The amaz_eing Delta and models used to manage it

Municipal Water Quality Investigations Meeting
July 30, 2014

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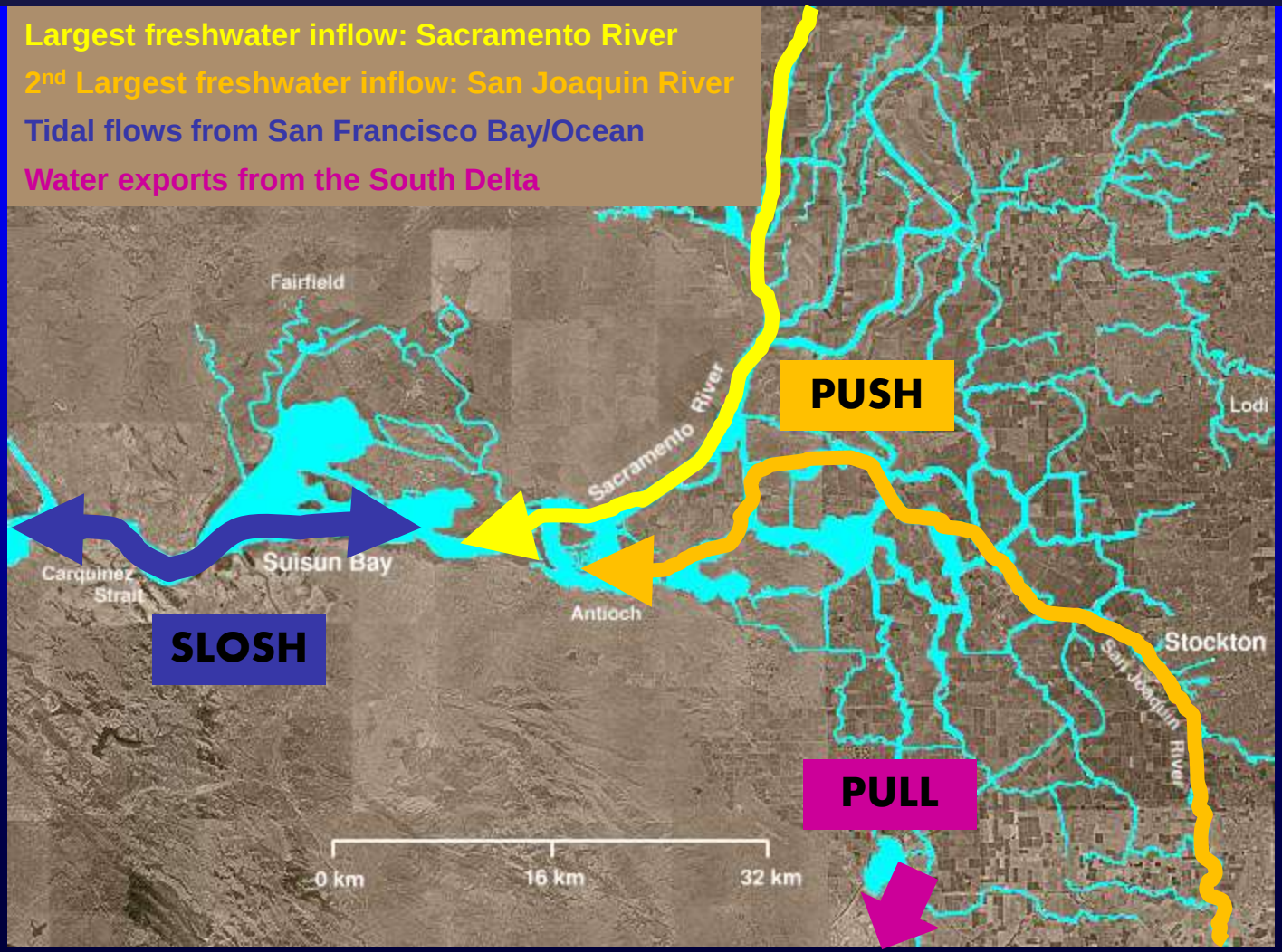
Dept of Water Resources
Modeling Support Branch
Bay-Delta Office

The Delta is a maze of channels that flow into San Francisco Bay



The amazeing Delta

- A maze of interconnected channels
- Hub of the state & federal water supply systems

Vital to Economy

- 2/3 of Californians rely on Delta water
- Los Angeles, San Diego, Silicon Valley, Contra Costa depend on Delta water
- 3 million of acres irrigated with Delta water
- Delta water supports about $400 billion of the California economy

Vital to Environment

- 80% of the state's commercial fish species live in or migrate through the Delta
- The Delta is home to over 700 species of plants and animals
- Several threatened or endangered species

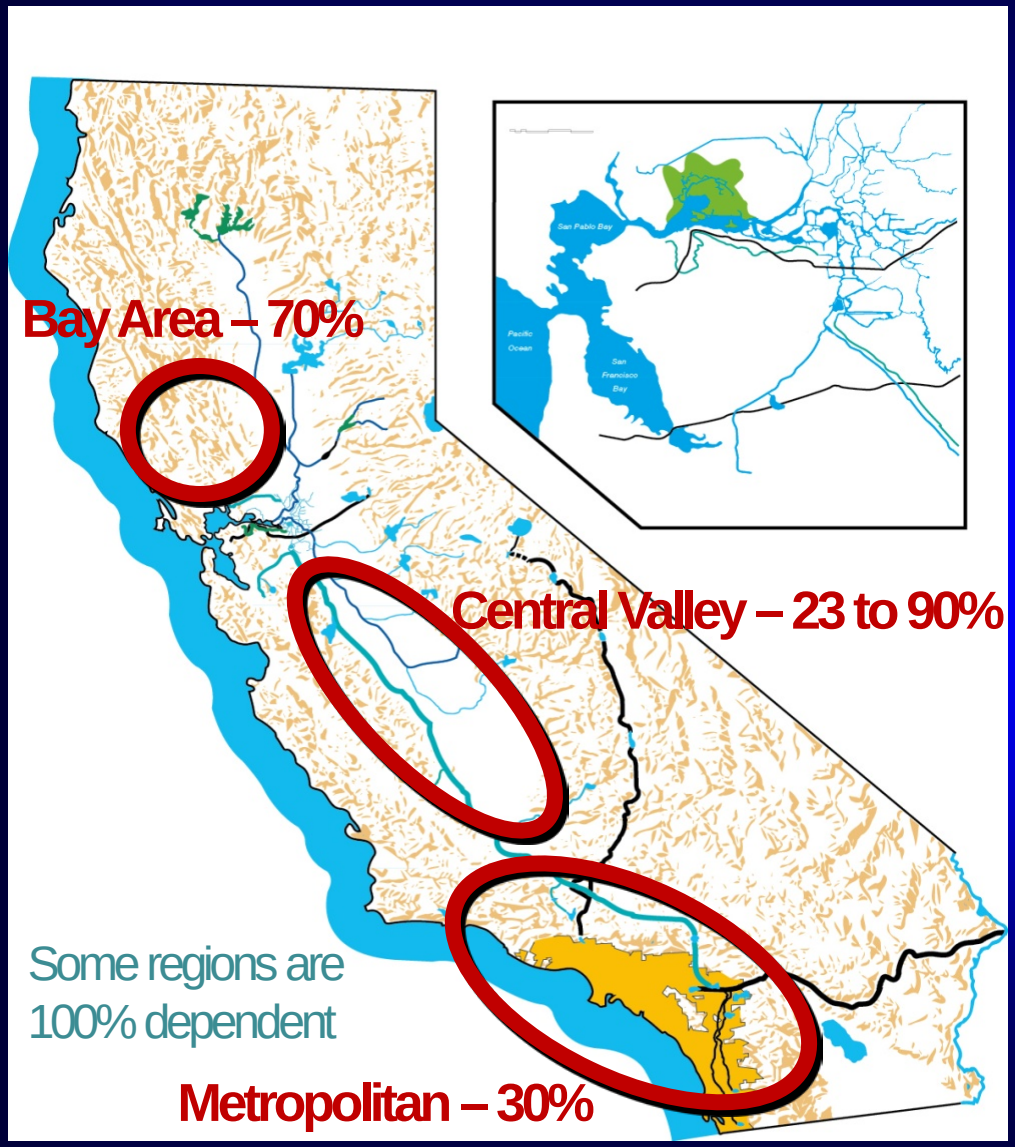
State & Federal Water Projects

- 54 reservoirs and lakes
- 1,200 miles of canals and pipelines
- 16 hydro facilities

Largest publically-built and operated water supply project in the world

Bay-Delta is the hub of this infrastructure

California Relies on Water that Flows Through the Delta



The amazeing Delta

- A maze of interconnected channels
- Hub of the state & federal water supply systems
- Islands are bowls surrounded by levees

Delta Islands are bowls

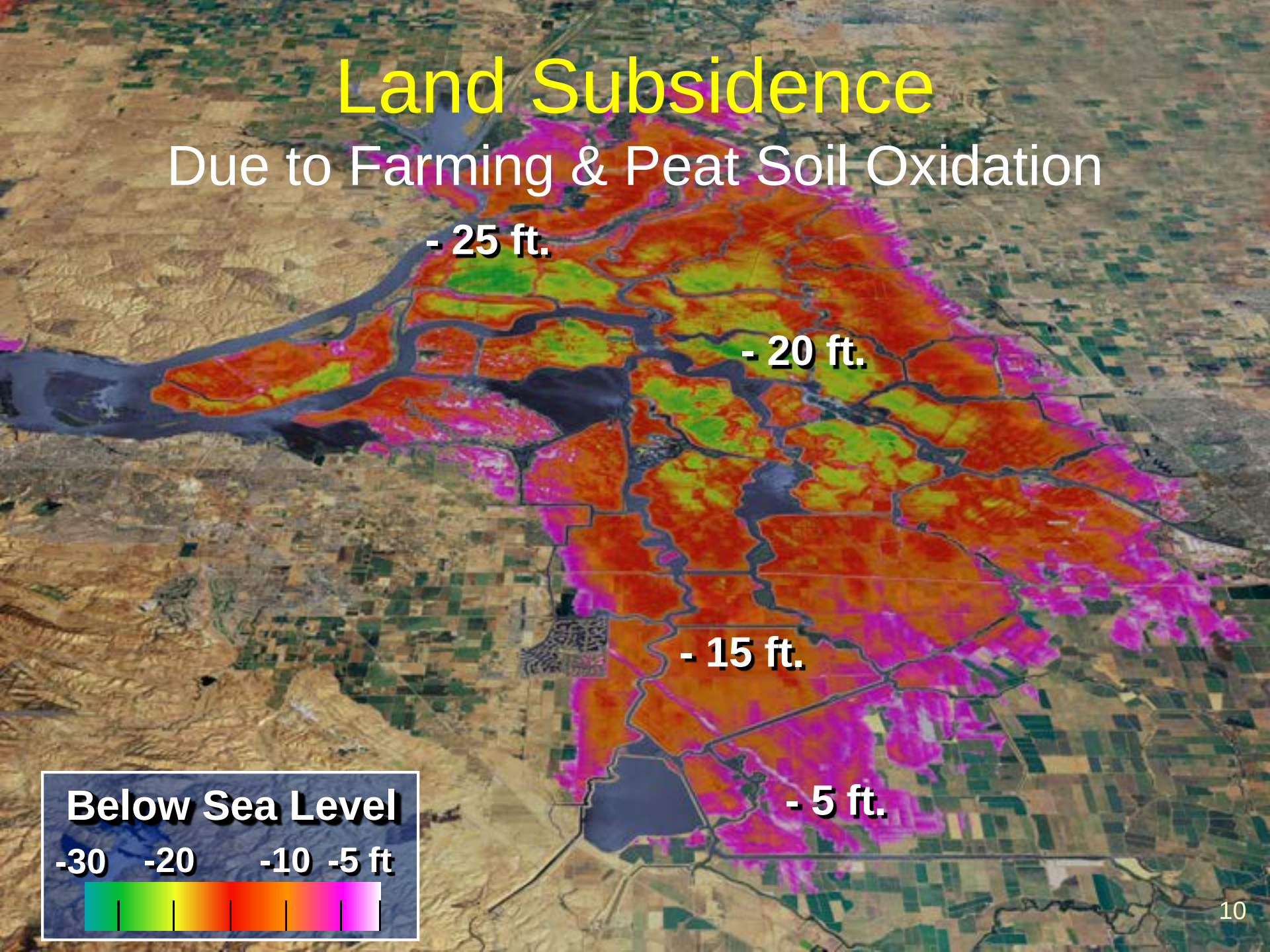
Delta islands are below sea level

1100 miles of levees protect Delta islands from rivers whose water levels are above the island ground levels

Image from
Dave Mraz, DWR

Land Subsidence

Due to Farming & Peat Soil Oxidation



The amazeing Delta

- A maze of interconnected channels
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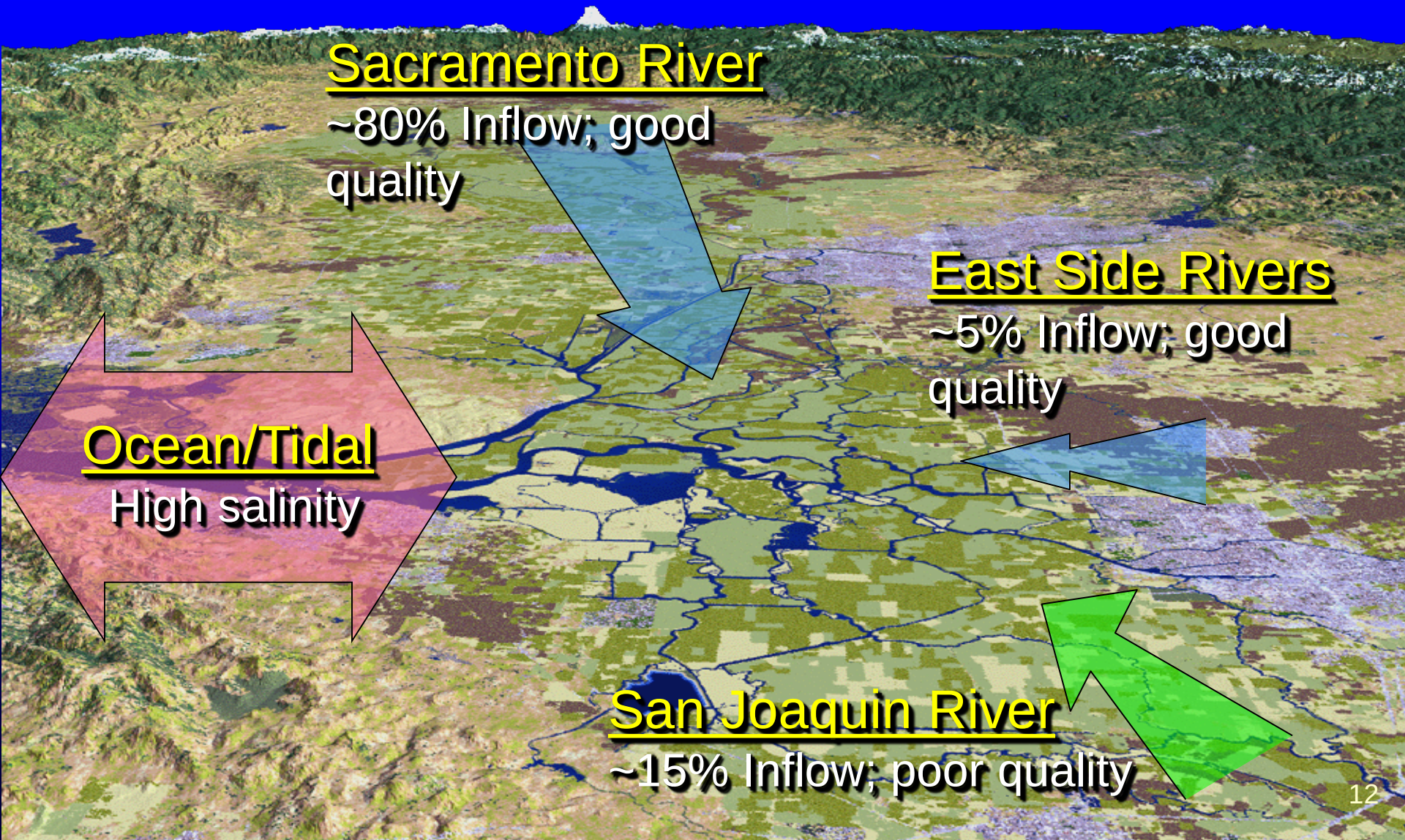
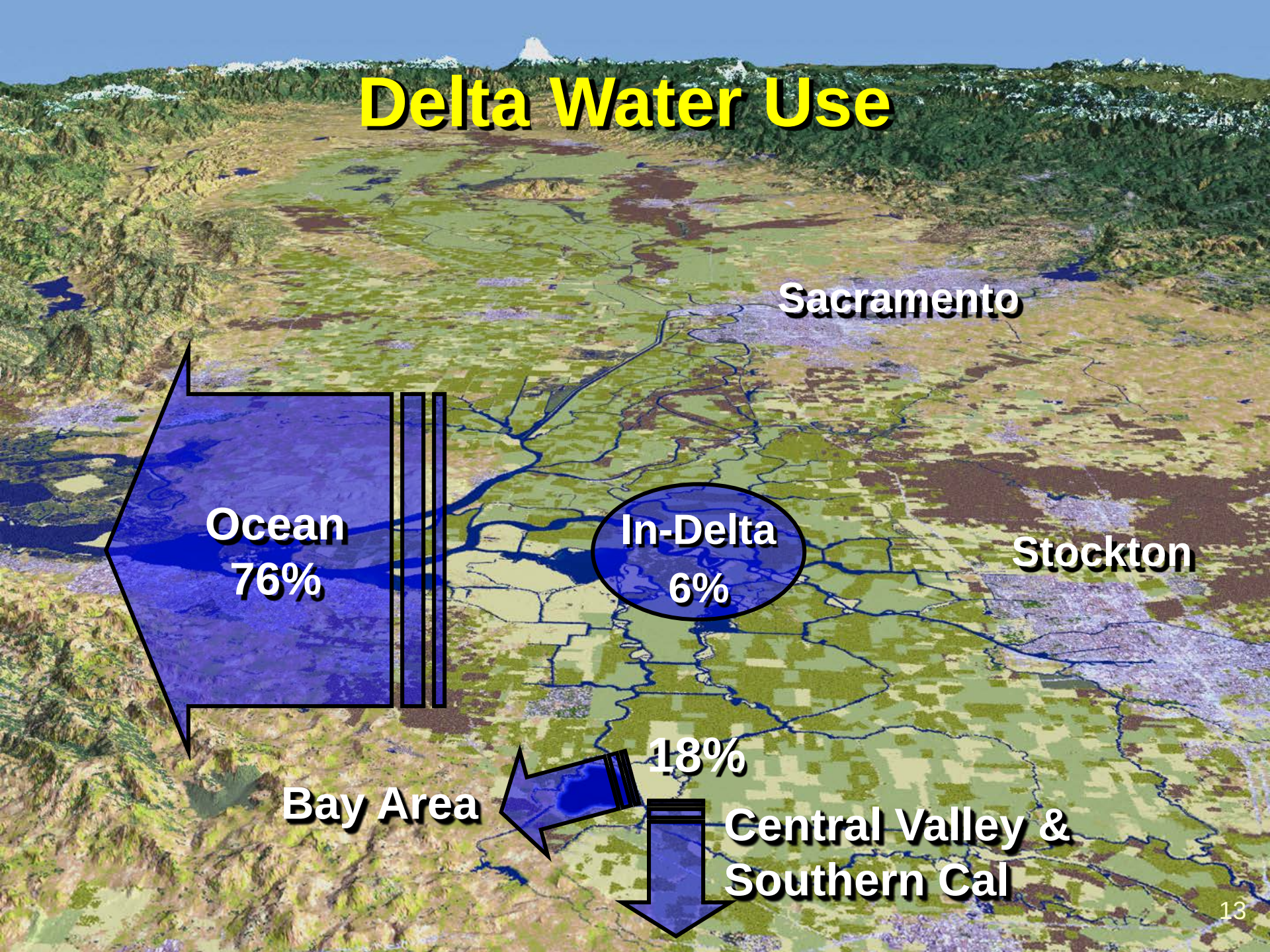
- Salinity is affected by tides, flows & pumping

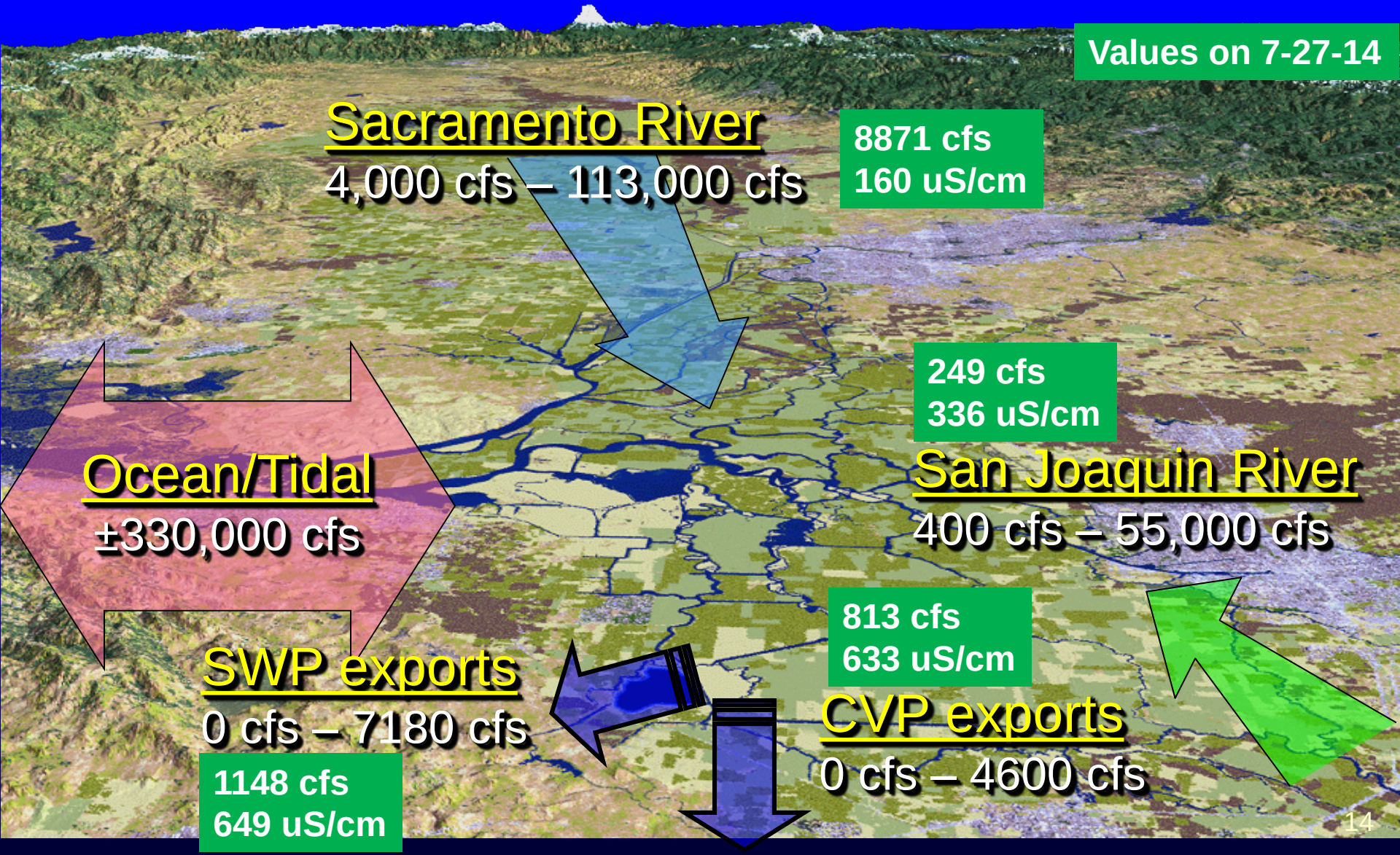
Delta Inflows



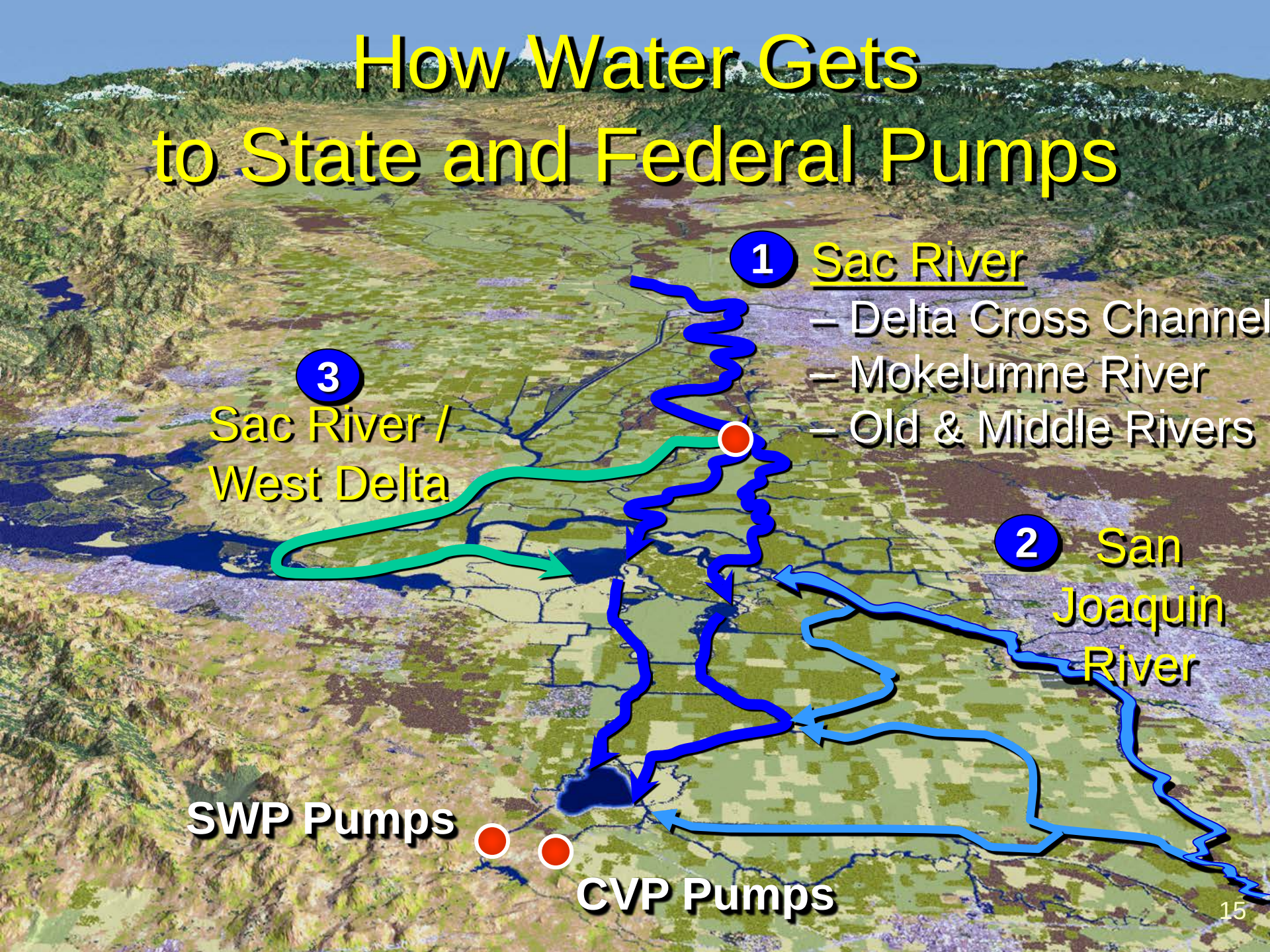
Delta Water Use



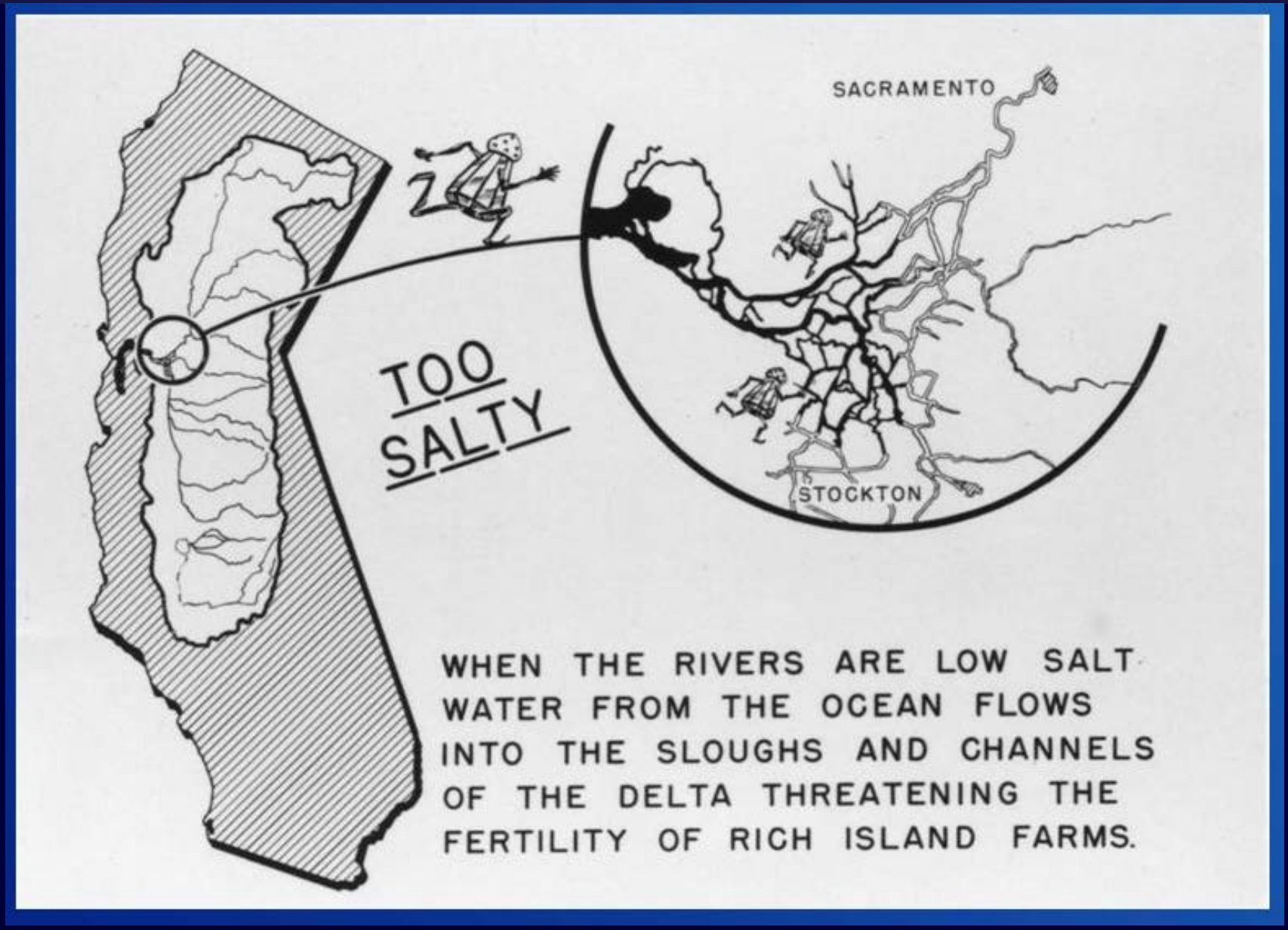
Delta Inflows and Exports



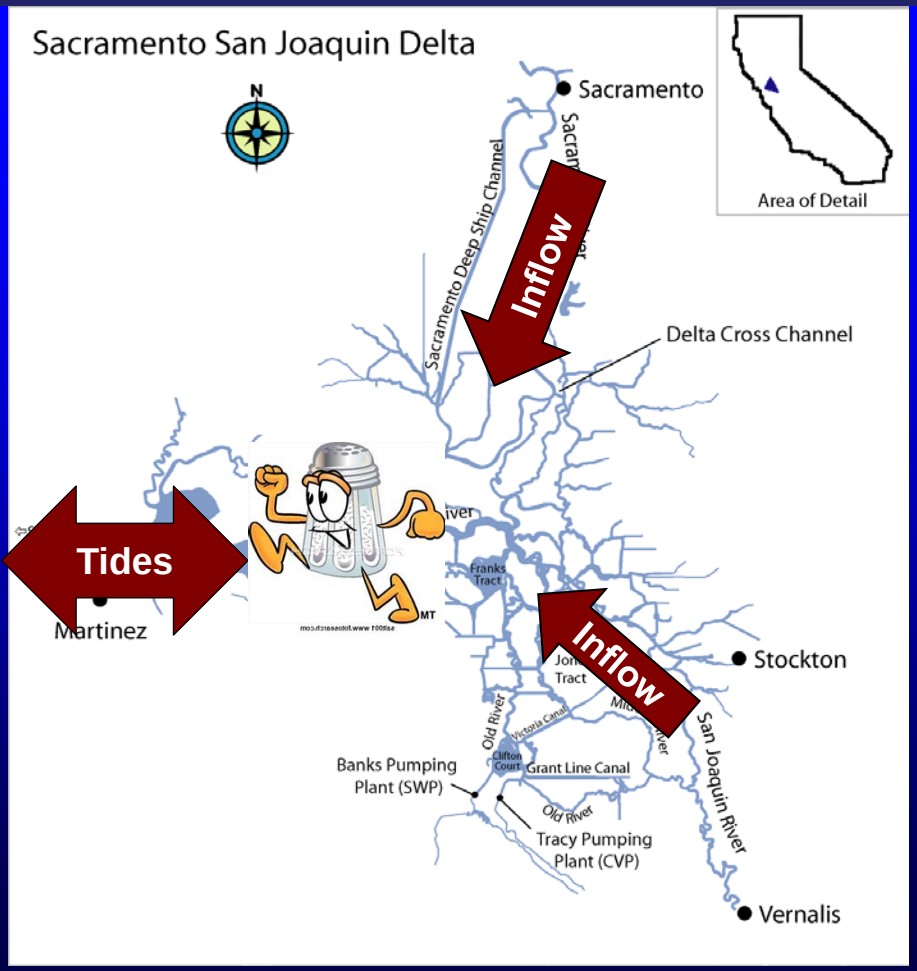
How Water Gets to State and Federal Pumps



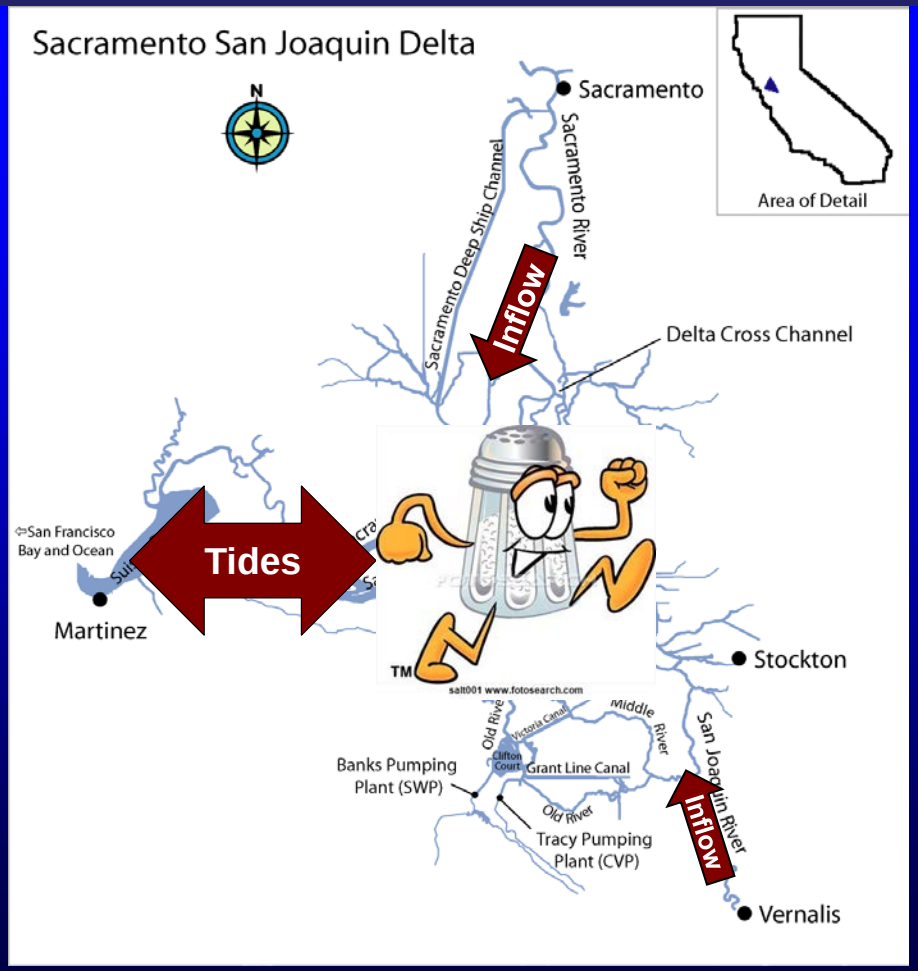
1930's Propaganda for CVP



Delta Salinity & Freshwater Inflows



Higher Inflows Reduce Delta Salinity

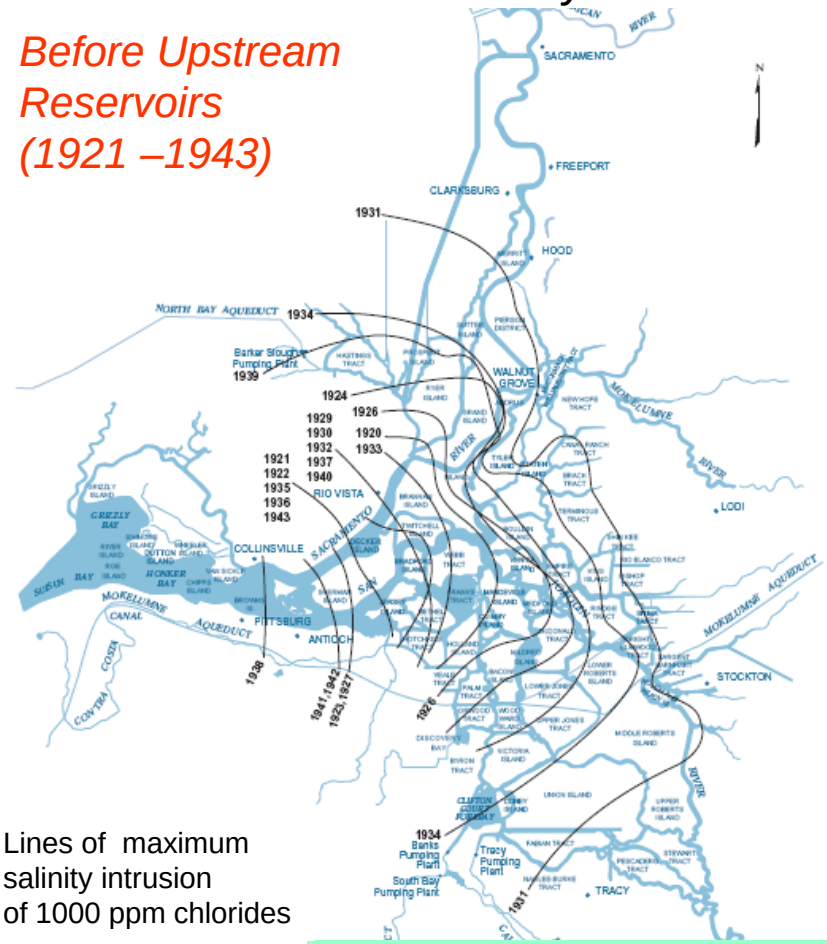


Lower Inflows Increase Delta Salinity

Salinity Intrusion Before and After Managed Upstream Reservoirs

Maximum Salinity Intrusion

Before Upstream Reservoirs (1921 –1943)



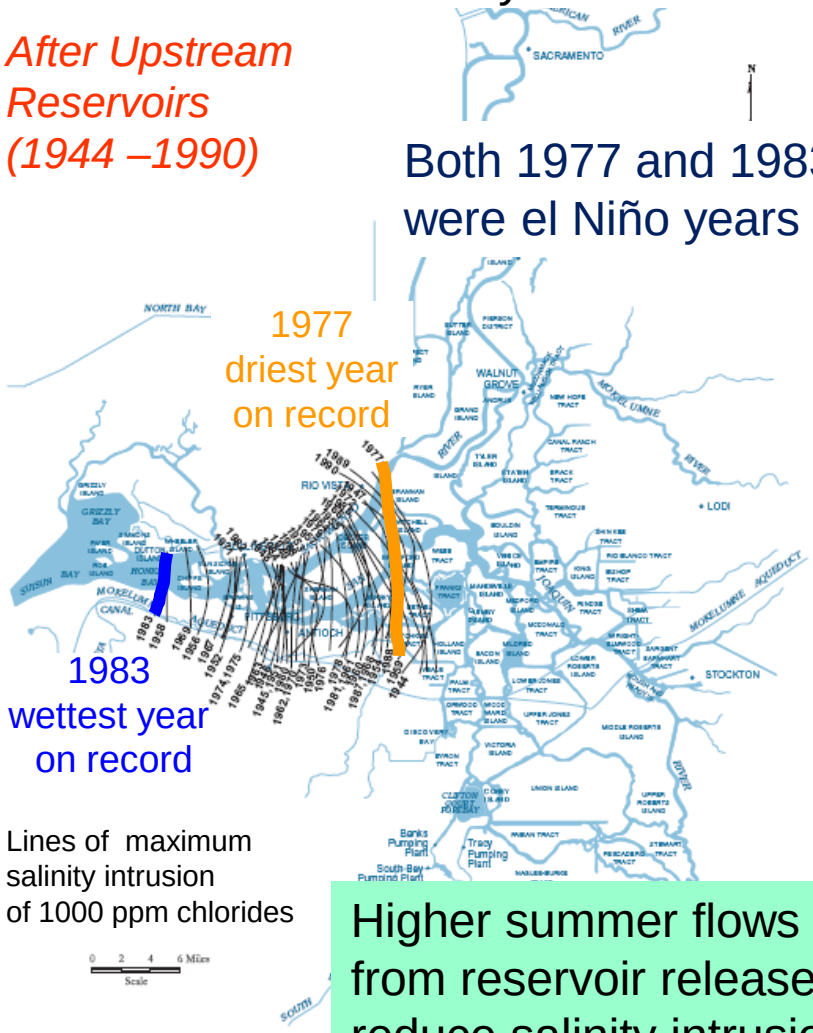
Lines of maximum salinity intrusion of 1000 ppm chlorides

High salinity intrusion during low summer flows

Maximum Salinity Intrusion

After Upstream Reservoirs (1944 –1990)

Both 1977 and 1983 were el Niño years



1977 driest year on record

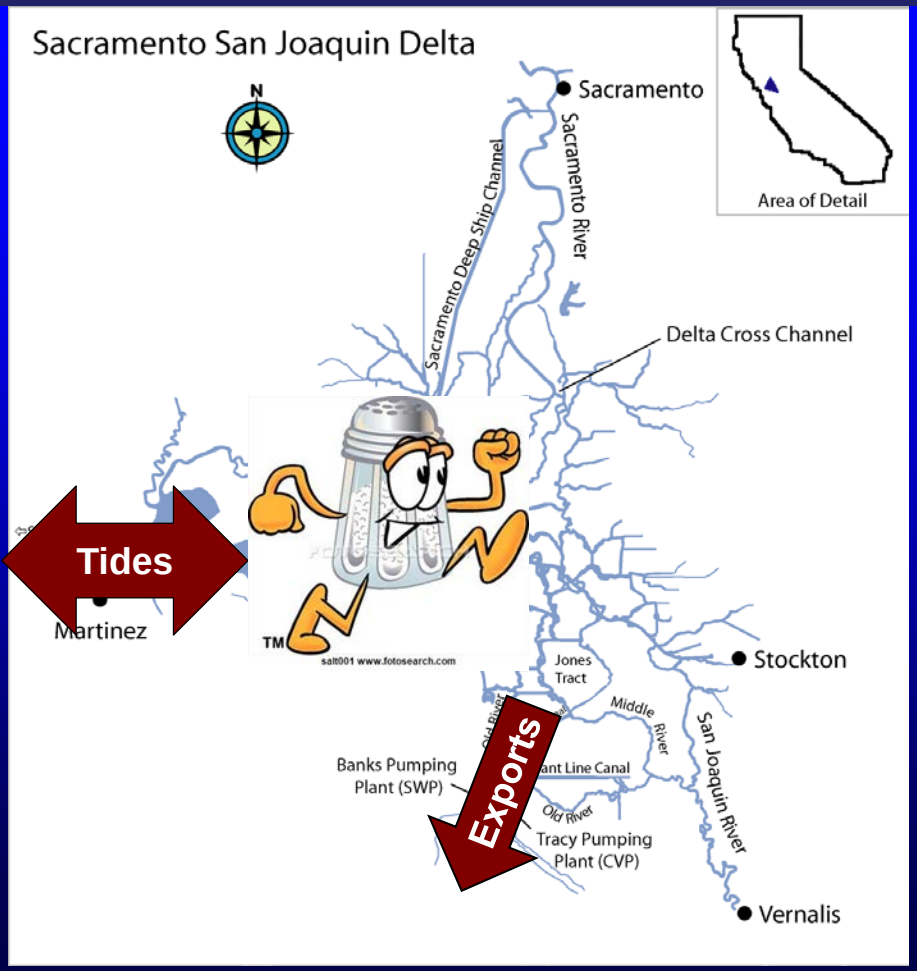
1983 wettest year on record

Lines of maximum salinity intrusion of 1000 ppm chlorides

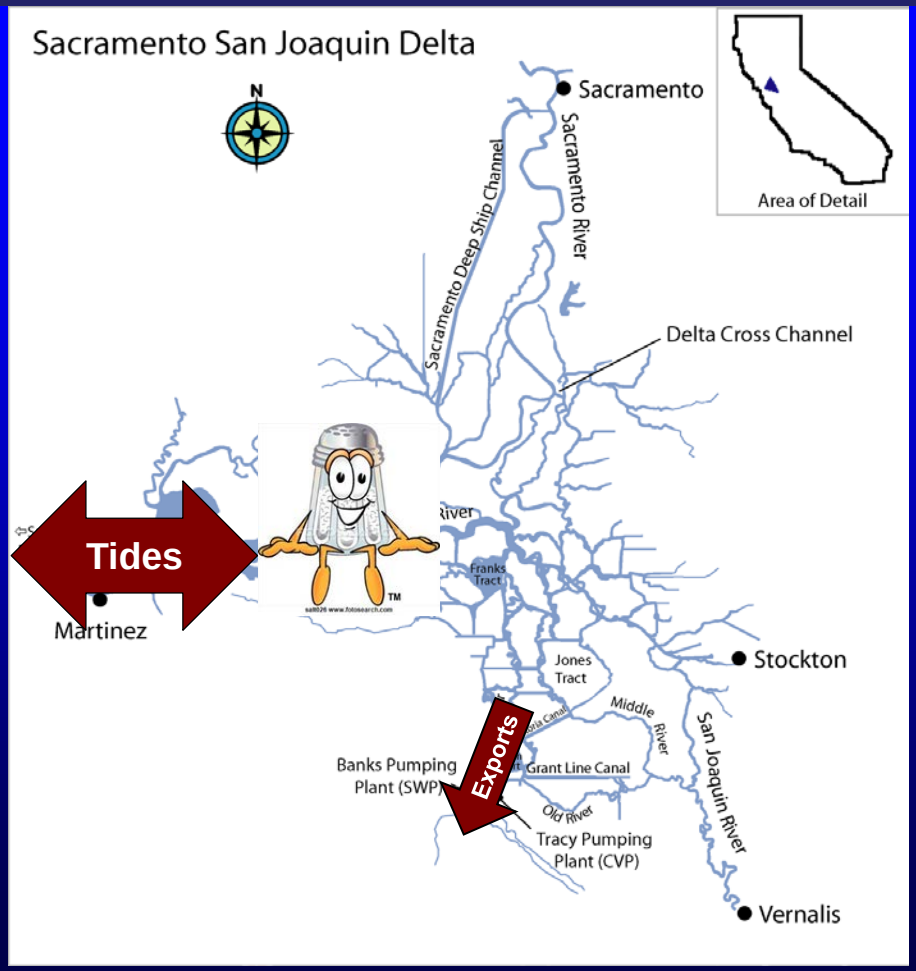
Higher summer flows from reservoir releases reduce salinity intrusion

Salt Wedge Demo

Delta Salinity & Export Pumping

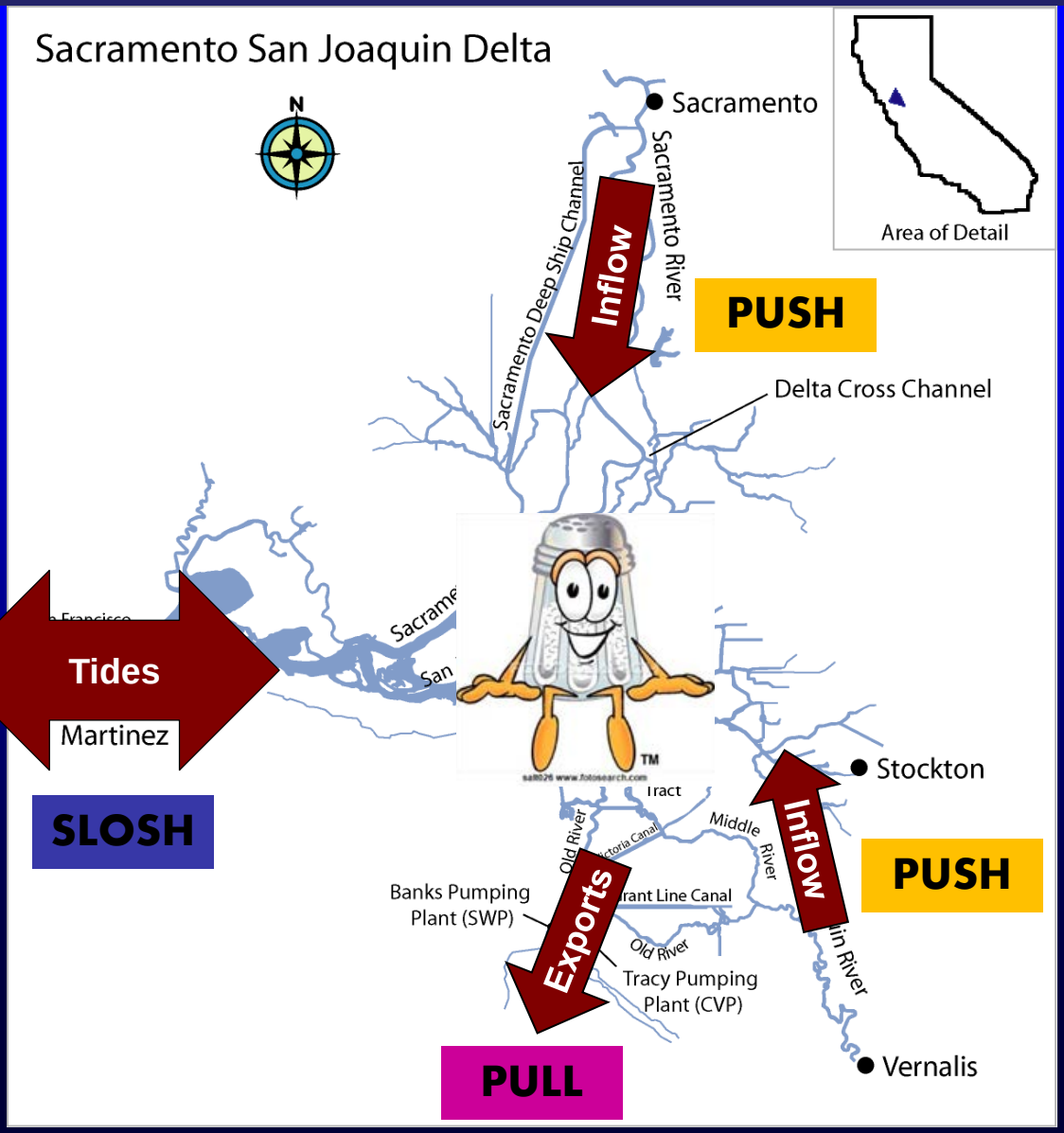


Higher Exports Pull In Delta Salinity

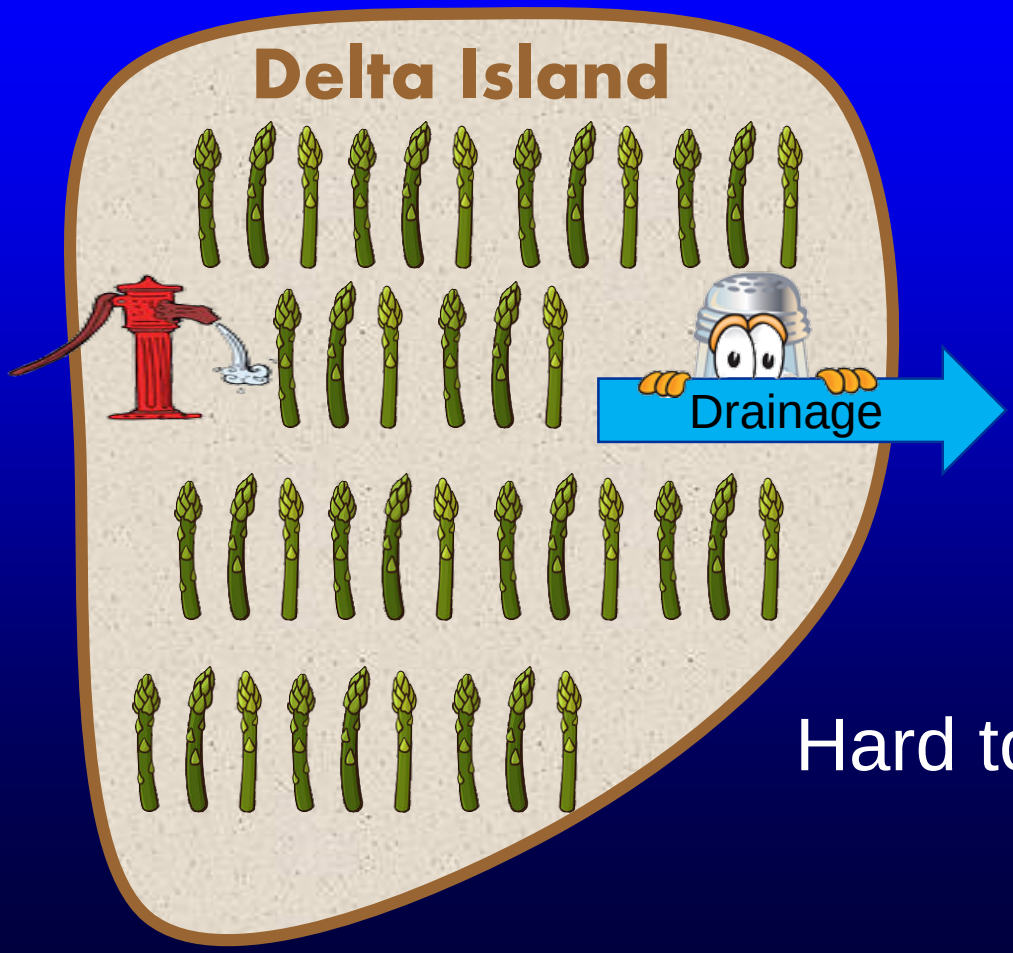


Lower Exports Pull In Less Salinity

Delta Salinity is determined by the combination of Tides, Inflows and Pumping



Consumptive Use also affects Salinity

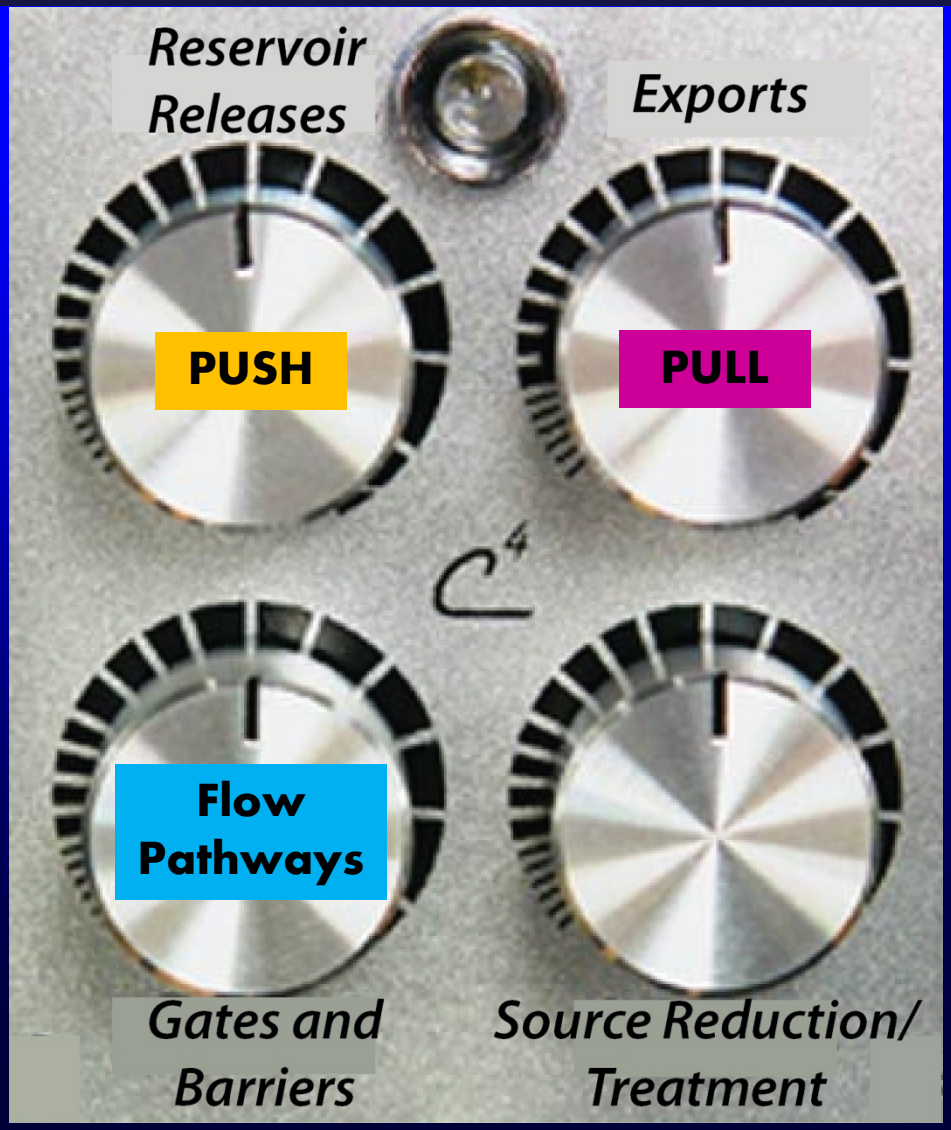


Hard to Estimate

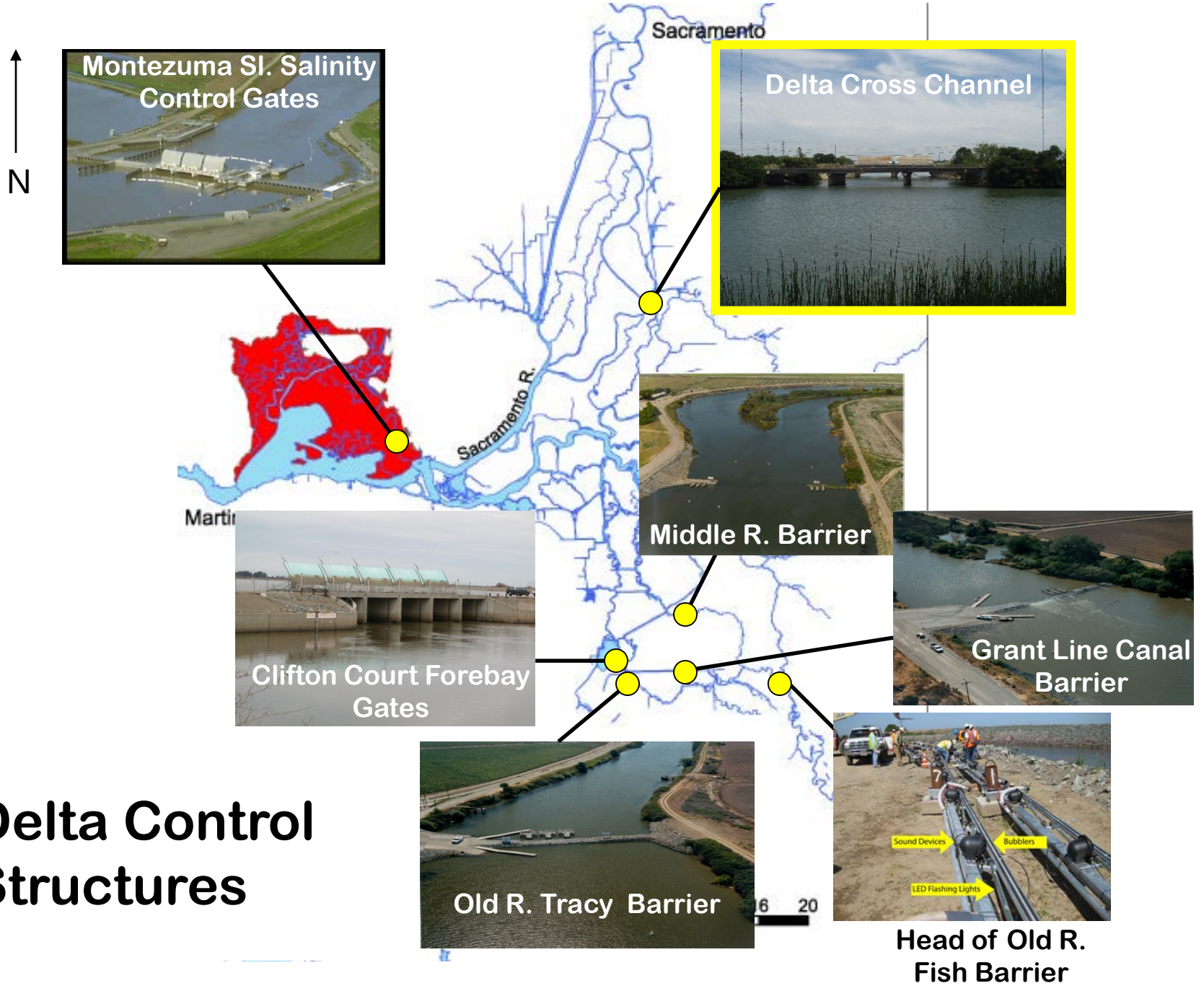
The amazeing Delta

- A maze of interconnected channels
- Hub of the state & federal water supply systems
- Islands are bowls surrounded by levees
- Salinity is affected by tides, flows & pumping
- “Knobs” to change flows and salinity

Options to help meet Delta Water Quality Standards



Delta Control Structures



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- A maze of interconnected channels
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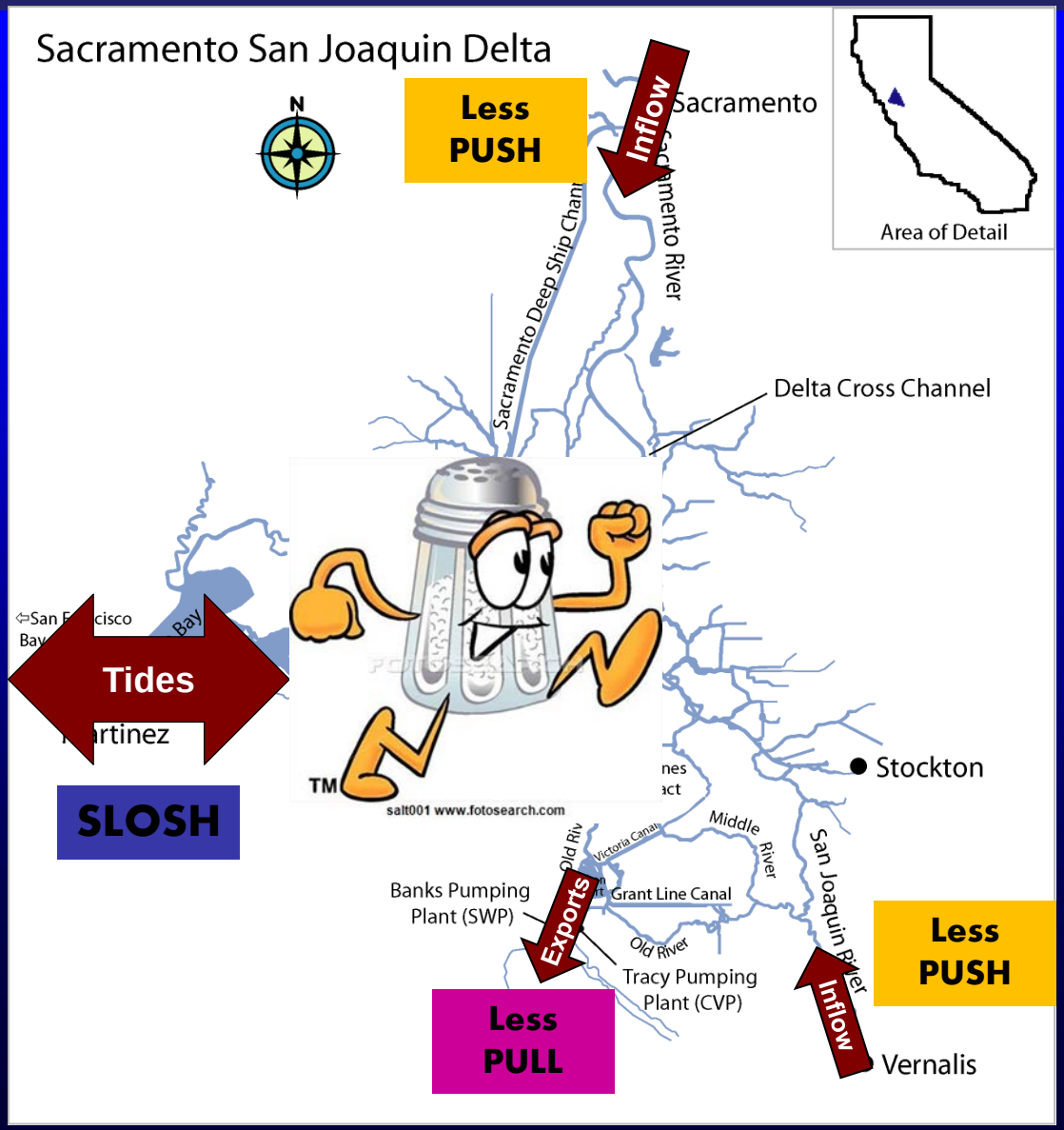
- Islands are bowls surrounded by levees
- Salinity is affected by tides, flows & pumping
- “Knobs” to change flows and salinity
  - Reservoir releases and export pumping
  - Gate/barrier operations
- Drought

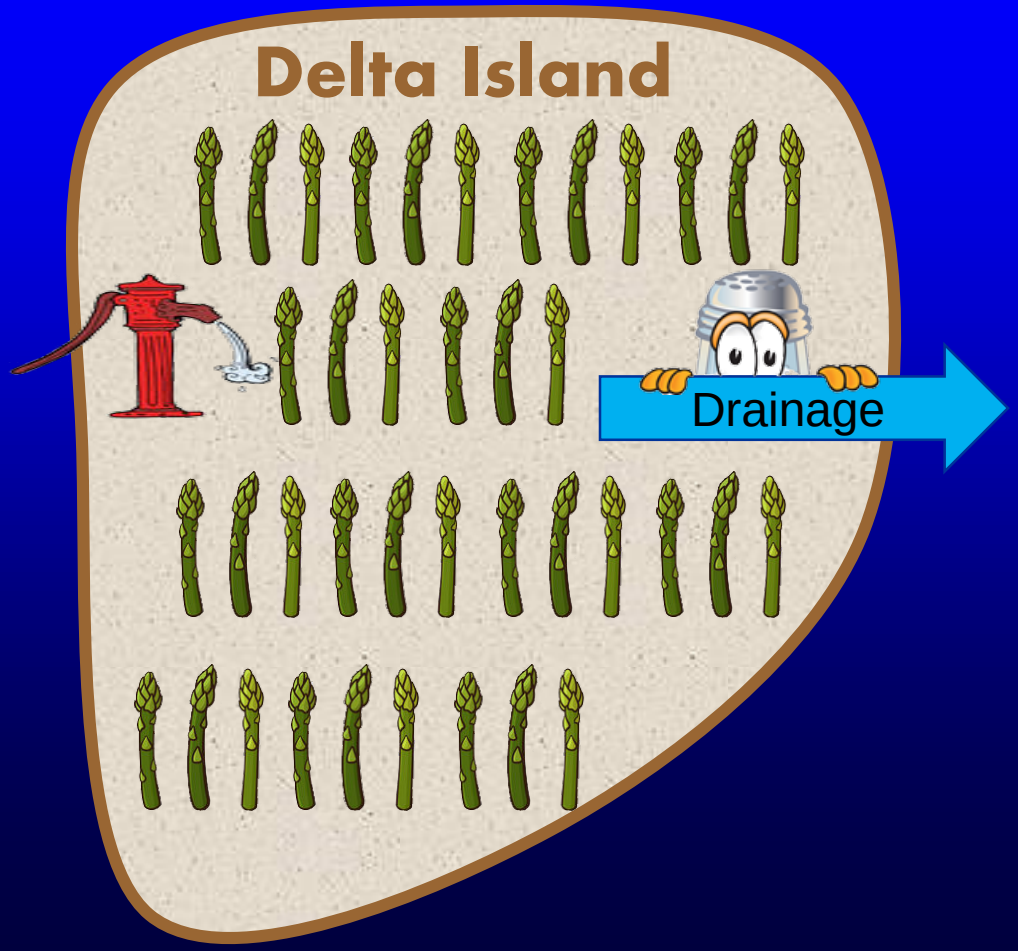
Delta Salinity during Droughts

- Lower inflows
- Reduced exports
- Increased salinity intrusion



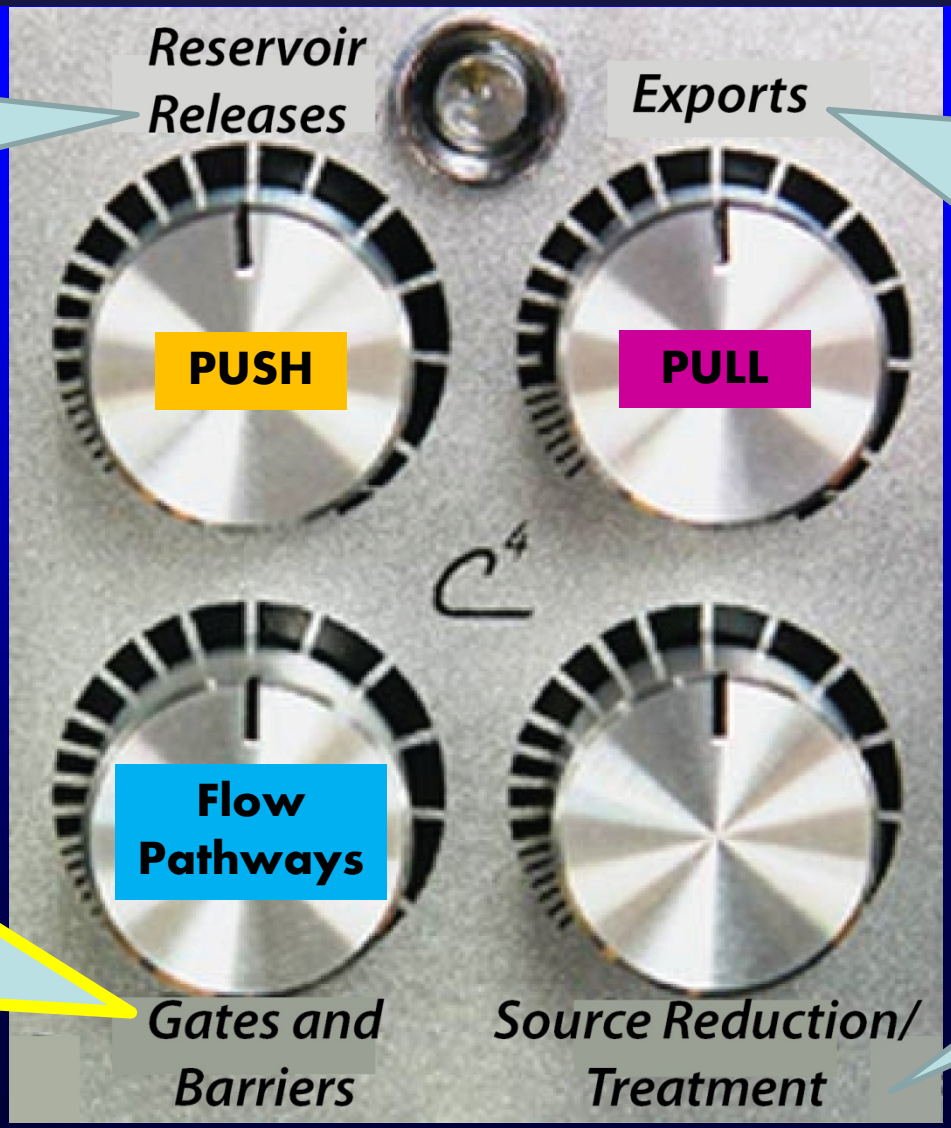
During Droughts, Consumptive Use has a larger affect on Salinity

- Low flows in channels
- Consumptive Use is a significant portion of
  - Volume
  - Salinity
- Consumptive Use is hard to estimate



Drought Reduces Options to Manage Salinity

Less water in storage to release to repel salinity intrusion



Exports reduced

less water available to export

try to reduce salinity intrusion

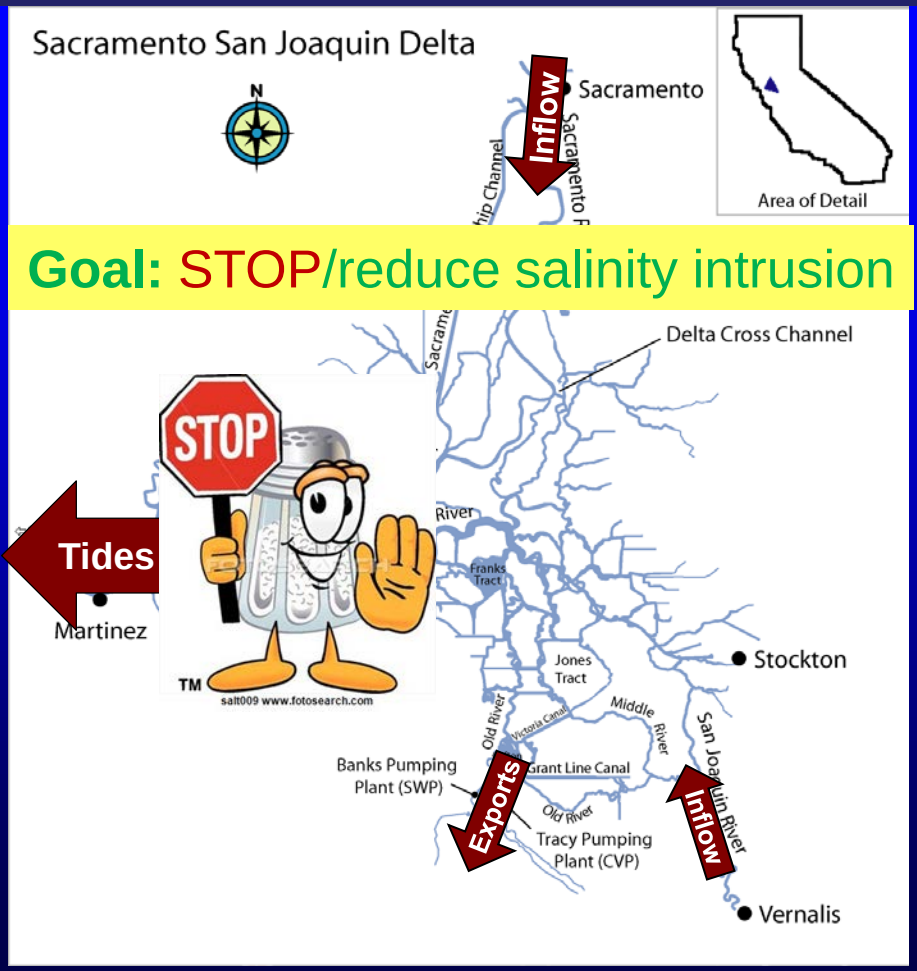
Physically block salty water

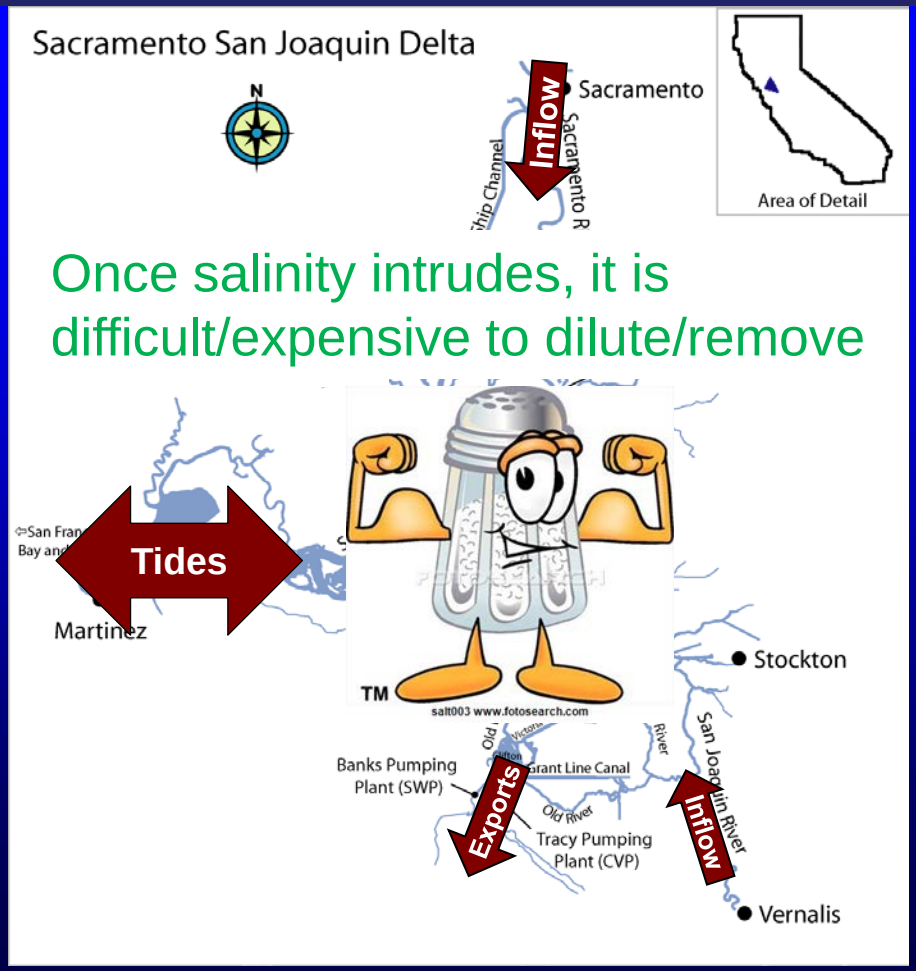
Direct freshwater flows into desired channels

Expensive

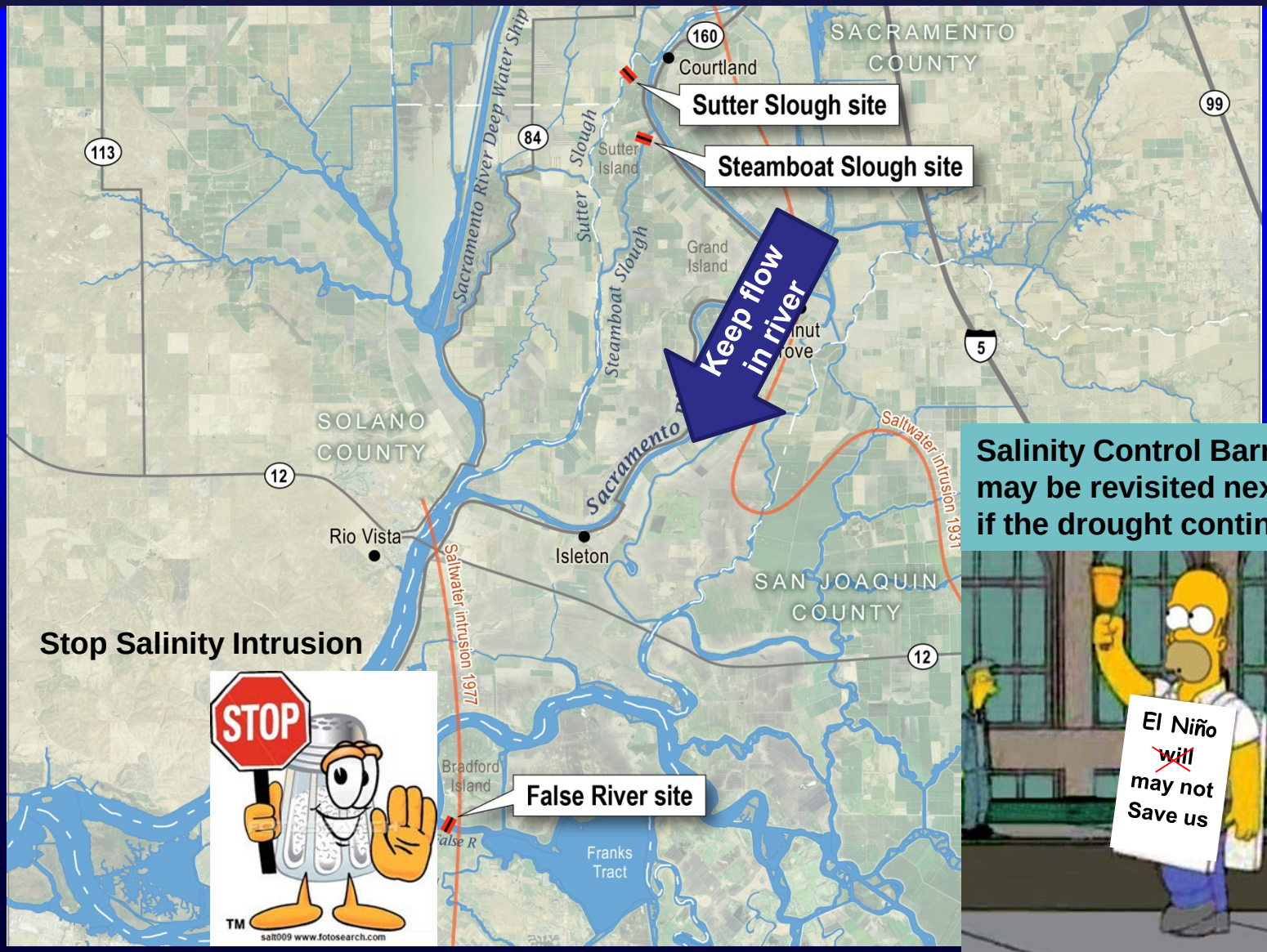
Requires treatment facilities

Managing Salinity Intrusion in a Drought





Proposed Emergency Salinity Control Barriers



Stop Salinity Intrusion

Salinity Control Barriers may be revisited next year if the drought continues

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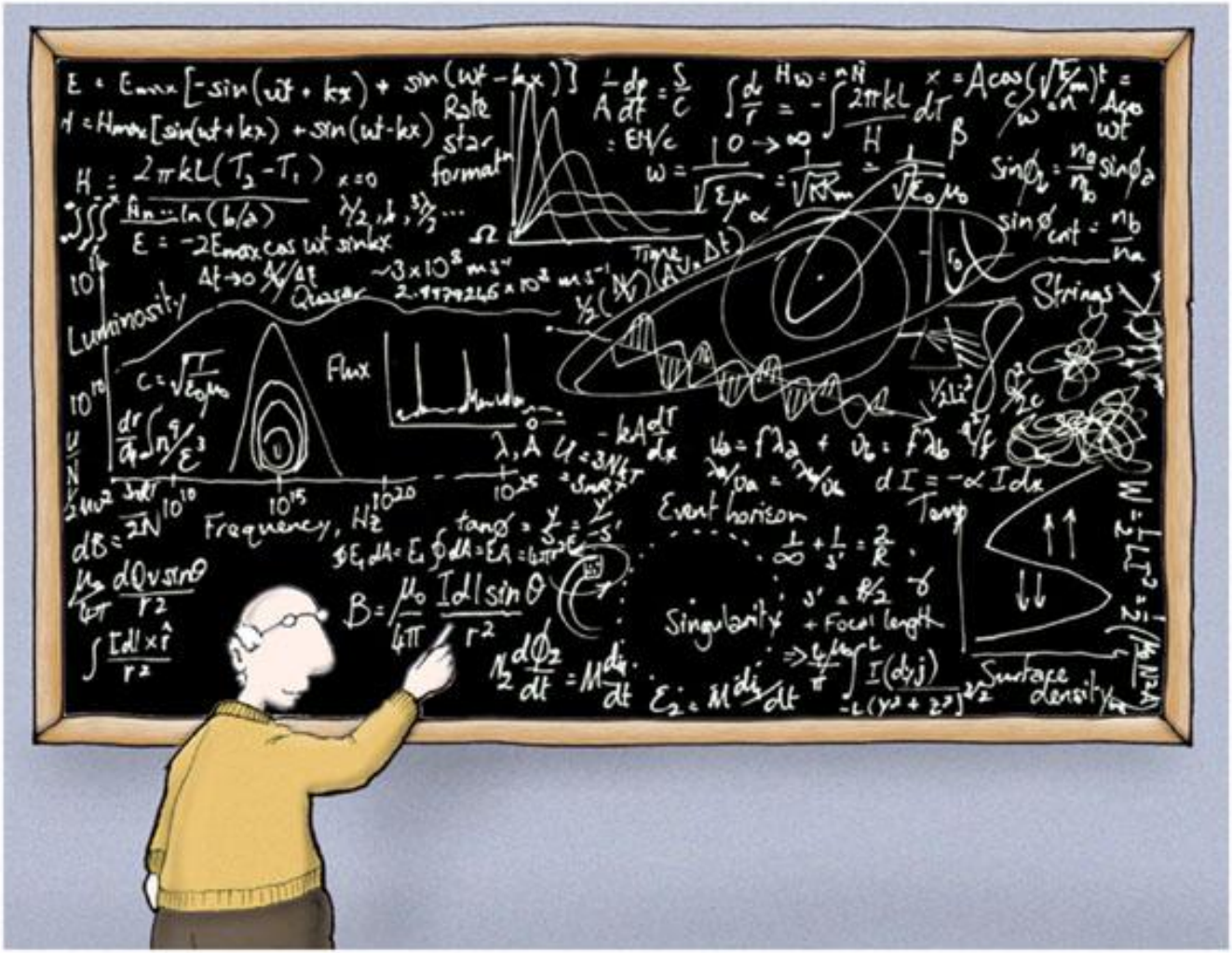
- “Knobs” to change flows and salinity
  - Reservoir releases and export pumping
  - Gate/barrier operations
- Drought
  - Reduces freshwater inflows
  - Affects amount of water that can be exported
  - Can increase salinity intrusion

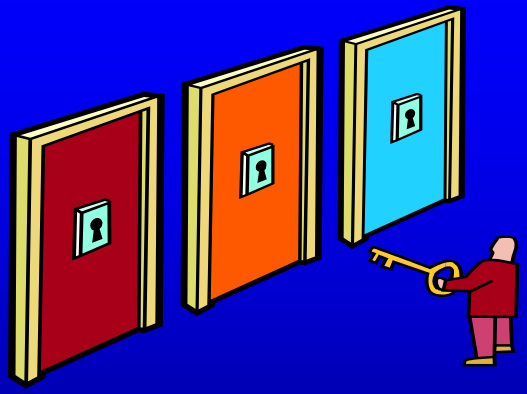
Modeling the Delta



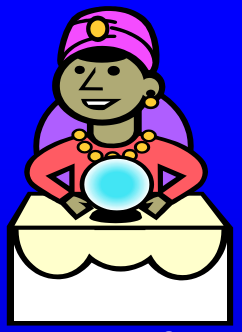
Models help explore complex Delta management options

How do we use models?

Represent
past conditions



Assess Alternatives



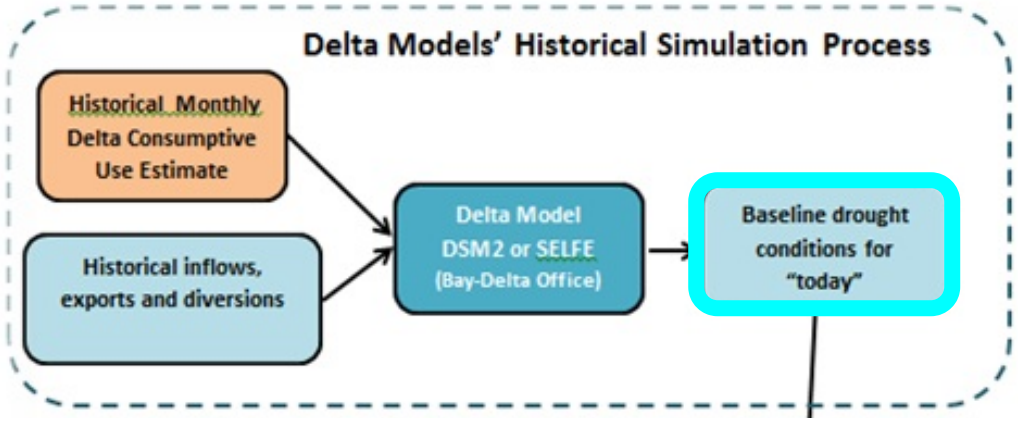
Forecast future
conditions

Fill data gaps

Drought barrier studies involved most of these

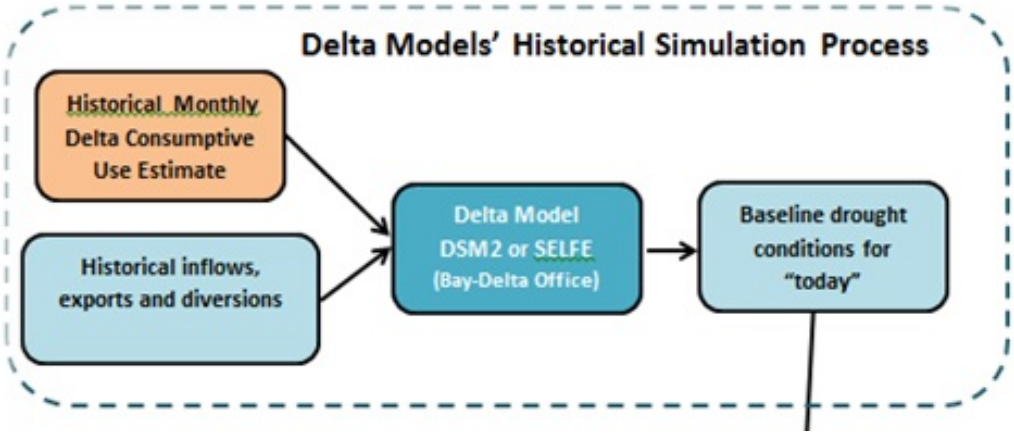
Drought Barrier Modeling Approach

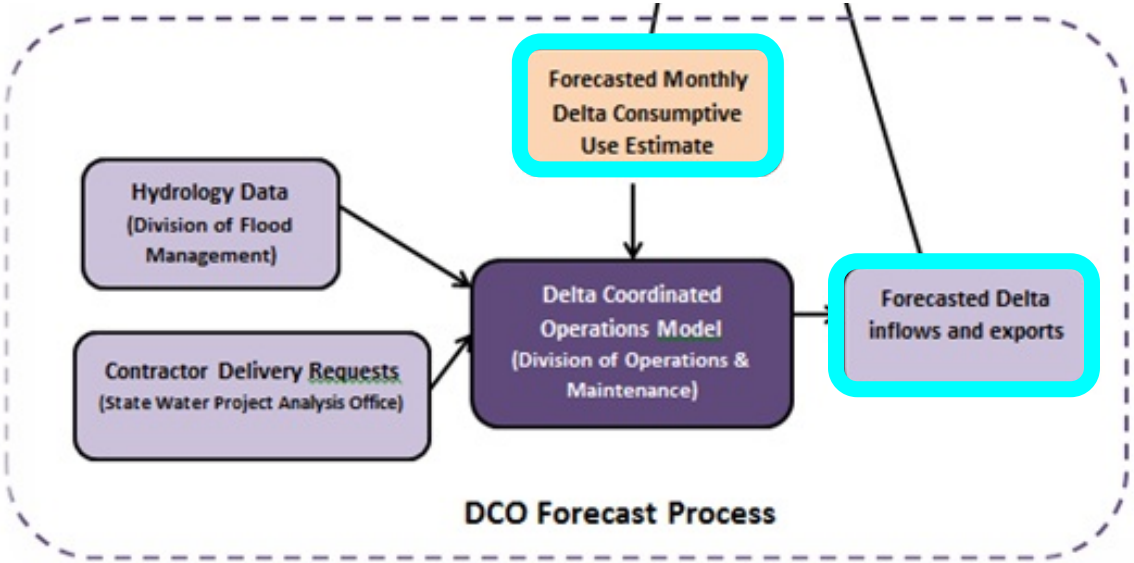
- Represent historical conditions



Drought Barrier Modeling Approach

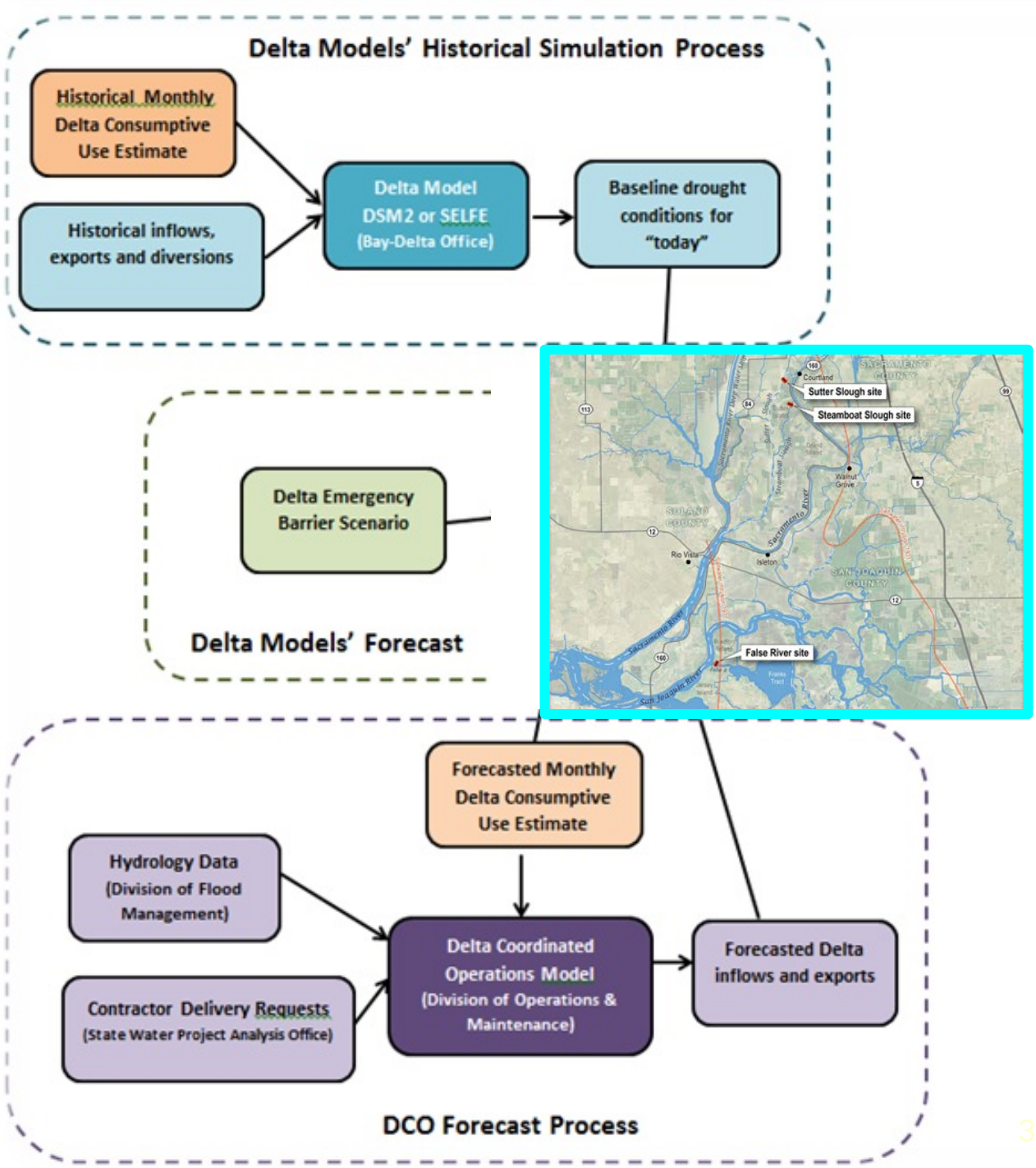
- Represent historical conditions
- Forecast future conditions





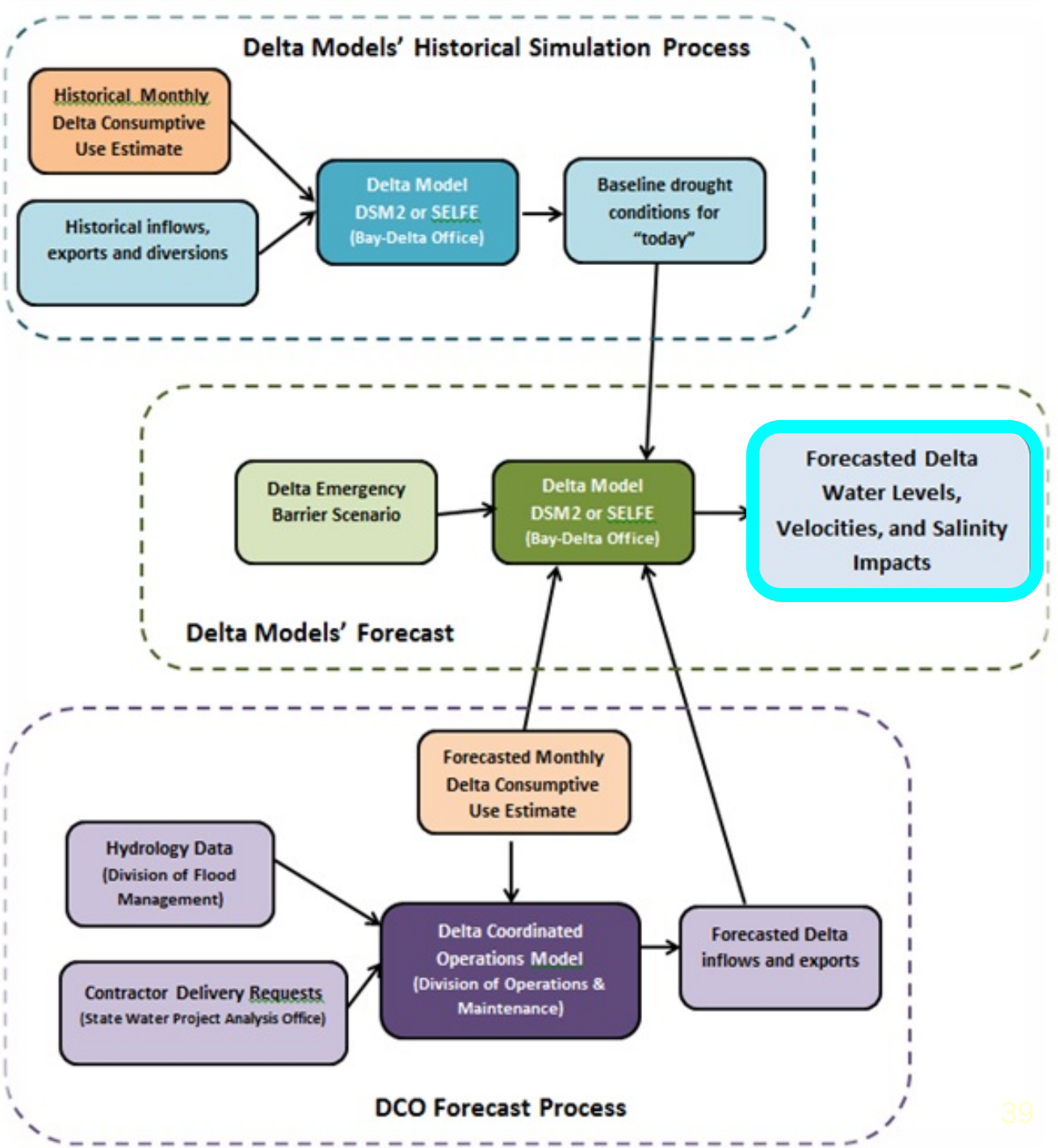
Drought Barrier Modeling Approach

- Represent historical conditions
- Forecast future conditions
- Select a drought barrier scenario



Drought Barrier Modeling Approach

- Represent historical conditions
- Forecast future conditions
- Select a drought barrier scenario
- Model potential salinity impacts with & without drought barriers

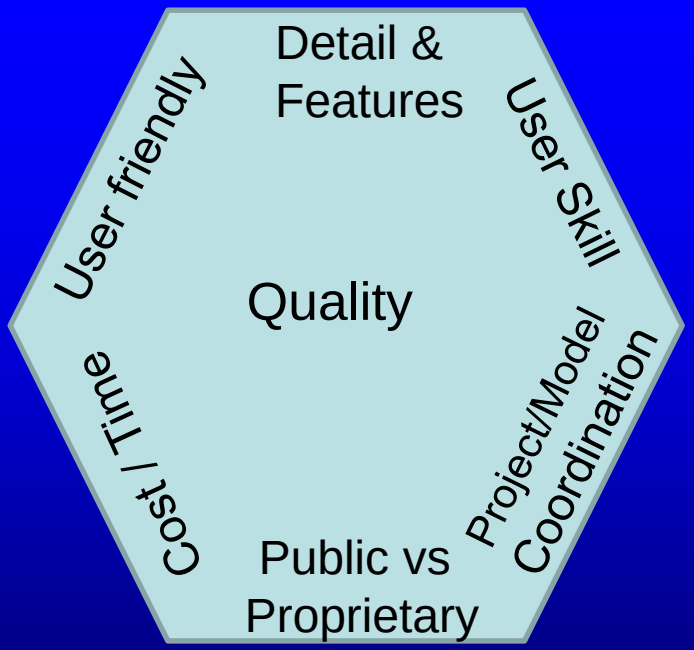



Thank You!
Jamie.Anderson@water.ca.gov
http://baydeltaoffice.water.ca.gov/modeling/

Extra Slides

Tradeoffs

Project Management
Triple Constraint

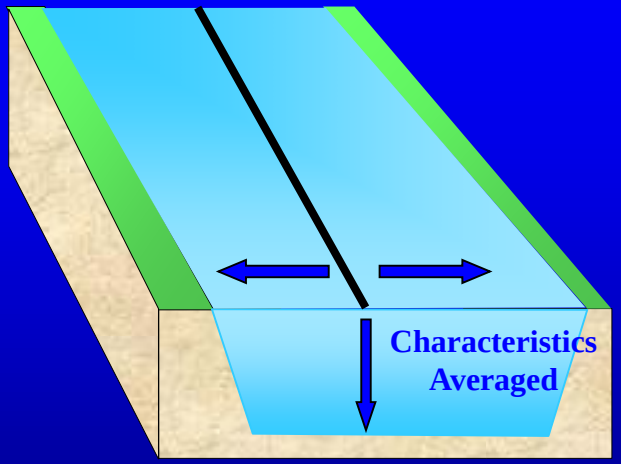


Modeling Tradeoffs
might be something like this

Delta Models used in Drought Barrier Studies

DSM2

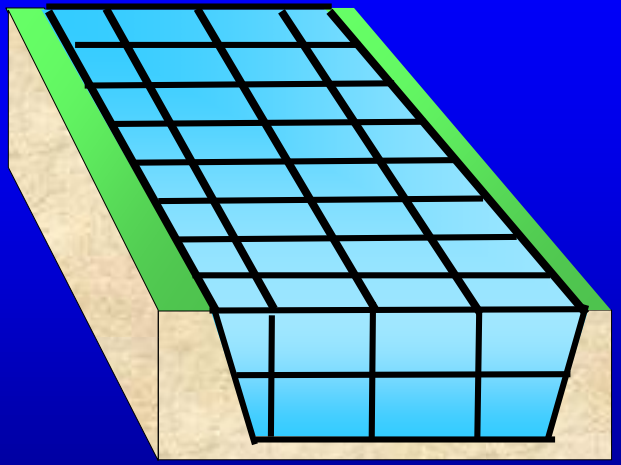
1-D representation



- Flow, velocity, water quality along main flow direction
- Runs faster
- Can simulate long time periods (years)
- Needs field data to tune model
- Long history of use

SELFE

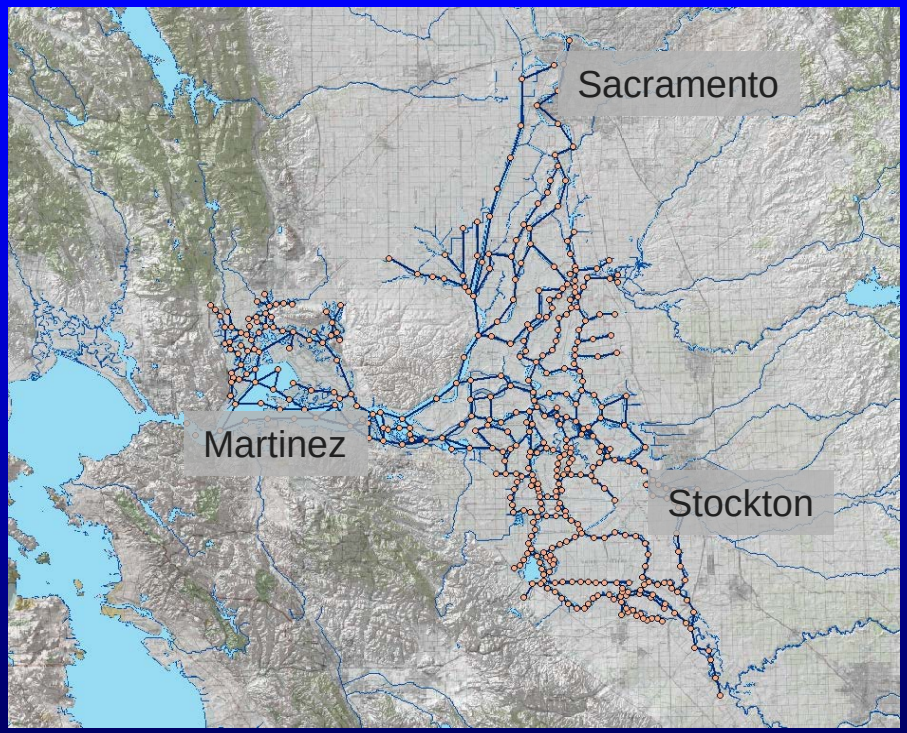
3-D representation



- Flow, velocity, water quality in all directions
- Runs slower
- Typically simulate shorter time periods (months)
- Needs more data to tune model
- New kid on the block

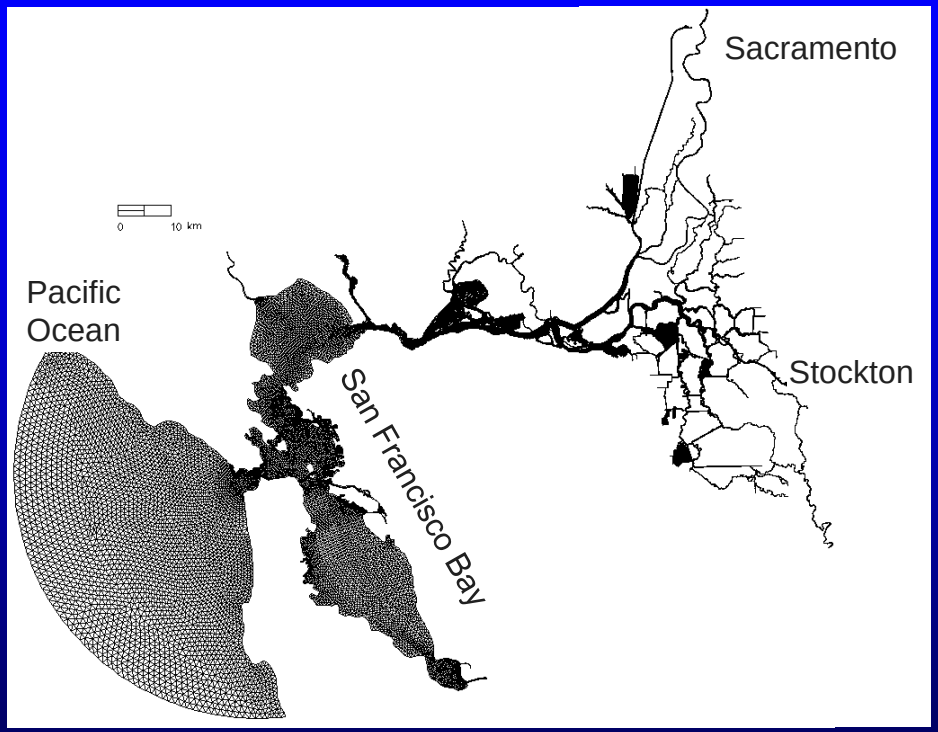
Delta Models used in Drought Barrier Studies

DSM2



- Represents Delta
- Used for evaluating large numbers of alternatives

SELFE



- Represents SF Bay and Delta
- Used for more detail on select alternatives