SWRCB Workshop 3
Modeling Tools

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Outline

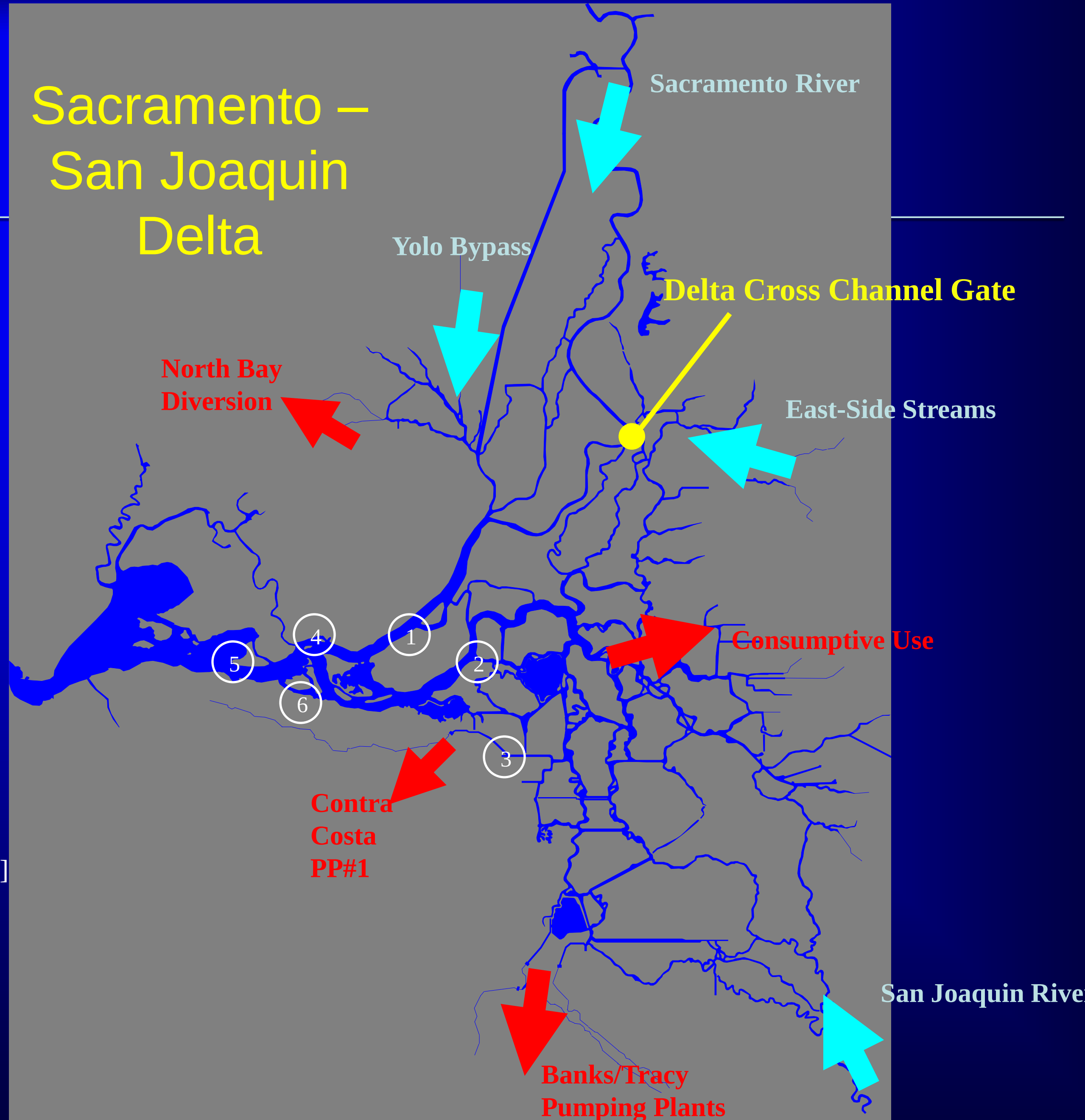
- Brief Discussion of Selected Models
    - CalSim-II
    - CalLite
    - DSM2
    - SELFE
- Case Study (Fall X2 Analysis)
- Unimpaired versus Natural Flow

What is CalSim-II?

- Statewide long-term planning model
- Simulates operations of SWP and CVP facilities on a monthly time-step
- Represents the Sacramento and San Joaquin River system and Delta
- Accounts for system operational objectives, physical constraints, legal and institutional agreements and statutes

California Water Resources System

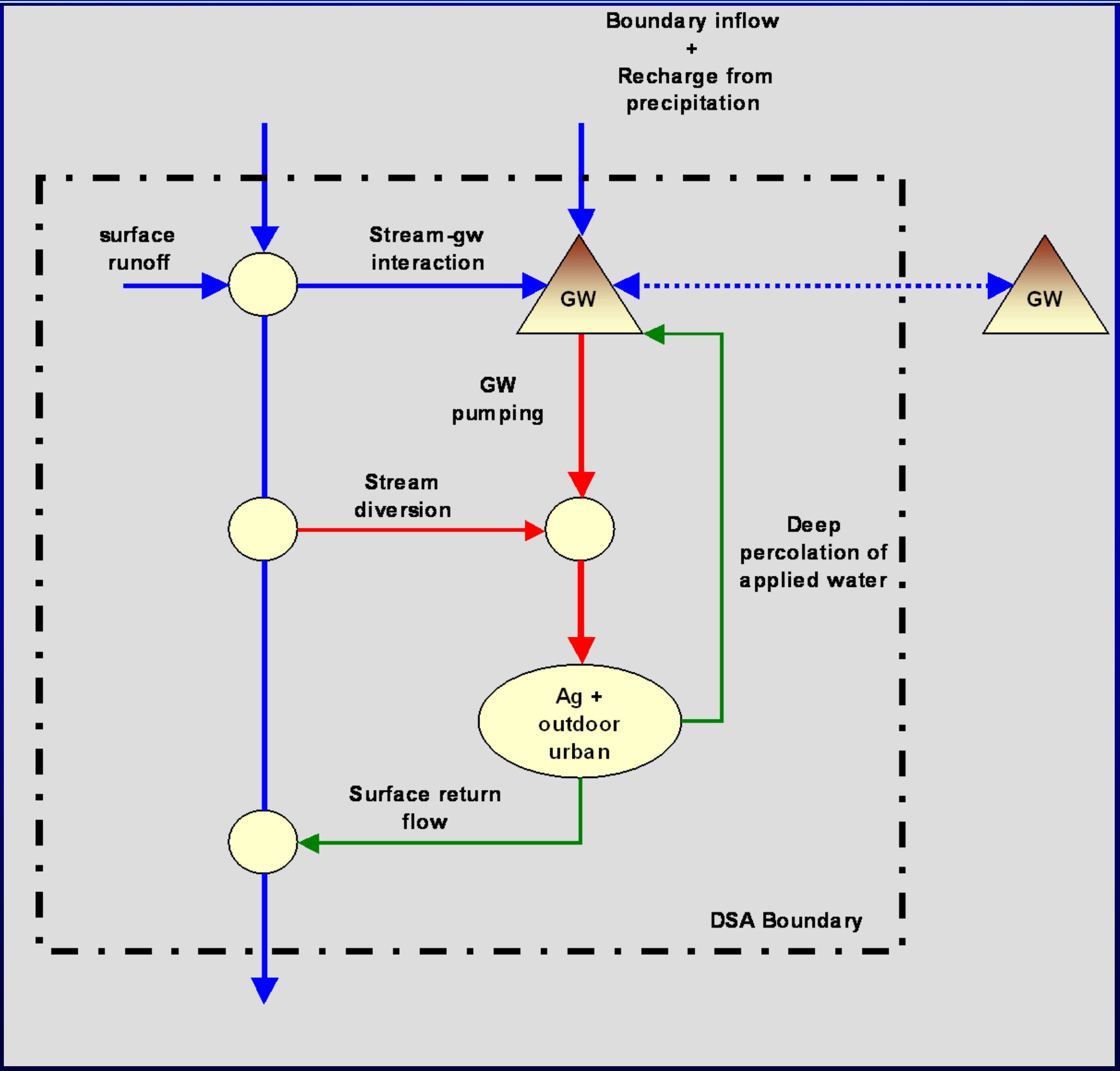
Sacramento – San Joaquin Delta



Salinity Standards

1. Emmaton
2. Jersey Point
3. Rock Slough [CC PP#1]
4. Collinsville
5. Chipps Island
6. Antioch

Representation in CalSim-II



Why use CalSim-II?

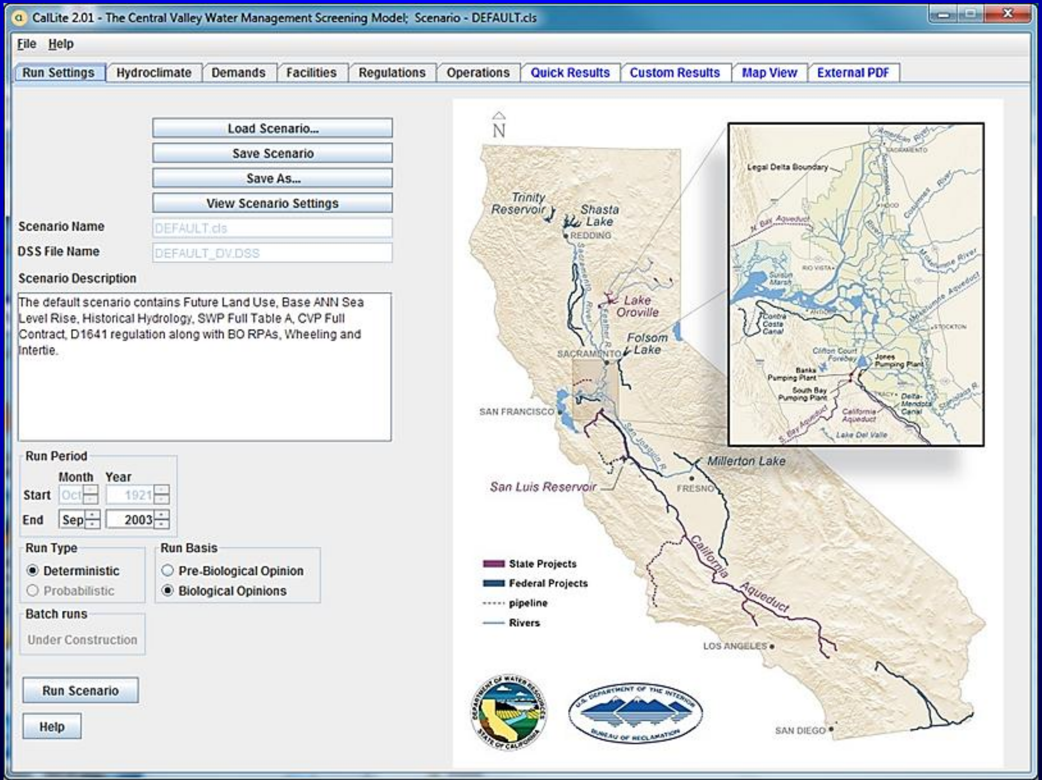
- Addresses many **SWP** and **CVP** obligations throughout the state (local demands, upstream river minimum flows, delta water quality, delta outflow, exports to contractors, etc.).
- Ability to assess operational objectives over a **long-term planning horizon** (82 years of simulation).
- Ability to evaluate potential water supply impacts throughout the state using **comparative analysis**.
- Ability to incorporate **Climate Change** and **Sea Level Rise** effects

CalSim-II Limitations

- Monthly time-step
  - mid month, 1 week, 3-day, 1-day, daily variability
- Demands aggregated in relatively large geographic areas (course resolution)
- Assumes existing water rights rules
- Imprecise groundwater representation
- More suitable for comparisons than stand-alone applications

CalLite Model

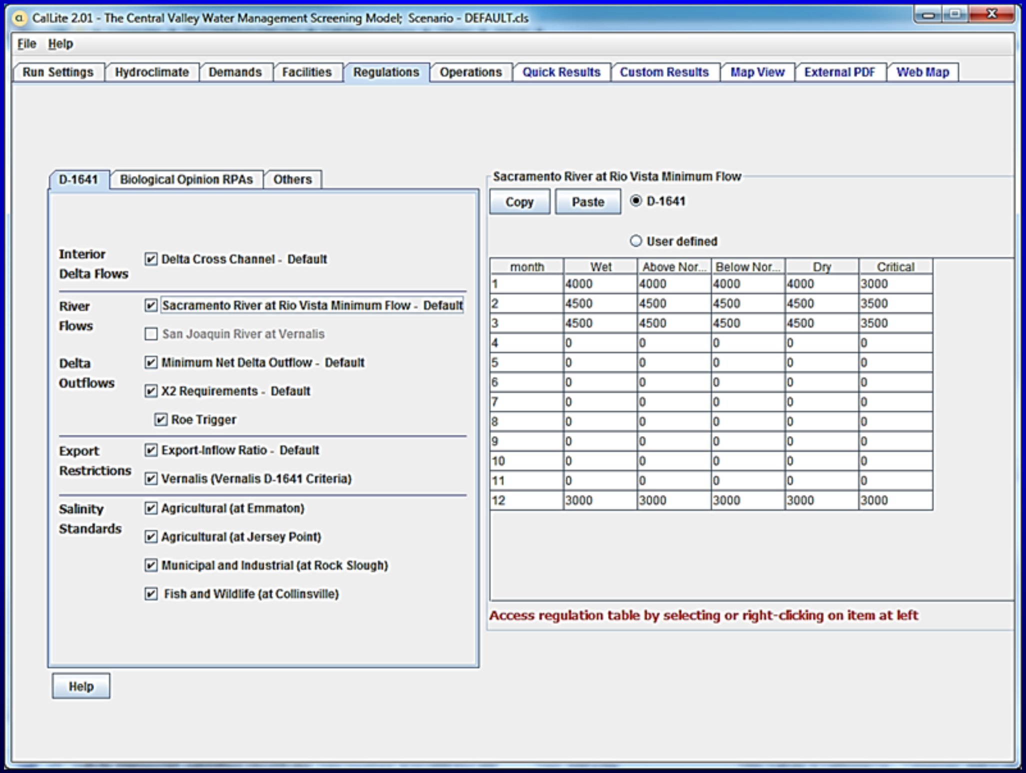
- Central Valley Water Management Screening Model
- Derived from CalSim-II model
- Simplified Sacramento and San Joaquin Valleys, but Same Delta representation.
- Simulation Period is 82 years (1922-2003)
- Flexible Graphical user interface for Input and output



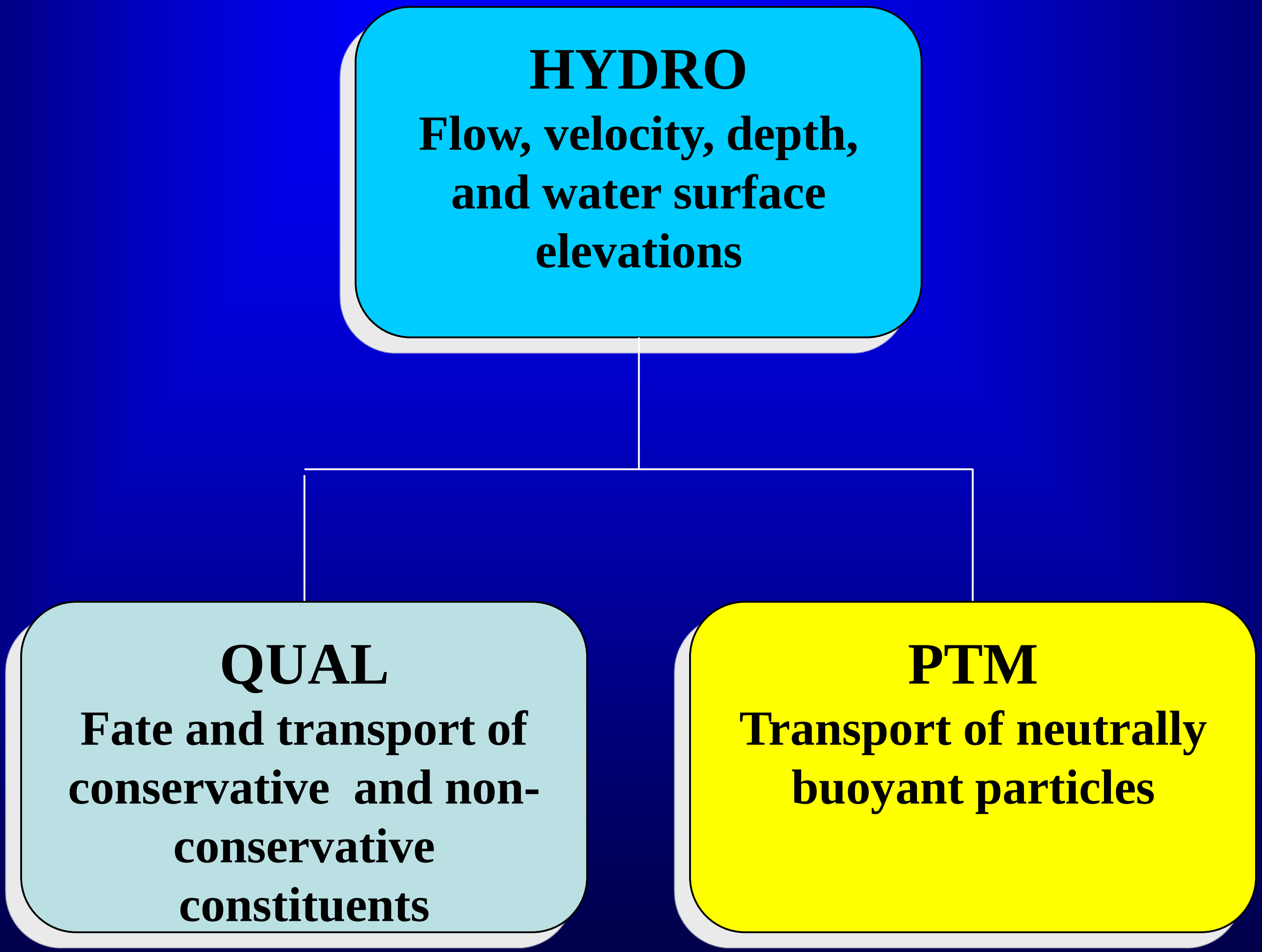
CalLite Model

CalLite allows interactive modification of water management actions

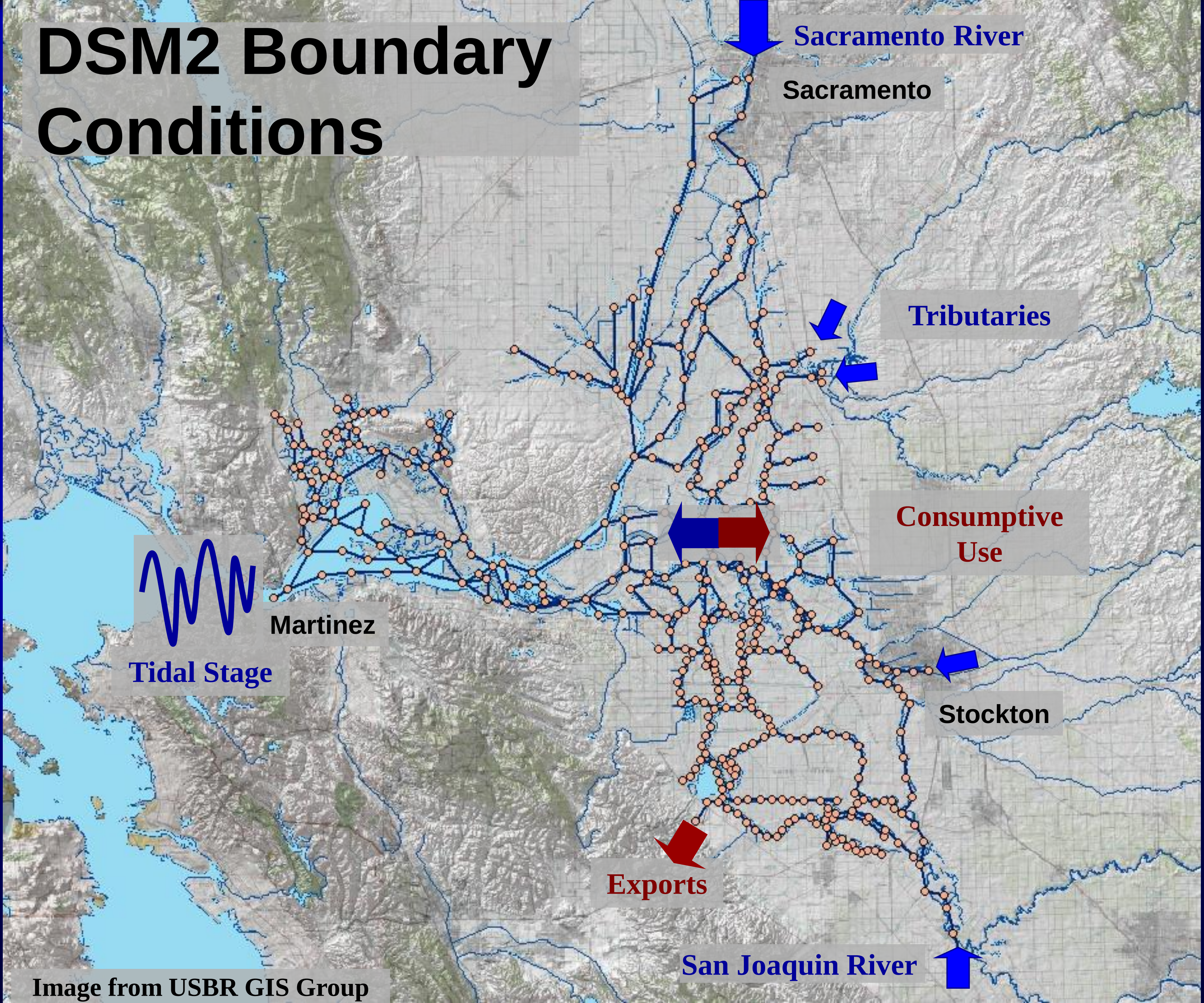
- Facilities (Isolated Facility, Storage investigation)
- Delta regulation options (D1641, Biological opinions)
- Demand management (Current and Future level)
- Hydrology (Current, Future, and Climate Change)



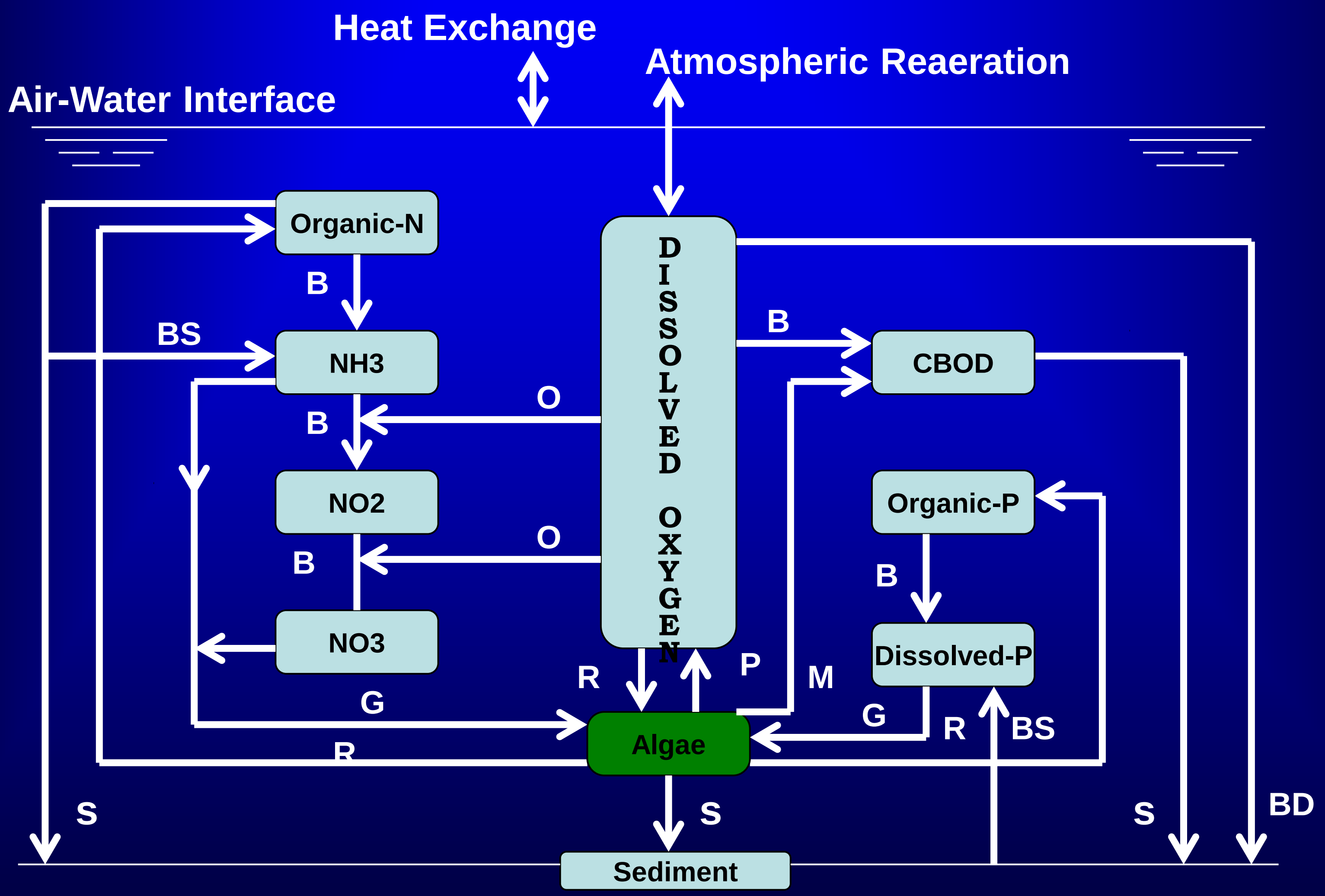
DSM2


HYDRO
Flow, velocity, depth, and water surface elevations
QUAL
Fate and transport of conservative and non-conservative constituents
PTM
Transport of neutrally buoyant particles

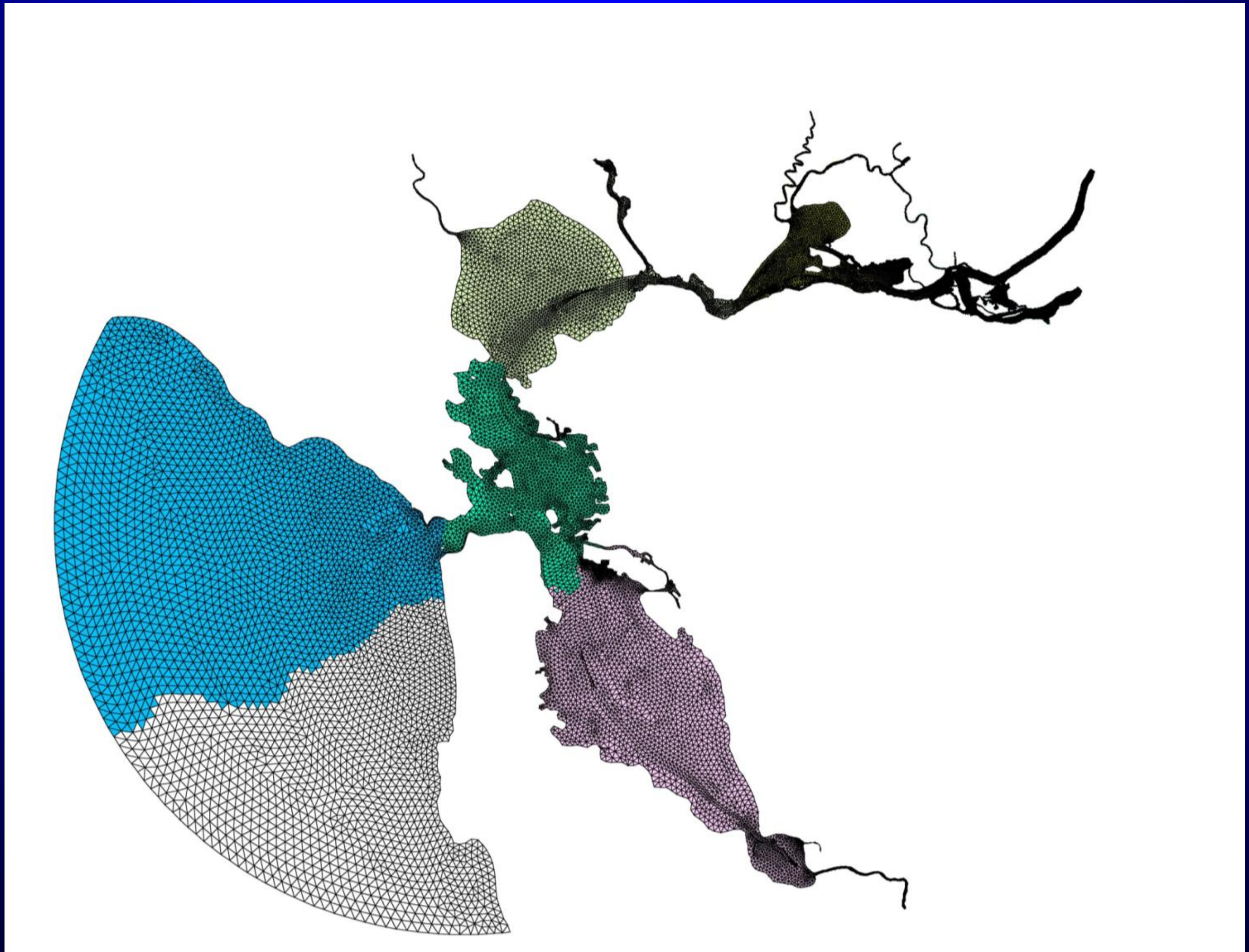
DSM2 Boundary Conditions



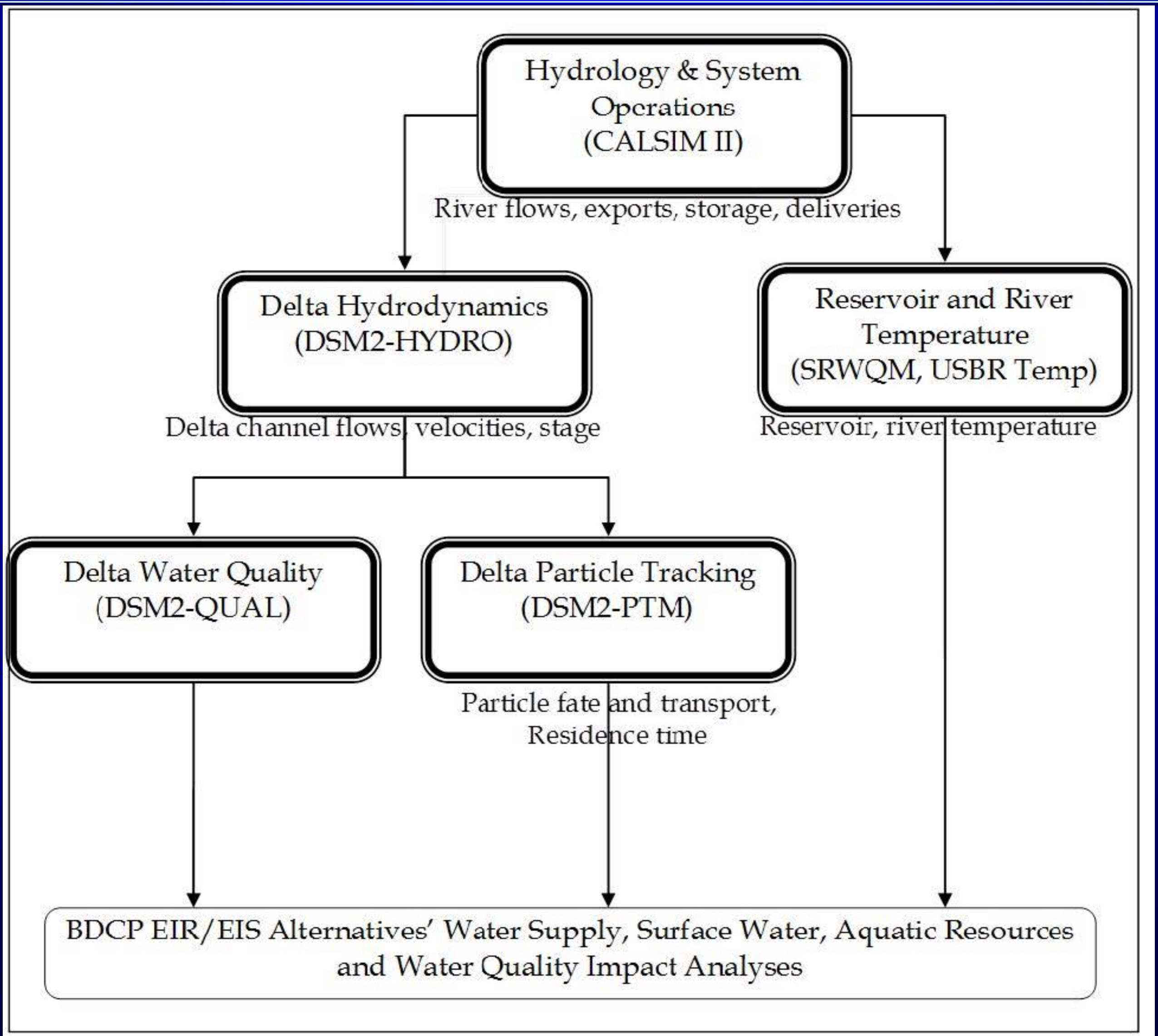
DSM2 (Nutrient Modeling)



SELFE (3-D Model Bay/Delta/Ocean)



CalSim-II links to other models and processes



Case Study – CalSim-II Fall X2 Analysis

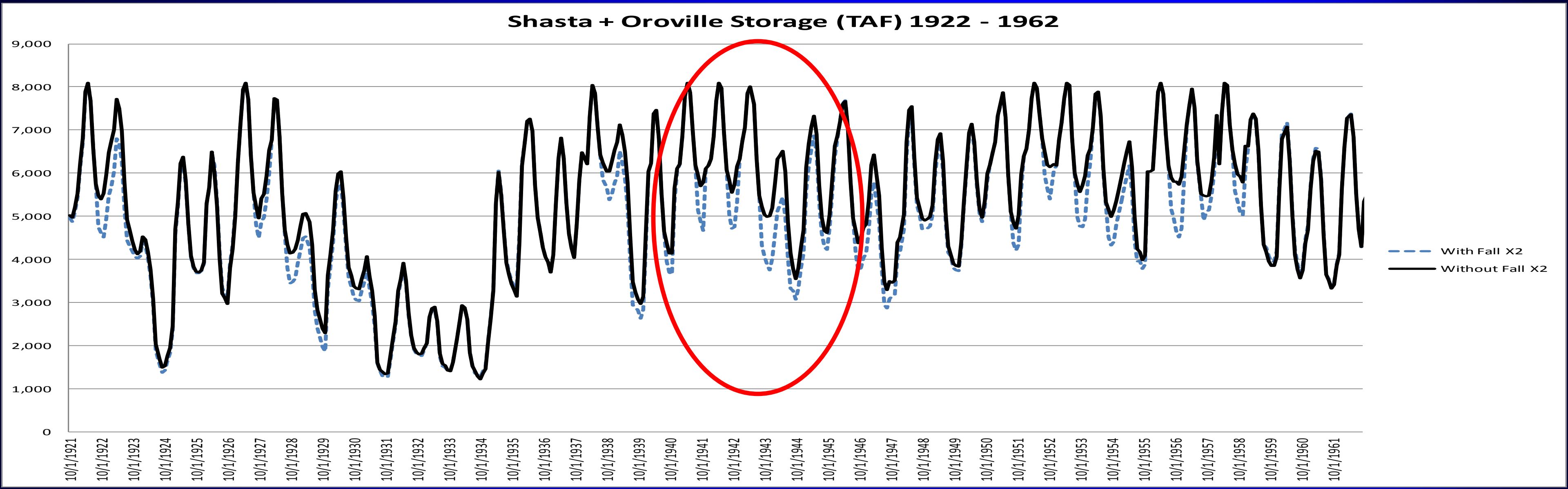
- **Major Assumptions**
  - No Action Alternative Simulation (With Fall X2)
    - 1922 – 2003 Simulation Period
    - Future Level of Development Land-Use and Demands (2030)
    - Future Level of Climate Change (2025)
    - Future Level of Sea Level Rise (15 cm)
    - Water Rights Decision 1641 regulations
    - 2008 USFWS Biological Opinion Reasonable and Prudent Actions including Fall X2 requirements which occur only in years following Wet or Above Normal years
    - 2009 NMFS Biological Opinion Reasonable and Prudent Actions
      - **Temperature and storage requirements under Action 1.2 not modeled**
  - No Fall X2 Alternative Simulation
    - Same as No Action with the exception of the removal of the Fall X2 requirement

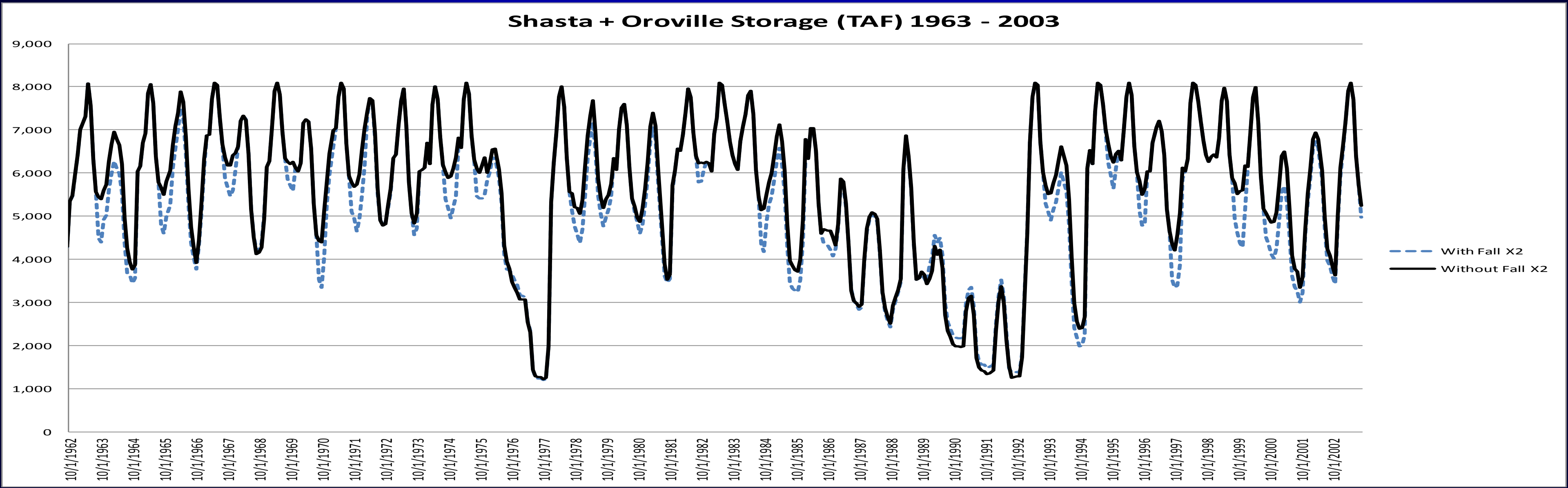
Case Study – Fall X2 (Export Impacts)

Total SWP + CVP Export (TAF)	With Fall X2	Without Fall X2	Diff
1922 - 2003 Average	4728	4927	199
Average of 1 Year Following W or AN	5040	5374	335
Max Impact of Year Following (1944)	3915	4690	775
Min Impact of Year Following (2000)	4987	4997	10

- Different metrics can show different impacts
- Model results need to be evaluated qualitatively and quantitatively

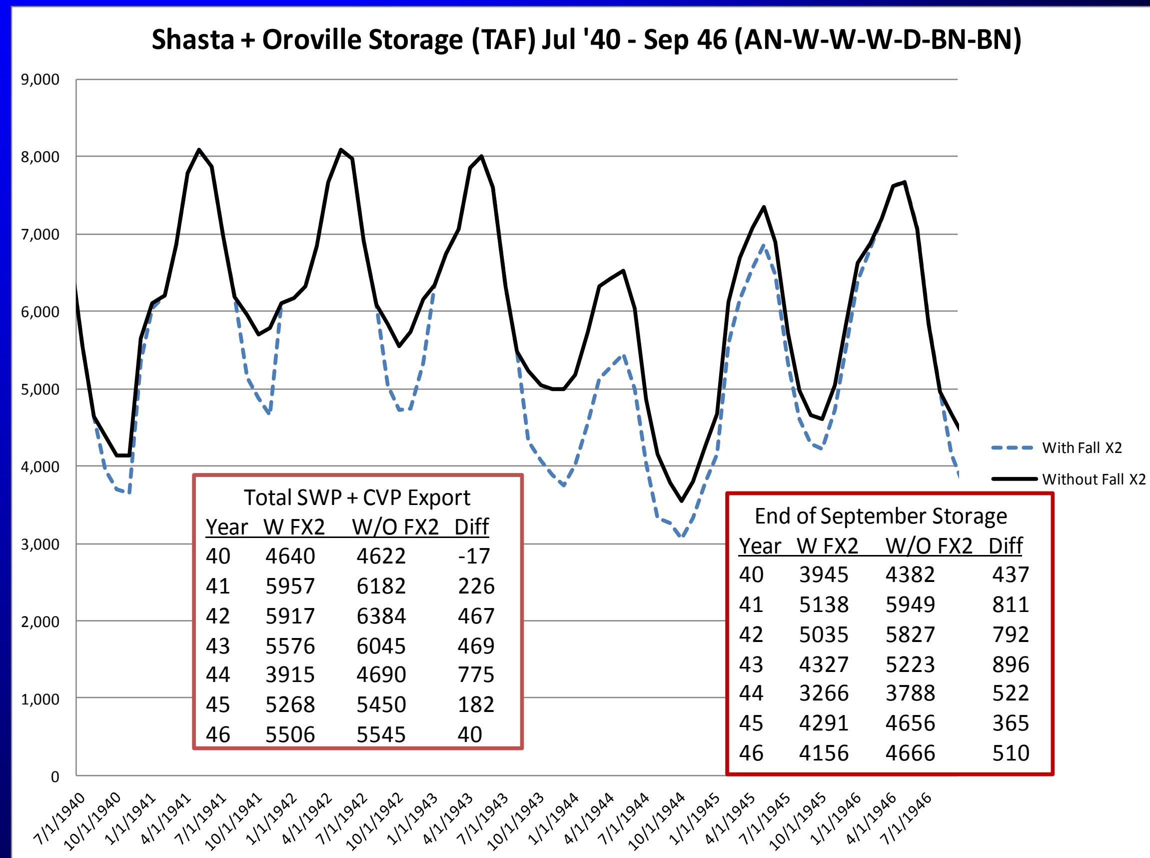
Case Study – Fall X2 (Storage Impacts)





Case Study – Fall X2

- Wet years help storage to recover
- Exports still Impacted
- 1944 shows largest export impact



Case Study – Fall X2 Analysis
Summary of Findings

- Storage generally lower when implementing Fall X2
- Storage impacts can be more pronounced in periods following Fall X2 requirements
- Reduced storage is accompanied by a reduced ability to meet temperature requirements for listed species
- Reduced storage is accompanied by reduced exports

Unimpaired versus Natural Flow

- Unimpaired Flow (UF) can be significantly different from Natural Flow (NF)
- UF is a conceptual quantity estimated through various means to approximate “total water available” at a location
- NF is also a conceptual quantity that is the streamflow that would have occurred naturally if the watershed were not altered by “human activity”
- UF and NF quantities are more similar for upper watersheds

Limitations on the use of UF

- No channel flow routing
- Some estimates are based on expert judgment; hence not precise
- Direct field measurement and forecast of the UF is possible but very difficult
- Difficult to implement UF based requirements in real time

Take Home Points

- Models are simplifications of the real physical world and should be used with caution
- There are multiple modeling tools that should be used together to examine the CA water system holistically
- The effects of Climate Change and Sea Level Rise should be considered in all modeling
- System objectives and impacts will likely need to be balanced

Statewide SWP-CVP System