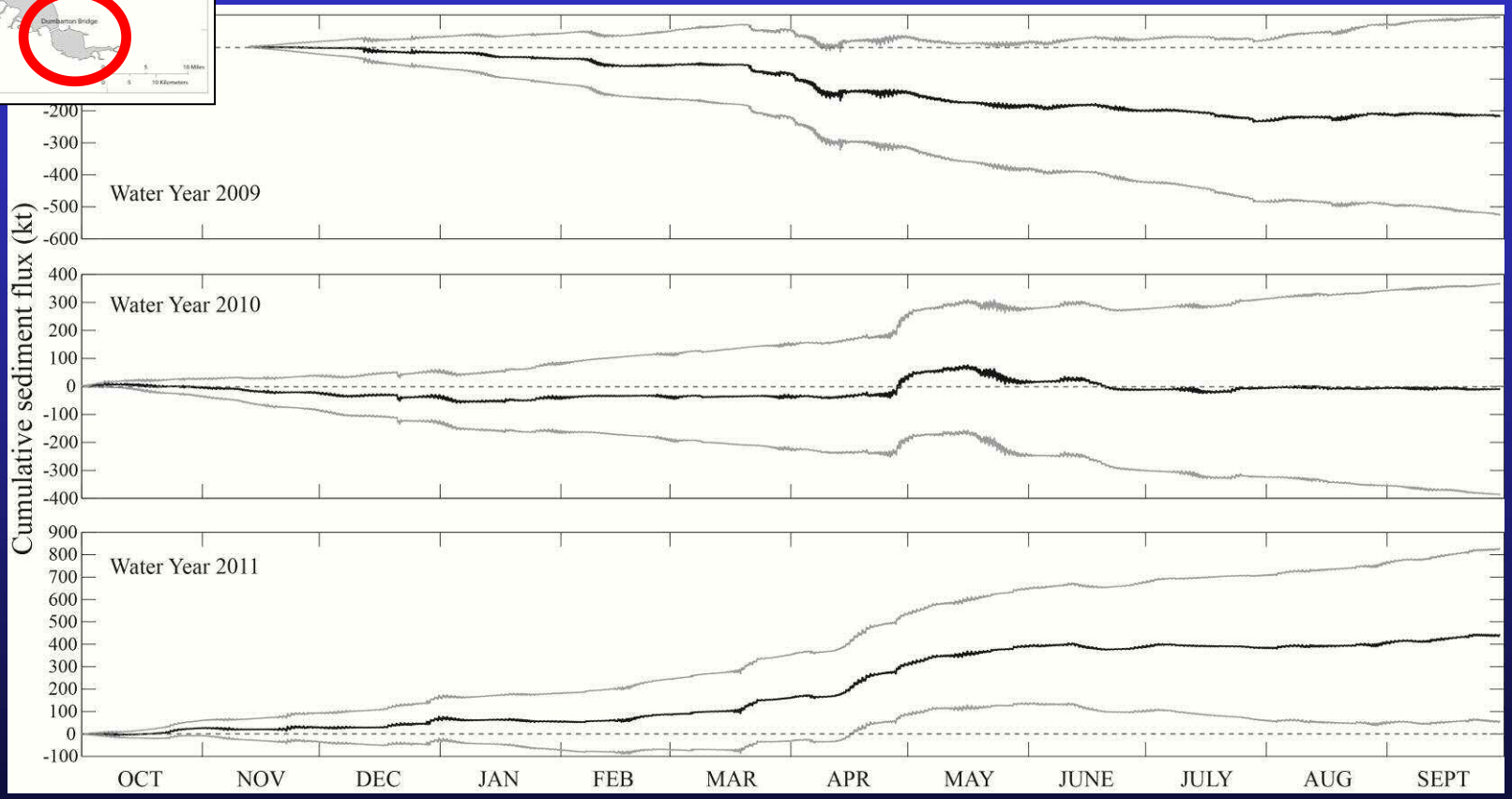
SSC decreased ~50% 1994-2011

USGS

Dumbarton sediment flux fact sheet

Greg Shellenbarger TRC presentation March 2012

Positive values are seaward



USGS can not publish new results in a fact sheet, awaiting USGS approval of accepted *Marine Geology* article. Both are being revised

USGS

Salinity station update:

- Funded by DWR
- Continued operation of Benicia, Carquinez Bridge, Richmond Bridge, Alcatraz, and San Mateo Bridge stations.
- Dumbarton moved from vehicle to railroad bridge for bridge retrofit.
- Hamilton disposal station discontinued, replaced with deep Central Bay station in 2013.
- RSM stations: Corte Madera Creek and Alviso Slough

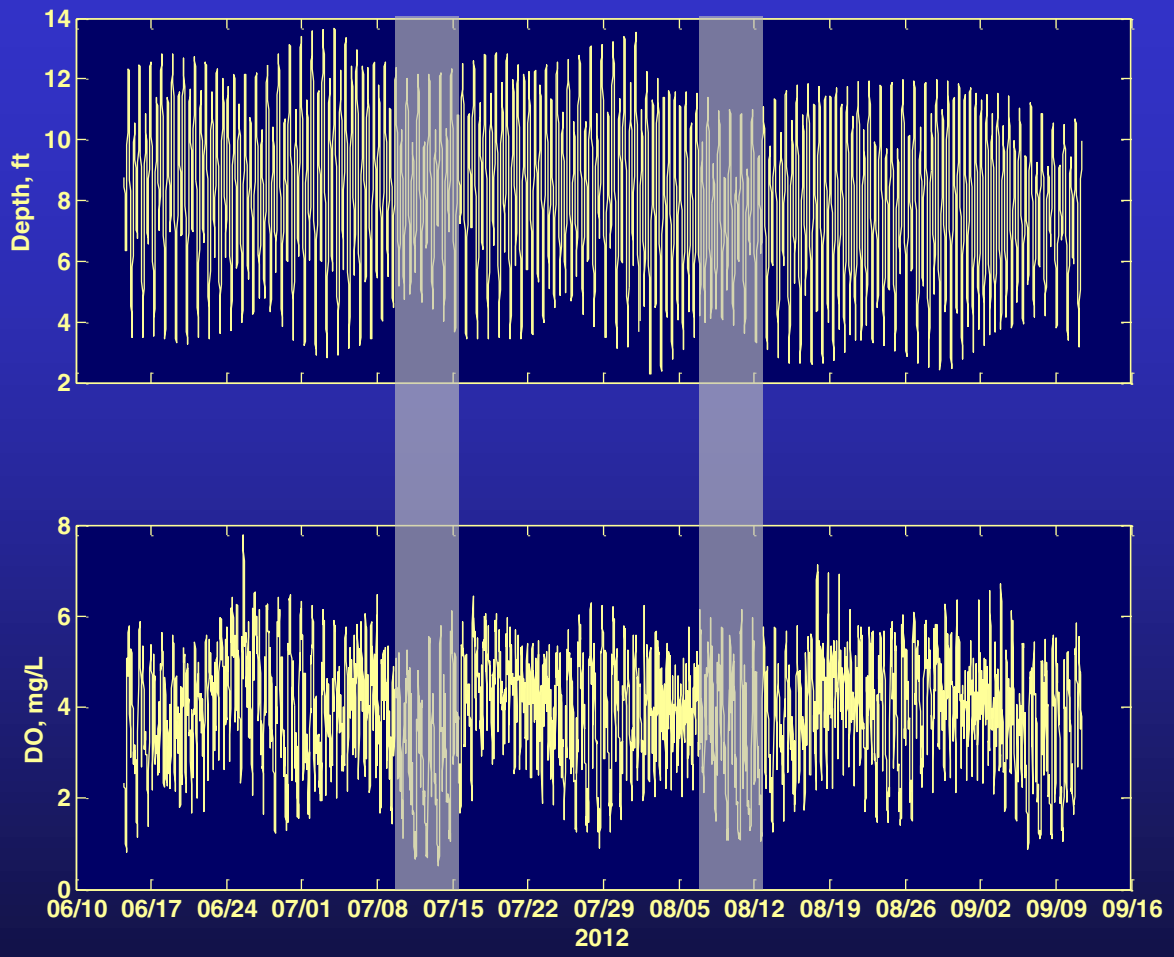
USGS

DO station update:

- DO sensors deployed near-bottom at Benicia, Richmond Bridge, and San Mateo Bridge stations.
- Dumbarton moved from vehicle to railroad bridge for bridge retrofit.
- Deep Central Bay station in 2013.
- RSM stations with DO: Corte Madera Creek and Alviso Slough
- Sensors deployed in 2012, still QAing data

USGS

DO in Alviso Slough

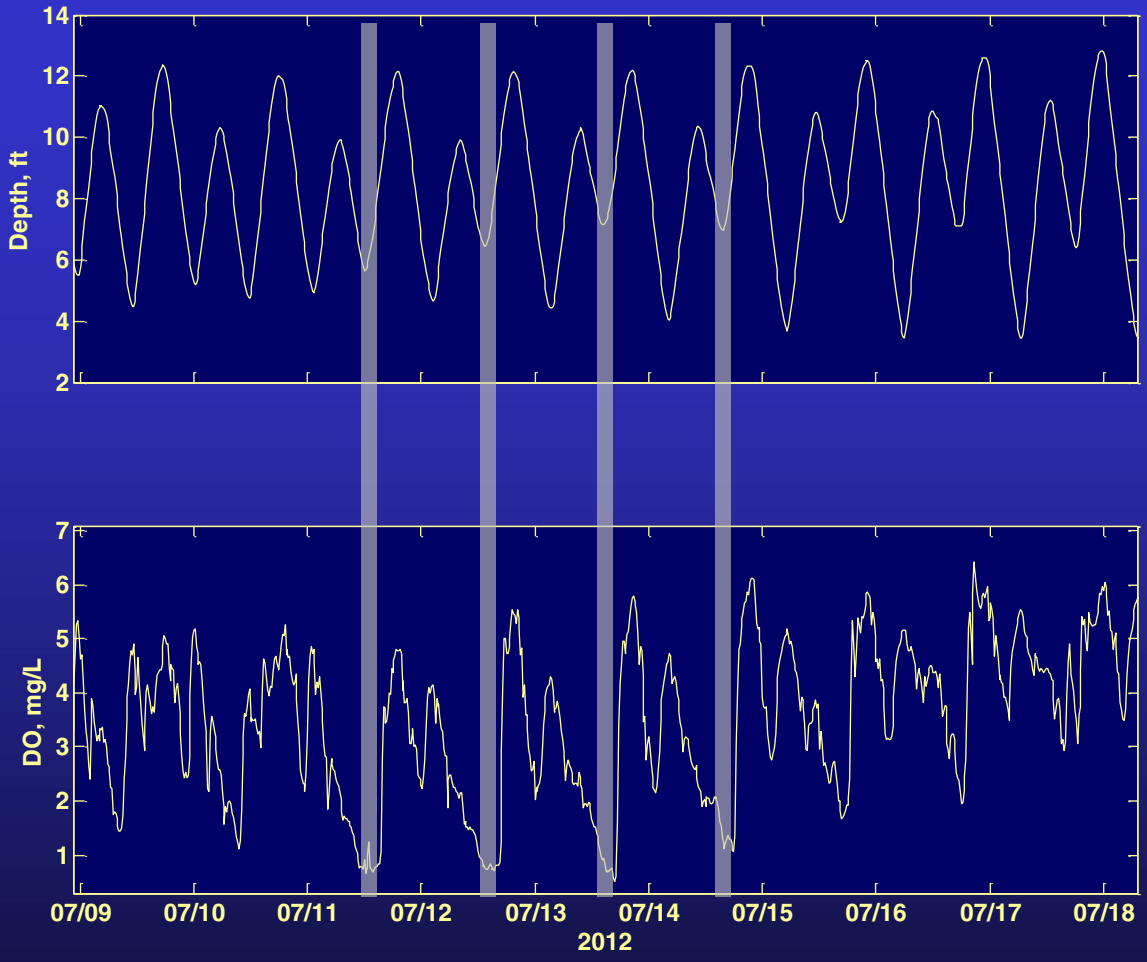


- Confirms DO in sloughs lower than in Bay (Shellenbarger et al. 2008)
- DO sag during neap tides due to less tidal mixing

Preliminary data subject to revision

USGS

Neap tide minimum DO at slack after weak ebb



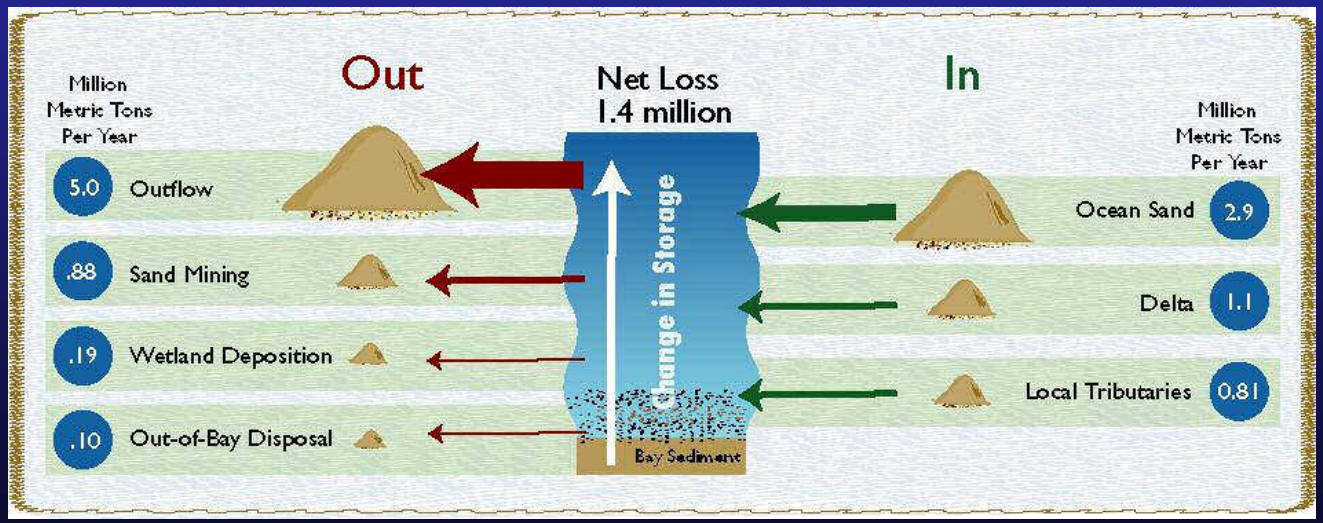
- Transport of lower DO water from upstream to the mouth
- End of 12 hours of weaker tides with less mixing

Preliminary data subject to revision

USGS

Suspended-sediment outflow at Golden Gate

- Analysis in lieu of replacing Hamilton ATF station in 2012
- Sediment budgets show that suspended-sediment flux at the Golden Gate is the largest and most uncertain term
- Objective: Evaluate whether Alcatraz SSC and other data can be used as a surrogate to estimate suspended-sediment outflow at Golden Gate
- Collaboration with Li Erikson, USGS Santa Cruz

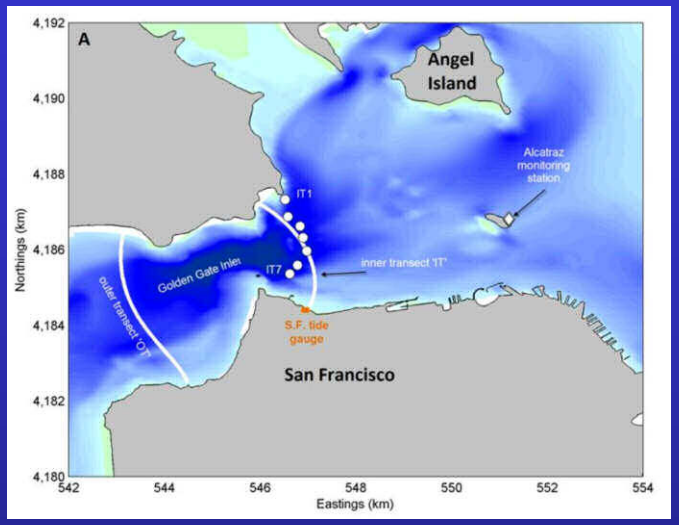


Schoellhamer et al. 2005 RMP Pulse of the Estuary, 1995-2002 sediment budget

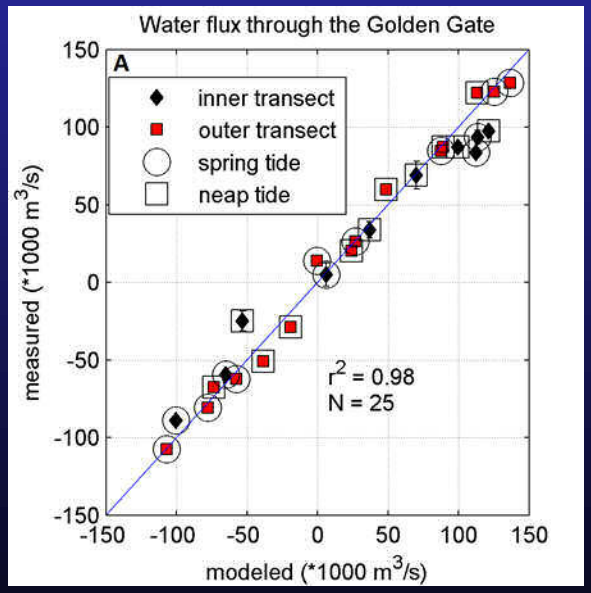
USGS

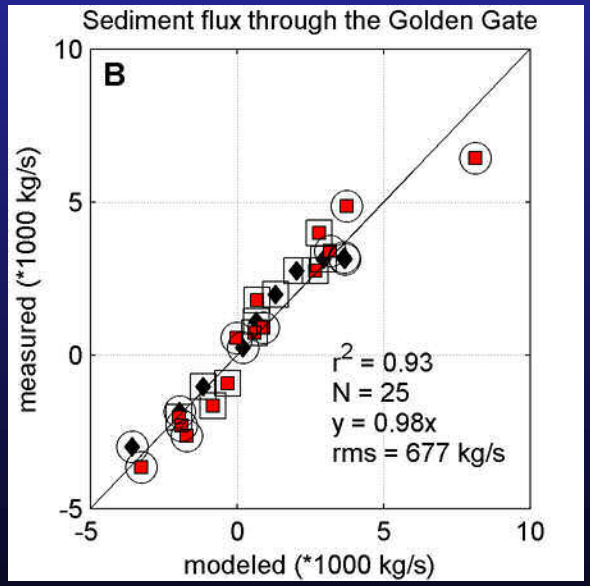
Approach

Numerical model (DELFT) for coastal studies validated with measurements of water and sediment flux collected by USGS in January 2008



Erikson et al. accepted





USGS

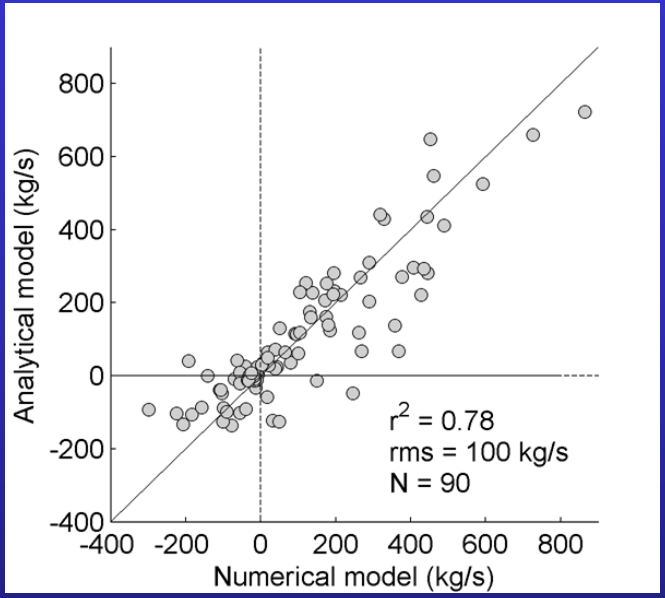
Approach

Analytic relation for tidally-averaged sediment flux F developed from model results:

$F = 3*10^{-8}\varphi^2 + 4.8*10^{-3}\varphi$

$\varphi = C\,(aU+Q)$

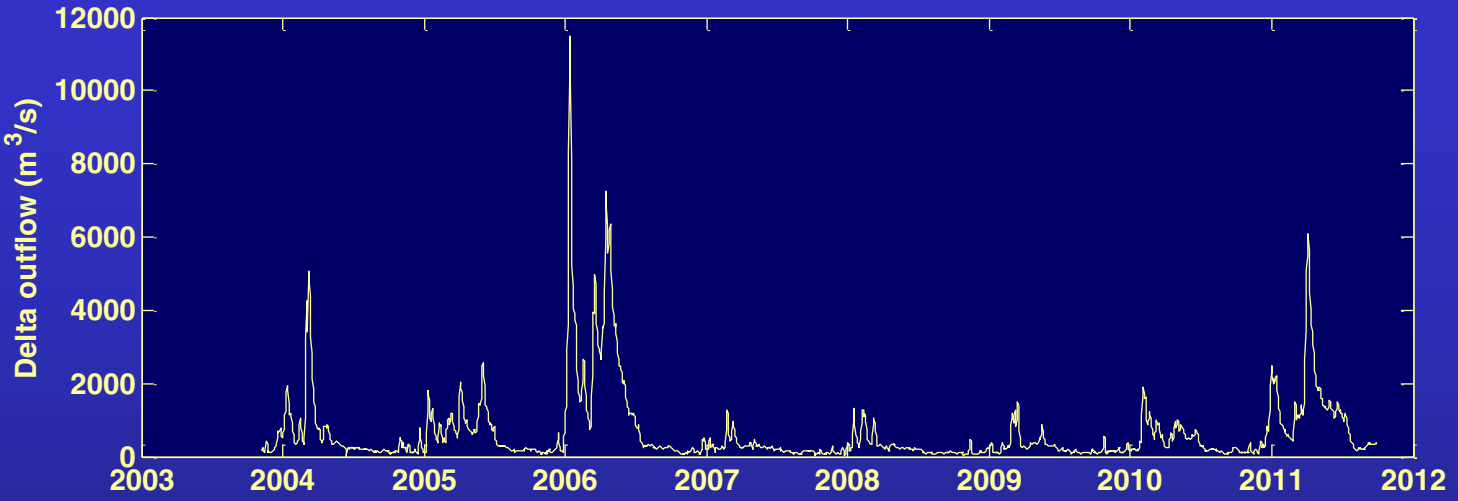
F = suspended-sediment flux (kg/s)
C = Alcatraz suspended-sediment concentration (kg/m^3)
a = constant
U = tidal average of predicted Alcatraz tidal currents (m/s)
Q = Delta outflow lagged by 10 days (m^3/s)

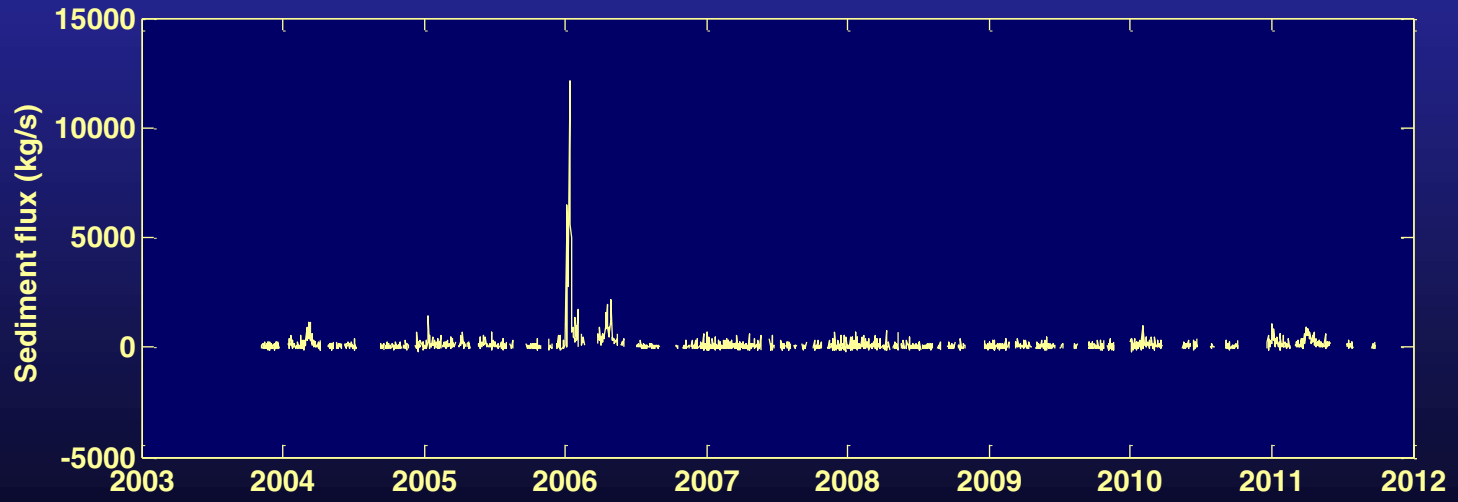


Erikson et al. accepted

USGS

Results



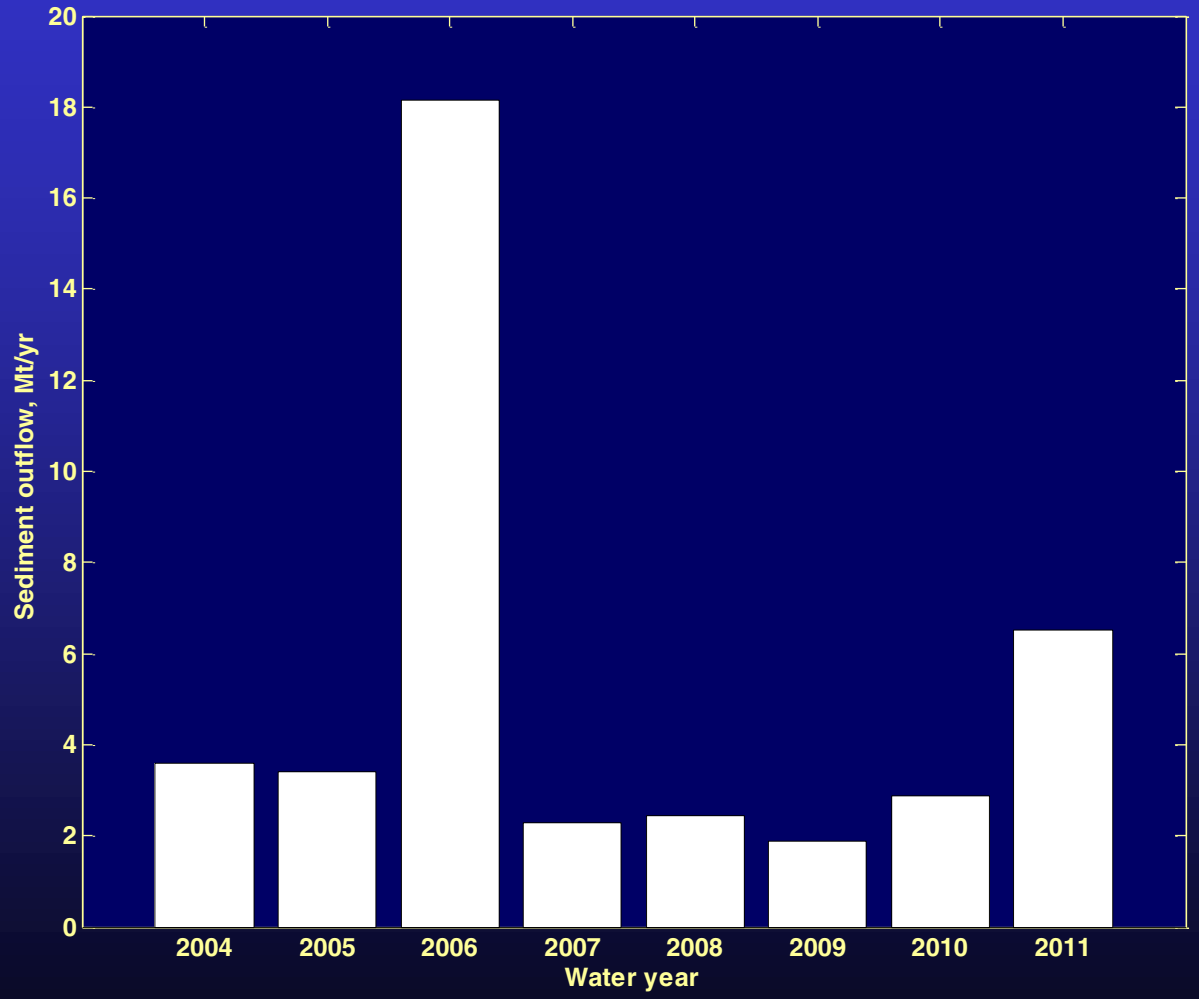


Erikson et al. accepted

USGS

Water years vary

- WY2006 had 10 times more sediment outflow than WY2009

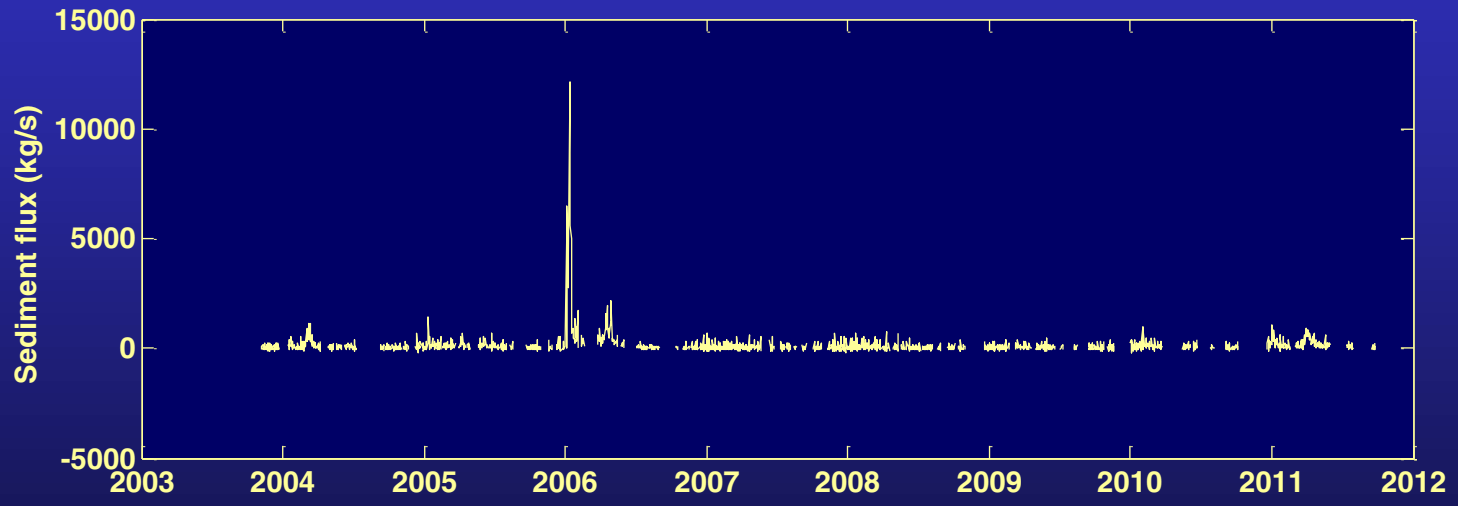


Erikson et al. accepted

USGS

Big flows matter

- 44% of sediment outflow during WY2004-2011 in WY2006
- 16% of sediment outflow during WY2004-2011 from January 1-17, 2006



Erikson et al. accepted

USGS

Results similar to recent mass conservation estimates

Source	Years	Method	Sediment outflow (Mt/yr)
Gilbert (1917)	1849-1914	Arbitrary estimate	20.2
OBK (1992)	1955-1990	Mass conservation	1.3
Schoellhamer et al. (2005)	1955-1990	Mass conservation	5.0
Schoellhamer et al. (2005)	1995-2002	Mass conservation	4.2
This study	2004-2011	Surrogate flux	5.0

USGS

Normalize by mean Delta outflow to 1955-1990

- Remove a couple of water years so mean Delta outflow is similar to 1955-1990
- Effect of Bay clearing not apparent because mass conservation estimates too low, this study's estimates are too high, and/or normalizing by mean Delta outflow not appropriate

Source	Years	Method	Mean Delta Outflow (m^3/s)	Adjusted sediment outflow (Mt/yr)
OBK (1992)	1955-1990	Mass conservation	795	1.3
Schoellhamer et al. (2005)	1955-1990	Mass conservation	795	5.0
Schoellhamer et al. (2005)	1995-2002	Mass conservation	987	4.0
This study	2004-2011	Surrogate flux	646	5.4

USGS

Evaluation of surrogate method

- Superior temporal resolution: Mass conservation requires estimate of bed mass change from bathymetric surveys (last done in 1990) or numerical models (bed change harder to simulate than fluxes). Results are available every 30 hours, not ~30 years.
- The fact that results from two different inexact methods are close (well within a factor of 2) is somewhat remarkable.
- Uncertainty is likely reduced. Uncertainty of mass conservation is at least 30%.
- For known sediment inflows, enables estimation of sediment erosion

- In summary: not perfect, but a worthwhile improvement

USGS

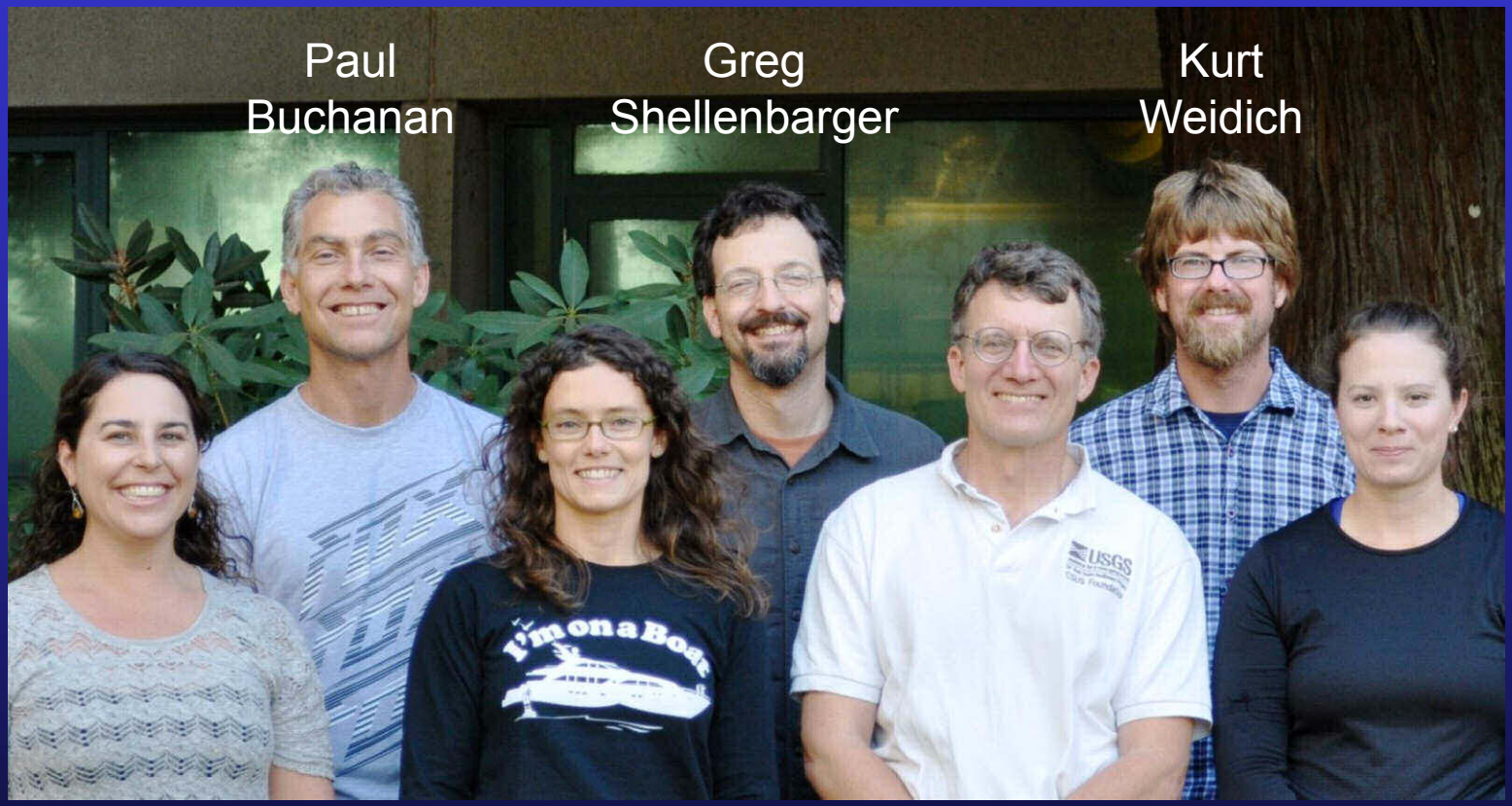
Acknowledgements

- Lead author for *Marine Geology* Golden Gate flux paper: Li Erikson, USGS Santa Cruz
- Coauthors for *Marine Geology* Golden Gate flux paper: Scott Wright, Edwin Elias, and Dan Hanes

- US Army Corps of Engineers
- San Francisco Bay Regional Monitoring Program
- California Department of Water Resources

USGS

San Francisco Estuary Sediment Transport Research Project



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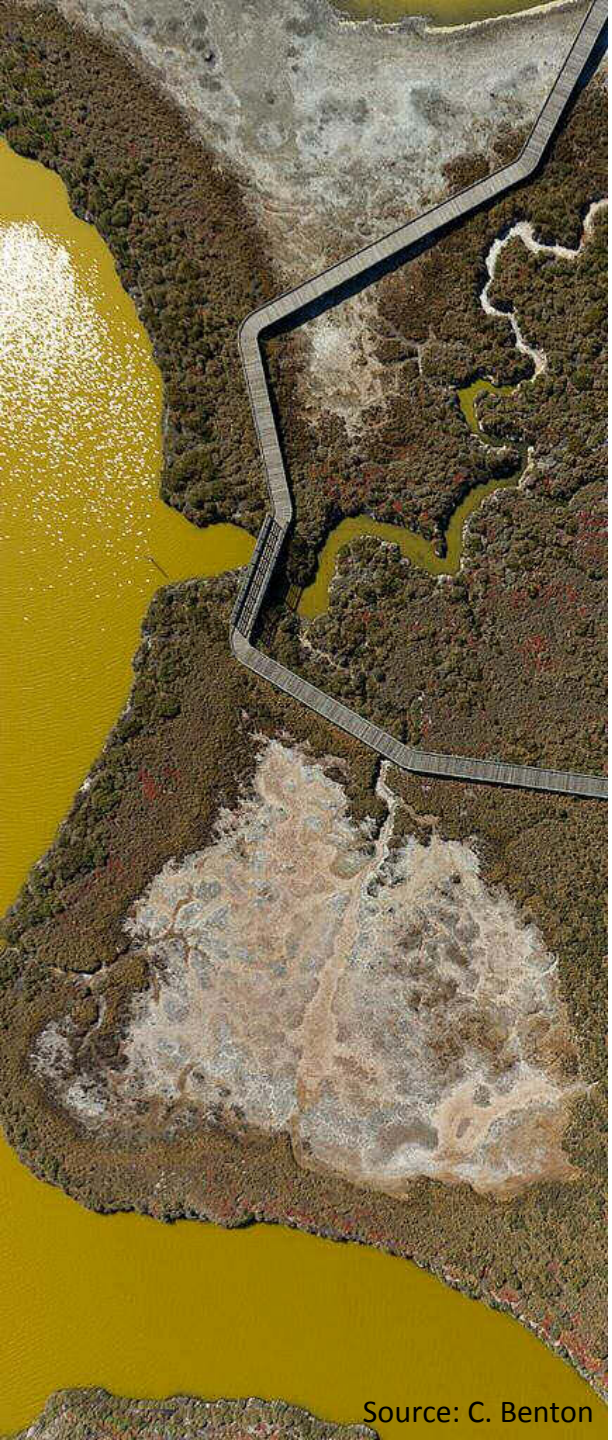
in class: Chris Silva

USGS


Source: C. Benton

Nutrients Update

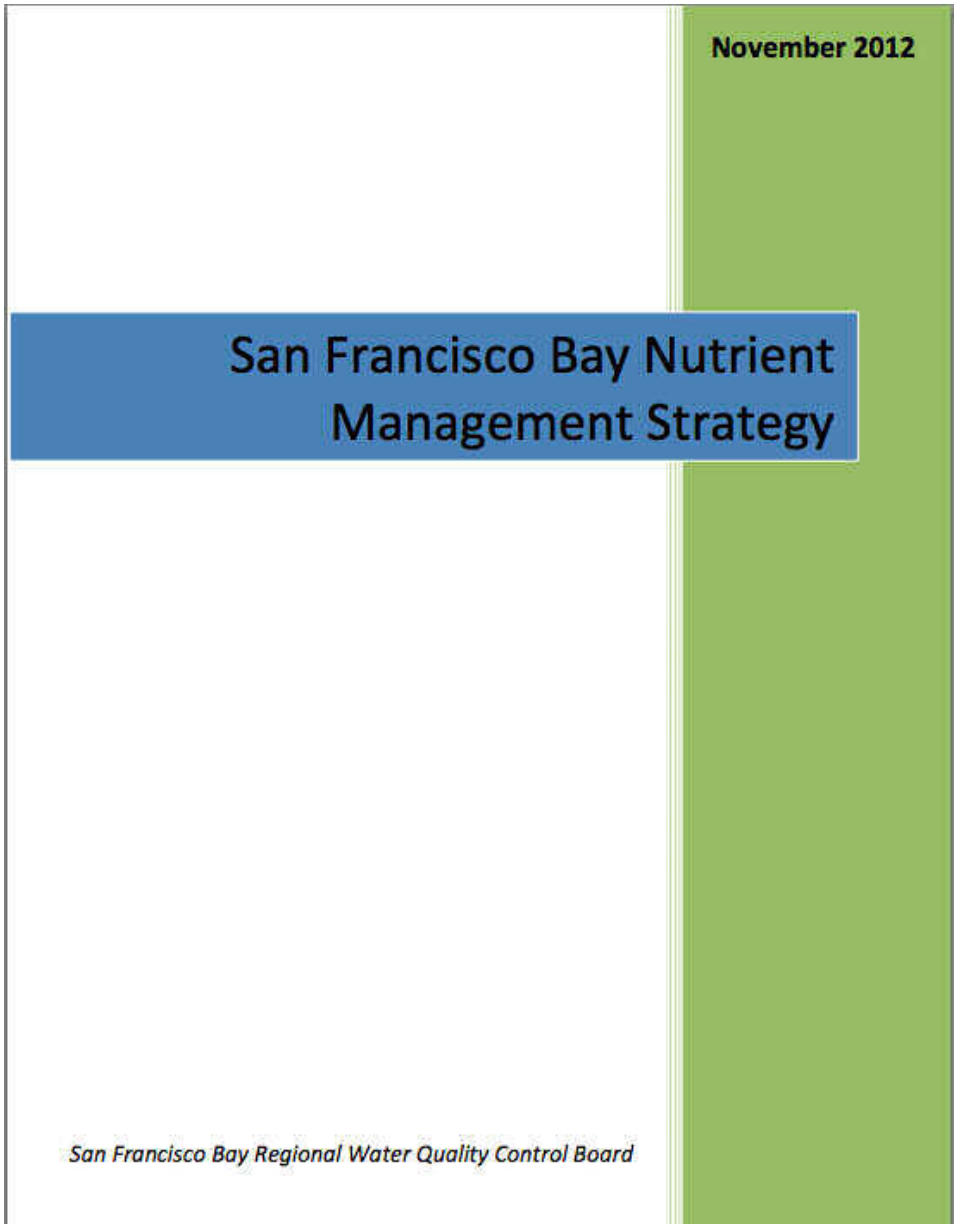
1. Overall Nutrient Strategy Update

2. RMP 2012 Project Update
   - Loading Study

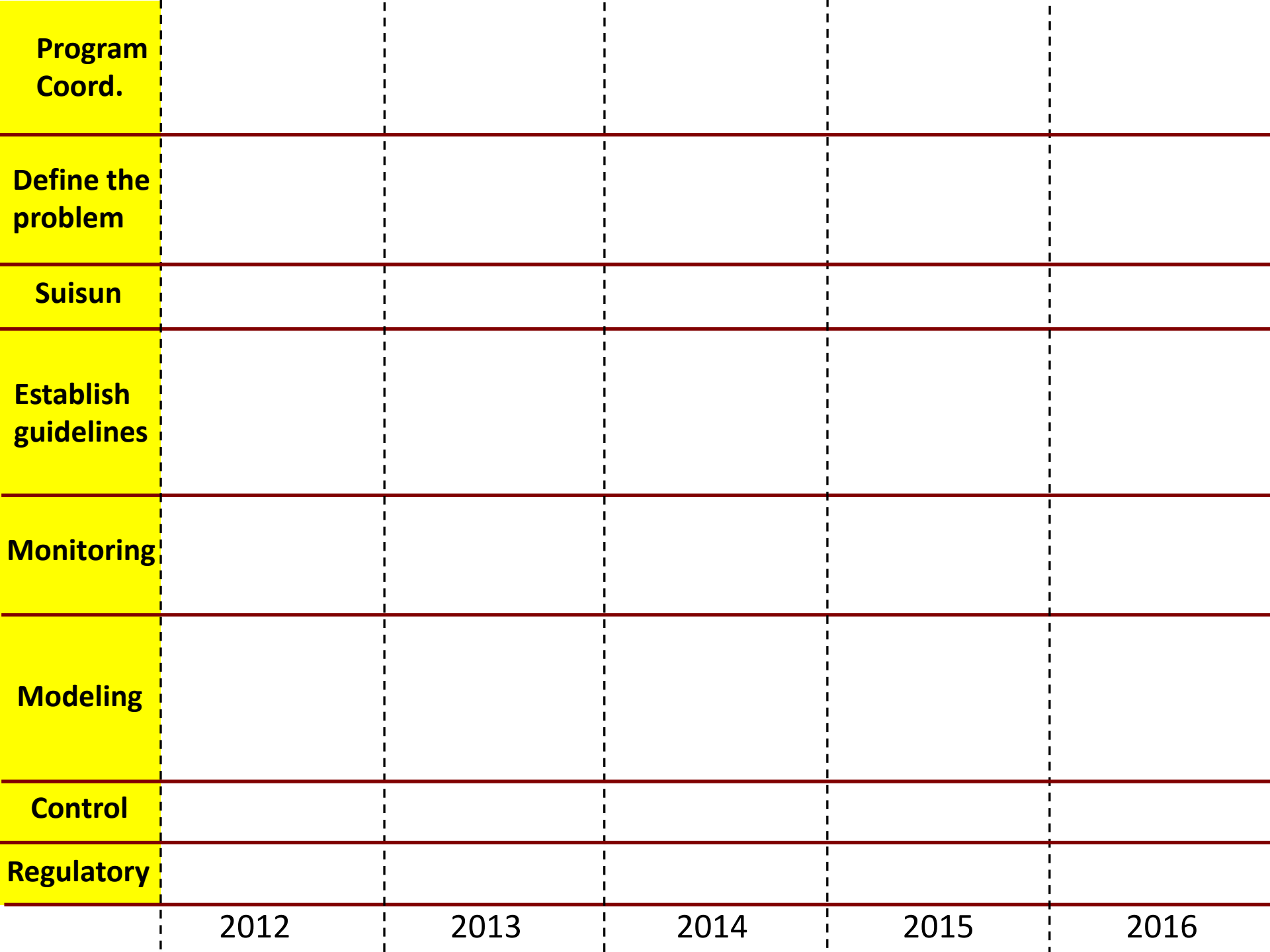
3. Work progress and planning
   - 2012-2013

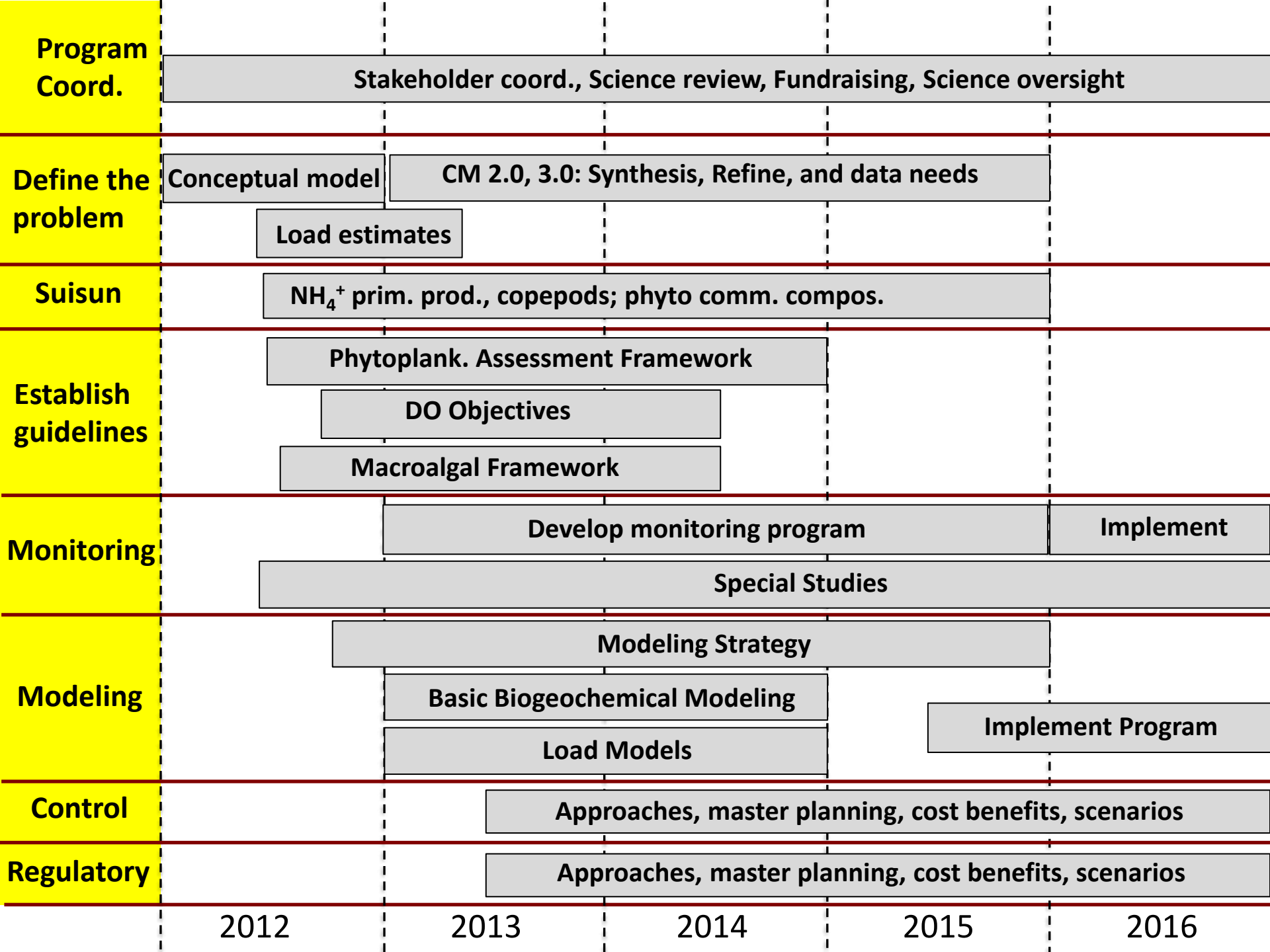
4. Modeling

Status of Nutrient Strategy



- Initial strategy: March 2012
- Comments and discussion
  - SAG: March 2012
  - Comments: May 2012
- Revised strategy out
  - November 2012


Program Coord.
Define the problem
Suisun
Establish guidelines
Monitoring
Modeling
Control
Regulatory
2012
2013
2014
2015
2016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CM 2.0, 3.0: Synthesis, Refine, and data needs
Load estimates
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NH_4^+ prim. prod., copepods; phyto comm. compos.
Establish guidelines
Phytoplank. Assessment Framework
DO Objectives
Macroalgal Framework
Monitoring
Develop monitoring program
Implement
Special Studies
Modeling
Modeling Strategy
Basic Biogeochemical Modeling
Load Models
Implement Program
Control
Approaches, master planning, cost benefits, scenarios
Regulatory
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2013
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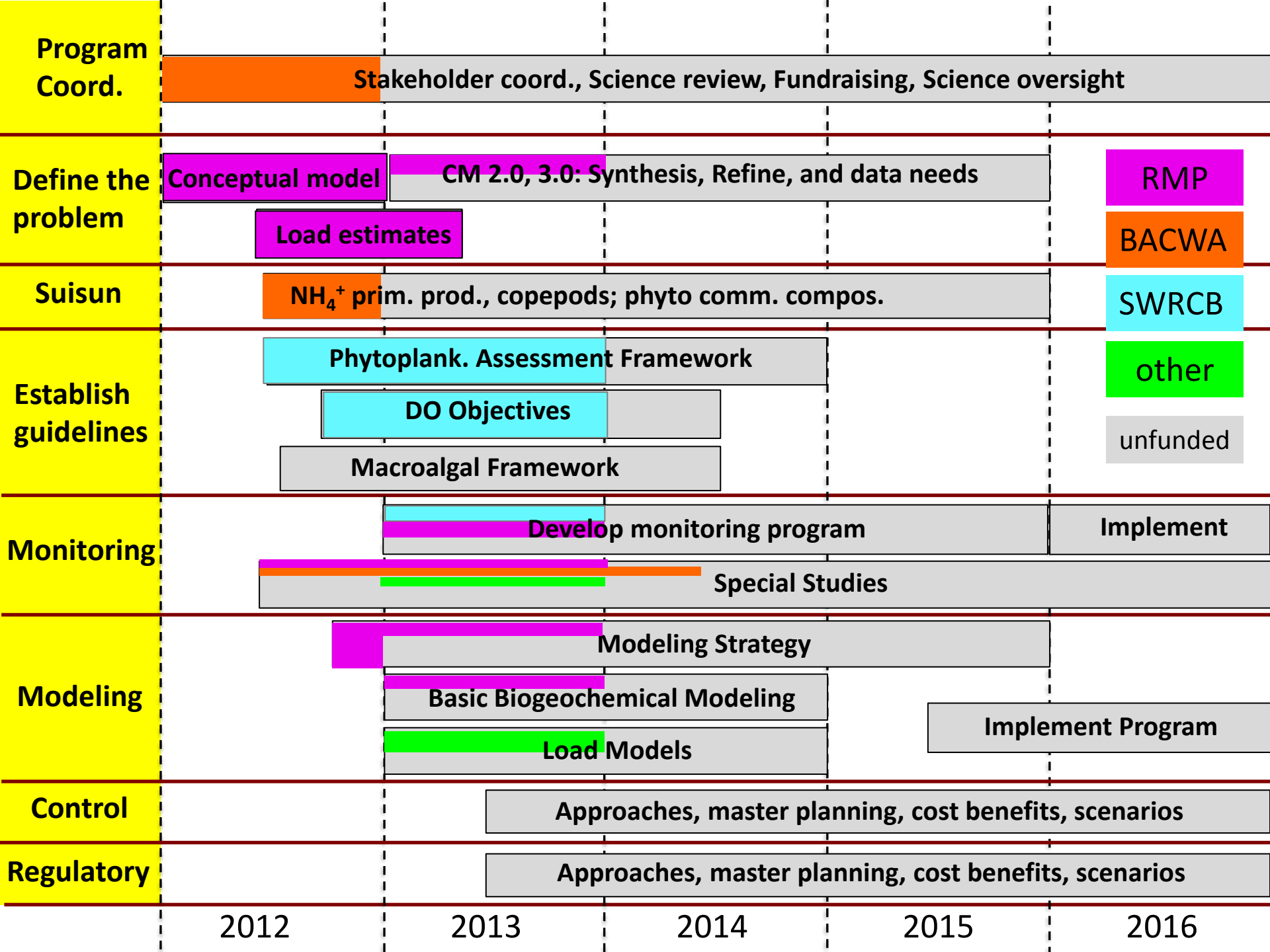
2016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BACWA
SWRCB
other
unfunded
2012
2013
2014
2015
2016

bayareanutrients.aquaticscience.org

Google

Nutrients in San Francisco Bay

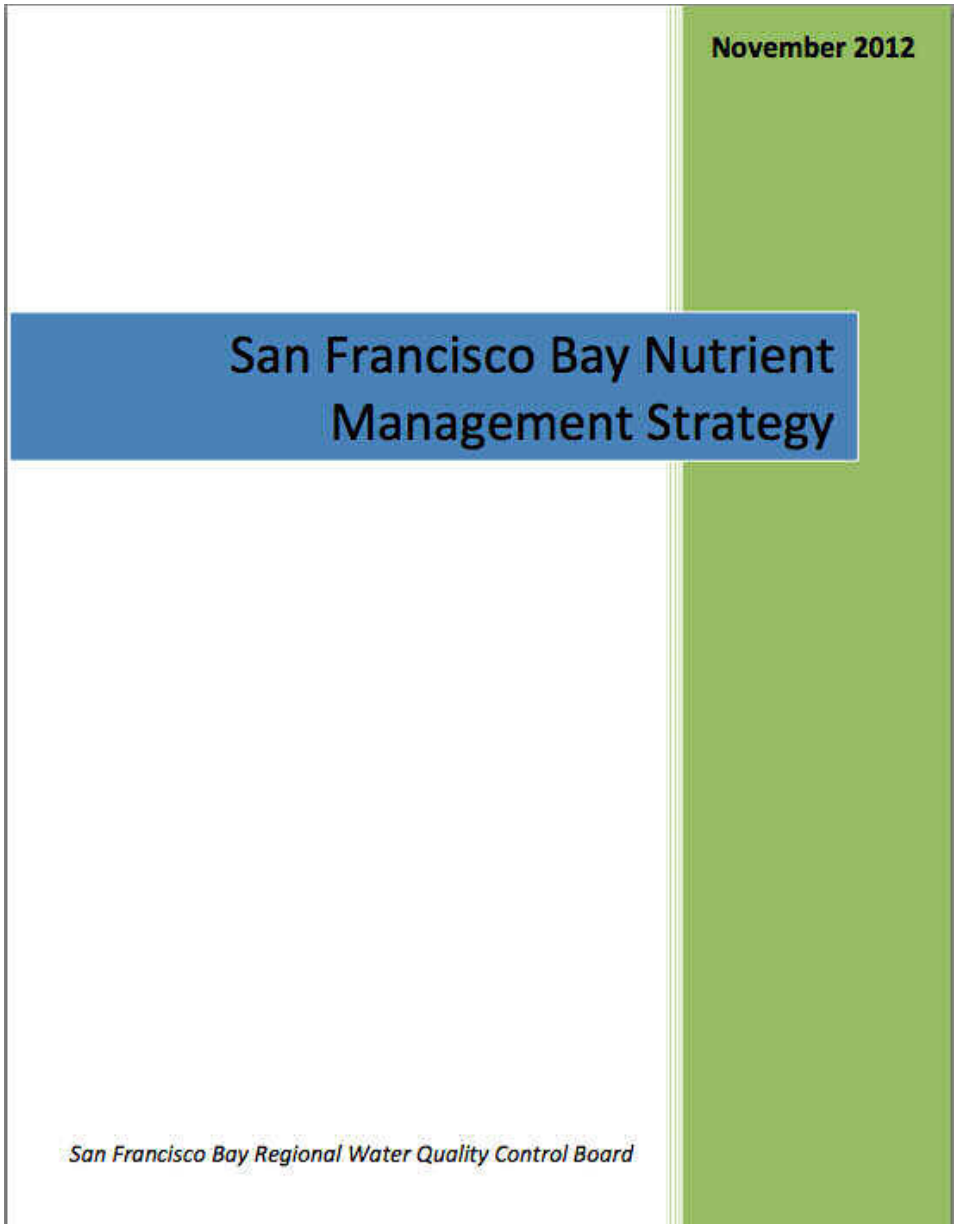
Home | Motivation | Initiative Goal | Partners | Projects | Project Documents | Events | Links | Bibliography

Research and Synthesis to Inform Nutrient Management in San Francisco Bay

The San Francisco Bay Nutrient Science and Management Strategy is a regional initiative for developing the science needed for informed decisions about managing nutrient loads and maintaining beneficial uses within the Bay. San Francisco Bay Nutrient Strategy partners include federal and state agencies, local governments, non-profit organizations, and academic institutions.

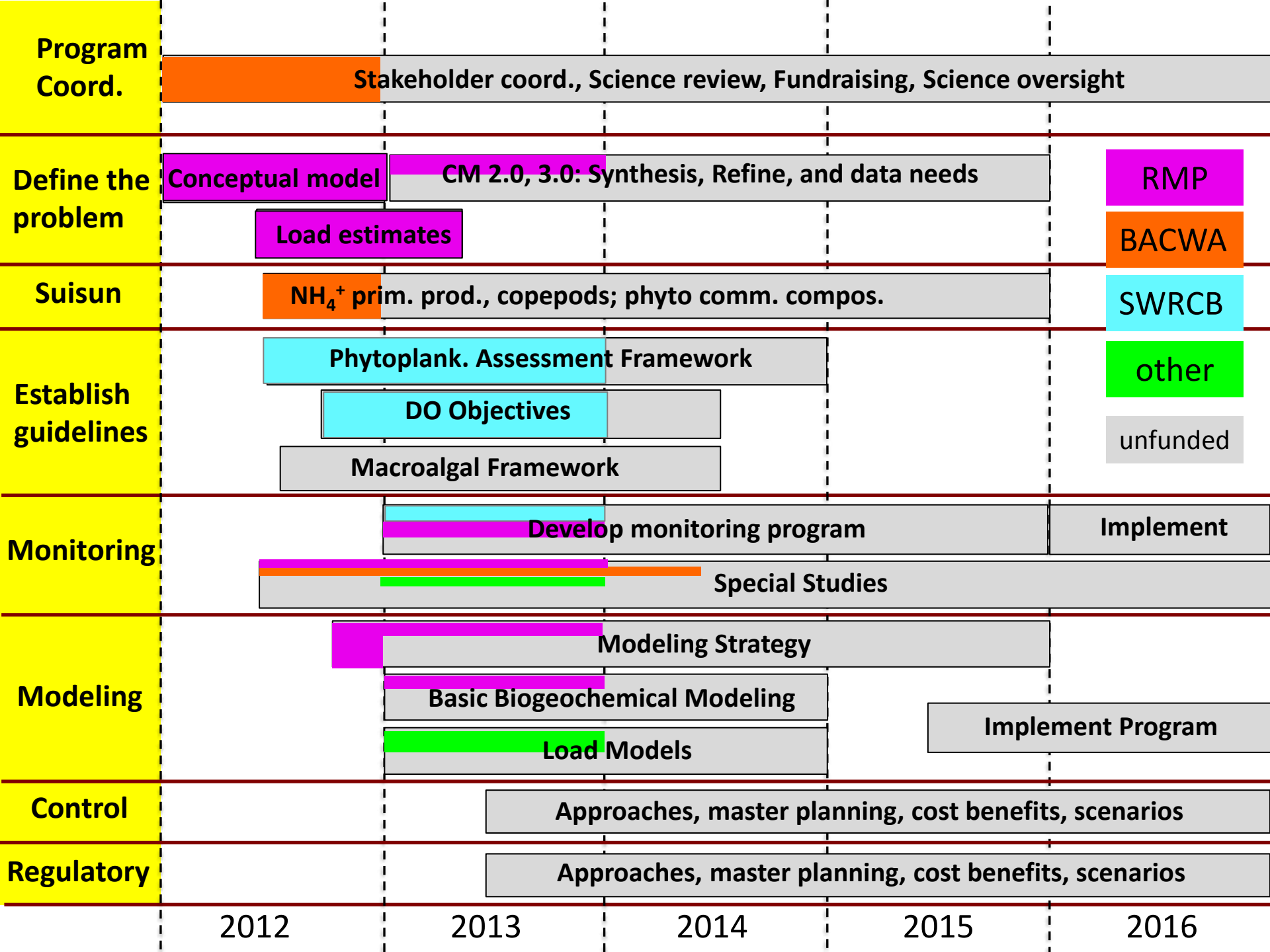
bayareanutrients.aquaticscience.org

Status of Nutrient Strategy



NEXT STEPS…

- Governance/decision-making structure
- Further prioritization…regulatory decisions and science needs
- Fine-tuning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other
unfunded
2012
2013
2014
2015
2016

Nutrient Loading Study

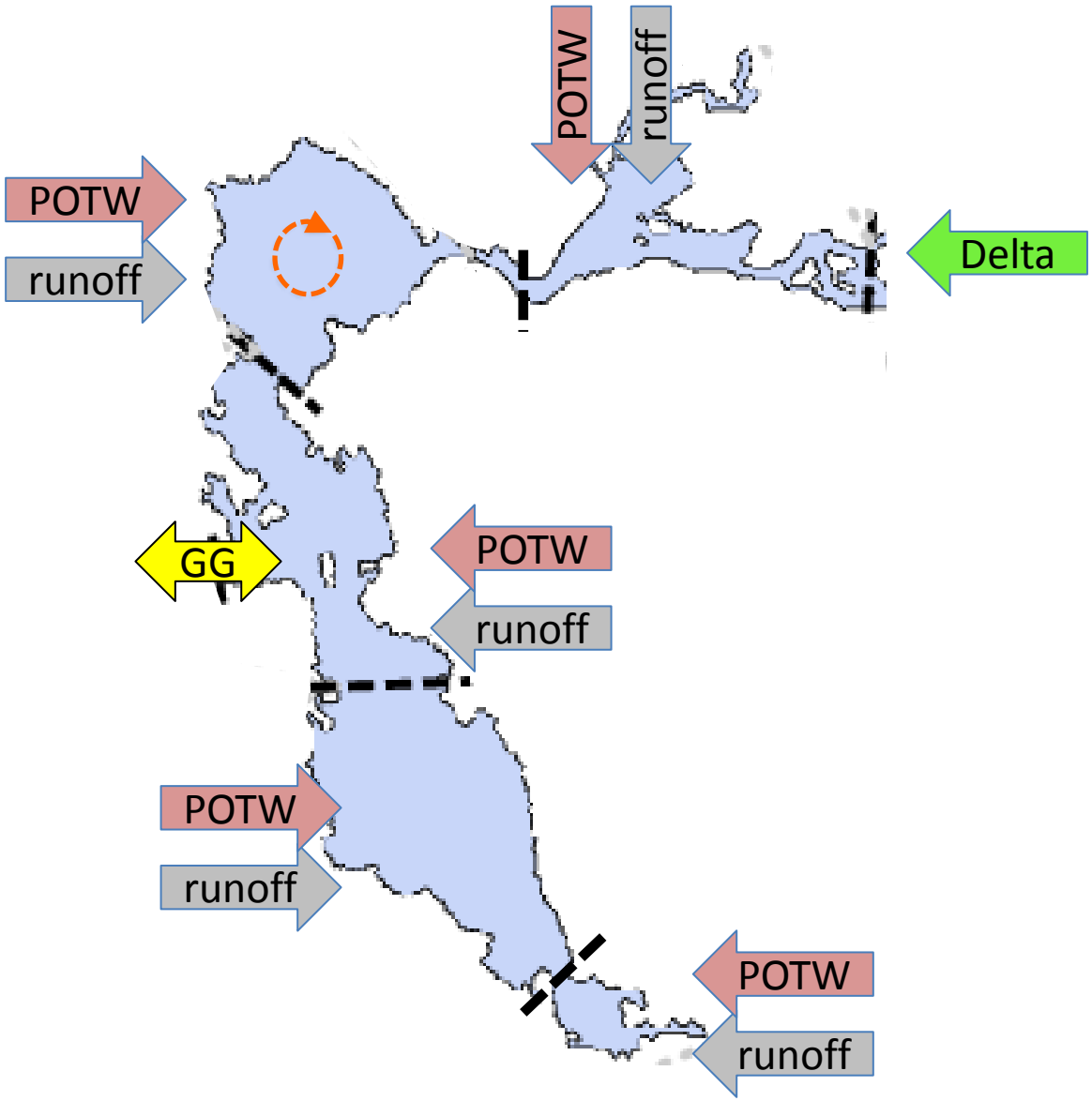
Goals:

- Quantify nutrient loads to SFB

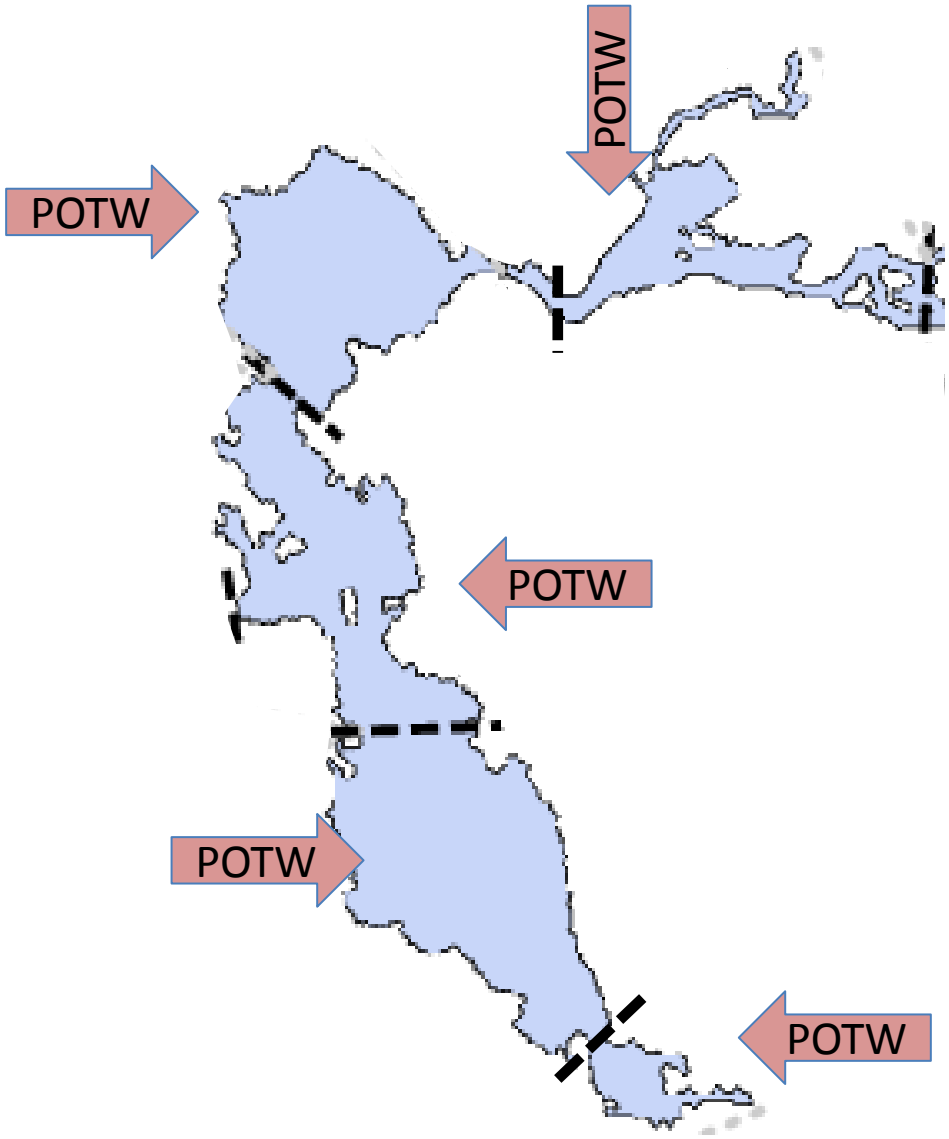
- Explore how relative importance of different sources varies spatially, seasonally and over time

- Identify major data gaps

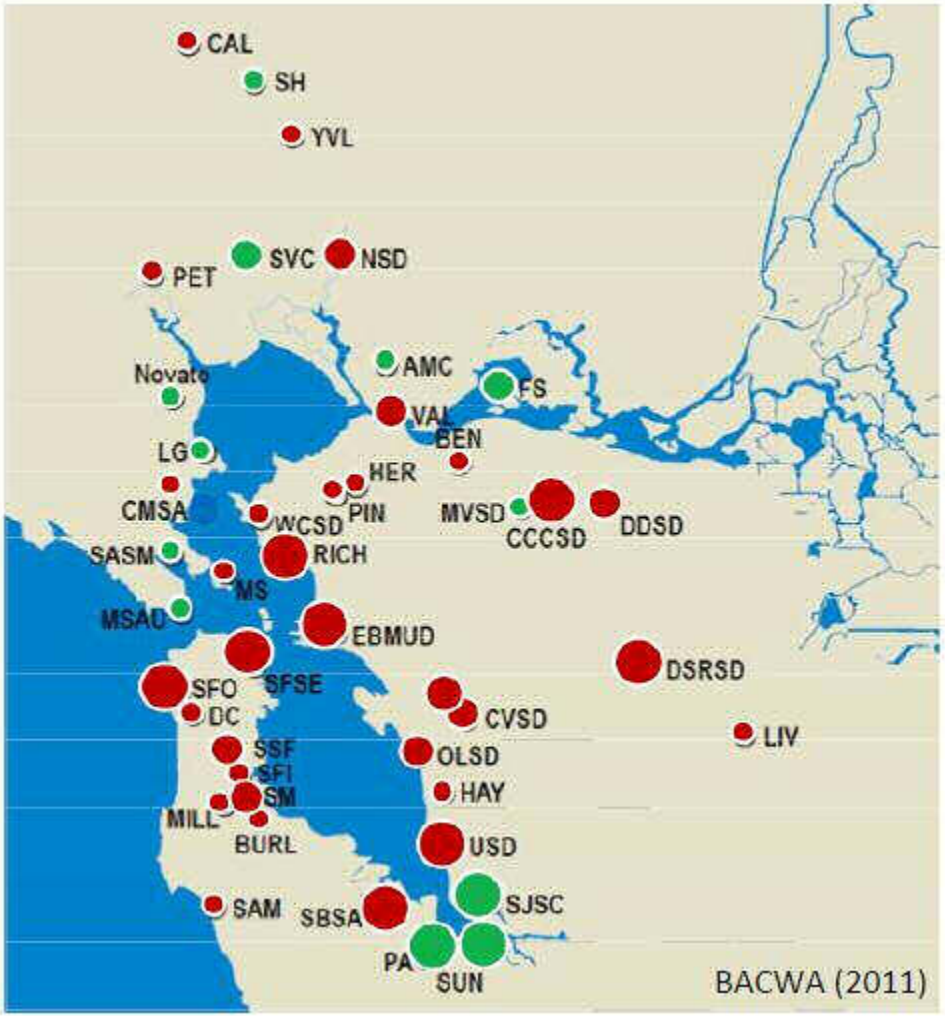
Sources Considered



POTW discharges



POTW discharges - approach



Flow (mgd)	Ammonia Removal	Secondary Treatment
>20	●	●
10-20	●	●
<10	●	●

Analysis

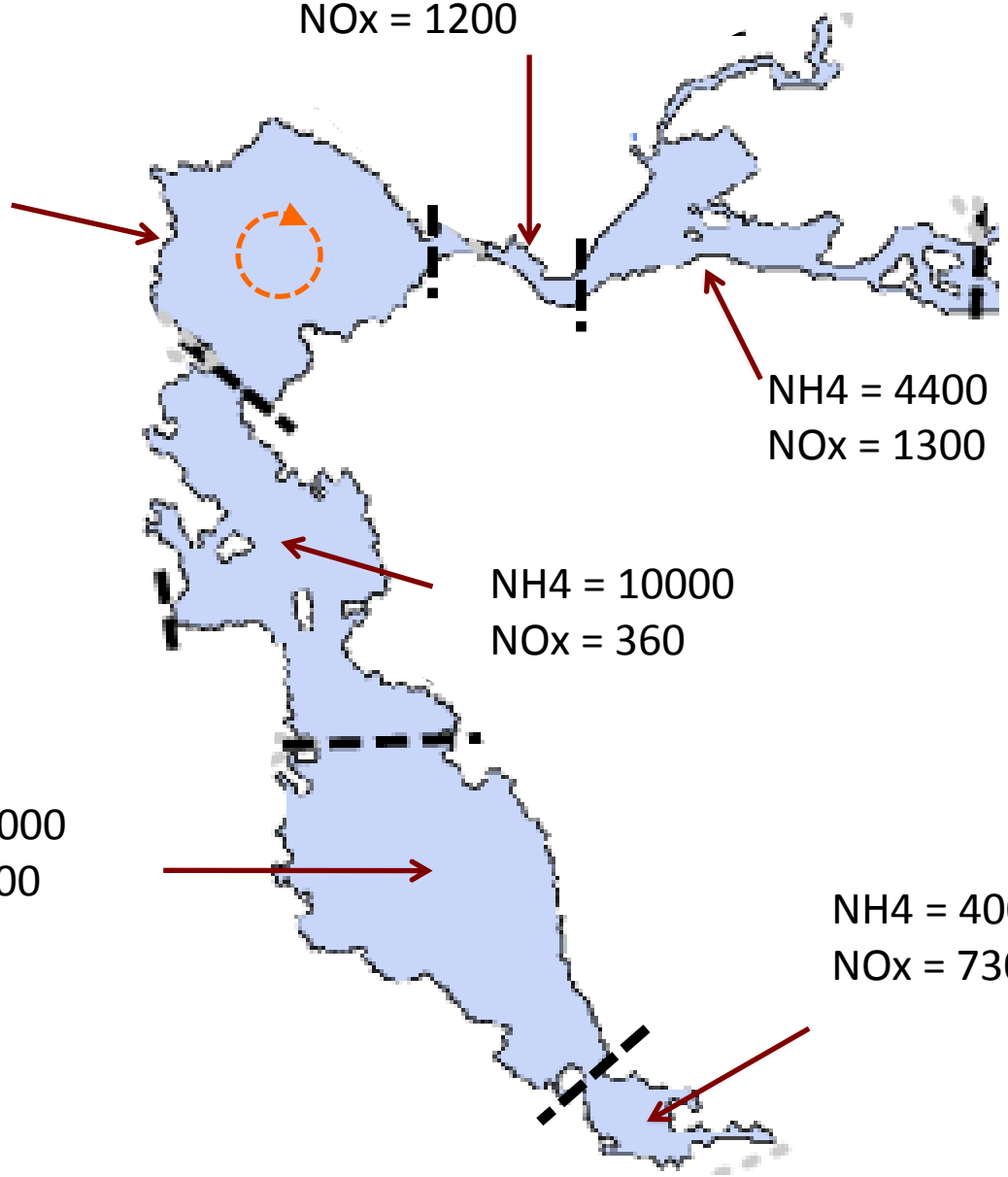
-Generate estimates for each POTW

-Variations between subembayments

-Seasonal variations

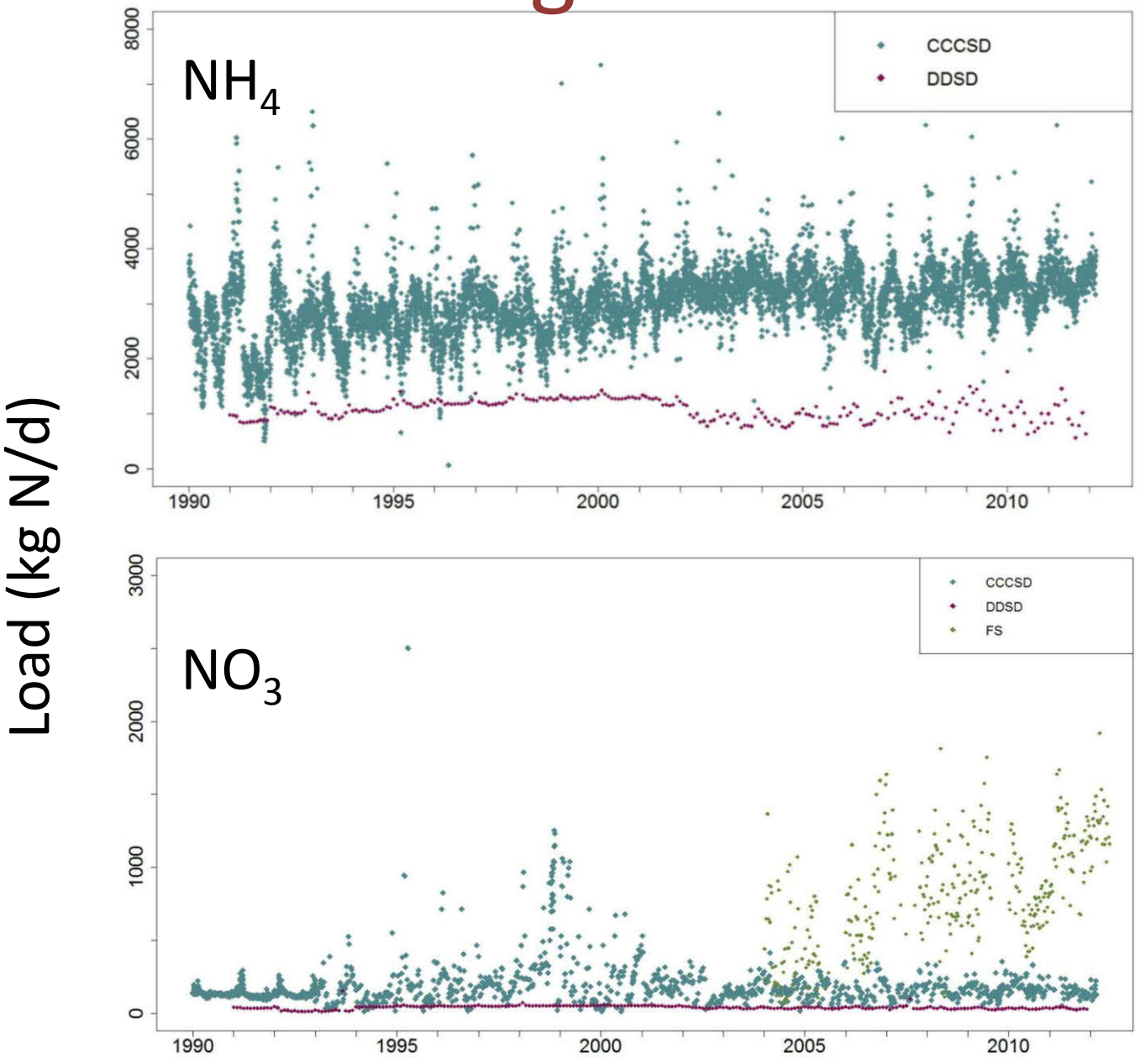
-Changes over time

POTW discharges – initial results



NH4 loads (kg/d)

POTW discharges – initial results



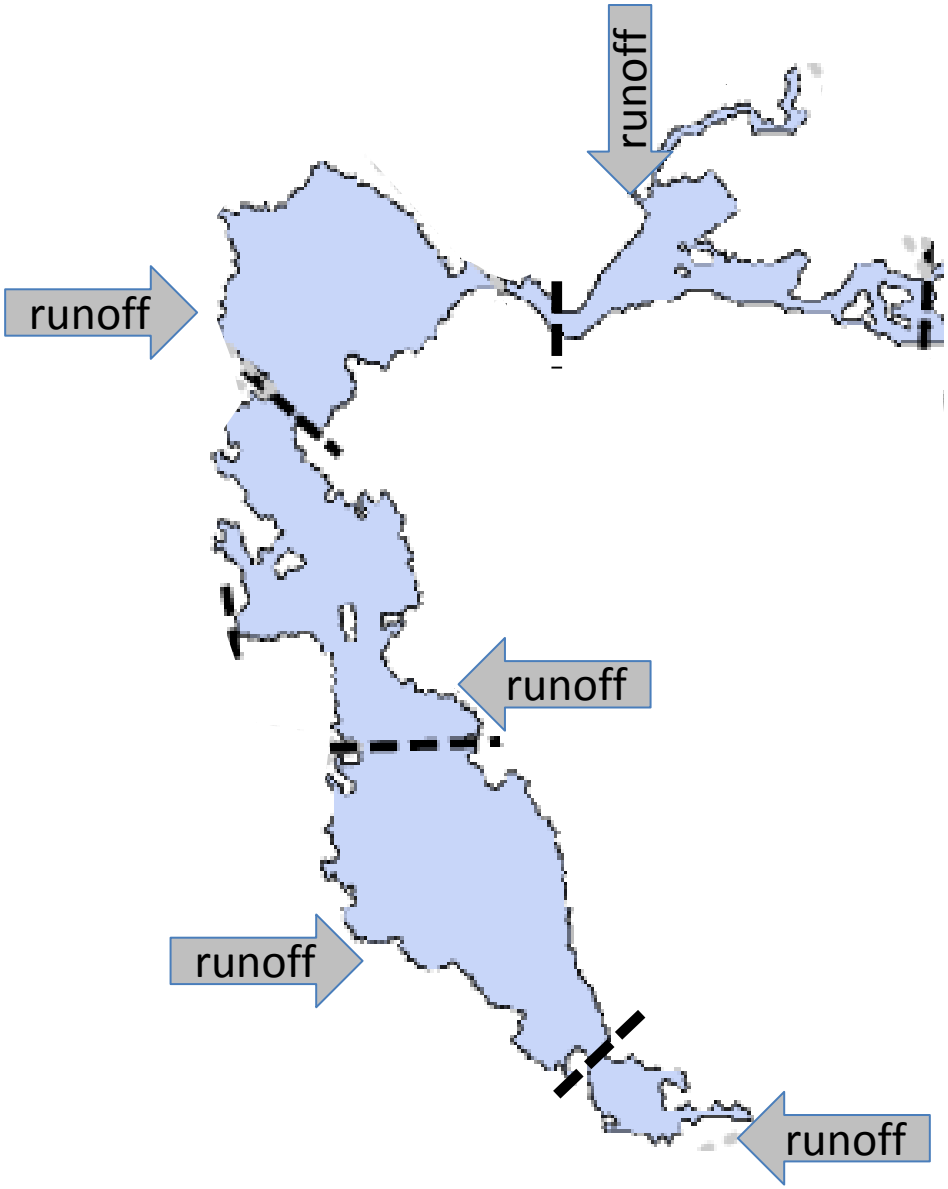
POTW discharges – next steps

- Incorporate Q3 and Q4 2012 data submitted per Water Code Section 13267 order

- Compare POTW loads between subembayments

- Identify locations and times of year where POTW loads are most significant

Stormwater loads

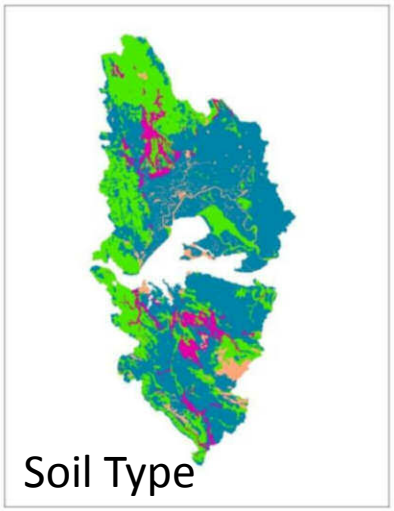


-Less constrained than POTW estimates

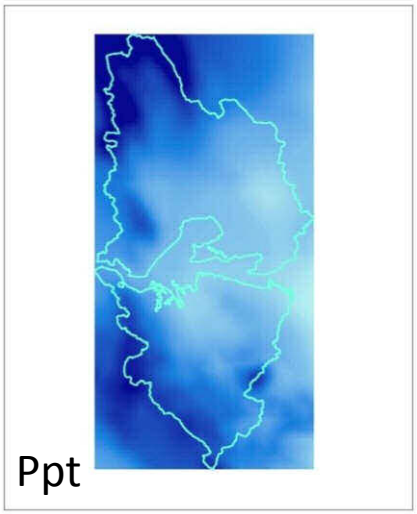
-Chose a rainfall-runoff model with fine spatial resolution

Stormwater loads- approach

Regional Watershed Spreadsheet Model

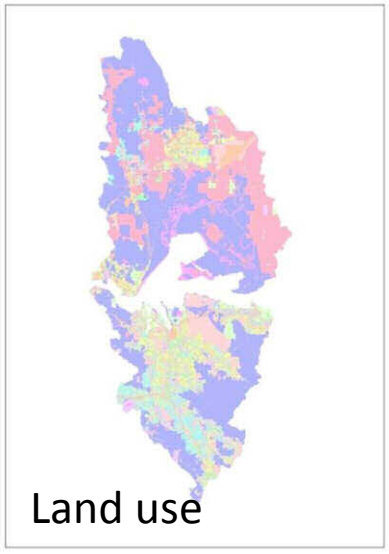


Soil Type

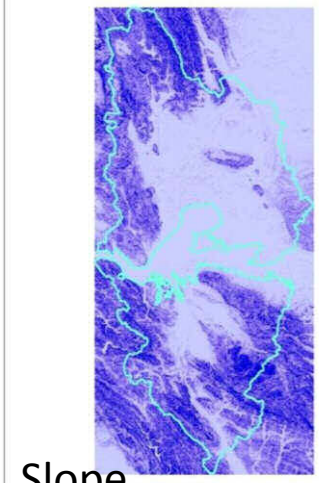


Ppt

+



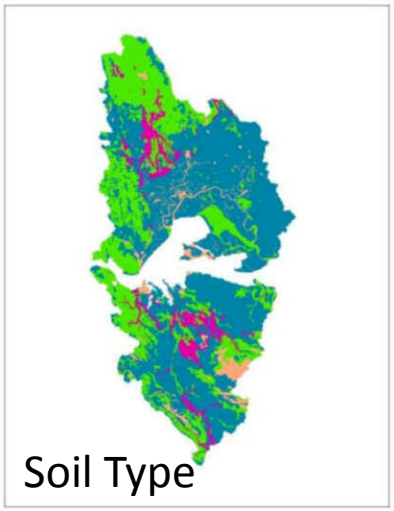
Land use

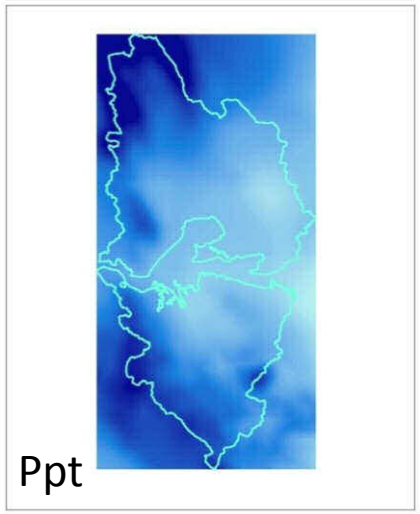


Slope

Stormwater loads- approach

Regional Watershed Spreadsheet Model





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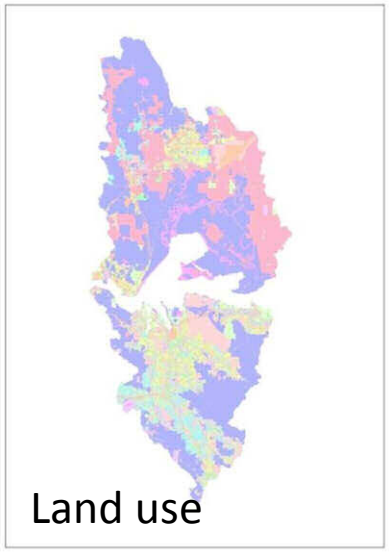

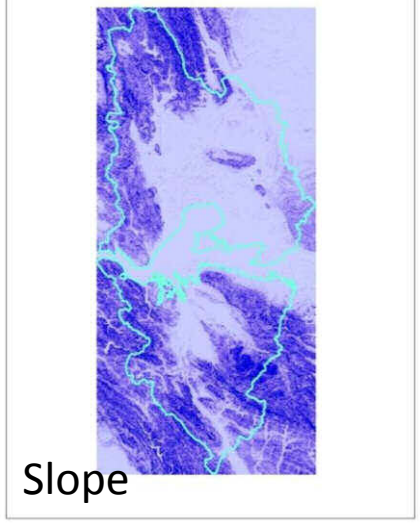

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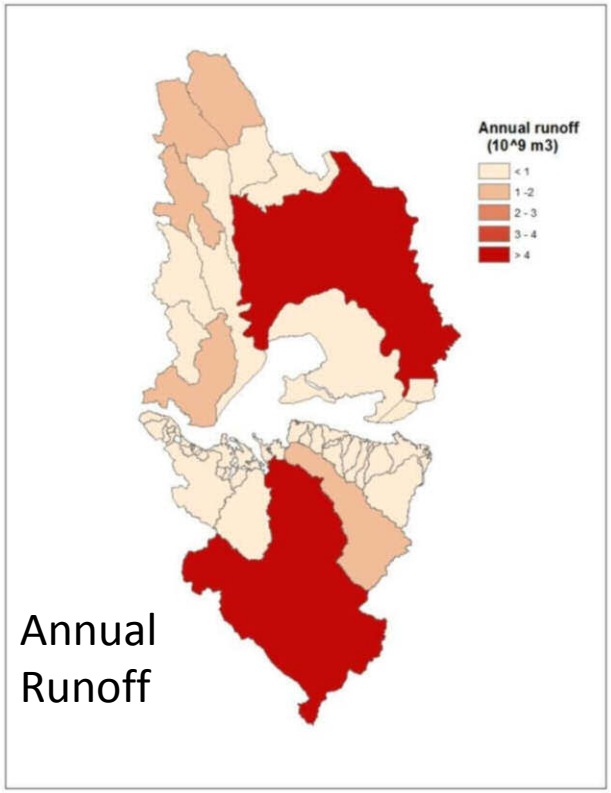
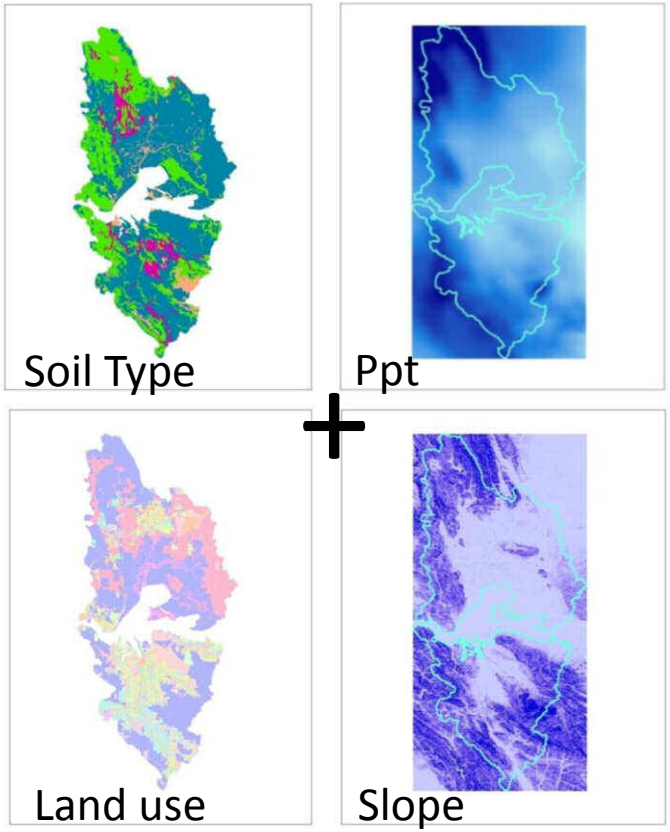
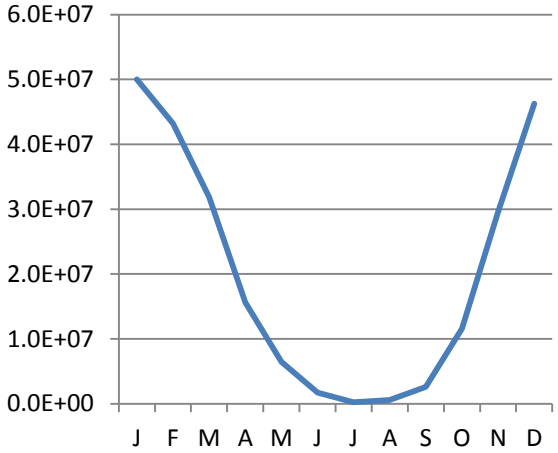


Stormwater loads- approach

Regional Watershed Spreadsheet Model



Stormwater loads- approach



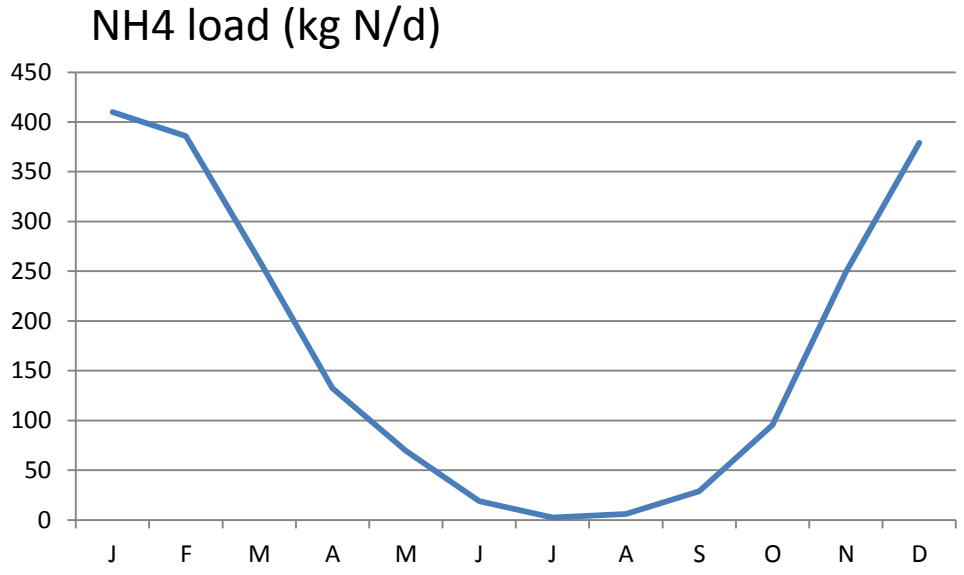
Runoff per month (m^3)

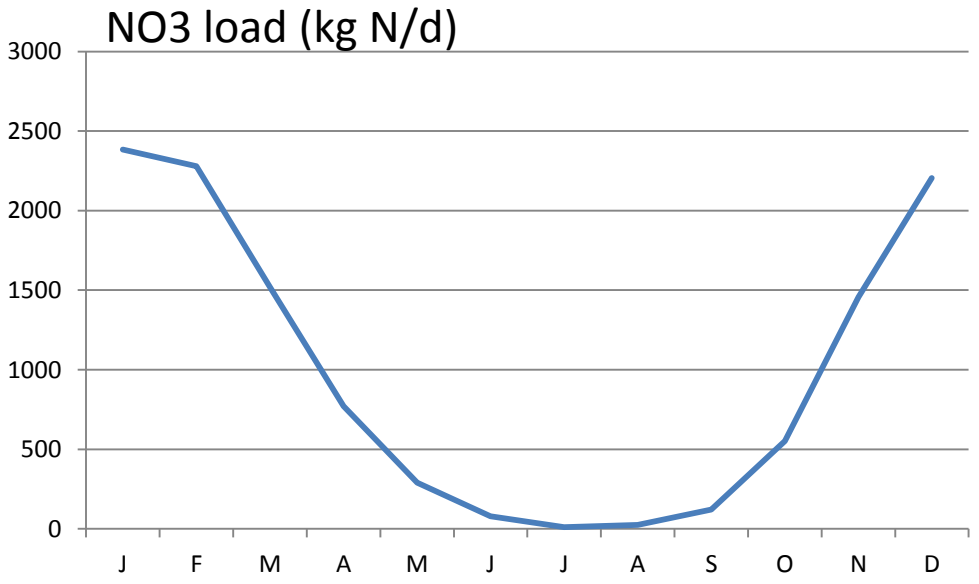
*

(mg/L)	Wet season avg.	Dry season avg.
NH4	0.25	0.33
NO3	1.01	0.949

McKee and Gluchowski (2011)

=





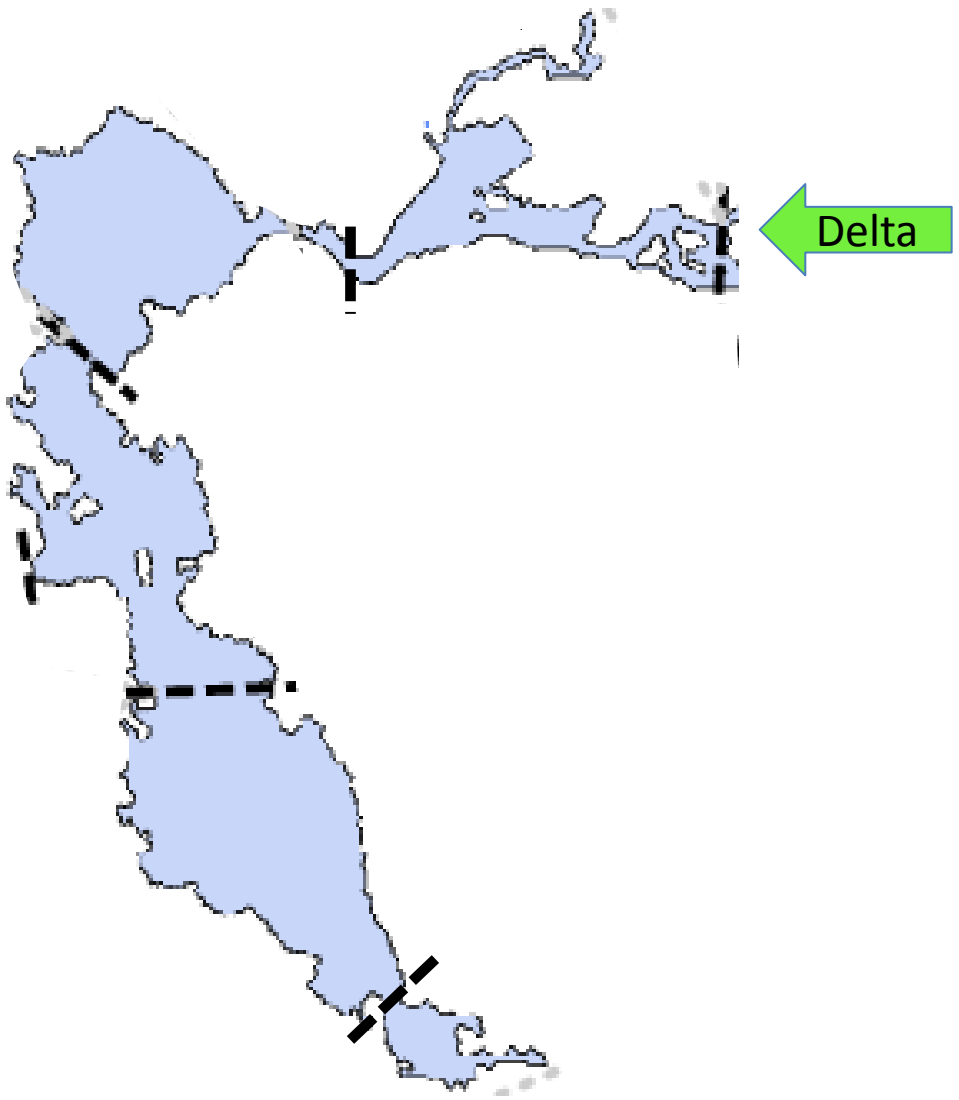
Stormwater loads – next steps

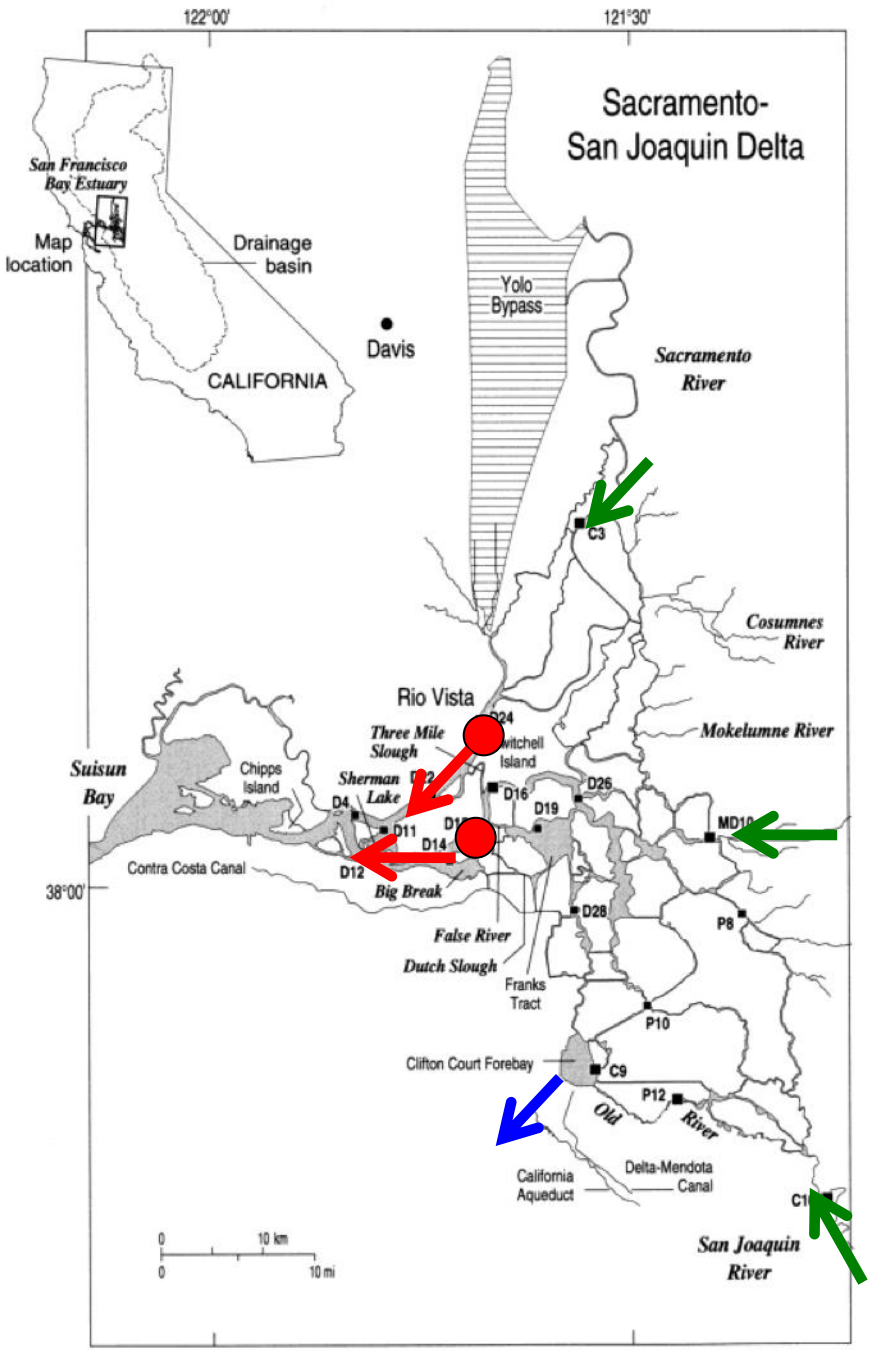
- Incorporate land-use specific concentrations from the literature into Regional Watershed Spreadsheet Model

- Characterize the relative importance of stormwater loads relative to other sources (by subembayment), and at what times of year they are most significant

- Explore other potential watershed models (i.e. SWMM), based on relative importance of stormwater loads

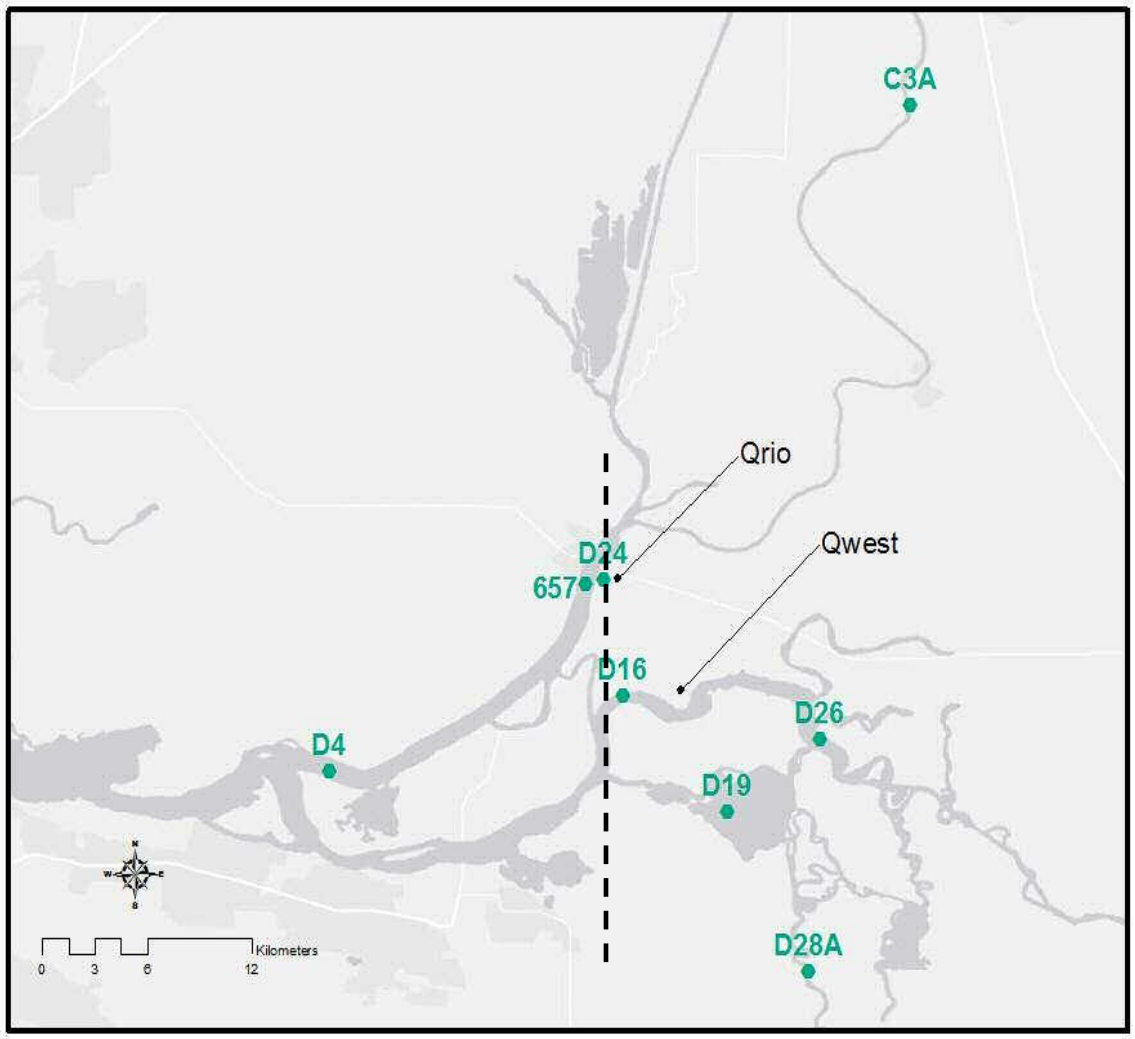
Delta efflux





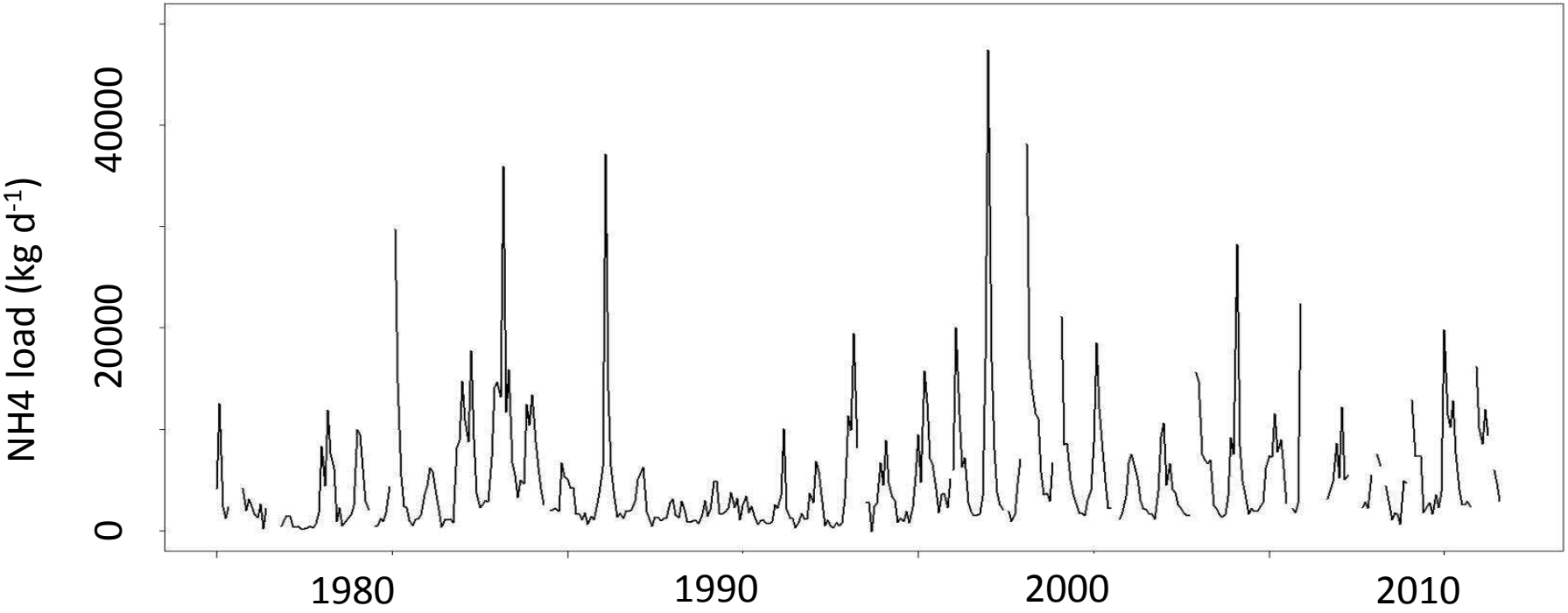
Jassby and Cloern 2000

Delta efflux - approach

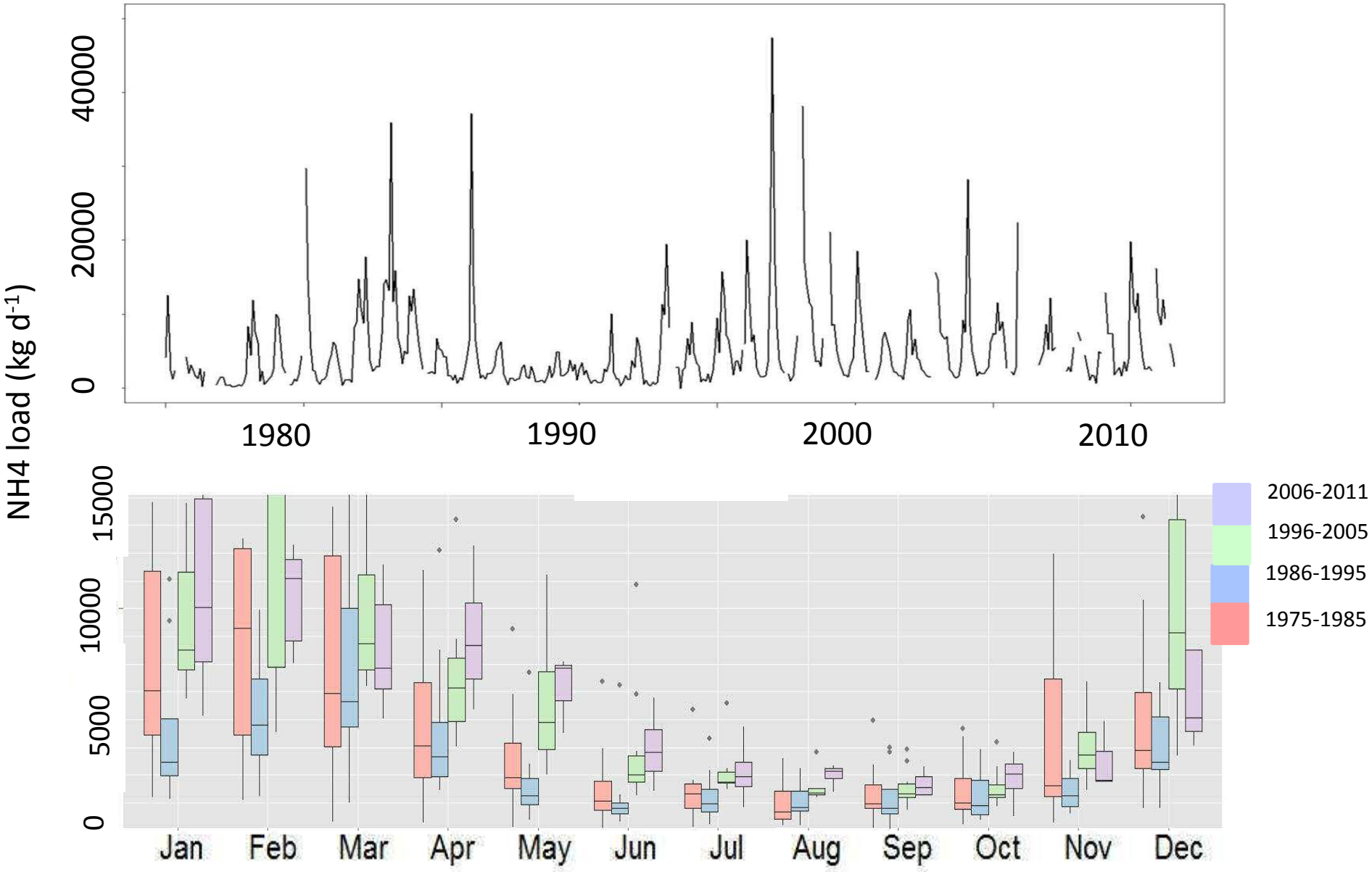


-After 1995, nearby stations substituted for D16 and D24

Delta efflux – initial results



Delta efflux – initial results

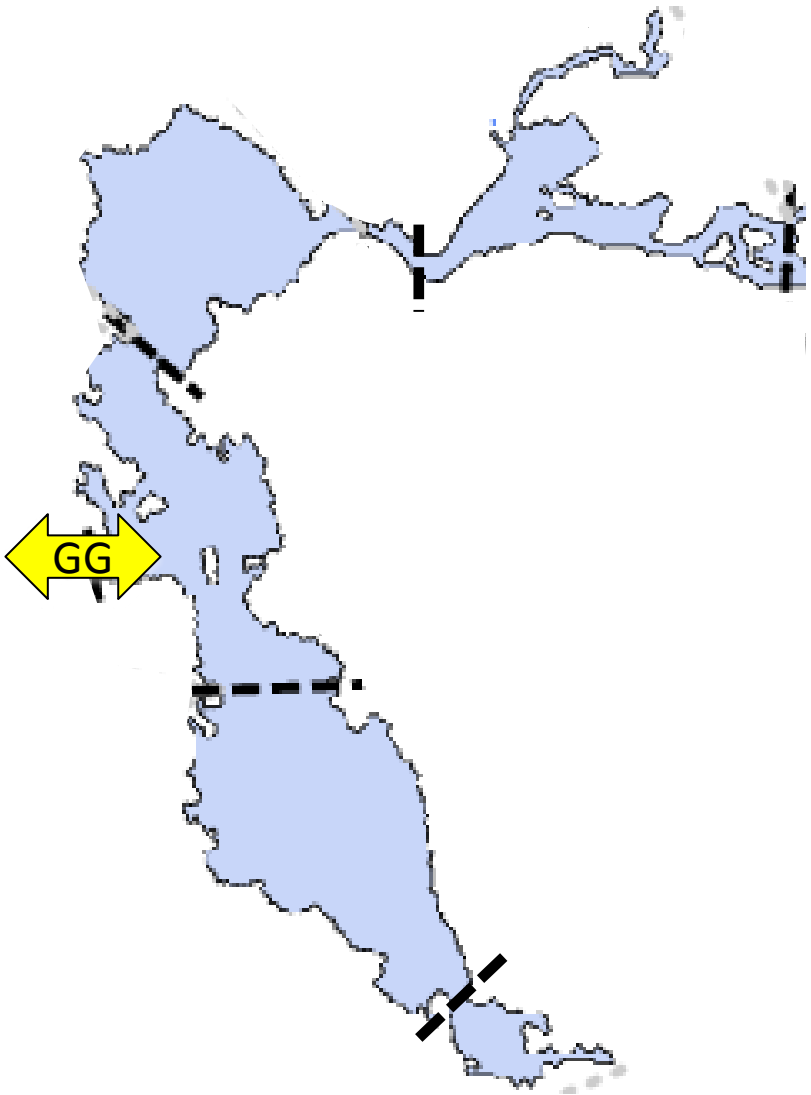


Delta efflux loads – next steps

- Evaluate uncertainty in load estimates

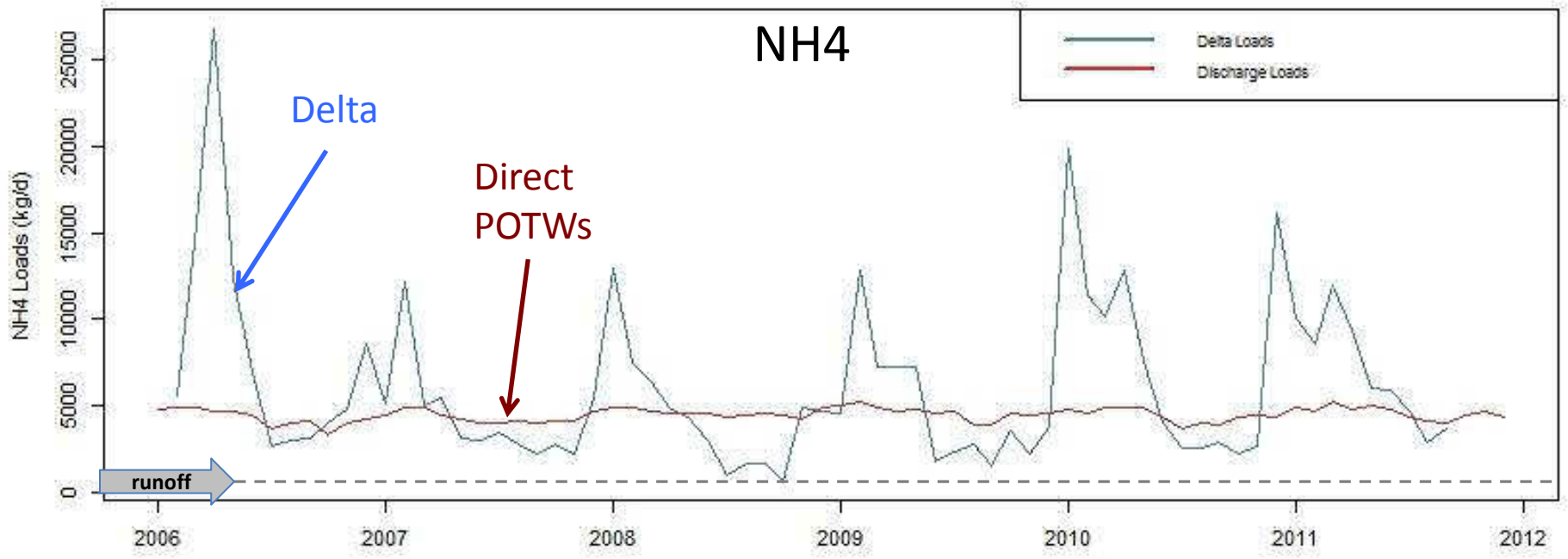
- Characterize role Delta plays in modulating nutrient loads to Suisun Bay (unlikely before deadline for this report)

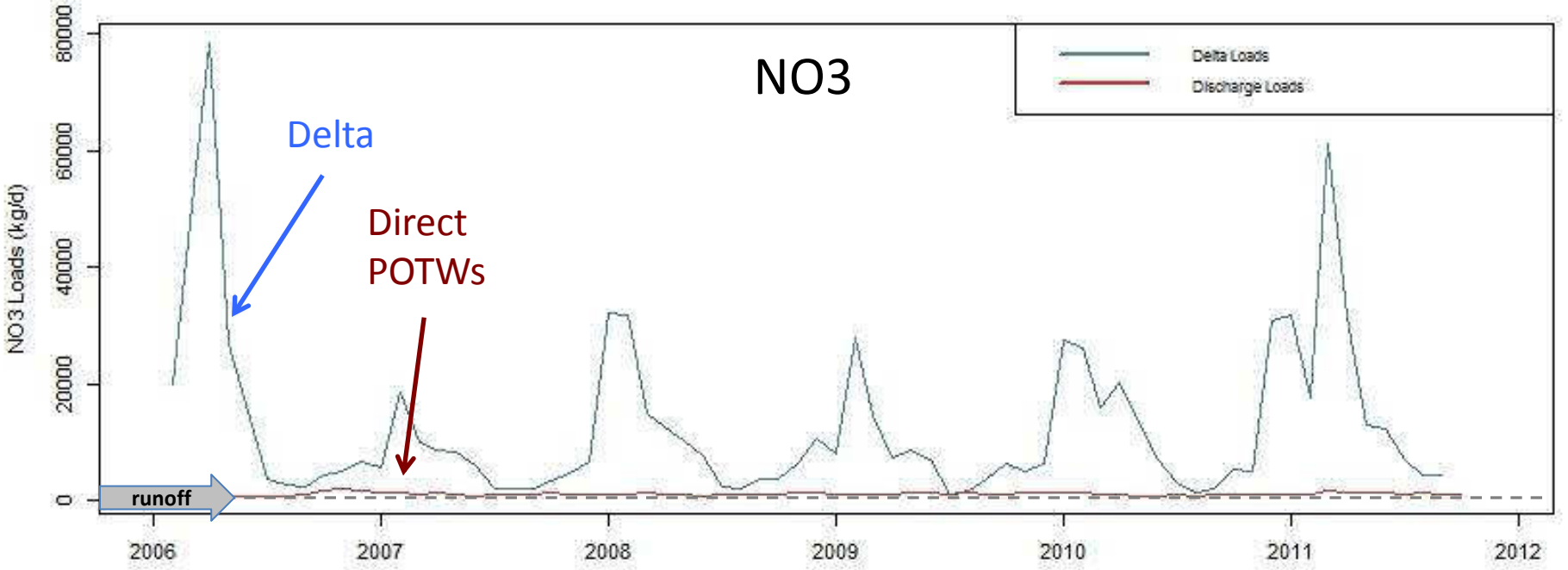
Sources Considered



Golden Gate Exchange - approach

- Seeking external funding for local experts (M. Stacey, J. Langier) to contribute a section on exchange across the Golden Gate

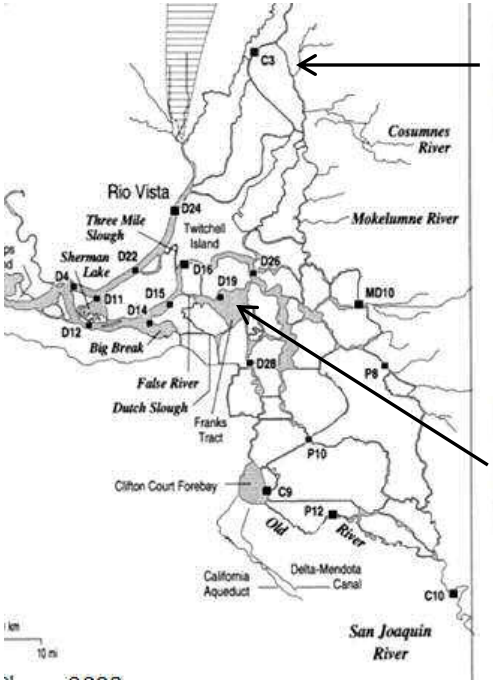

NH4
Delta Loads
Discharge Loads
Delta
Direct
POTWs
runoff
NH4 Loads (kg/d)
0
5000
10000
15000
20000
25000
2006
2007
2008
2009
2010
2011
2012

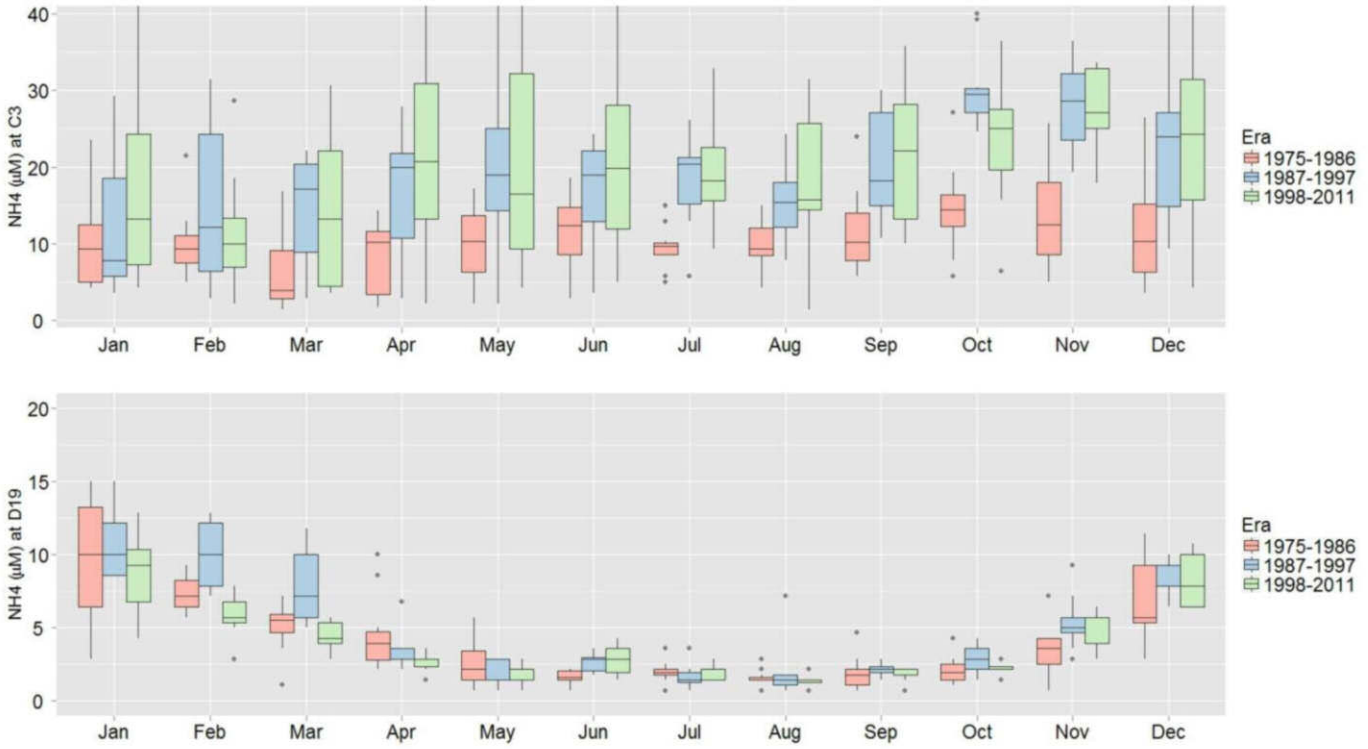

NO3
Delta Loads
Discharge Loads
Delta
Direct
POTWs
runoff
NO3 Loads (kg/d)
0
20000
40000
60000
80000
2006
2007
2008
2009
2010
2011
2012

Loading study – next steps

- Incorporate 13267 Data into POTW estimates
- Refine stormwater estimates and explore the need for additional modeling
- Characterize transformation processes in Delta in order to constrain efflux load estimates
- Characterize spatial, seasonal and temporal variation
- Draft report March 2013

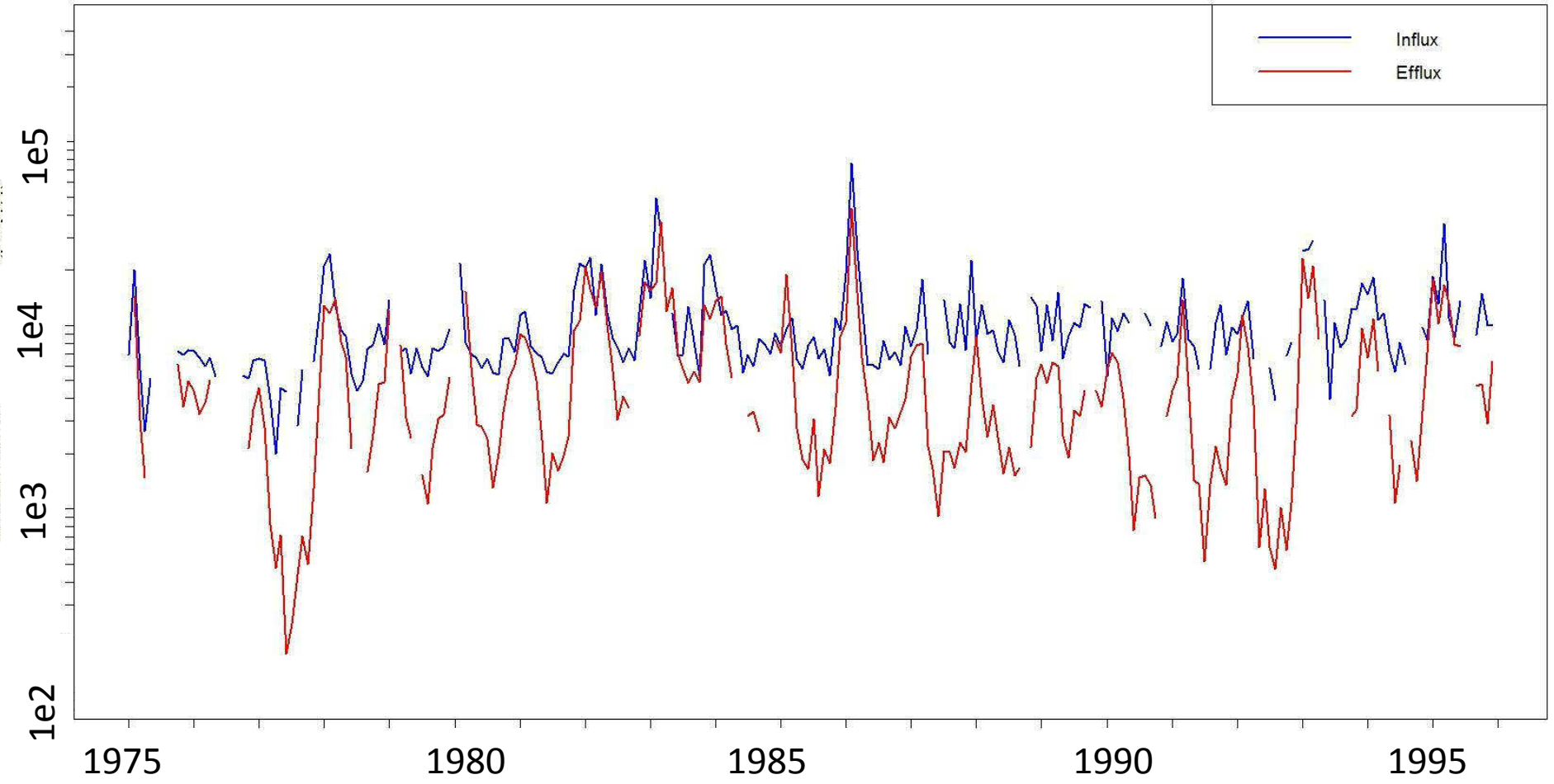
The role of the Delta



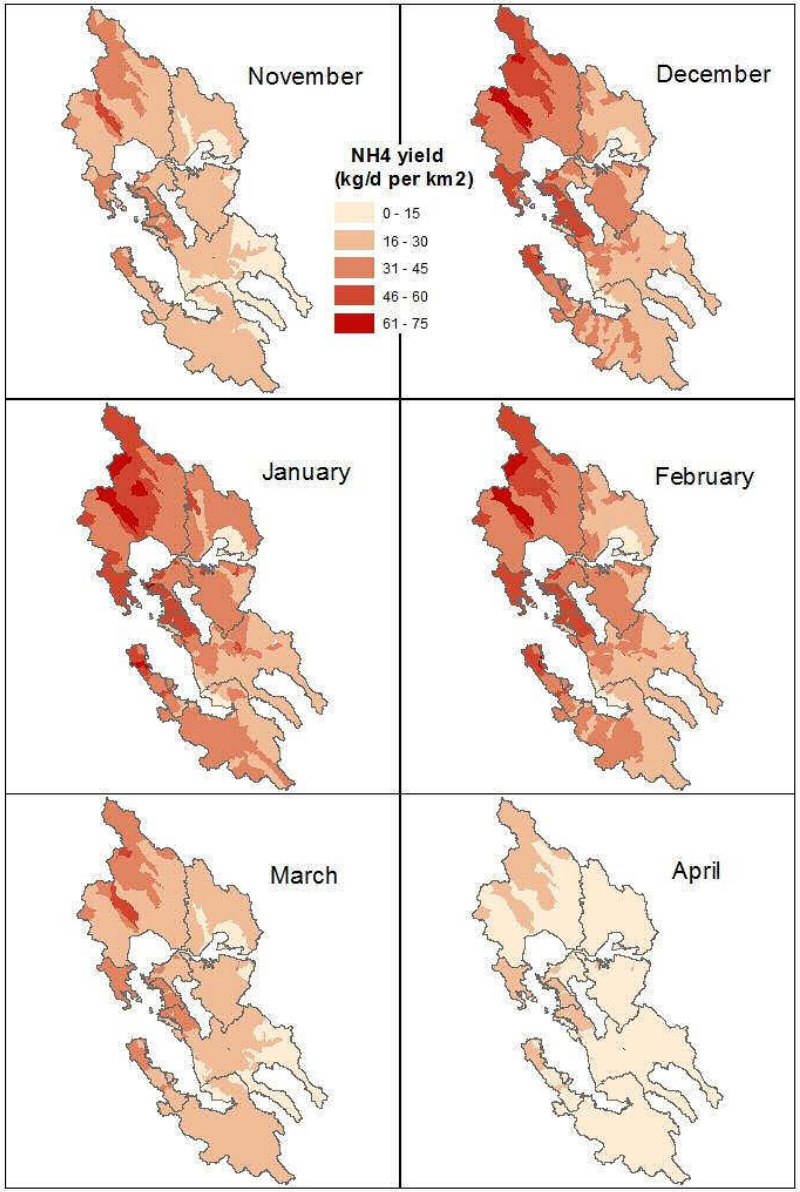


The role of the Delta

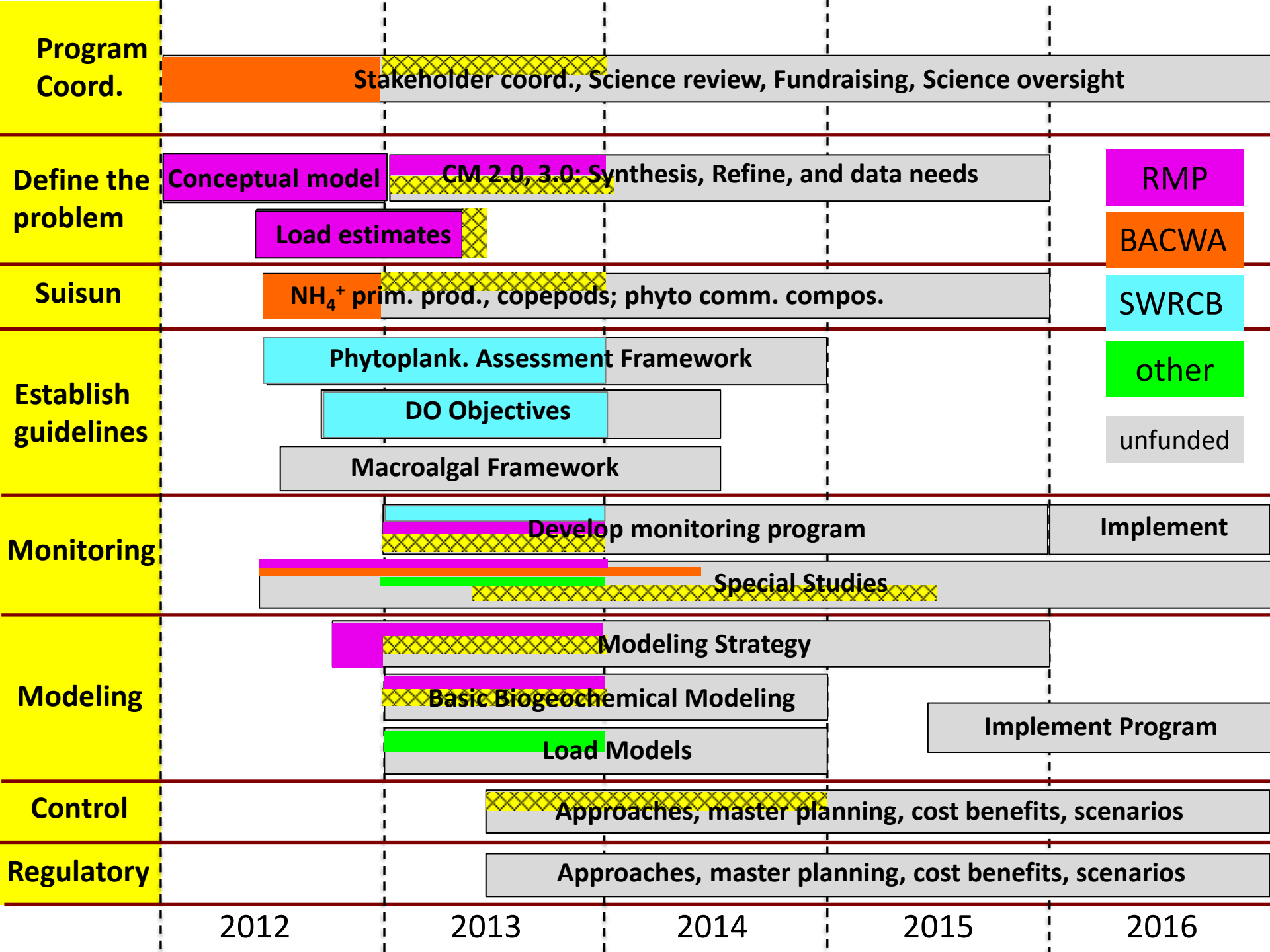
Daily Delta NH4 loads (kg N/d)



Stormwater loads- initial results



- Important drivers of runoff volume?
- Land-use specific concentrations?
- Event-specific rainfall data?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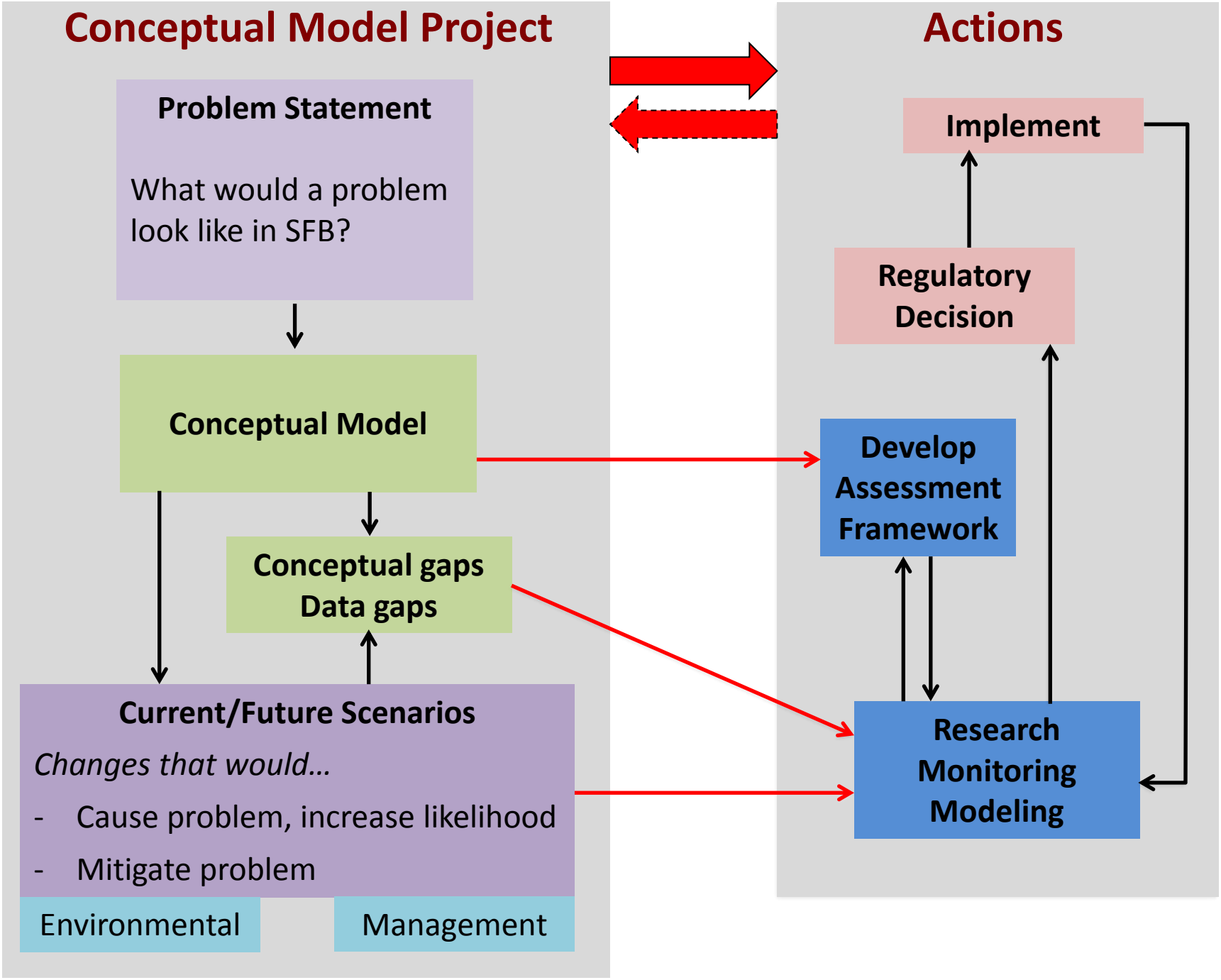
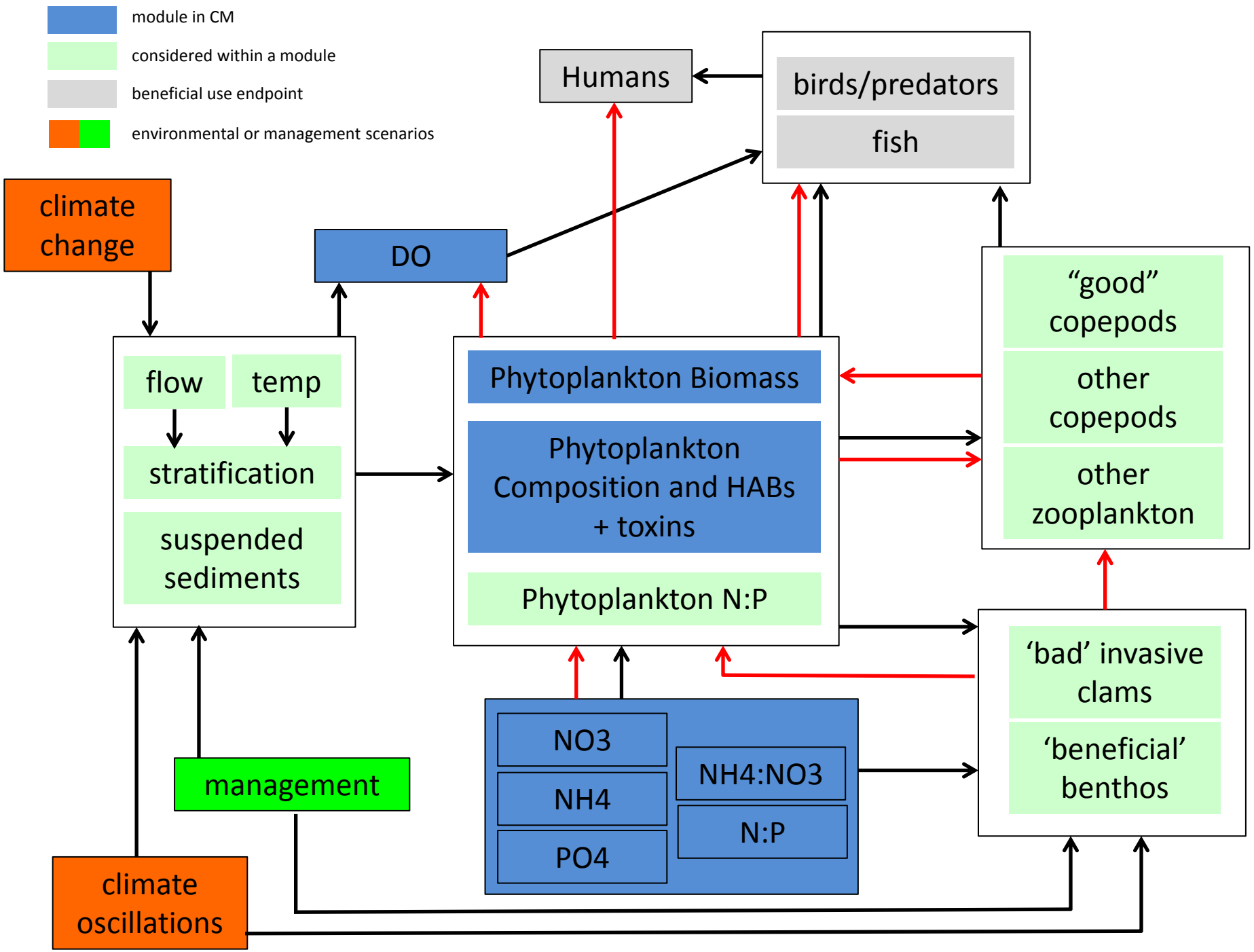
RMP Nutrients – 2012-2013

- Convene Nutrient Workgroup
- Conceptual model
- Monitoring program development
- ✔ Loading study
- Synthesis (CM 2.0)
- Modeling program development
- Stormwater nutrients


Conceptual Model Project
Actions
Problem Statement
What would a problem look like in SFB?
Conceptual Model
Conceptual gaps
Data gaps
Current/Future Scenarios
Changes that would…
- Cause problem, increase likelihood
- Mitigate problem
Environmental
Management
Implement
Regulatory Decision
Develop Assessment Framework
Research
Monitoring
Modeling


module in CM
considered within a module
beneficial use endpoint
environmental or management scenarios
Humans
birds/predators
fish
climate change
DO
"good" copepods
other copepods
other zooplankton
flow
temp
stratification
suspended sediments
Phytoplankton Biomass
Phytoplankton Composition and HABs + toxins
Phytoplankton N:P
'bad' invasive clams
'beneficial' benthos
NO3
NH4
PO4
NH4:NO3
N:P
management
climate oscillations

Approach

- Collaborative approach with team of regional experts
  - J Cloern — USGS
  - M Connor — EBDA
  - D Dugdale — SFSU-RTC
  - T Hollibaugh — U Georgia
  - W Kimmerer — SFSU-RTC
  - L Lucas — USGS
  - R Kudela — UC Santa Cruz
  - A Mueller-Solger — IEP
  - M Stacey — UC Berkeley

- Meetings: May 7-8 2012, Sep 14 2012, January/February 2013

- Schedule
  - Full Draft — Jan/Feb 2013 *(Dec 2012)*
  - Nutrient Workgroup Draft — Mar 2013 *(Dec 2012)*
  - *Final Draft* — May 2013

Suisun Bay: evaluating potential impacts of nutrients and NH_4^+

Synthesis I:

- NH4 and primary production
- NH4 and copepods
- Ambient NH4 – sources, fate

→ Workshop: Primary production → Recommendations

→ Peer Review: Copepods → Recommendations

Synthesis II

- N:P, NH4:NO3 on phytoplankton community composition
- 'Ecological stoichiometry'

→ Workshop → Recommendations

Synthesis III

- Overview: multiple stressors

→ Workshop → Recommendations

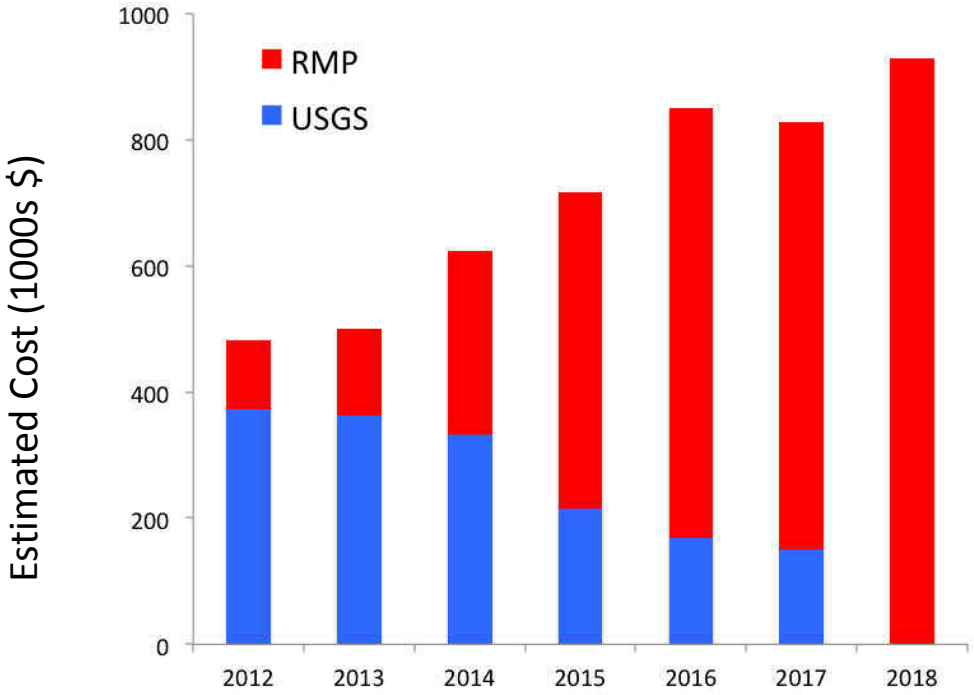
Monitoring Program Development - 2013

- Monitoring Program Planning and Special Studies :
  - Planning: transition, institutions, costs, funding
  - Moored sensor pilot study: Dumbarton
  - Develop algal toxin measurement approaches

SWRCB

RMP | USGS

RMP



J Cloern, pers. comm.

Major Questions Related to Monitoring Program

Scientific

- Parameters to be measured, most efficient approaches?

- What spatial/temporal frequency?

- What combination of approaches is needed
    - ship-based, moored sensors, others

Institutional

- Approx. cost for running the program?

- What institutional agreements need to be established?
    - e.g., continued partnering with USGS, IEP

- Transition timeline?

Monitoring Program Development I

Objective: Develop a transition plan for Monitoring Program migration from USGS to RMP

Approach:

- Convene advisory team or WorkGroup
- Historic data and future measurements – what/where/when/how
- Investigate costs, infrastructure, logistics for various scenarios
- Identify institutional agreements, timelines, constraints

-*Product:* Technical Report on migration plan

Moored Sensor Study

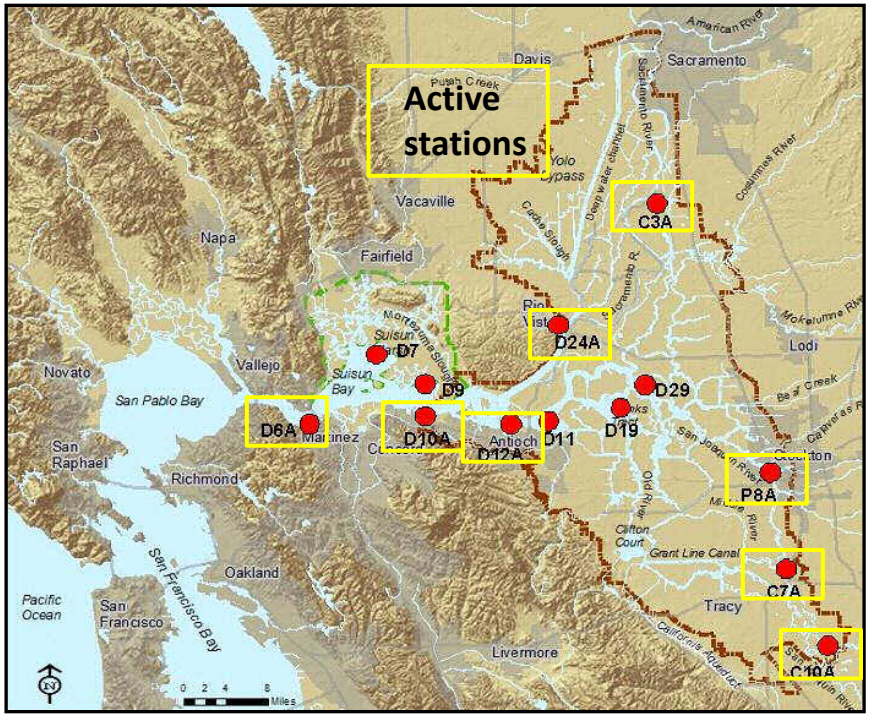
Original proposal (and still Plan A):

- Deploy a moored sensor system at Dumbarton Bridge to measure (SpC, T, DO, chl-a, turbidity, NO3)
- On schedule…
  - Consider options, purchase in January/February
  - Deploy in April at Redwood dock, test, calibrate
  - Deploy at Dumbarton – June 2013

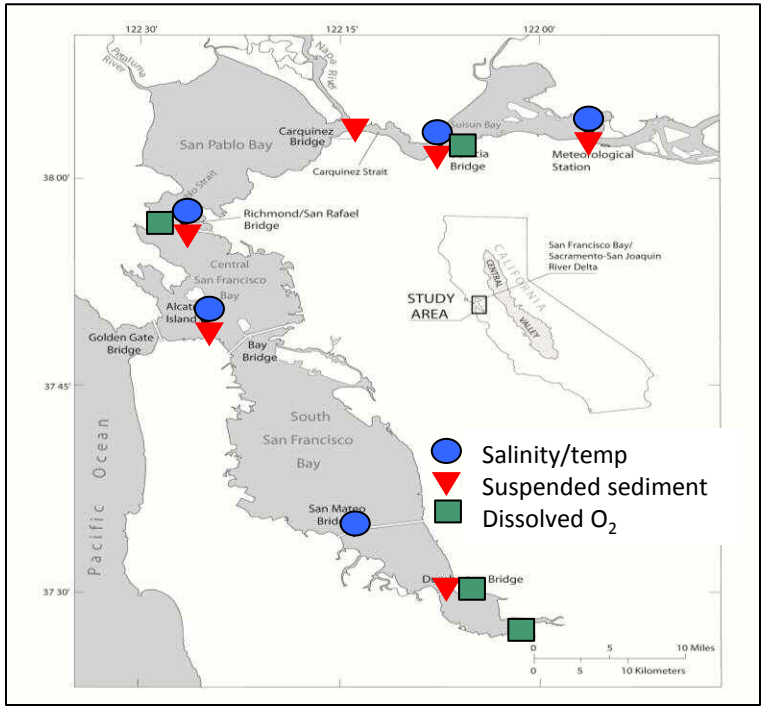
Nagging Question (…Plan B):

- Would we learn more (long-term planning, science) at Dumbarton alone, or by collaborating with other efforts?
  - add fewer sensors at Dumbarton
  - Use remaining funds to add sensors to existing moored stations

Moored Sensor Study



DWR-IEP Continuous water quality monitoring



USGS Continuous water quality monitoring

Algal biotoxins monitoring

(R Kudela, UCSC)

Objective:

- Characterize the distribution of algal biotoxins in SF Bay
- Calibrate sampler for quantification of ambient concentrations
- Develop approach for use in monitoring program

Schedule: To begin in January 2013

-*Product:* Technical report

Nutrient Workgroup

- Convene in March/April 2013 ?

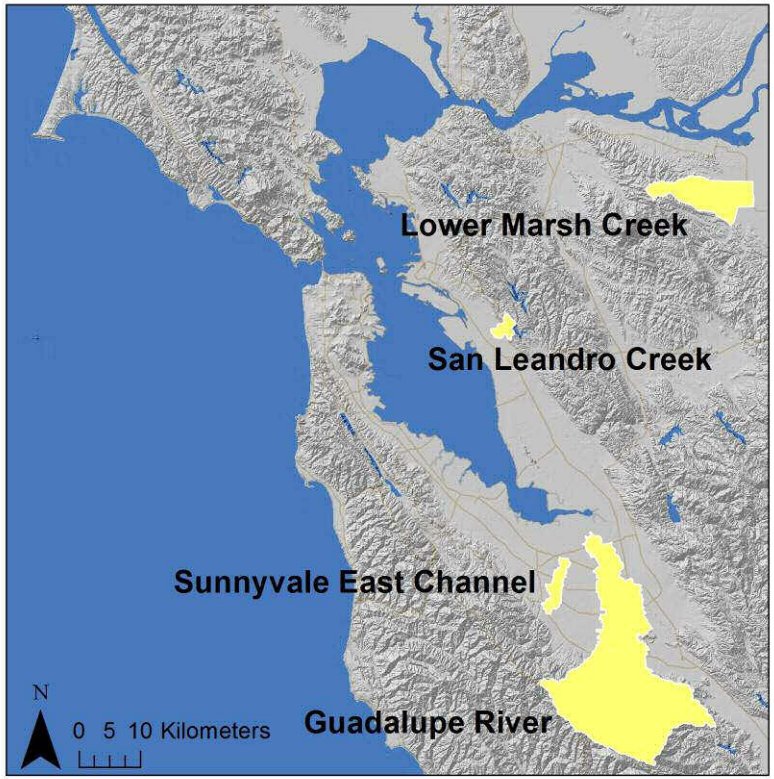
- Issues to address
  - Conceptual Model findings
  - Loading study
  - Monitoring program planning
  - Modeling program

- Who?

Stormwater nutrient monitoring, 6 watersheds – 2012/2013

Objective:

- Characterize nutrient concentrations and quantify loads in diverse watersheds



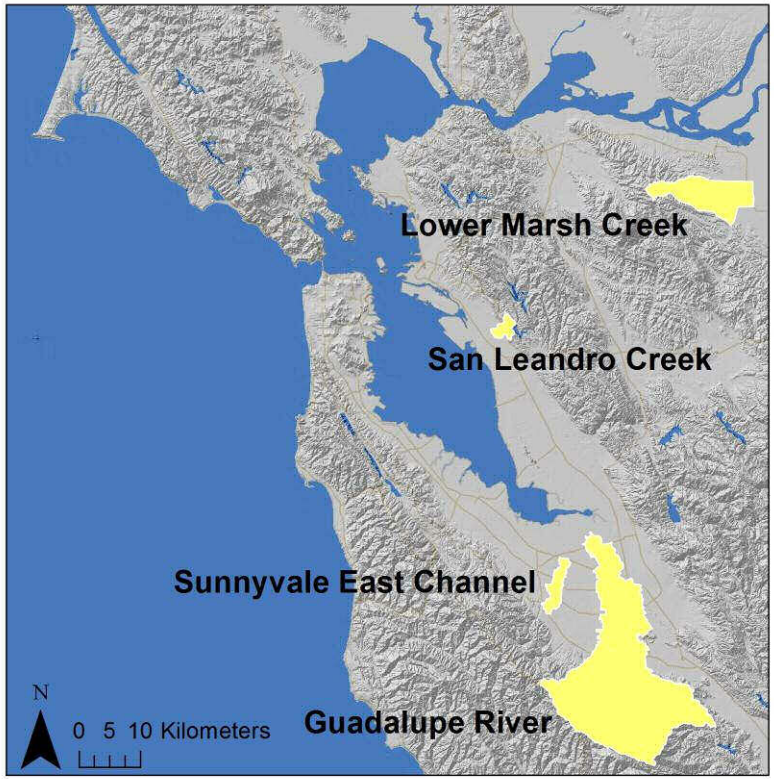
New sites:
- North Richmond pump station
- Pulgas

Funding: RMP and BASMAA

Stormwater nutrient monitoring, 6 watersheds – 2012/2013

Objective:
- Characterize nutrient concentrations and quantify loads in diverse watersheds

Approach:
- Piggy-back on larger study
- 6 sites x 4 storms 2013
- 4 sites x ~4 storms 2012
- NO3, NO2, NH4, PO4, TN, TP
- *Product:* Technical report 1 (2012) & 2 (2013)
- *Schedule*: Delay due to data usage issues
- *Revise?*: One technical report for 2 years
  - start July 2013?



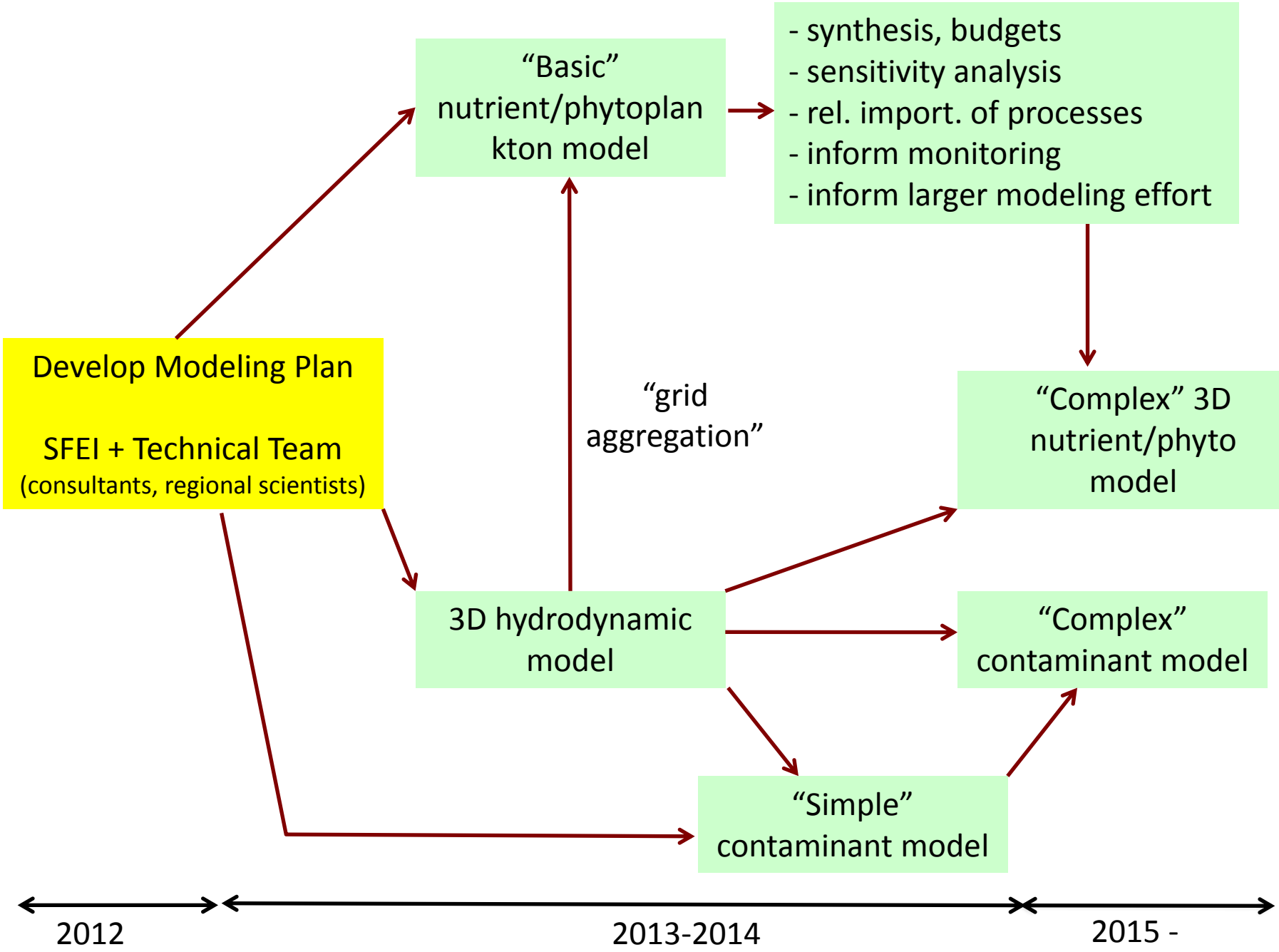
Funding: RMP and BASMAA

Data Synthesis - 2013

- Apply CM to explore existing data
  - refine data needs
  - identify conceptual gaps
  - refine conceptual model
- Key step for model development
- Synergies with other synthesis efforts
  - Suisun
  - LSB
- Additional section added to CM report

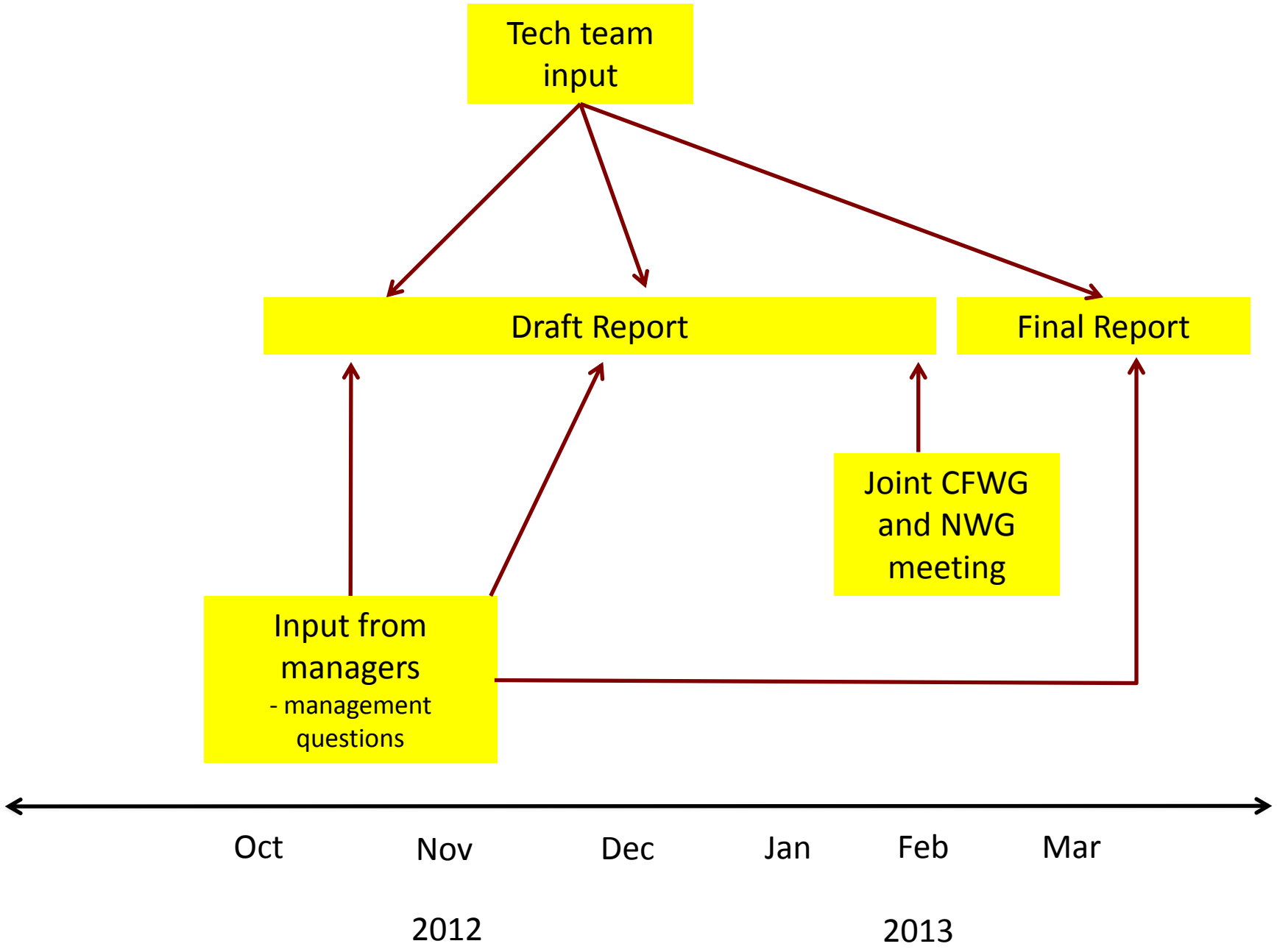
Developing a Bay-wide Modeling Tool

- Goal: Develop a 'goldilocks' model for informing important current and future management decisions
  - Balance sophistication (to be used confidently) with the resolution needed to inform management decisions
  - Usable by SFEI/RMP staff
  - Existing tools
  - Can be used for multiple issues…
    - 'contaminants' – legacy, bioaccum., CEC
    - nutrients, phytoplankton, biogeochem.
    - sediments
    - sea-level rise?
- Driven by nutrients in near-term


"Basic" nutrient/phytoplankton model
- synthesis, budgets
- sensitivity analysis
- rel. import. of processes
- inform monitoring
- inform larger modeling effort
Develop Modeling Plan
SFEI + Technical Team
(consultants, regional scientists)
"grid aggregation"
"Complex" 3D nutrient/phyto model
3D hydrodynamic model
"Complex" contaminant model
"Simple" contaminant model
2012
2013-2014
2015 -

Developing a Bay-wide Modeling Tool

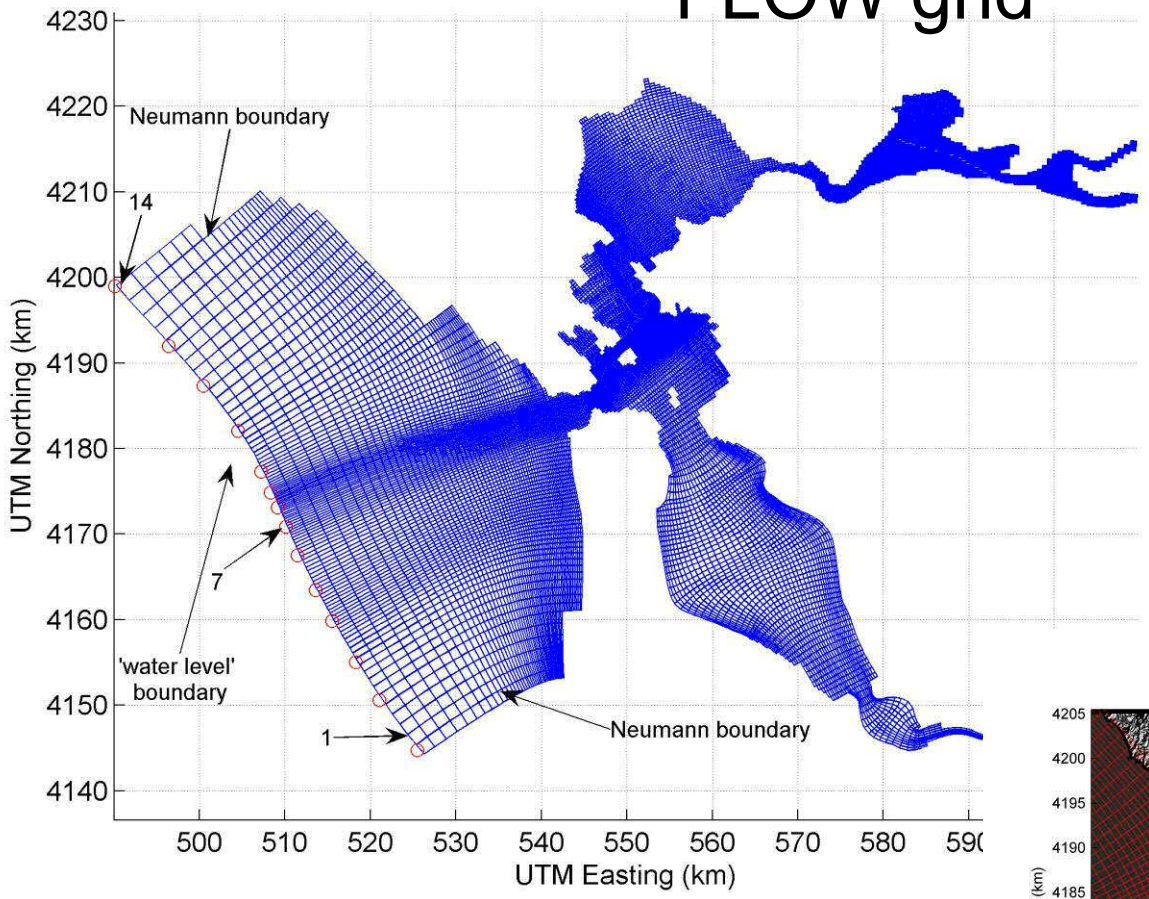
- Approach:
  - Engage Regional Board and stakeholders in identifying management questions and modeling needs
  - Develop a modeling program white paper
  - Engage expert community
  - Modeling workshop and joint work group meeting (nutrients, contaminants)
  - Recommend a modeling approach
  - Revise & Implement

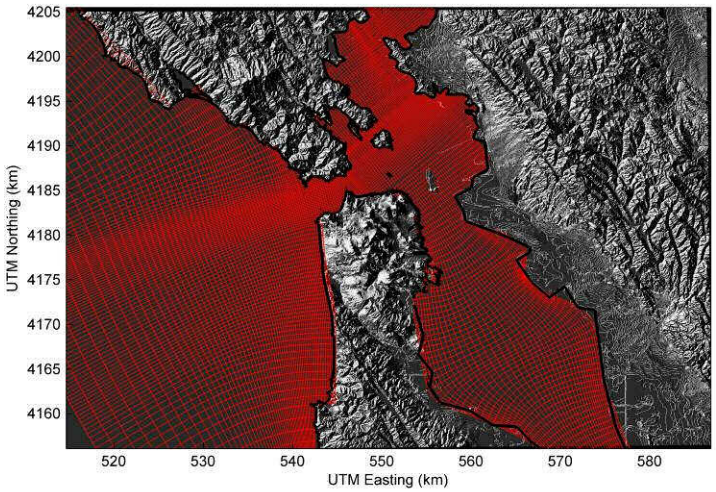

Tech team input
Draft Report
Final Report
Joint CFWG and NWG meeting
Input from managers
- management questions
Oct
Nov
Dec
Jan
Feb
Mar
2012
2013

Developing a Bay-wide Modeling Tool

- Approach:
  - Outline: modeling program white paper
    - Management Questions (Contaminants, Nutrients)
      - Spatial, temporal requirements
      - Processes (hydrodynamic, biogeochemically)
    - Model output requirements
    - Model Platform Requirements
      - Peer-reviewed
      - Open source
      - Large user community
      - Usable by SFEI/RMP and partners
      - Major institutional partners
    - Strawman: Delft 3d
      - Pros and cons relative to other platforms
    - Draft work plan:Delft3D
      - Science
      - Institutional: Costs, agreements

Delft3D Base Model Set up

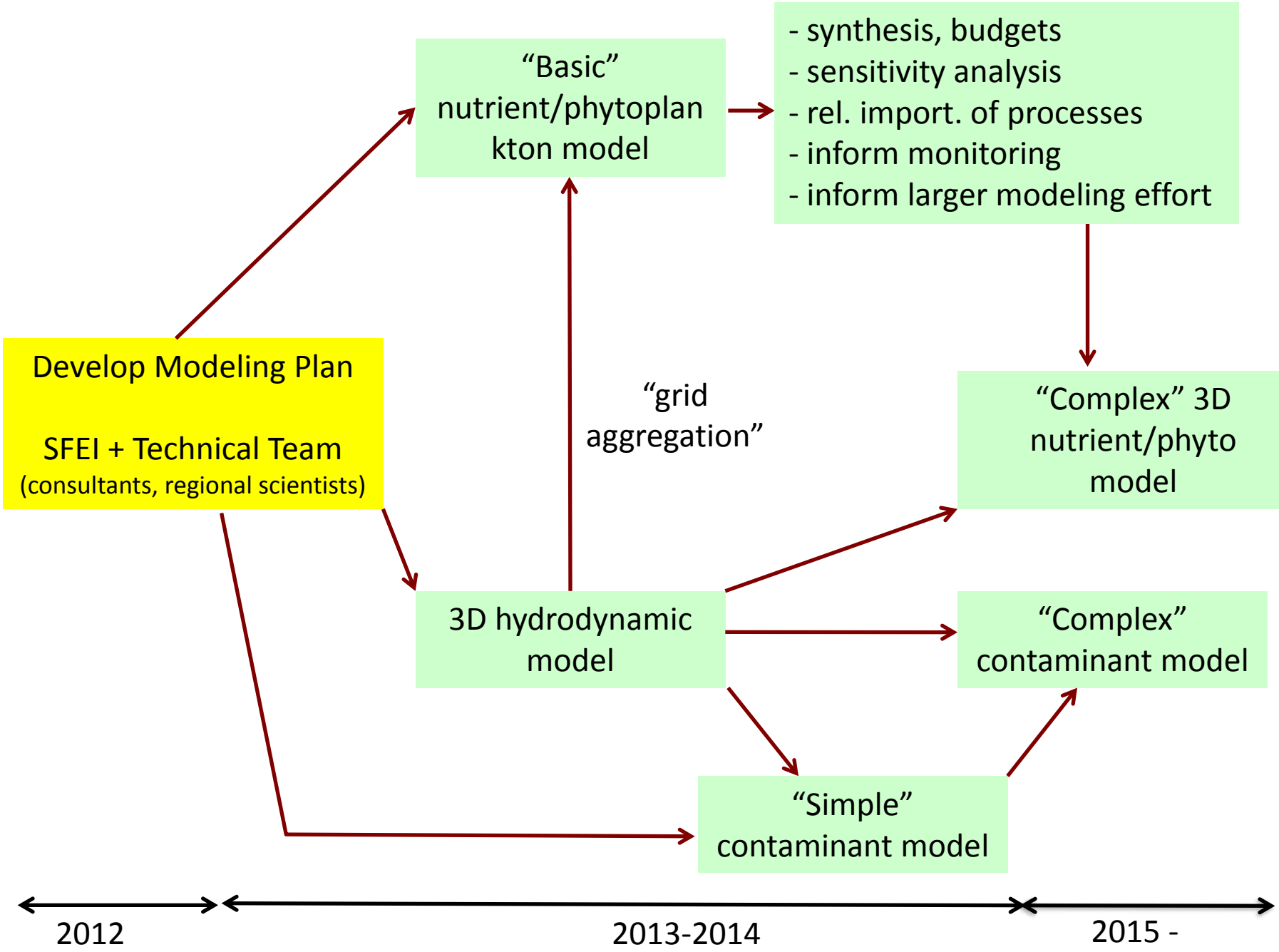




Single domain model application

On-going work

- October technical meeting
  - C Jones, Fitzpatrick
- Develop draft outline (Oct/Nov)
  - Identify primary management questions
  - Develop draft approach to address management questions
- Expand outline, draft report (Dec/Jan)
- Technical workshop (Jan/Feb)
- Nutrient and Contaminant Fate Workgroup (Feb/Mar)


"Basic" nutrient/phytoplankton model
- synthesis, budgets
- sensitivity analysis
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Develop Modeling Plan
SFEI + Technical Team
(consultants, regional scientists)
"grid aggregation"
"Complex" 3D nutrient/phyto model
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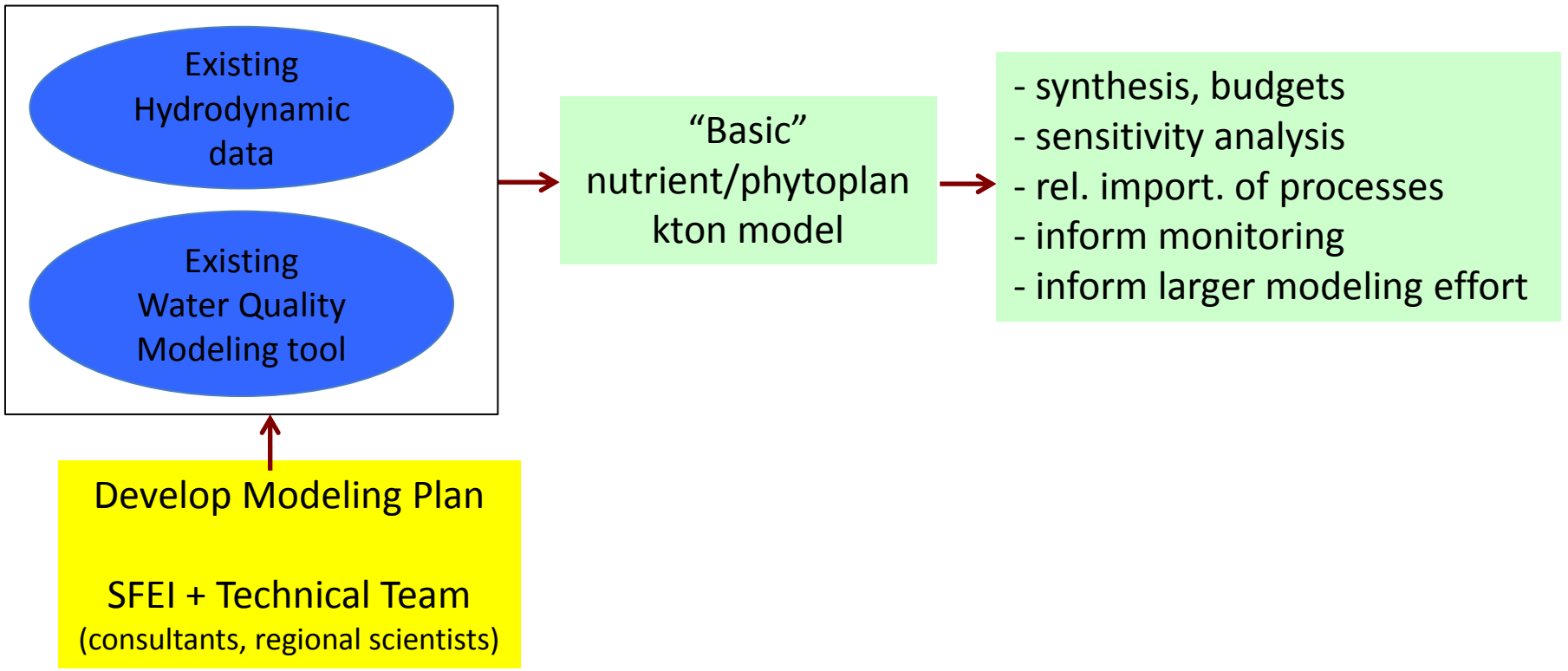
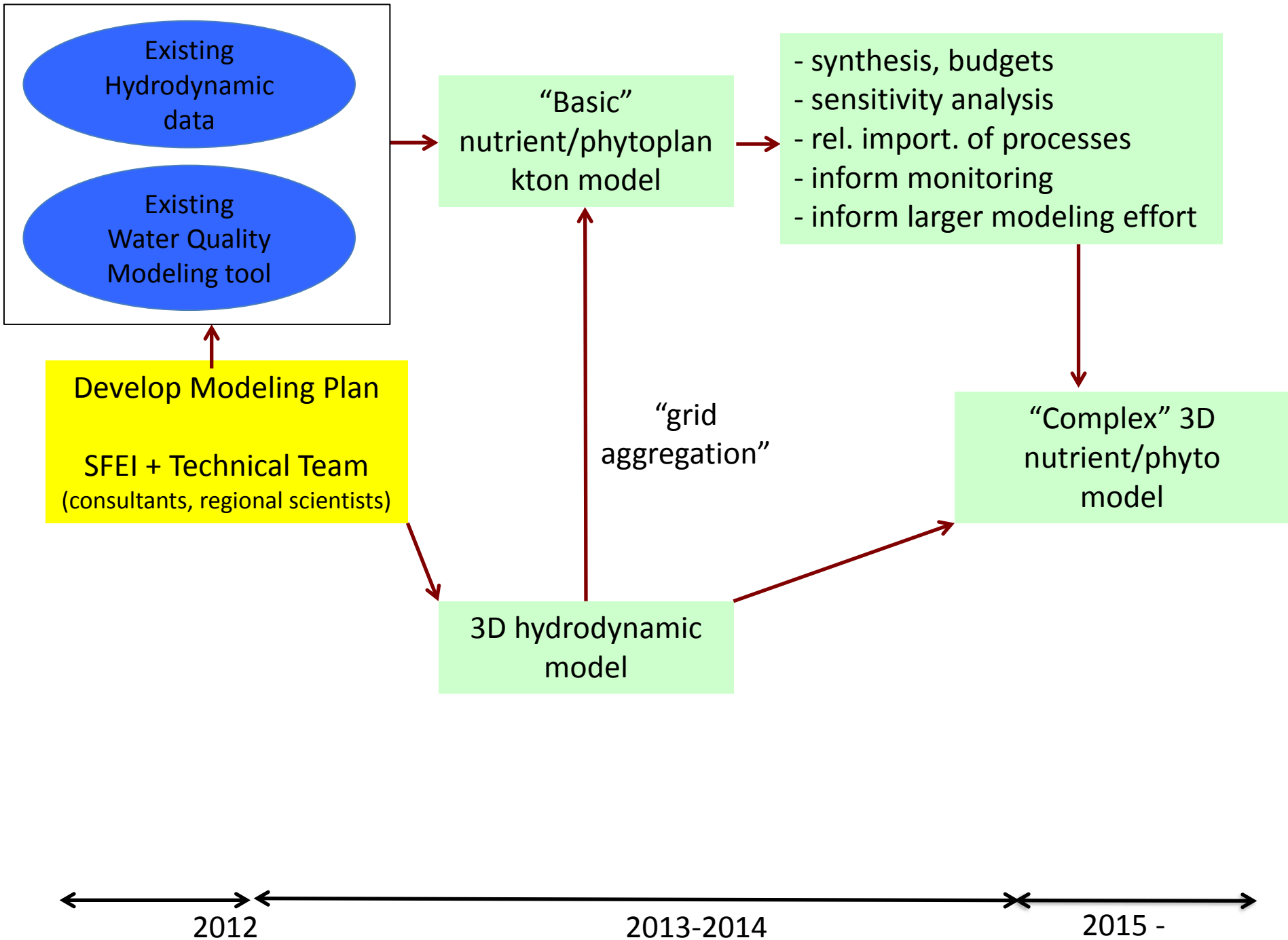
"Simple" contaminant model
2012
2013-2014
2015 -


Existing Hydrodynamic data
Existing Water Quality Modeling tool
"Basic" nutrient/phytoplankton model
- synthesis, budgets
- sensitivity analysis
- rel. import. of processes
- inform monitoring
- inform larger modeling effort
Develop Modeling Plan
SFEI + Technical Team
(consultants, regional scientists)
2012
2013-2014
2015 -


Existing Hydrodynamic data
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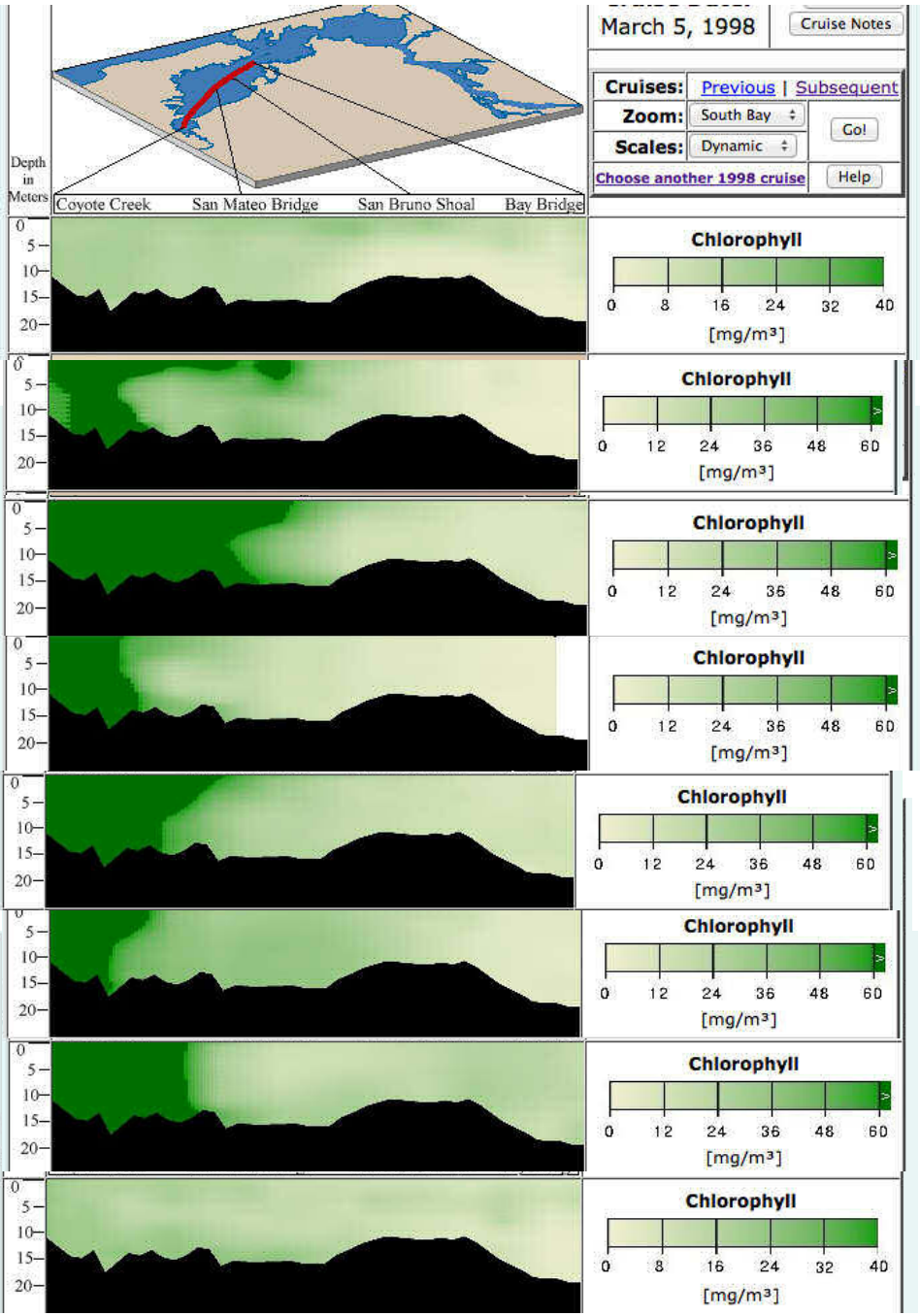


e.g., What type of "basic" model do we need to reproduce an event like this?

- get avg chl correct
- get timing, duration accurate

March 5, 1998

March 12

March 17

March 27

April 2

April 9

April 14

April 21

What can we learn about the LSB system's DO response to events such as this by also being able to model DO with reasonable accuracy?

What was the potential magnitude of clam grazing in eventually reigning in this bloom?

Biogeochemical Modeling: Lower South Bay and Suisun

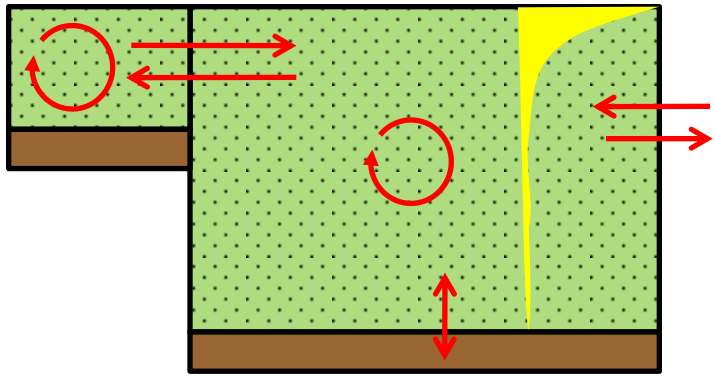
PI: D Senn

Collaborators: Technical team, Cloern (USGS), Dugdale (RTC), others

Objective: Develop biogeochemical models for…

- Quantitative data synthesis and nutrient budgets
- Assessing relative importance of key processes/drivers
- Sensitivity analysis, identify critical uncertainties and data gaps
- Characterizing response (e.g., chl, O_2) under future scenarios
- Inform monitoring program and special studies

Biogeochemical Modeling: Lower South Bay and Suisun



- flow, tidal exchange (t_{res})

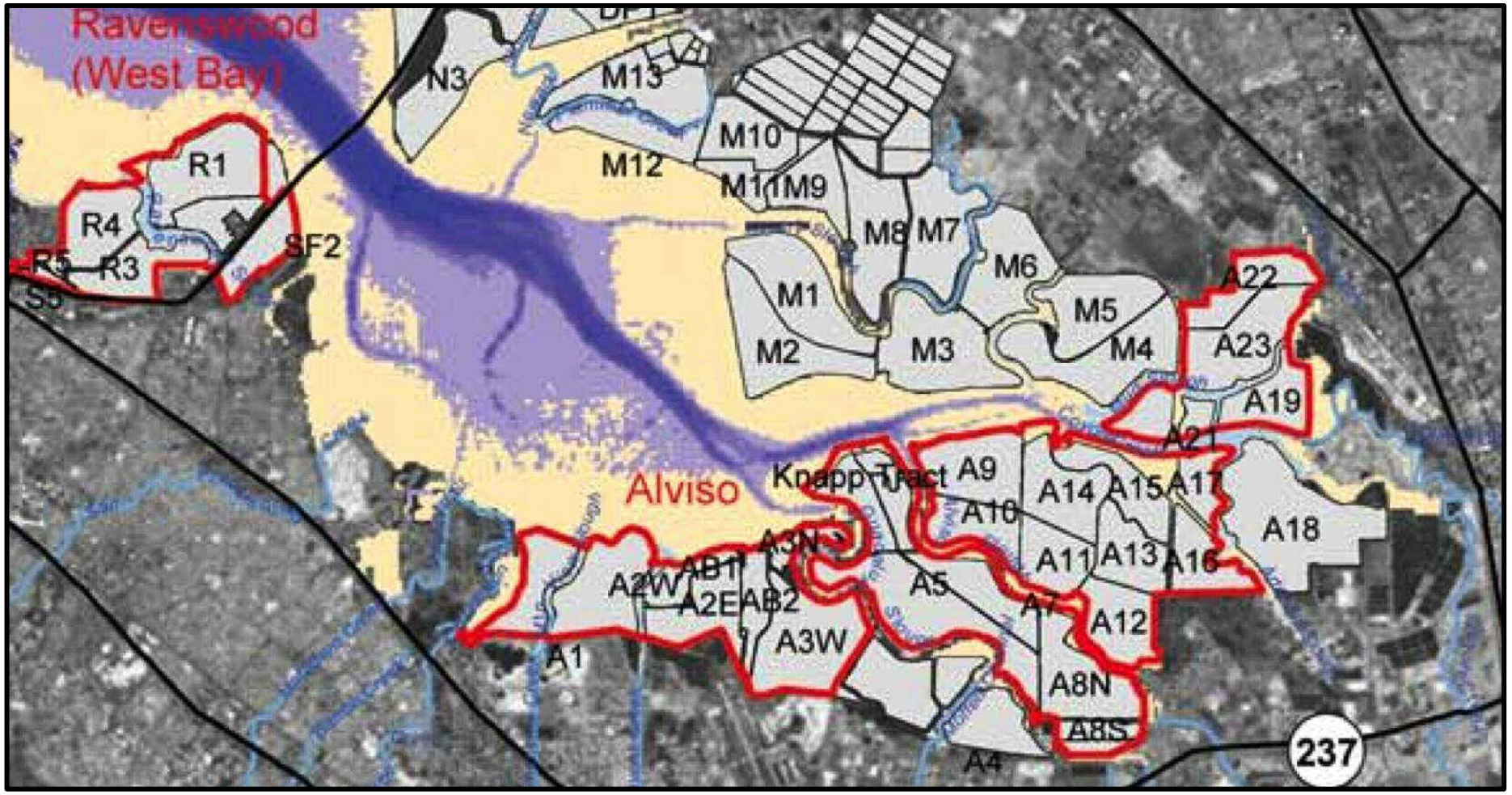
- light limitation

- benthic grazing

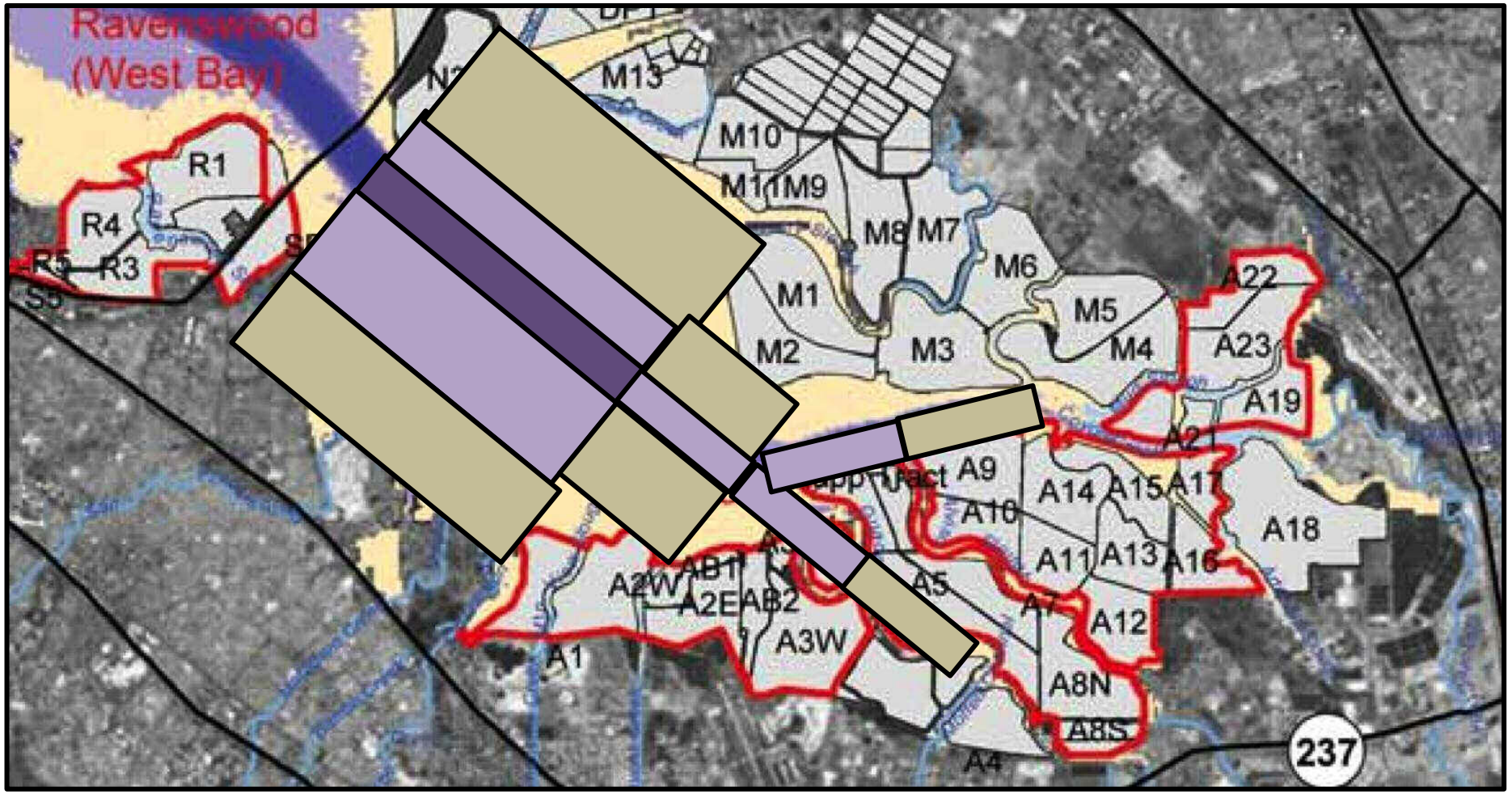
- potential inhibition of PP by NH_4^+

- budgets: transformations, sources, and sinks

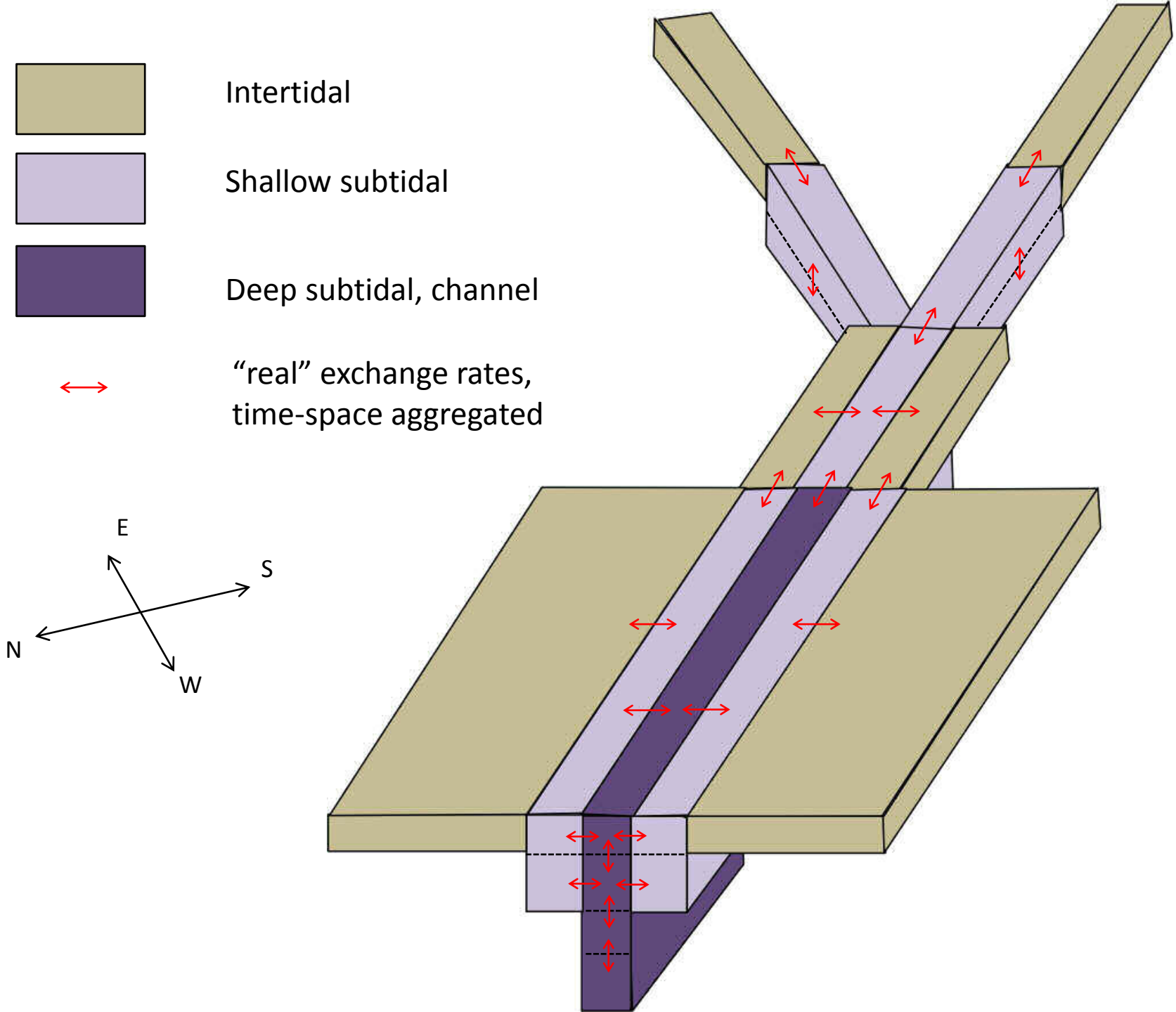
Example Schematic for LSB Model



Example Schematic for LSB Model



- highly-aggregated hydrodynamics from existing hydrodynamic model (e.g. 2000 hydro to 20 WQ boxes)


Intertidal
Shallow subtidal
Deep subtidal, channel
“real” exchange rates,
time-space aggregated
E
S
N
W

UPDATE ON EXPOSURE AND EFFECTS

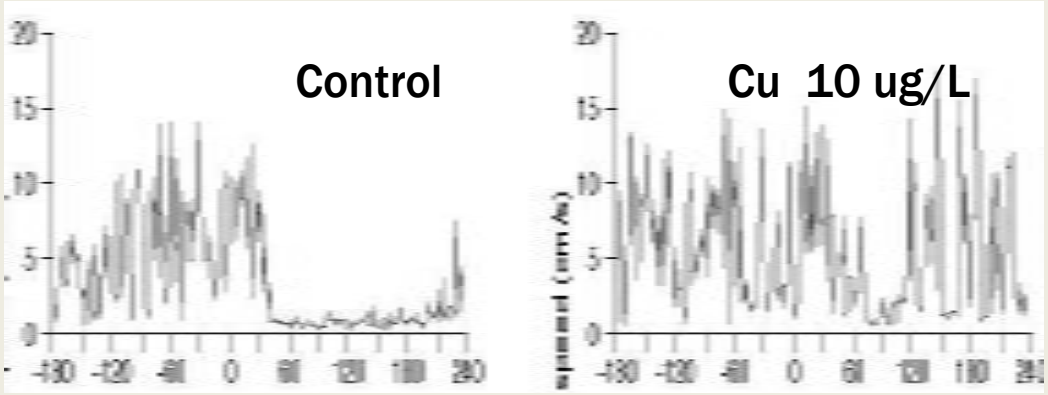
December 4th, 2012

GOALS OF WORKGROUP

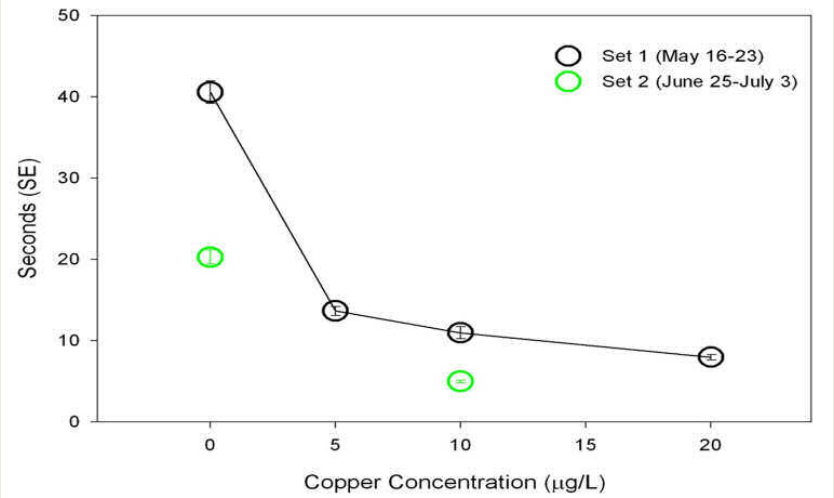
- Are contaminants individually or in combination having adverse impacts on Bay biota?
- Are there particular regions of concern?
- Which contaminants are responsible for the impacts?
- Are there cost-effective tools that can be used to easily monitor these impacts?
- What are appropriate guidelines?

ARE CONTAMINANTS HAVING ADVERSE IMPACTS ON BAY BIOTA?

- Cu and Olfactory Nerve
- Effects nose, behavior and predator avoidance
  - Example: Swimming speed

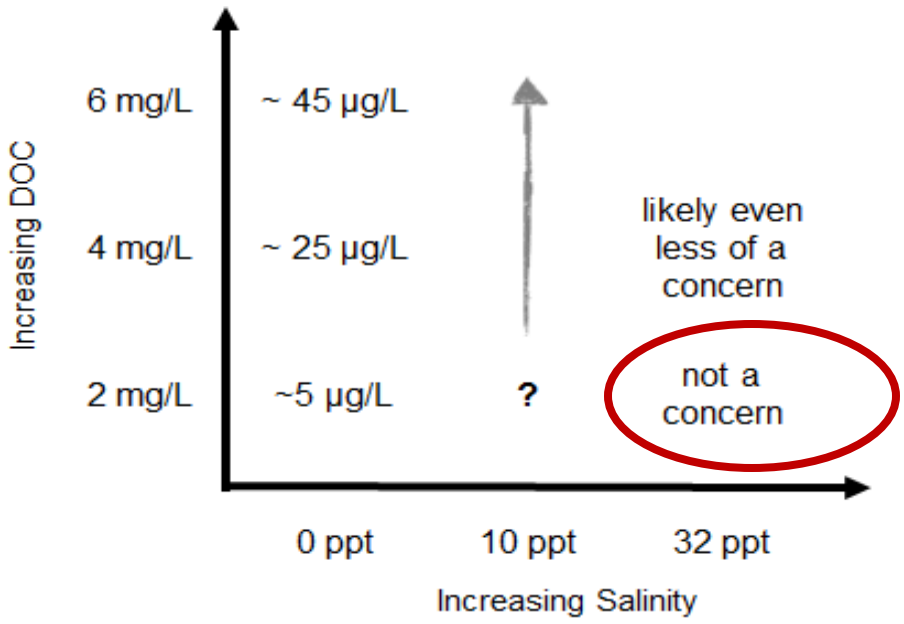


  - Survival time



2012
COPPER STUDIES

Olfactory toxicity of copper to seawater-phase salmon

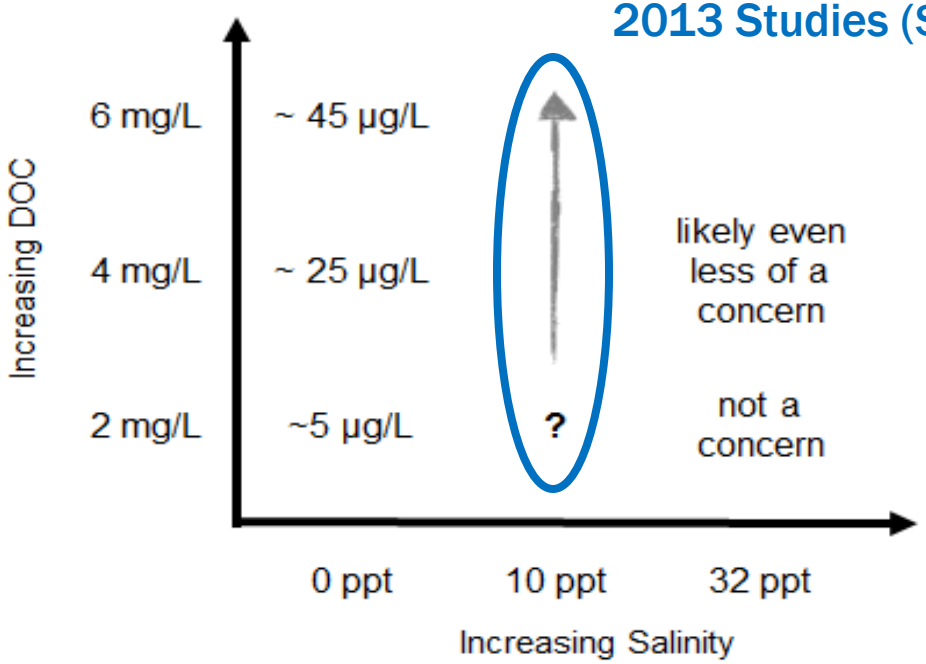


2012 Results
Cu at 100 ug/L

Report by end of December

2013
COPPER STUDIES

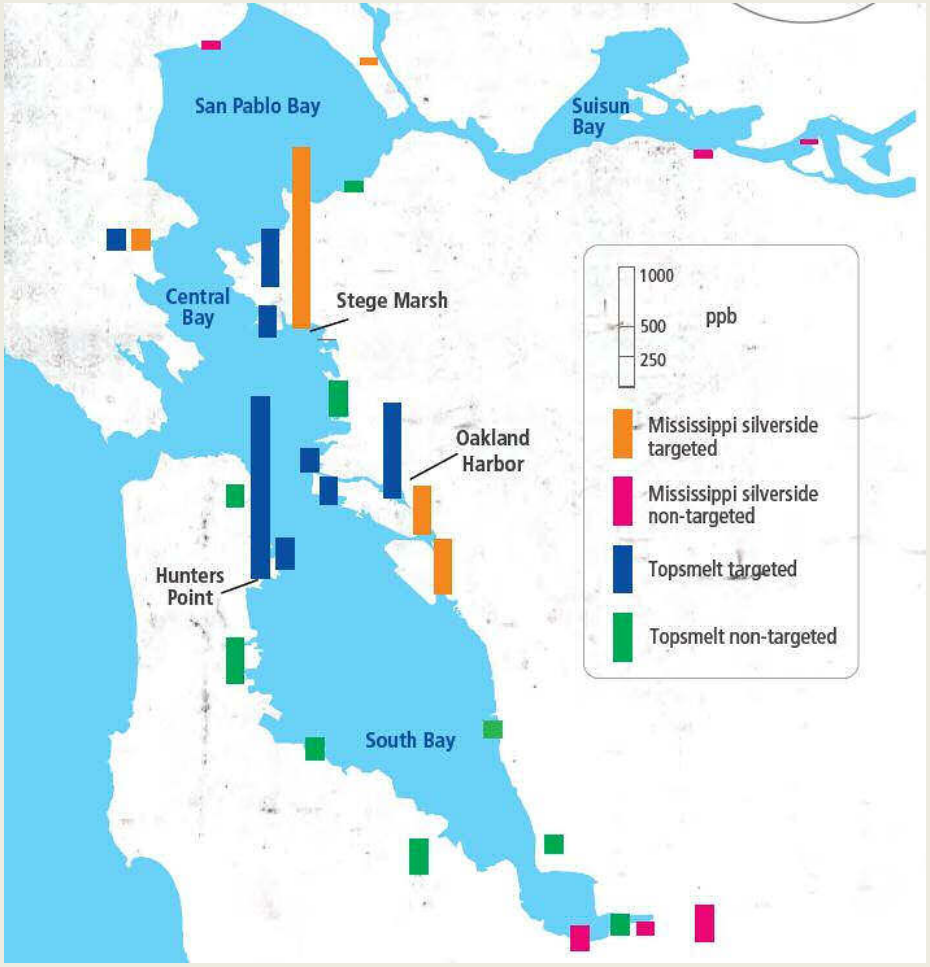
Olfactory toxicity of copper to seawater-phase salmon



ARE THERE REGIONS OF CONCERN?

- Small Fish
  - PCB Spatial Trends
    - Targeted sites much higher than probablistic
    - PCBs in small fish comparable to higher level trophic fish
    - Good correlation to sediment contamination
- Manuscripts
  - PCB – Chemosphere
  - Hg Temporal Trends- Science of the Total Environment
    - Goby high in summer/fall; Topsmelt high in winter
      - Seasonal MeHg patterns
      - Habitat
  - Hg Spatial – to be submitted by January

PCBs in Small Fish

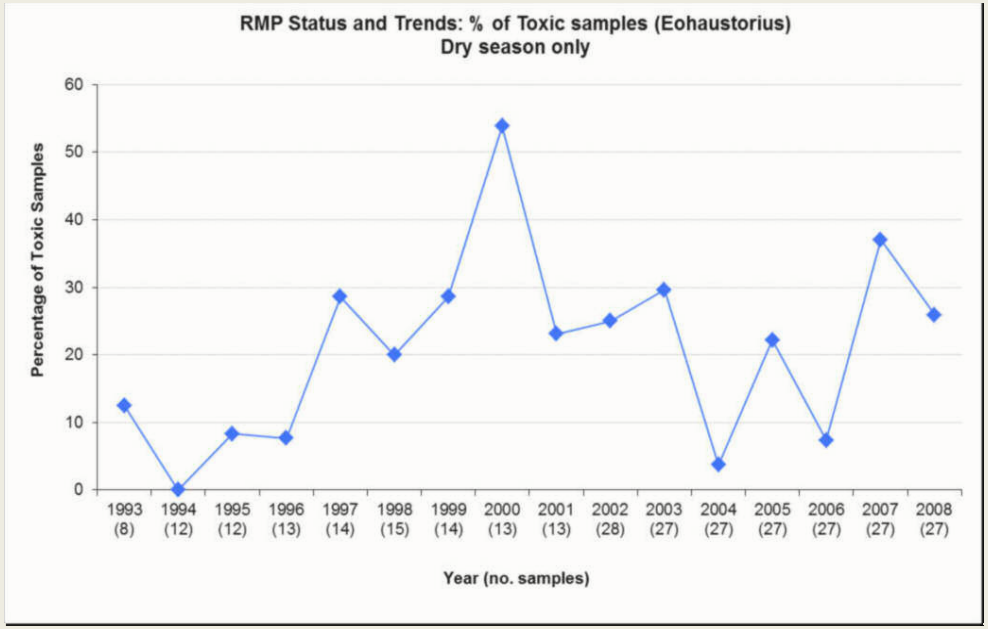


WHICH CONTAMINANTS ARE RESPONSIBLE FOR THE IMPACTS?

- 2012 Moderate Toxicity Workshop – What is causing moderate toxicity in Bay?

- Possible Factors:
  - Grainsize (Shape? Fines?)
  - Mixtures?
  - PAHs? Algal biotoxins?
  - Acclimation of test species? Predation? Stress?

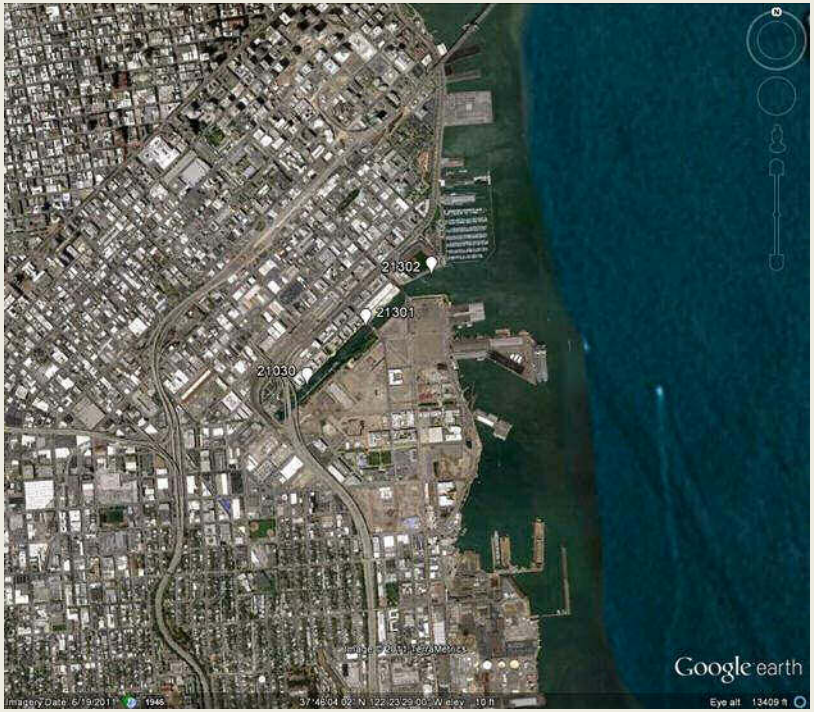
- Next steps:
  - Data mining – physical characteristics of sediment to tox
  - Review statistics
  - Evaluate algal biotoxins
  - Refinement of TIE



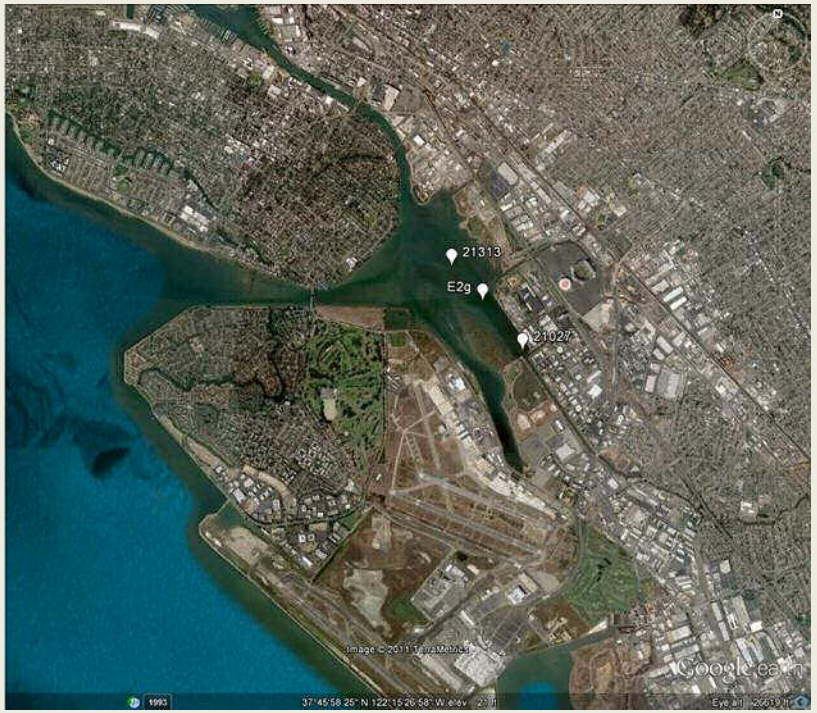
- Minutes available mid-December

ARE THERE TOOLS THAT CAN BE USED TO MONITOR THESE IMPACTS?

- 2012 Hotspot Study
- Mission Creek



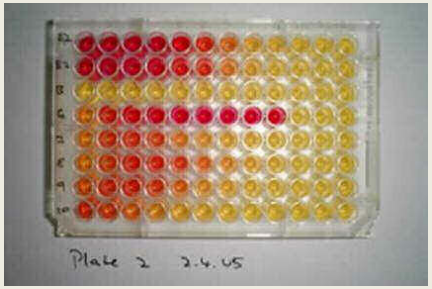
San Leandro



Report available Jan/Feb 2013 –waiting for EBMUD results

ARE THERE TOOLS THAT CAN BE USED TO MONITOR THESE IMPACTS?

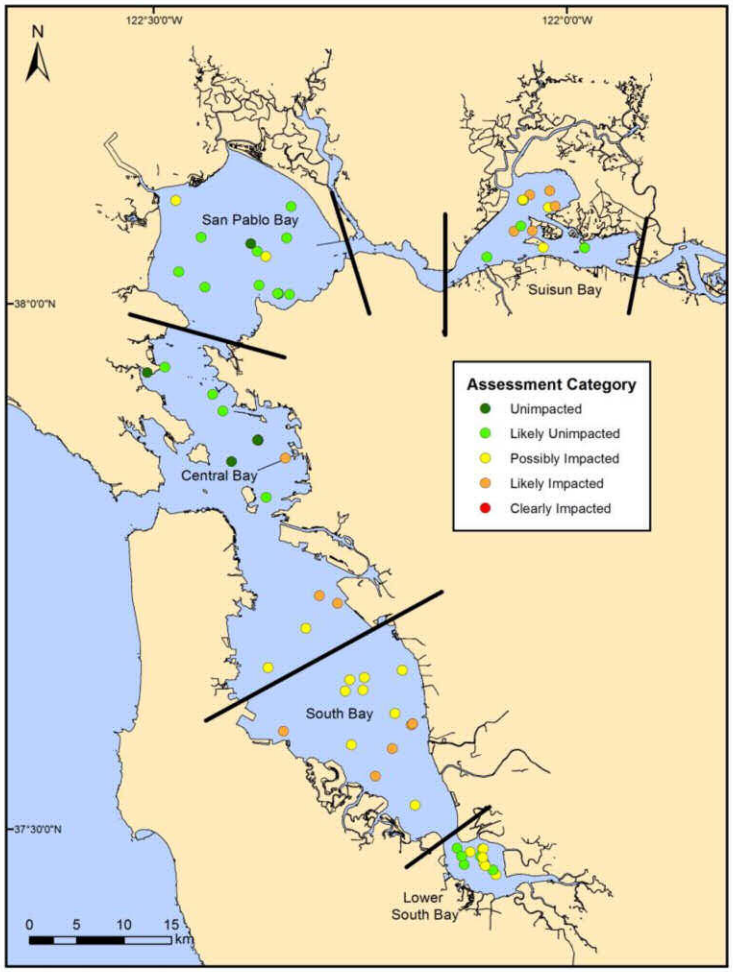
- 2013 Bioanalytical tools – linking gene effects to organisms



- 100,000s of chemicals – effective tool to work thru common modes of action
- Evaluating estrogenic pathway
  - Reproductive systems
  - Growth and development
  - Cardiac function
- Dr. Nancy Denslow (University of Florida) & Keith Mayura / Steve Bay (SCCWRP)
- 2-year study - $126,000 (42K match SCCWRP)

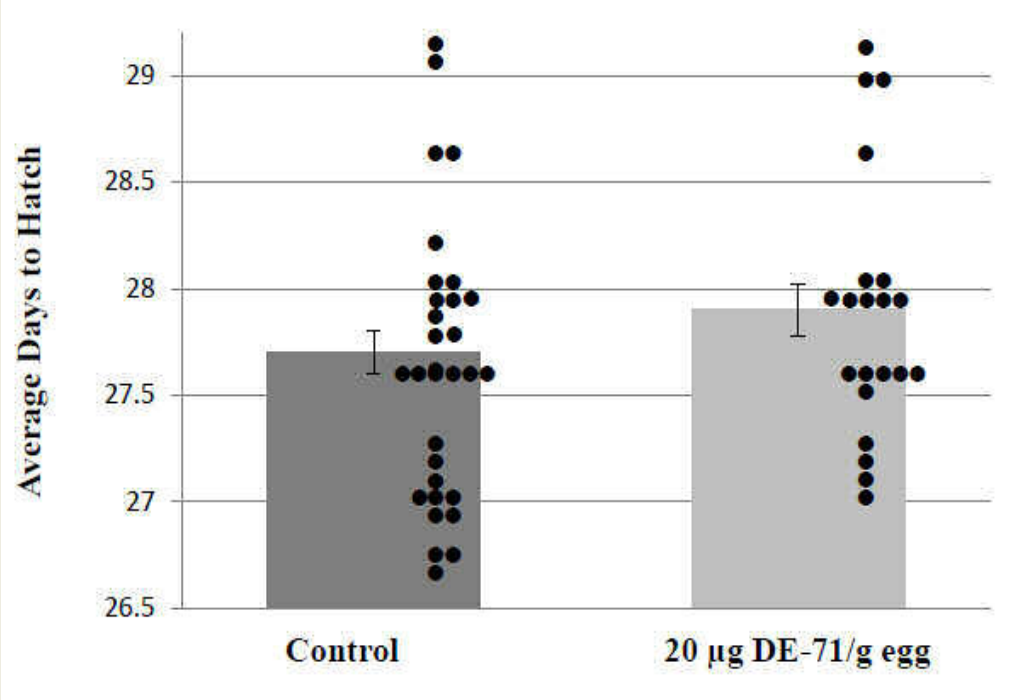
ARE THERE TOOLS THAT CAN BE USED TO MONITOR THESE IMPACTS?

- Develop indices for Mesohaline portion of the Bay
- 3 indices
  - Benthic Response Index
  - River Invertebrate Prediction and Classification System
  - Index of Biotic Integrity
- Completed by Fall 2013
  - Manuscript



WHAT ARE THE APPROPRIATE GUIDELINES?

- Barnett Rattner (USGS) publishing manuscript of findings from BDE egg injection study



REMAINING DELIVERABLES

- EEPS Summary Report
  - Finishing by end of year
- PAH and Flatfish
  - Draft report, waiting for histopathology
- 2006/2009 Bird Egg Report
  - Winter 2013
- 2012 Bird Egg report
  - Samples collected and at lab

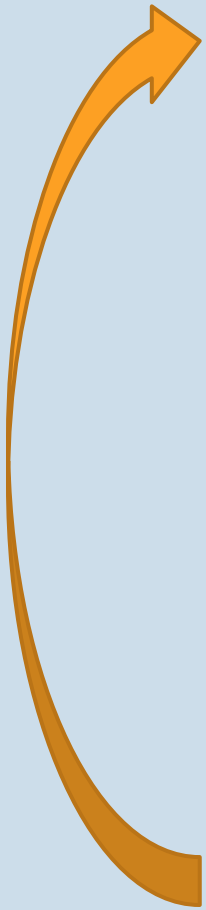
CONTAMINANTS OF EMERGING CONCERN

December 4th, 2012

GOAL OF THE WORKGROUP

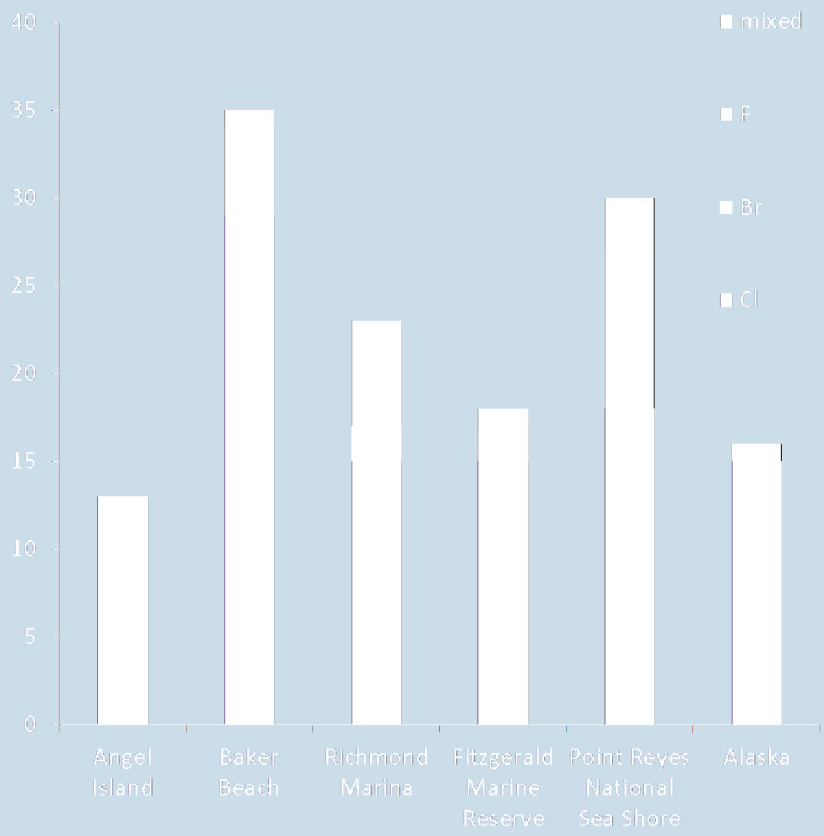
- Which CECs have the potential to adversely impact beneficial uses in San Francisco Bay?

WHICH CECS SHOULD WE MONITOR?



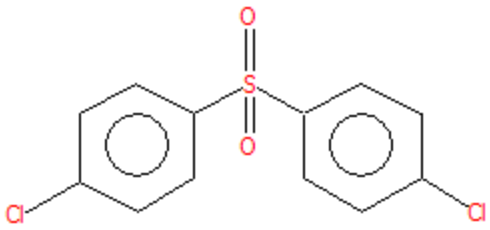
- Identifying CECs to monitor by:
  - Reviewing literature; Asking the experts
  - Using cutting edge instruments
  - Developing new bioanalytical techniques
- Quantifying CECs in the Bay
- Prioritizing based on thresholds
- Developing a CEC Strategy

BROAD SCAN WORK (NIST)

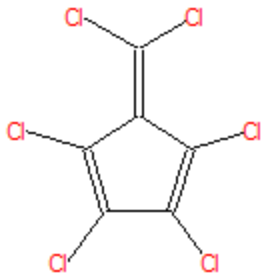


Chlorinated Compounds

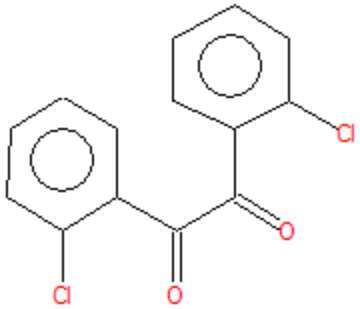
Compound	CAS#	Comments
Dechlorane 602	31107-44-5	flame retardant
p,p'-Dichlorodiphenyl sulfone	80-07-9	polymer starting material for "Udel"
Hexachlorofulvene	6317-25-5	polymer use?
Dichlorobenzil	21854-95-5	dyes, resins, disinfectant?
Dichlorobenzophenone	5293-97-0	?
Dichloroanthracene	605-48-1	combustion product?



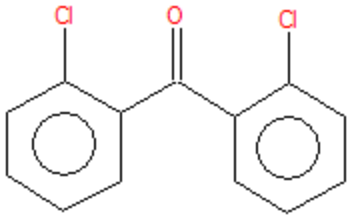
Dichlorodiphenylsulfone
On Howard and Muir List



Hexachlorofulvene



Dichlorobenzil

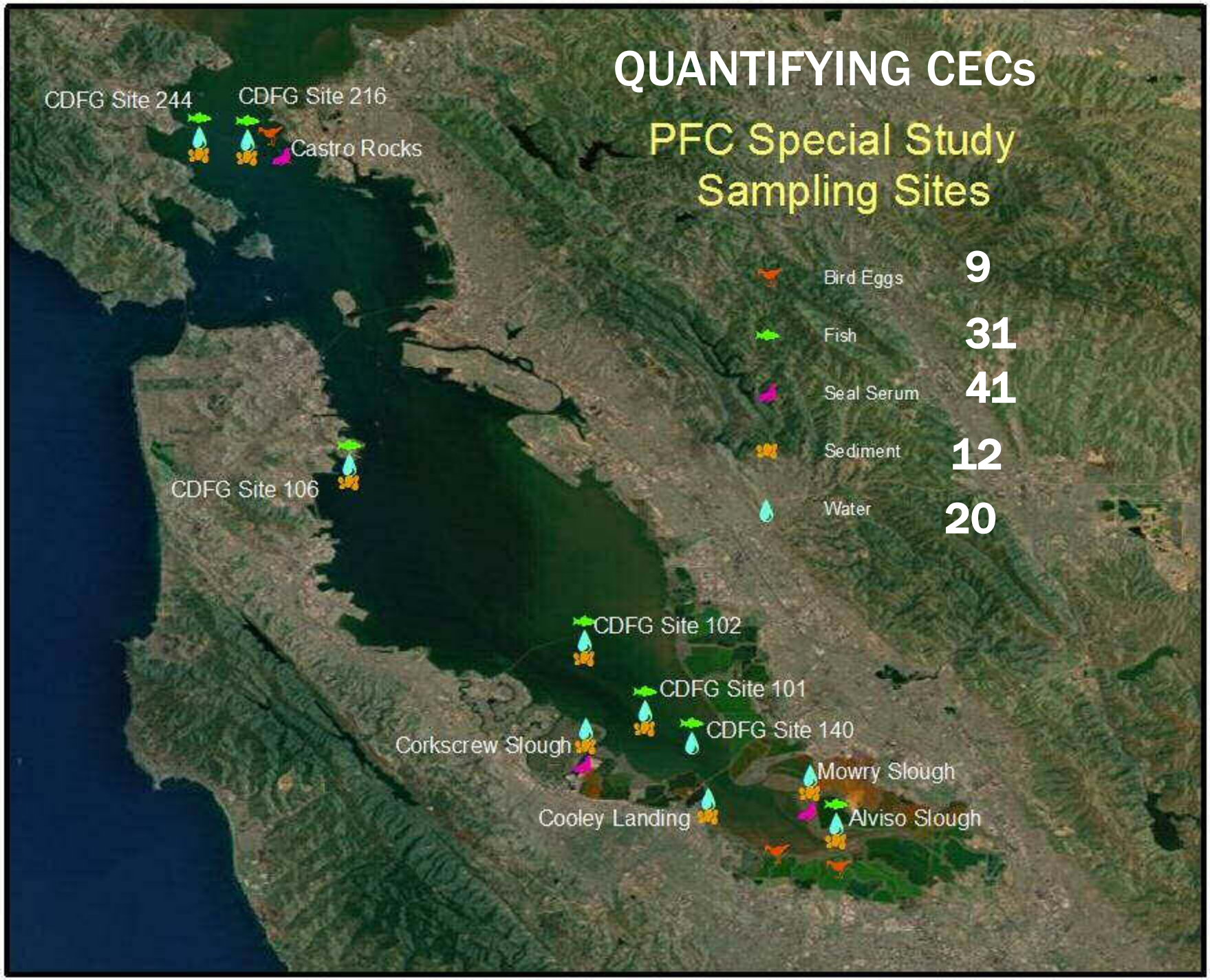


Dichlorobenzophenone

BROAD SCAN WORK

- Developed user library based on Howard and Muir paper and compared to results from this project
- Working on quantifying compounds where possible

- Manuscript on seal work
  - January 2013
- Modifying methods for mussel analysis and conducting analysis of mussel samples

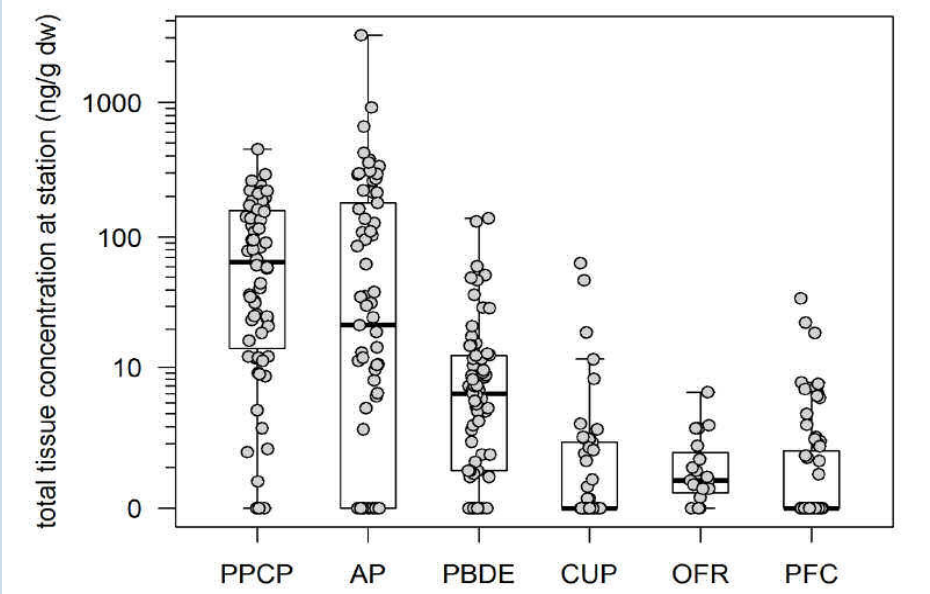

QUANTIFYING CECs
PFC Special Study
Sampling Sites
Bird Eggs 9
Fish 31
Seal Serum 41
Sediment 12
Water 20
CDFG Site 244
CDFG Site 216
Castro Rocks
CDFG Site 106
CDFG Site 102
CDFG Site 101
CDFG Site 140
Corkscrew Slough
Mowry Slough
Cooley Landing
Alviso Slough

PFCS

- 2012 PFOS Study
  - Data in QA/QC review: seal
  - Lab on cusp of submitting: sediment and bird egg
  - To be analyzed: water (pro bono) and small fish
- Sources PFC article – comments received. Submit end of December

NOAA MUSSEL WATCH

- NOAA Special study for 2010
- 68 Stations analyzed for 166 CECs (e.g., APs, PPCP, current use pesticides, flame retardants, PFCs, and nano tubes)
  - 4 Bay sites – DB, SM, YBI and Em
- Correlated to land use (urban, mix dev., low dev. and ag)
- APEs, PBDEs, and PFCs associated with urban land use
  - Emeryville site – one of the top 5 highest



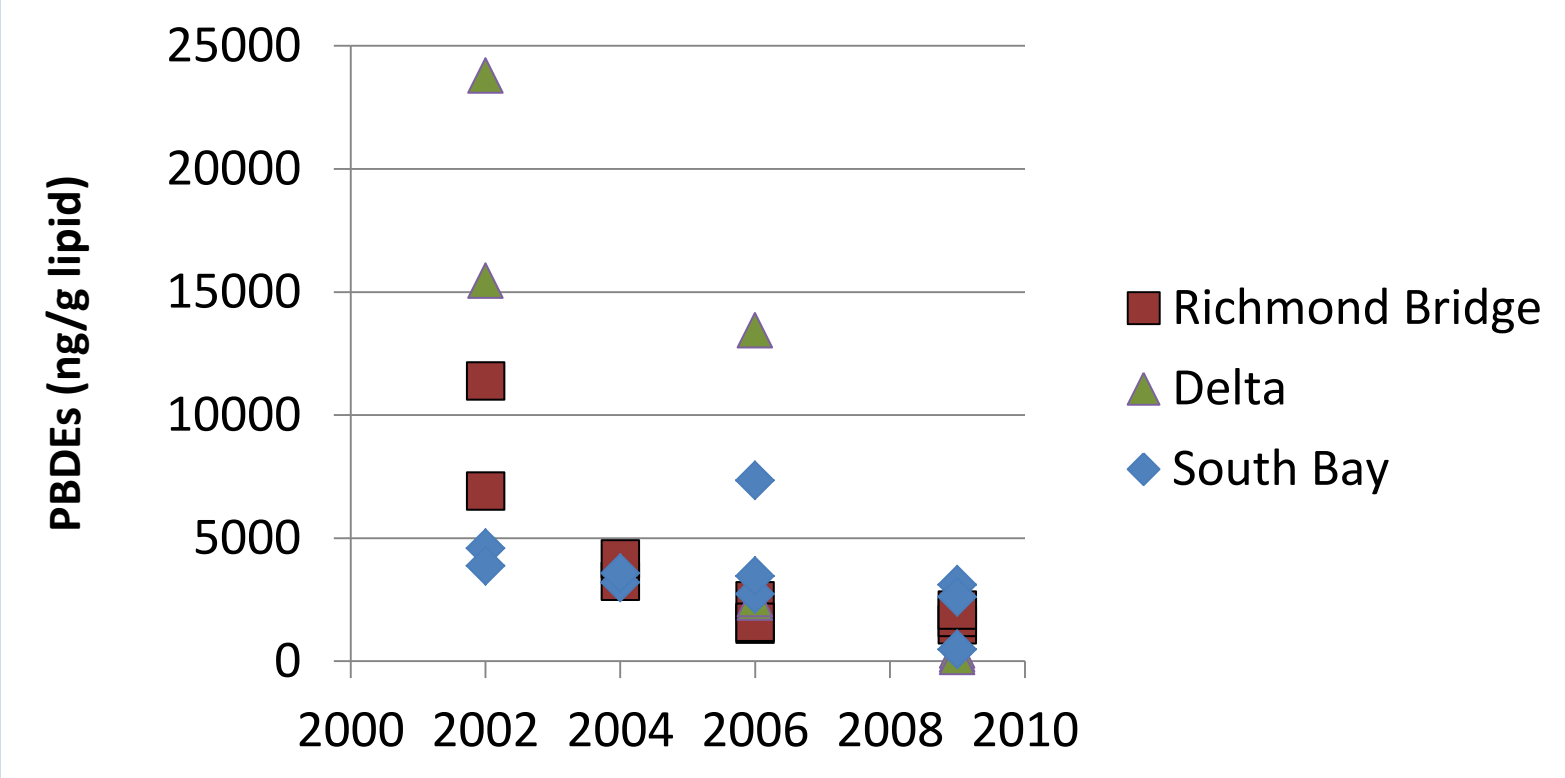
- Article submitted to Marine Pollution Bulletin

OTHER 2012 PRODUCTS

- Synthesis
  - Draft completed, responding to comments, and will finish by end of year
- 2012 CEC Strategy and 2013 Updating Strategy
  - Outline developed – Looking to complete 1st quarter of 2013
- Completed Articles:
  - Brominated and Chlorinated Flame Retardants in San Francisco Bay Sediments and Wildlife. Klosterhaus, Stapleton, La Guardia, and Greig. 2012. Accepted Environment International.
  - Method Validation and Reconnaissance of PPCPs and Alkylphenols in Surface Waters, Sediments, and Mussels in an Urban Estuary. Klosterhaus, Grace, Hamilton and Yee. 2012. Minor revisions requested. Environment International.
  - Estuary Insert on Alternative Flame Retardants
- Organizing Committee for 2012 SETAC in Long Beach
- SETAC Session Chair: Prioritizing Contaminants of Emerging Concern for Monitoring in California

2013 PBDE SUMMARY

- PBDE Summary Report – 1st Quarter 2012



2013 PBDE SUMMARY

- Surface waters (2002-2011)
- Sediments (2002-2012)
- Deployed bivalves (2002, 2003, 2005, 2006, 2008, and 2010)
- Sport fish (2000, 2003, 2006, and 2009)
- Cormorant and tern eggs (2002, 2004, 2006, and 2009)

- Comparison to relevant thresholds (OEHHA and bird egg study)

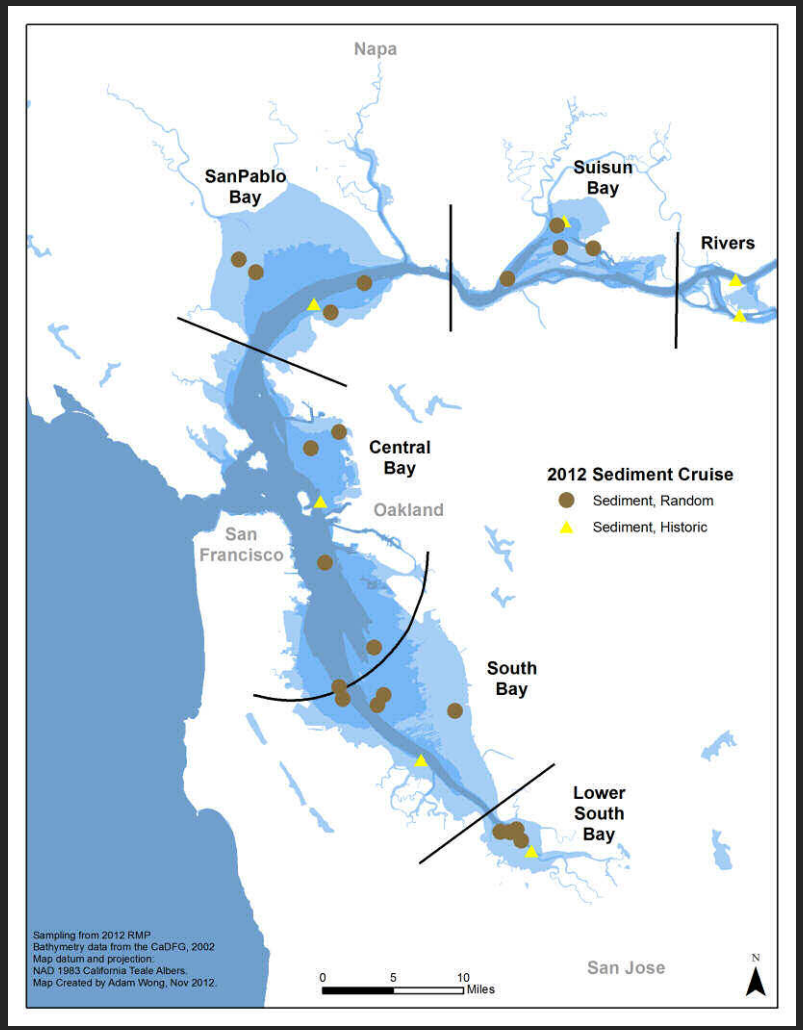
CURRENT USE PESTICIDES

- Convene a workshop to recommend current use pesticides for the RMP to monitor

- Likely invitees:
  - Kelly Moran, TDC
  - David Duncan, Head of the Environmental Monitor Branch at DPR
  - Joe Karkowski, Central Valley Regional Water Board
  - Tom Mumley and Jan O'Hara

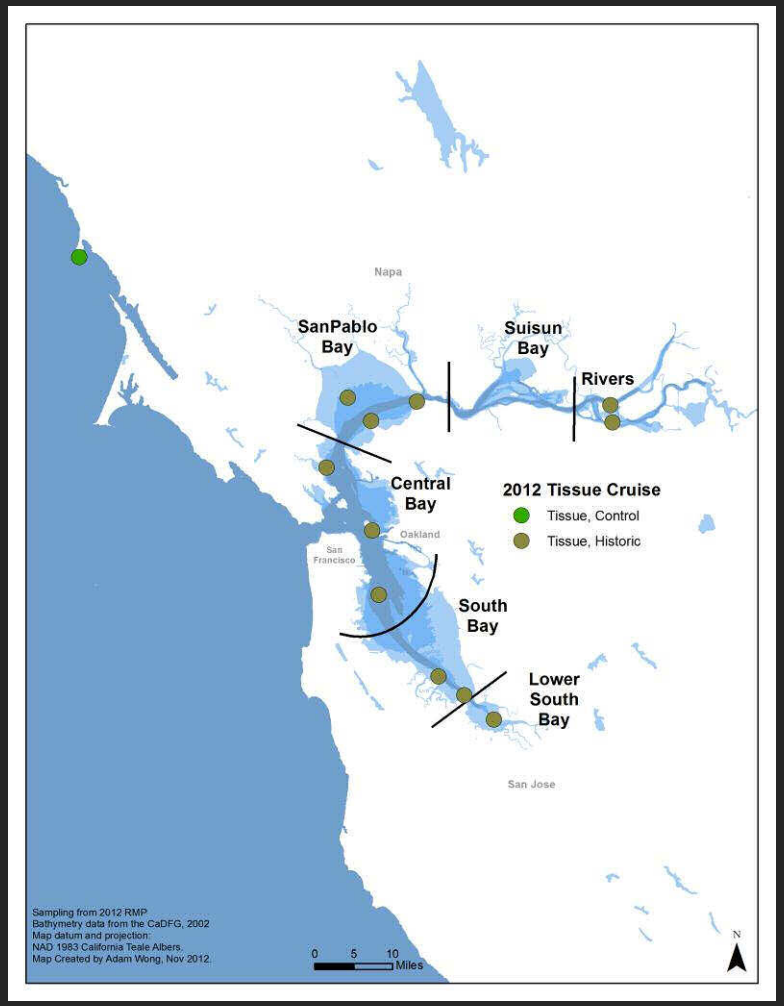
Status and Trends 2012 Sediment Cruise

- April 2012
- Sampled 28 sites
  - 20 Random sites
    - 4 per Bay Segment
  - 7 Historic sites
  - 1 Additional site (EBMUD)
- Chemistry, Toxicity and Benthos



Status and Trends 2012 Bivalve Cruise

- Deployed in June and retrieved in September 2012
- Sampled 12 sites
  - All sites are historic
  - 1 control site
  - 9 transplanted sites
  - 2 rivers stations use resident clams
- Organics and Growth
- Pro bono: Microcystin, Siloxanes



2012 Sediment Piggyback Studies

- Stanford University Benthic Nitrification Study
  - 28 samples
- SCCWRP Genetic Barcoding of Benthos
  - 2 samples

2013 Status & Trends Monitoring

- Water Chemistry (22 sites)
  - Trace elements and water quality parameters
- Organics are scheduled to be analyzed in 2015

2011 Annual Monitoring Report

- Coming soon - January 2013

UPDATE ON DATA MANAGEMENT

December 4, 2012

2012 HIGHLIGHTS

- Upload/QA review datasets
  - 2011 S&T – sediment pesticides in progress
  - 2011 Hot Spots – sediment pesticides in progress
  - 2012 S&T – pending grainsize & PCBs and tissue data
- Improved internal efficiencies
  - Chain of Custody Tool
  - RMP Deliverables Scorecard
  - WWTP Metals Upload Tool
  - Kriging Tool
  - Archive sample database
  - Ratio checking
- Better coordination with State and other projects
  - RMP data available in CEDEN & My Water Quality Portals
  - Wet weather projects

COC TOOL

Ship To: AXYS

AnalyteCode(s): PAH, PCB, PCB/PBDE

SampleID(s): 13-SFEI-1008, 13-SFEI-1015, 13

- [ ] (Select All)
- [x] 13-SFEI-1008
- [x] 13-SFEI-1015
- [ ] 13-SFEI-1016
- [ ] 13-SFEI-1023
- [x] 13-SFEI-1030
- [x] 13-SFEI-1115

Find | Next

Chain of Custody

Page 1 of 1

ip to:
KYS Analytical Services Ltd.
2045 Mills Road West
Sidney BC V8L 5X2

Contract No.:
983

Billing Code:
3013 Task 30 SubTsk A

4911 Central Ave.
Richmond CA, 94804

SampleID	Start Sample Date	End Sample Date	Sample Type	No. Of Containers	Analyte Code	Included	Notes
13-SFEI-1008	2012-11-28 10:00:00	2012-11-28 10:00:00	Grab	1	PCB	☐	
13-SFEI-1015	2012-11-28 10:44:00	2012-11-28 10:44:00	Grab	1	PCB	☐	
13-SFEI-1016	2012-11-28 10:46:00	2012-11-28 10:46:00	Grab	2	PAH	☐	
13-SFEI-1023	2012-11-28 11:10:00	2012-11-28 11:10:00	Grab	2	PCB/PBDE	☐	
13-SFEI-1030	2012-11-28 18:07:00	2012-11-28 18:07:00	Grab	1	PCB	☐	
13-SFEI-9103			FieldBlDup_Grab	1	PCB	☐	
13-SFEI-9104			FieldBlDup_Grab	1	PCB/PBDE	☐	

Shipment Method: _____

Shipped By: _____

Shipped Date/Time: _____

Accepted By: _____

Accepted Date/Time: _____

Cooler Temperature: _____

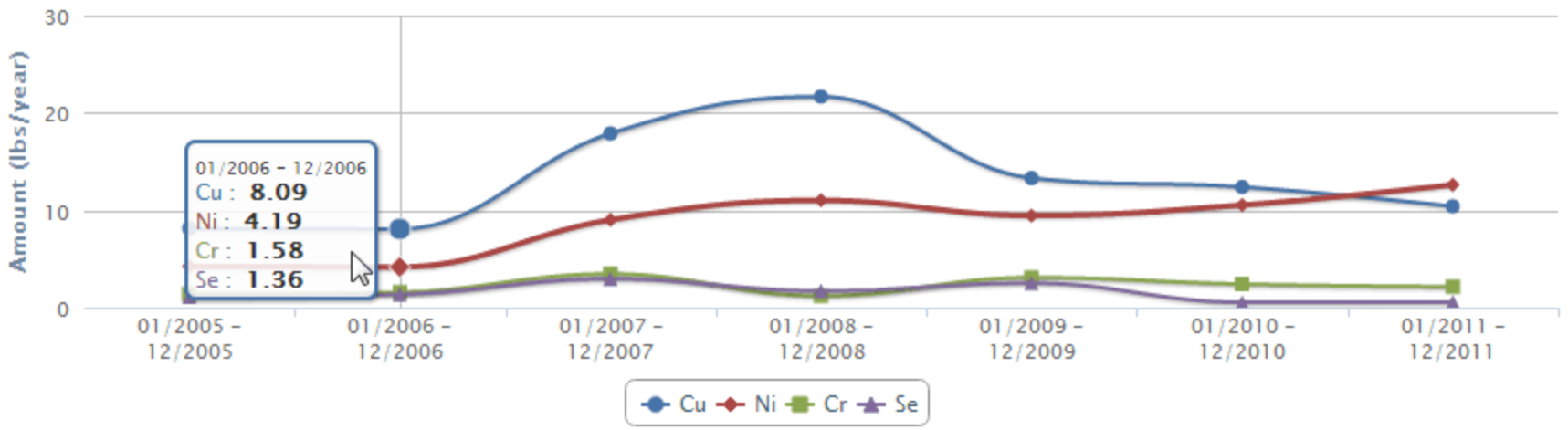
RMP SCORE CARD

RMP Deliverables Scorecard

Deliverable	Lead	Deliverable Type	Start Year	Original Due	Current Due	Stoplight	Comments	Months Overdue
Contaminant Fate								
1) Spatial Trends of Hg in Forage Fish	BG	Manuscript	2010	May-11	Jan-13	Red	Draft completed. Plan to submit manuscript by January 2013	19
2) Mercury Synthesis and Conceptual Model Update	JD	Report	2011	Aug-11	Jan-13	Yellow	Revised Article Submitted to Env Intl. RMP Version by Jan-13	16
2011 Mercury Food Web Uptake (Small Fish)	RA	Presentation	2011	Jul-12		Check	Completed	
4) PCB Conceptual Model	JD	Report	2011	Mar-12	Dec-12	Yellow		9
Emerging Contaminants								
5) PFC Sources	MS	Manuscript	2009	Jun-10	Dec-12	Red	Draft completed. In review.	30
6) EC Synthesis	SK	Report	2012	Mar-12	May-12	Check	Completed	2
PFCs in Bay Biota	MS	Report	2012	Mar-13		Green	Sampling underway	
8) EC Strategy	MS	Task	2012	Oct-12	Jan-13	Yellow	Outline presented to ECWG in June 2012	2
Exposure and Effects								
9) EEPS Summary Report	MS	Report	2009	Jun-09	Jan-13	Red	Outline presented to workgroup	42
10) Effects of PAH on Flatfish	MS	Report	2009	May-10	Mar-13	Red	Draft report completed. Awaiting additional results.	31
11) Hotspot Sediment Quality Followup Study	MS	Report	2011	Oct-12	Dec-12	Yellow	Sampling completed, waiting for data	2
12) Effects of Copper on Salmon	MS	Report	2011	Sep-12	Dec-12	Green	Study underway	3
Benthic Assessment for Mesohaline	MS	Report	2012	Jul-13		Green	Contract developed	
14) Moderate Toxicity Workshop	MS	Workshop	2012	Nov-12		Check	Completed	1

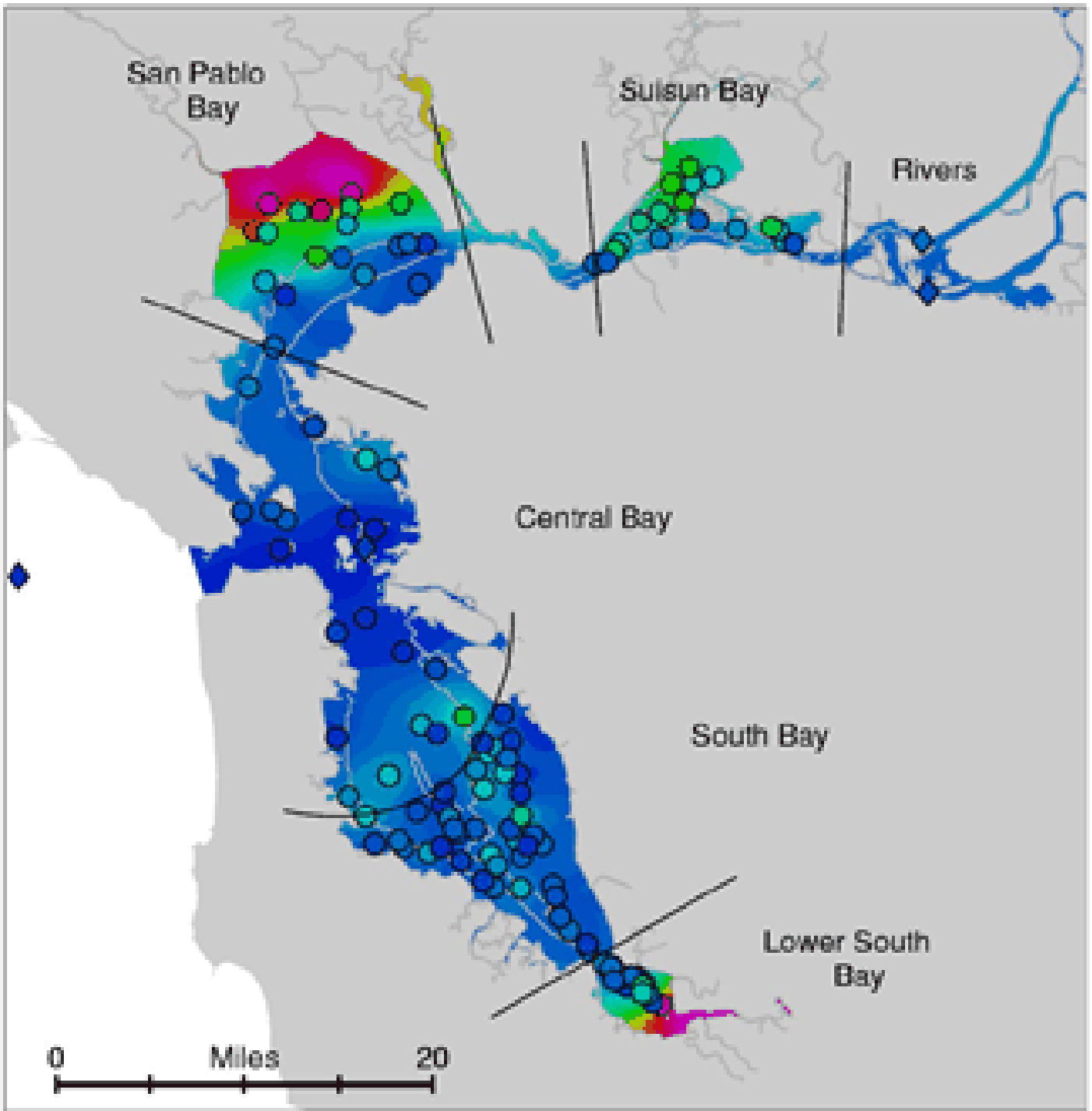
WWTP METALS UPLOAD

SF Airport PO Box 8097, San Francisco, CA 94128



Range	Cu	Ni	Cr	Se	Status	Total Fee	Invoice
01/2011 - 12/2011	10.4	12.61	2.16	0.59	Unpaid	$6,567.00	View Invoice
01/2010 - 12/2010	12.39	10.54	2.41	0.54	Paid	$6,240.00	View Invoice

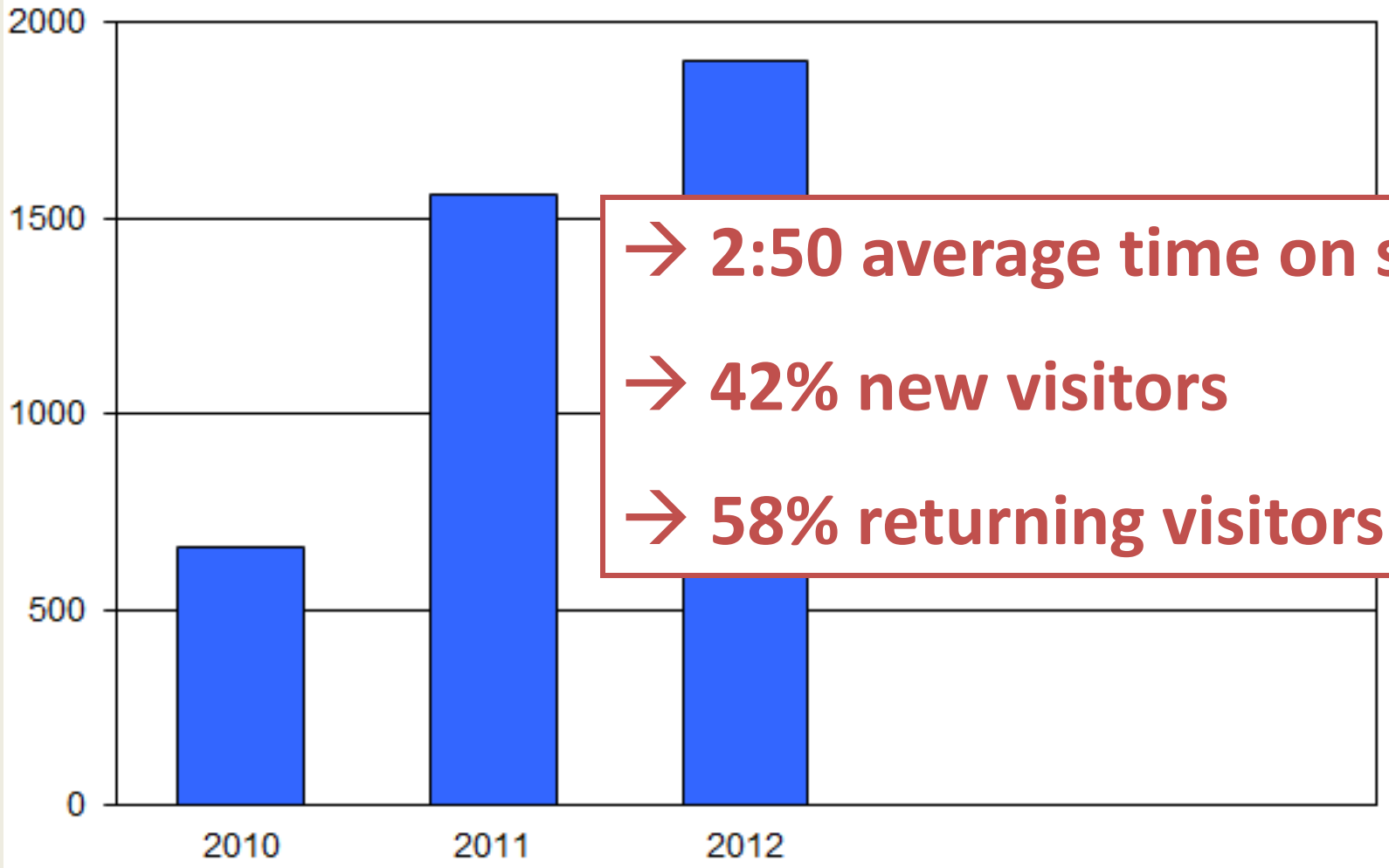
KRIGING TOOL



PERFORMANCE METRICS

- Web access to RMP data
- Timeliness of data from labs
- Timeliness of internal review

EXTERNAL USE OF CD3:
NUMBER OF QUERIES



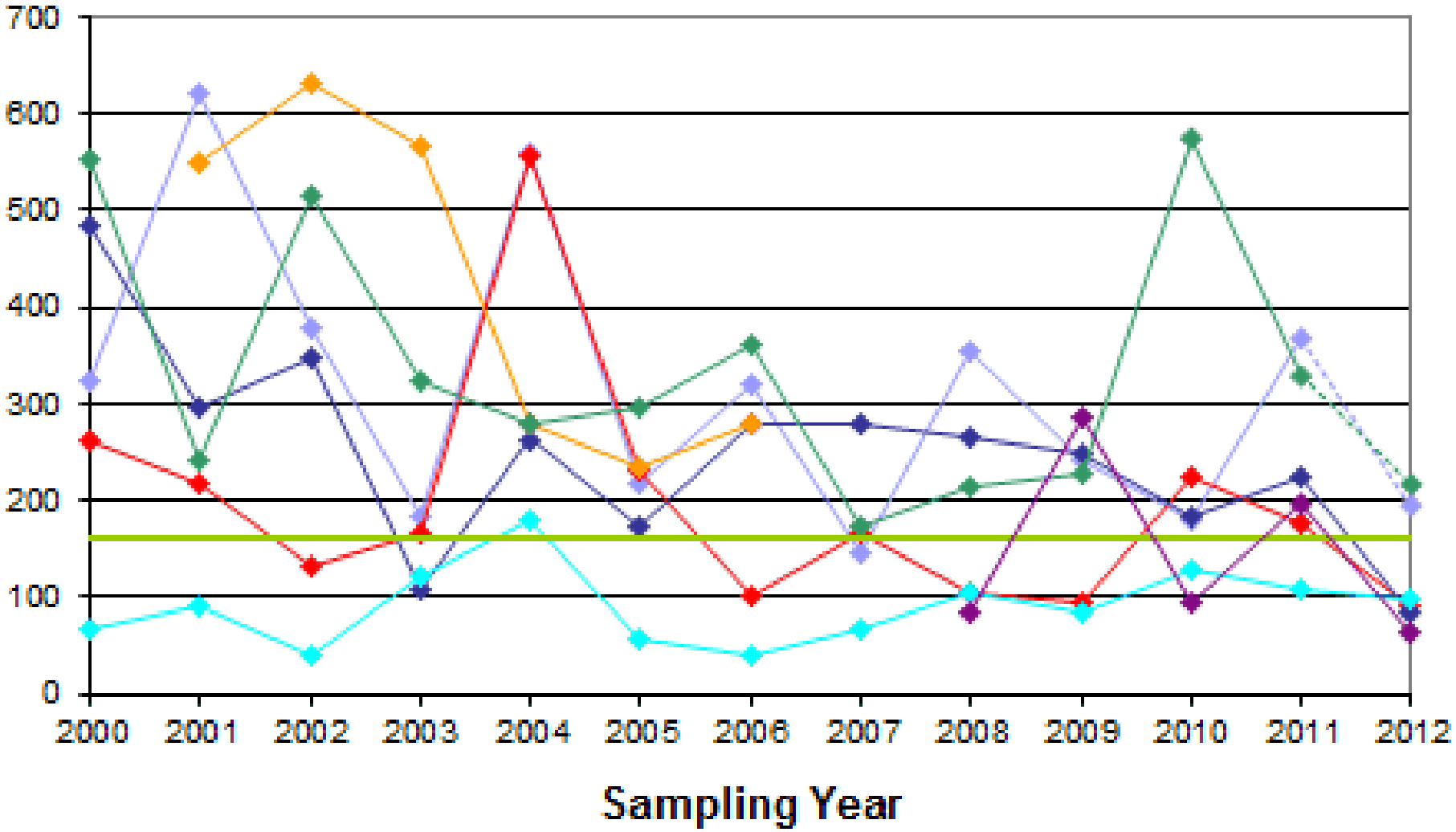
→ 2:50 average time on site

→ 42% new visitors

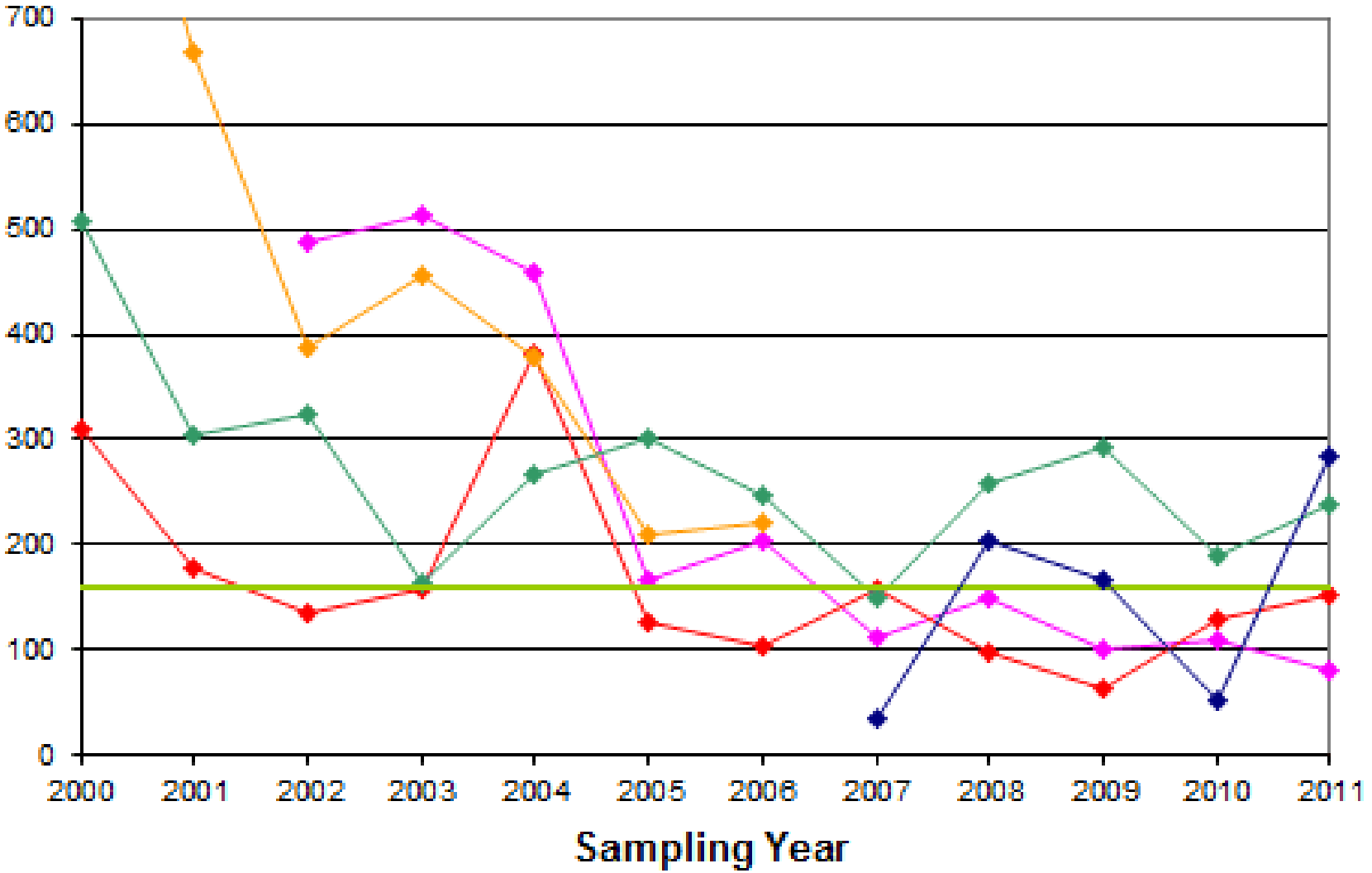
→ 58% returning visitors

TIMELINESS: SEDIMENT

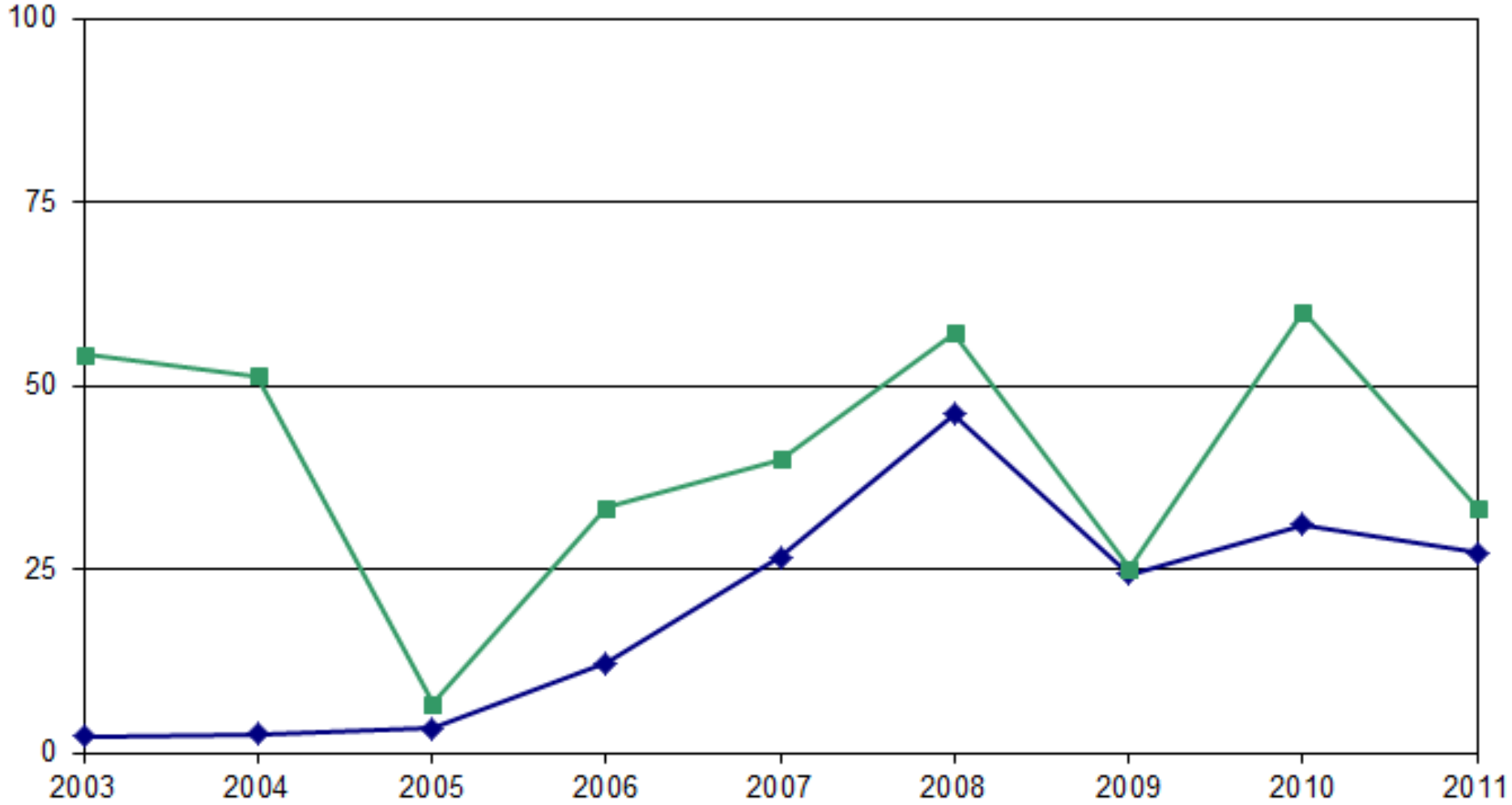
AVG. DAYS AFTER COLLECTION



TIMELINESS: WATER
AVG. DAYS AFTER COLLECTION



INTERNAL TIMELINESS:
PERCENT >45 DAYS

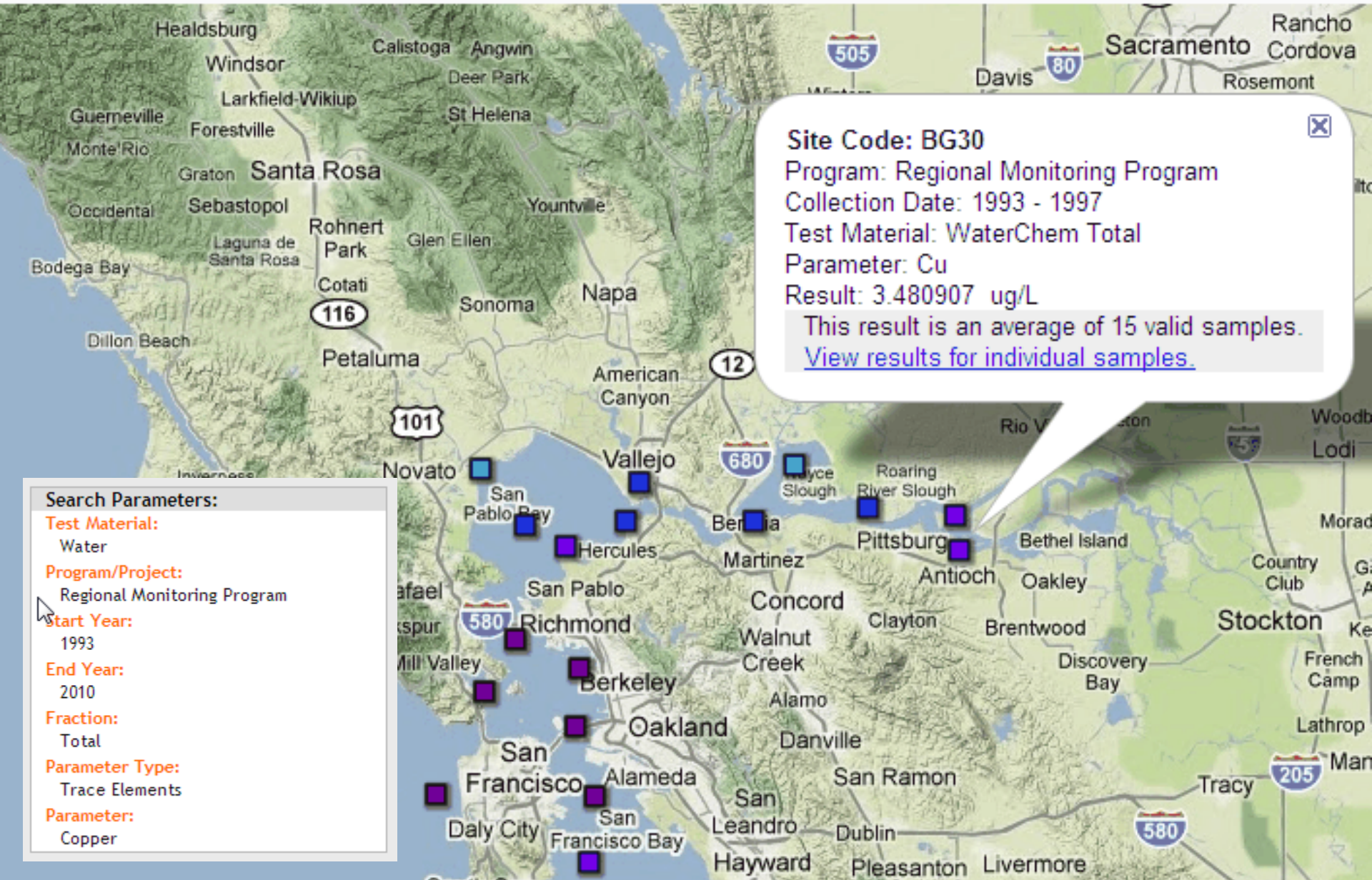


2013 GOALS

- Report high quality data within one year
- Enhance web query tool – CD3
  - Add kriging layer and statistical summaries
- Expand Regional Data Center
  - Improve data access and visualization
  - Maintain comparability with SWAMP/CEDEN

CD3 Contaminant Data Display & Download

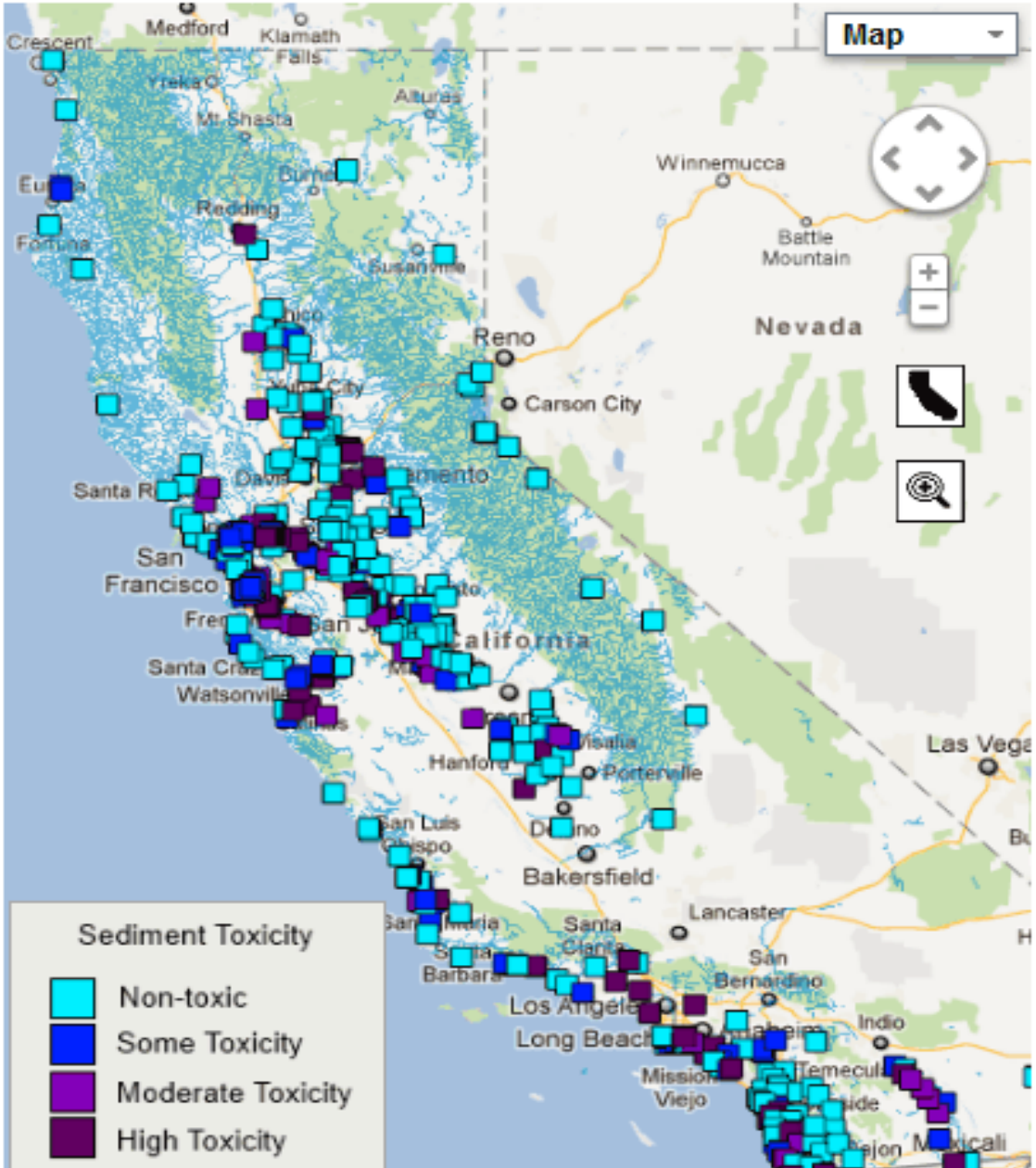
water sediment bivalves sport fish



HEALTHY STREAMS PORTAL

California Streams, Rivers and Lakes

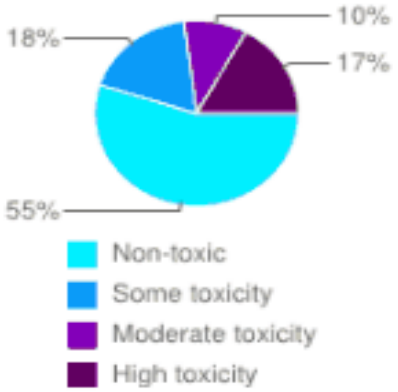
-- Select a Region Type --



How toxic is the sediment in our streams

Sediment at the bottom of a stream or suspended in th
these pollutants back into the water. Toxicity tests car
organisms express any adverse

In 2011 the State Water Board issued its report of nine
2001 and 2010, greater than 45% of sampled sites sh



This map shows data generated by:

SWAMP
Surface Water Ambient Monitoring Program

SFEI

SWAMP SFEI

(Updated 3/21/12)

Interactive Map

Layers Legends Background Overlays

Project Information

Aquatic Resources

quatic Resources - CARI
Area
Habitats
Aquatic Resources

Condition

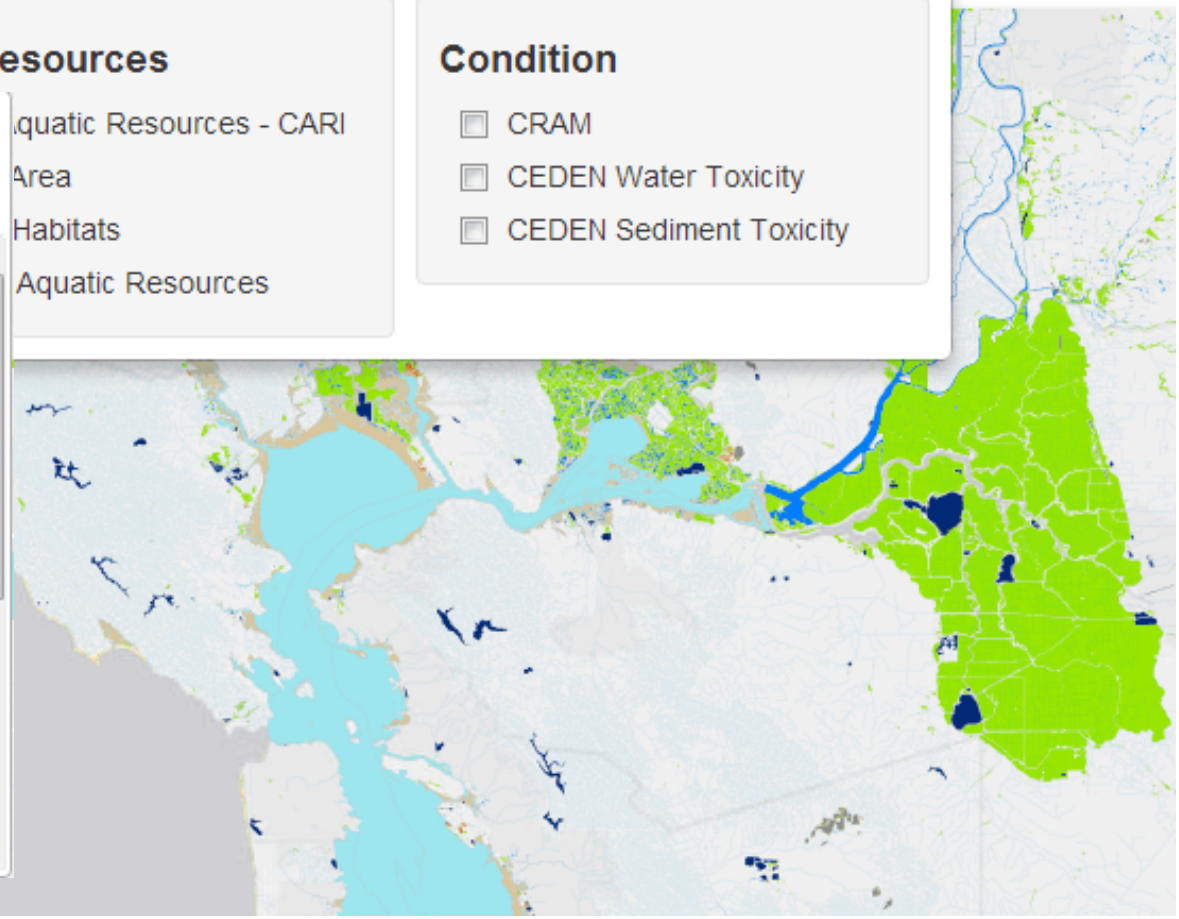
- [ ] CRAM
- [ ] CEDEN Water Toxicity
- [ ] CEDEN Sediment Toxicity

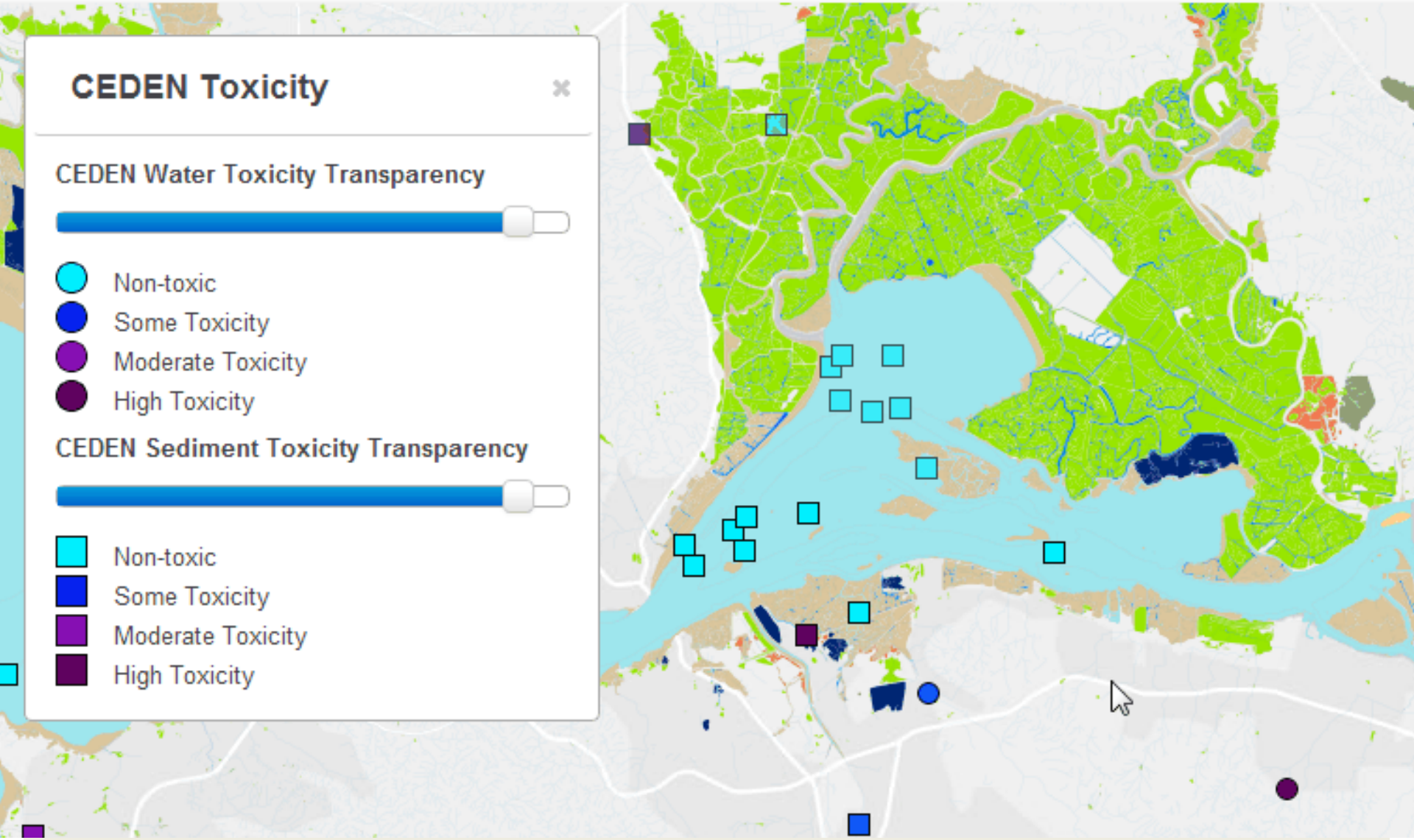
Existing Aquatic Resources - CARI

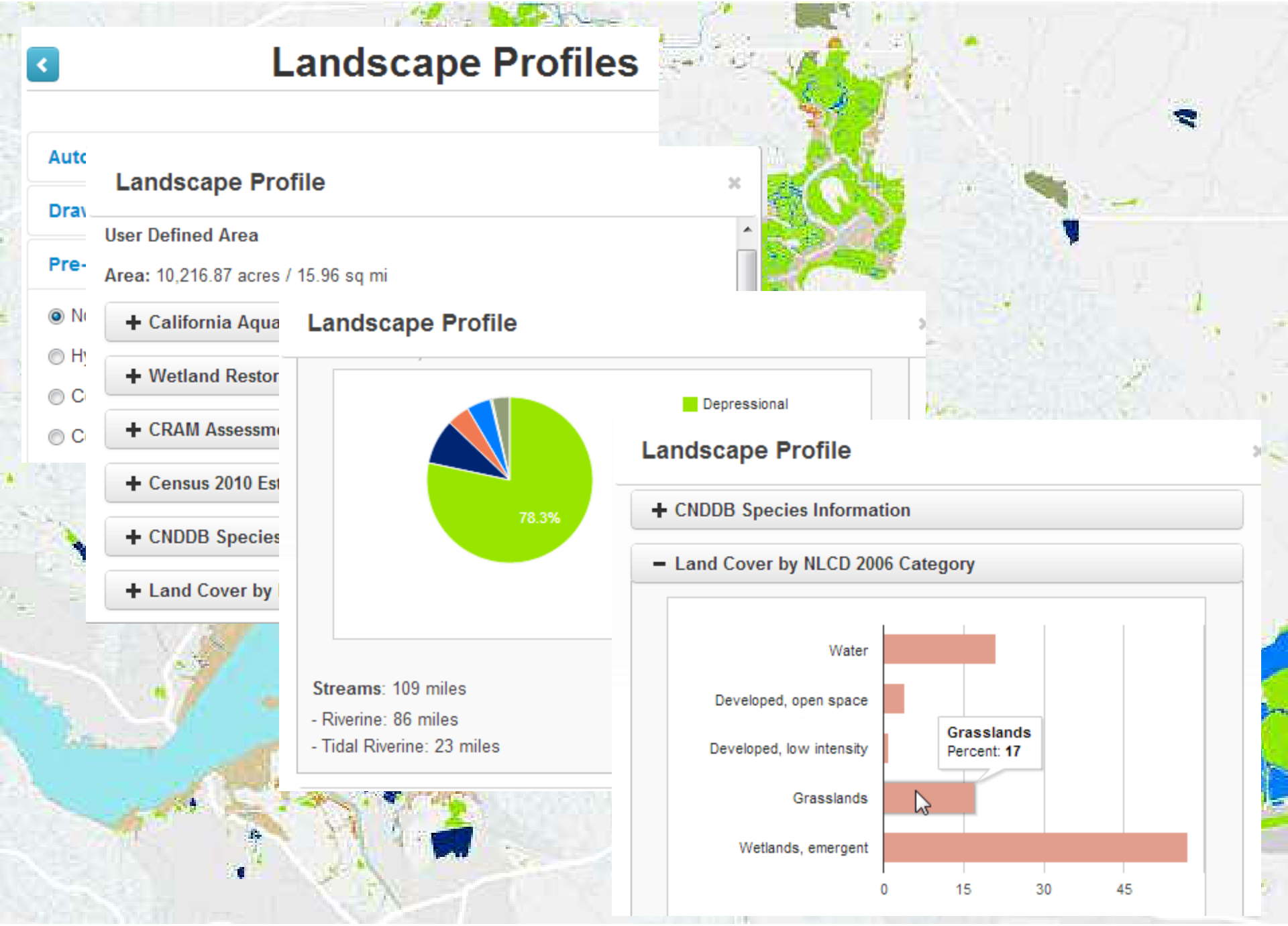
- [x] **Drainage Features**
  - Fluvial
  - Tidal
- [x] **Wetlands**

Estuarine and Coastal

- Estuarine Intertidal
- Estuarine Muted Tidal
- Estuarine Subtidal
- Marine Intertidal




CEDEN Toxicity
CEDEN Water Toxicity Transparency
Non-toxic
Some Toxicity
Moderate Toxicity
High Toxicity
CEDEN Sediment Toxicity Transparency
Non-toxic
Some Toxicity
Moderate Toxicity
High Toxicity


Landscape Profiles
Landscape Profile
User Defined Area
Area: 10,216.87 acres / 15.96 sq mi
+ California Aqua
+ Wetland Restor
+ CRAM Assessm
+ Census 2010 Est
+ CNDDB Species
+ Land Cover by
Landscape Profile
Depressional
78.3%
Streams: 109 miles
- Riverine: 86 miles
- Tidal Riverine: 23 miles
Landscape Profile
+ CNDDB Species Information
− Land Cover by NLCD 2006 Category
Water
Developed, open space
Developed, low intensity
Grasslands
Wetlands, emergent
Grasslands
Percent: 17
0
15
30
45