Recommendations for a Modeling Framework to Answer Nutrient Management Questions in the Sacramento-San Joaquin Delta

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Chair: Modeling Science Workgroup
California Water And Environmental Modeling Forum
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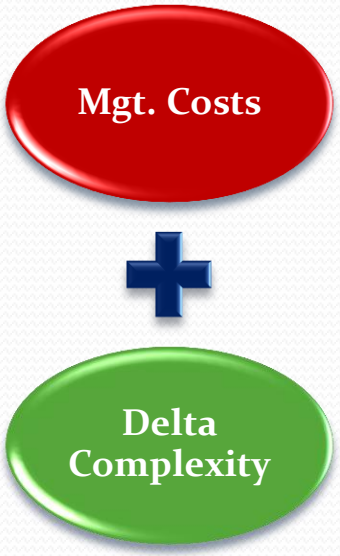
Modeling Science Workgroup

- Phil Trowbridge (SFEI-ASC)
- Mike Deas (Watercourse Eng.)
- Eli Ateljevich (DWR)
- Eric Danner (NOAA)
- Joe Domagalski (USGS)
- Chris Enright (DSP)
- Bill Fleenor (UC Davis)
- Chris Foe (RWQCB-V)
- Marianne Guerin (RMA)
- David Senn (SFEI-ASC)
- Lisa Thompson (Regional San)

Purpose

- Setting
  - Cost of management actions in the Delta
  - Complexity of the Delta ecosystem



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  - Cost of management actions in the Delta
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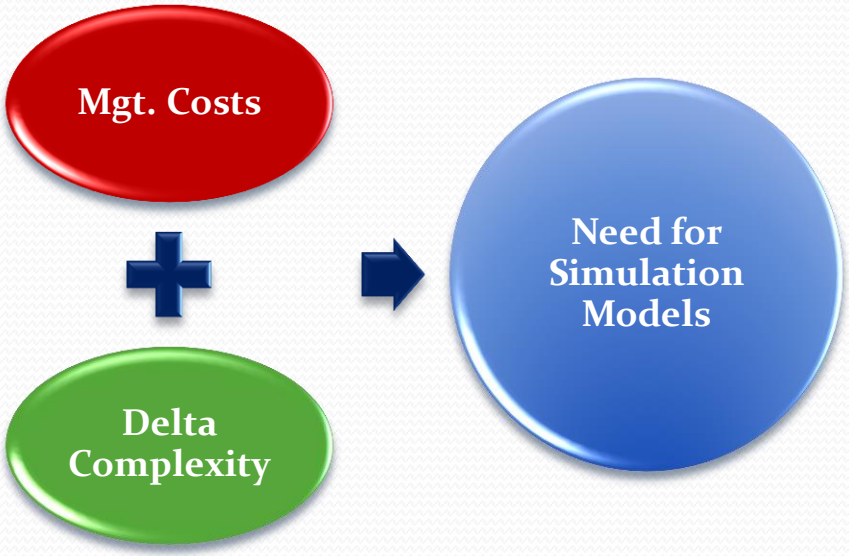
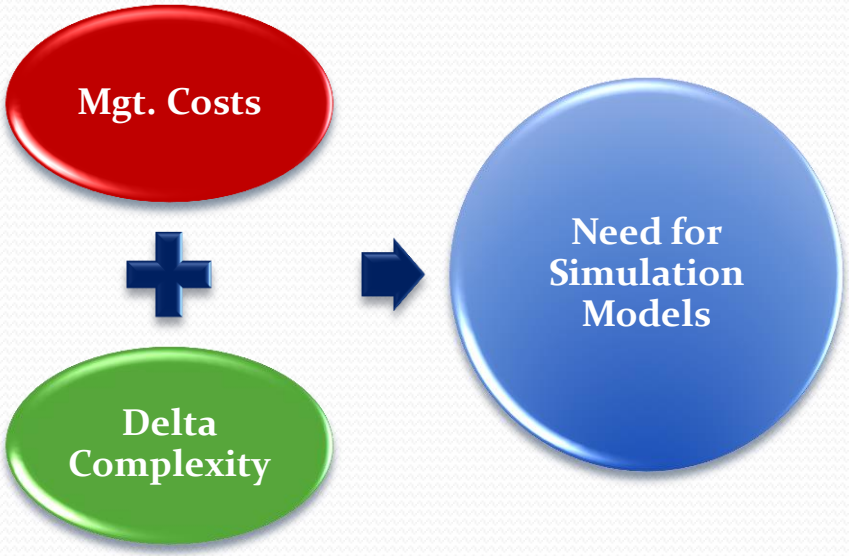
- Thesis
  - Setting requires that numerical, processed-based water quality modeling be part of Delta management efforts



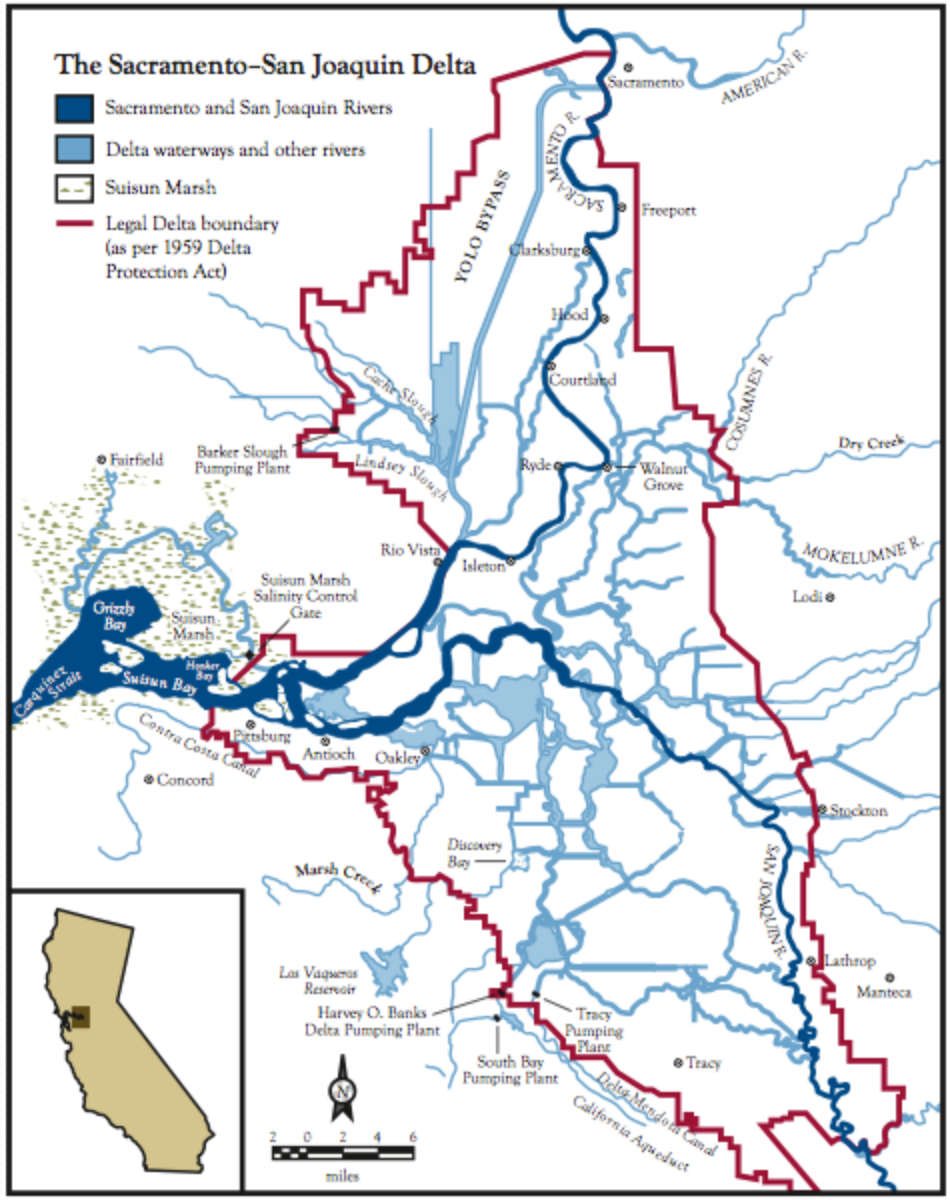
Purpose

- Setting
  - Cost of management actions in the Delta
  - Complexity of the Delta ecosystem
- Thesis
  - Setting requires that numerical, processed-based water quality modeling be part of Delta management efforts
- Response
  - Water Board convened the Modeling Science Workgroup convened in 2015 to develop a white paper on the development and use of water quality models as one component of the Water Board's Nutrient Research Plan.



Charge to the Workgroup

- Provide advice to the Water Board on:
  - Types of models needed to answer nutrient management questions
  - Organizational arrangements
  - Cost estimates and phasing
- Project Area – Legal Delta
- Outcome: White Paper

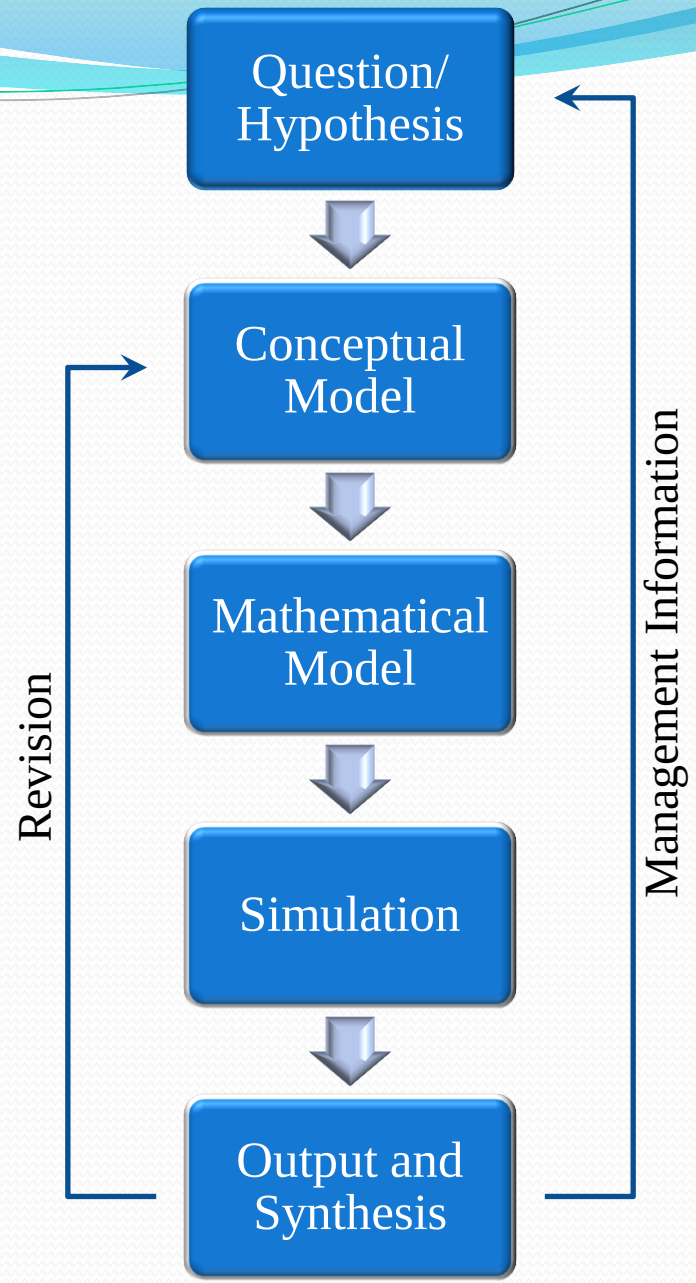


White Paper Organization

- Introduction to computer models
- Existing Model Software and Applications
- Nutrient Management Questions and Modeling Objectives
- Model Characteristics to Achieve Modeling Objectives
- Recommendations
- Cost Estimates
- References, Appendices, Glossary

Computer Models

"Models are tools to organize information, relate various processes, improve the understanding and characterization of aquatic systems, and test hypotheses in conjunction with field studies and management actions. *People using models as tools will provide the insight needed to formulate answers to management questions.*"



Model Strengths and Limitations

Strengths

- Comprehensive representation of complex systems
- Insight into ecological response
- Assess range of conditions
- Communication

Limitations

- Require technical expertise
- Simplistic
- Uncertainty
- Require extensive field data



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“All models are wrong. Some are useful.” - Box



Management Questions and Objectives

Scenarios

A: Current Conditions

B: Future Conditions: Permitted reductions

C: Future Conditions: "B" plus BMPs

D: Future Conditions: A-C plus Climate Change

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Questions

- What are sources/sinks?
- Contribution to ambient conditions?
- Important processes/rates?
- Primary production response?

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A: Current Conditions

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- What are sources/sinks?
- Contribution to ambient conditions?
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- Primary production response?

Objectives (Model)

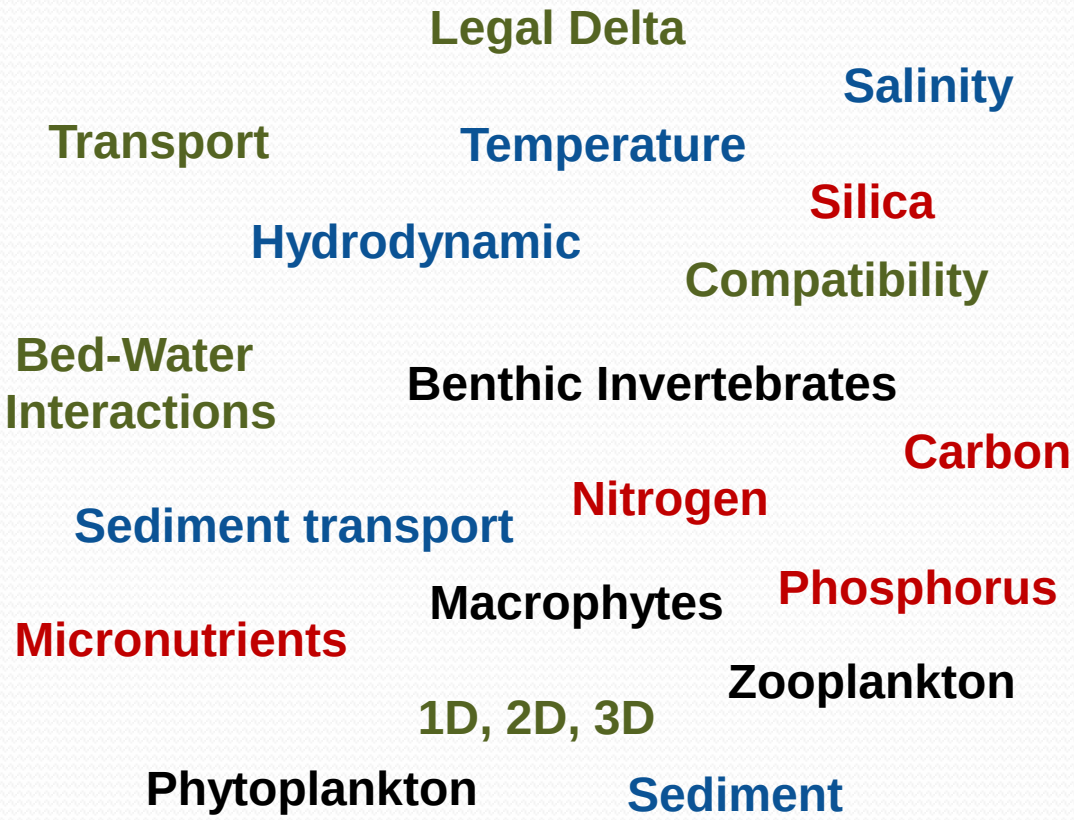
- Identify sources/sinks
- Quantify ambient concentrations
- Quantify important processes/rates
- Characterize primary production

Model Characteristics

- General
  - Costs
  - Peer review
  - User Community
  - Representations (see Technical)
  - Scalability

Model Characteristics

- Technical
  - Domain
  - Hydrodynamics
  - Biogeochemical
  - Dimensionality



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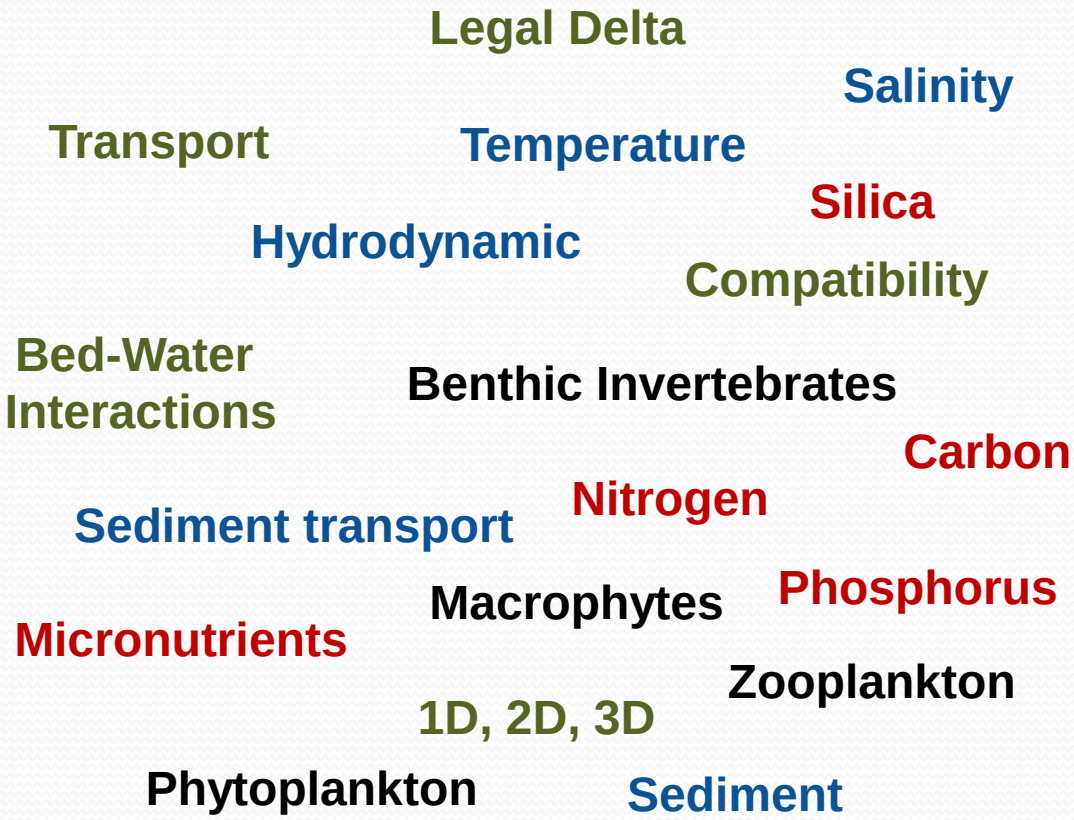
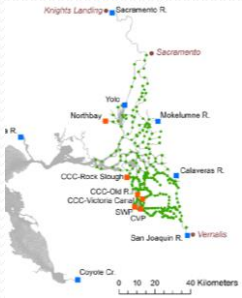
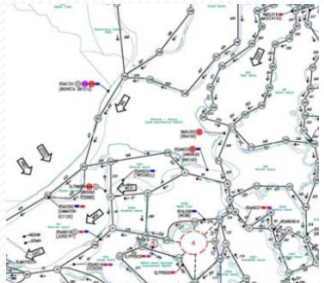


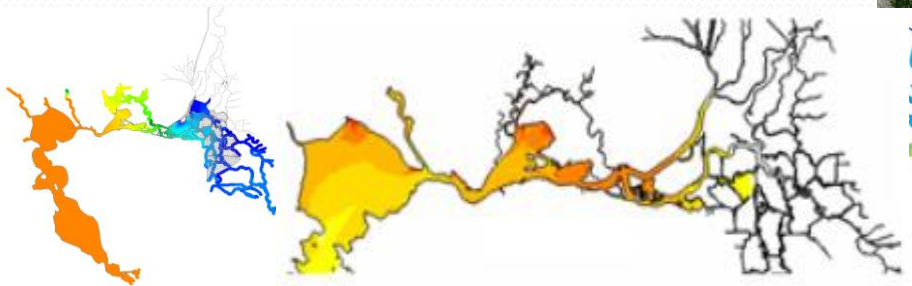
Existing models get us close to desired characteristics, but not all the way.

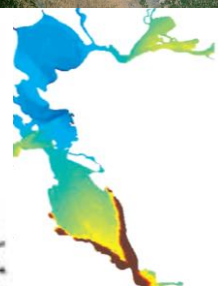
Considered Models

- SCHISM (Semi-implicit Cross-scale Hydroscience Integrated System Model)
- Suntans (Stanford Unstructured Nonhydrostatic Terrain-following Adaptive Navier-Stokes Simulator)
- CASCaDE (Computational Assessments of Scenarios of Change for the Delta Ecosystem)
- DSM2 (Delta Simulation Model II)
- RMA-2 Bay-Delta Model
- EFDC (Environmental Fluid Dynamics Code)
- UnTRIM (Unstructured Tidal, Residual, Intertidal Mudflat Model)
- CE-QUAL-W2
- SI-3D (Semi-Implicit-3D Model)



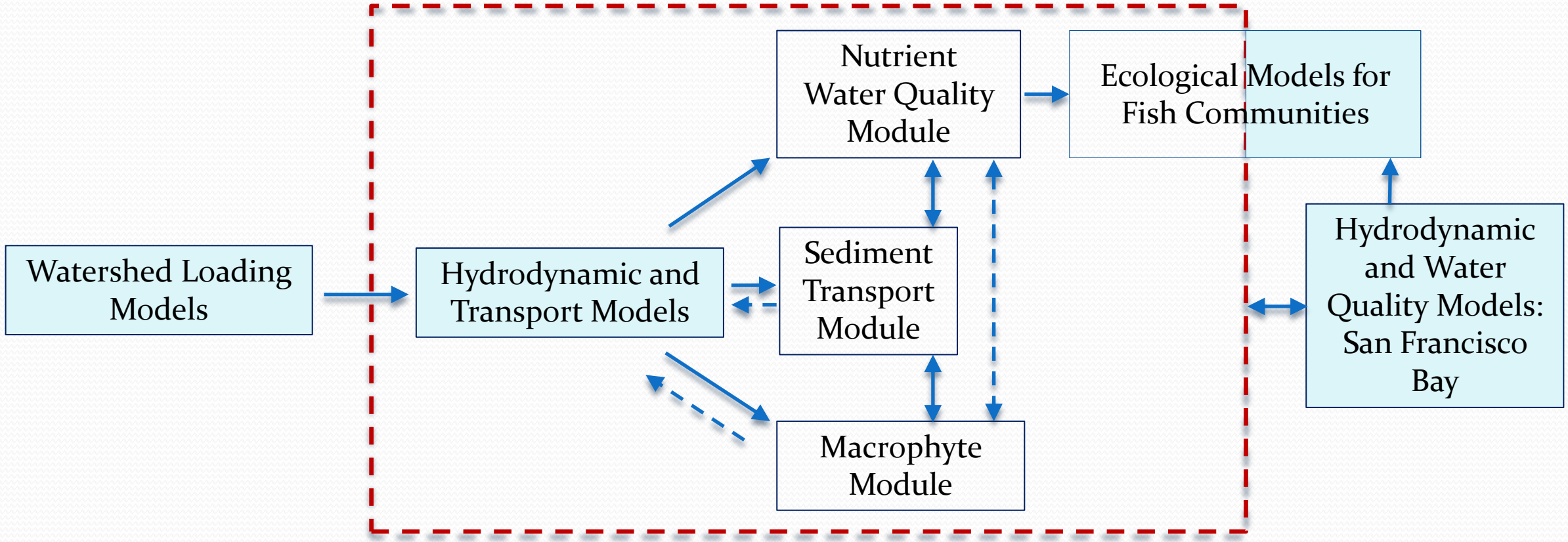






Desired Technical Characteristics

Watershed Models **Delta Hydrodynamic and Water Quality Model(s)** *SF Bay Models*



Legend

Text — Existing model(s)

Text — New or Better Model(s) Needed

One-way linkage

Two-way linkage

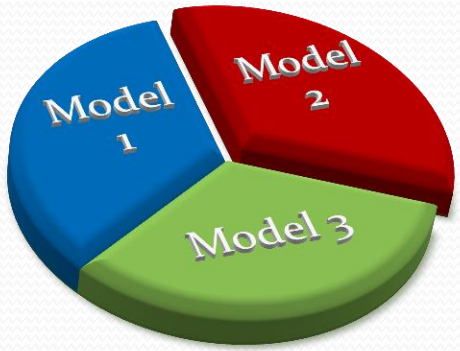
Linkage that is only important in certain areas

Key Recommendations

- Invest in a team approach

- Phased implementation using existing models

- Use multiple models



Schedule and Cost

- Components:
  - Steering Committee
  - Modeling Support
  - Data Informatics Support
  - Data Synthesis Support
  - Monitoring Program Support
  - Peer Review Panel



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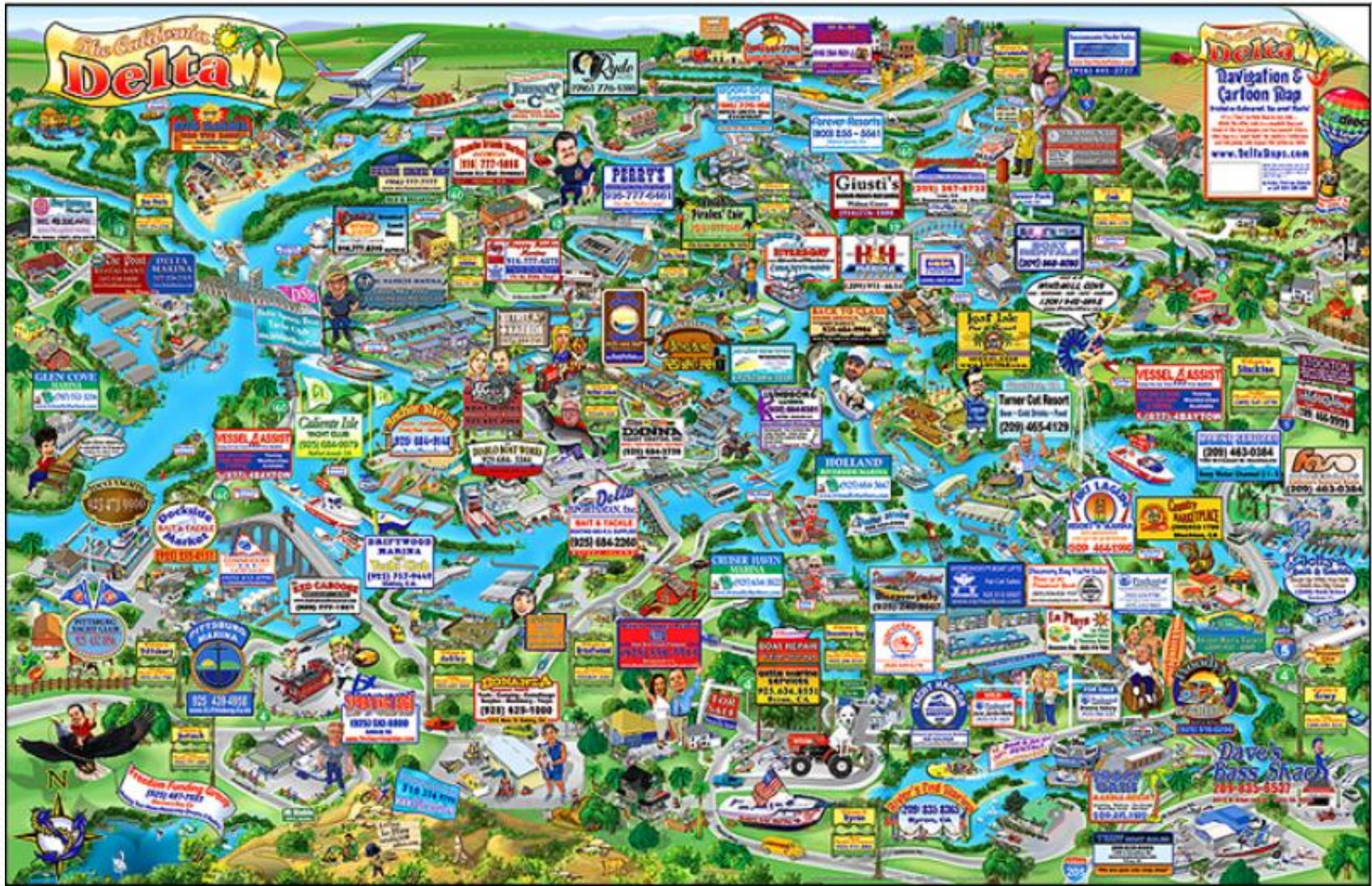
- Components:
  - Steering Committee
  - Modeling Support
  - Data Informatics Support
  - Data Synthesis Support
  - Monitoring Program Support
  - Peer Review Panel
- 10 years to fully answer management questions
  - 2 five-year phases
- $1.7 million per year



True Delta Complexity

- Delta Navigation and Cartoon Map
  - Created by Locals!
  - NEW (2014)!
  - Supports Local Businesses!
  - Waterproof!
  - Fun!



http://www.deltamaps.com/