

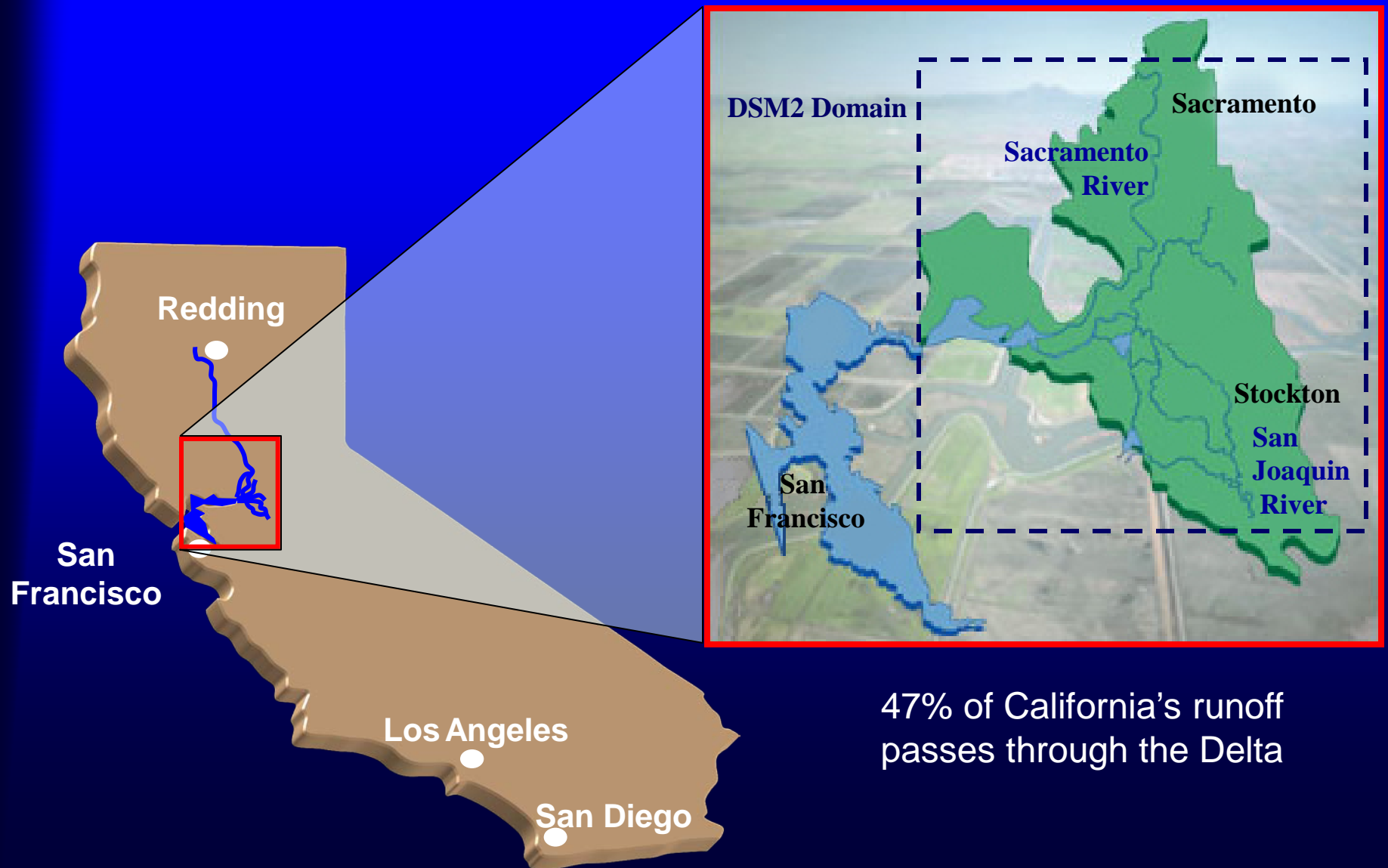
# *Constraints in the Sacramento-San Joaquin Delta*

Paul A. Marshall, Chief  
Bay Delta Office  
April 26, 2016

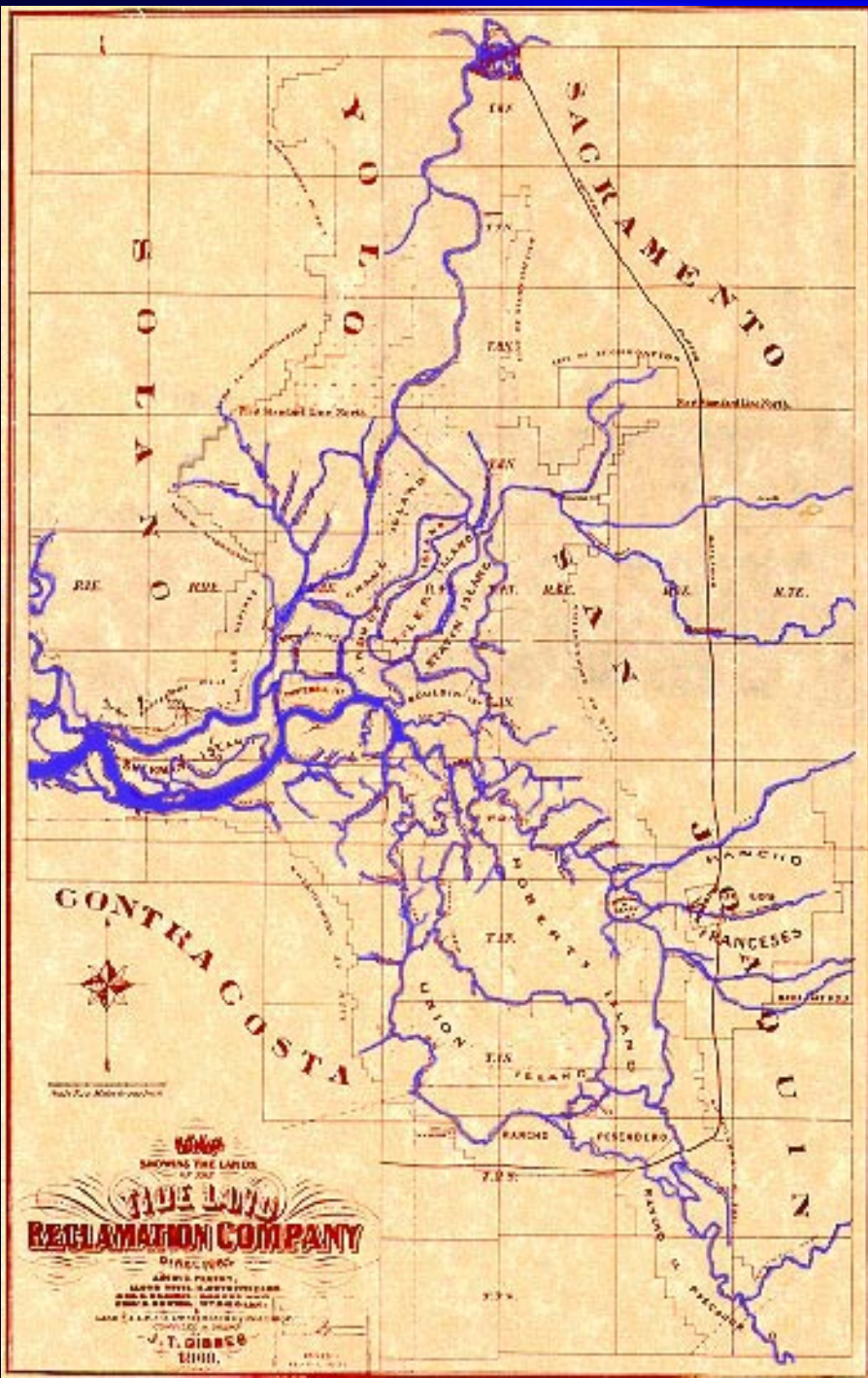


Adapted from Jaime Anderson, PhD, PE  
Bay Delta Office

# Bay-Delta System



47% of California's runoff passes through the Delta

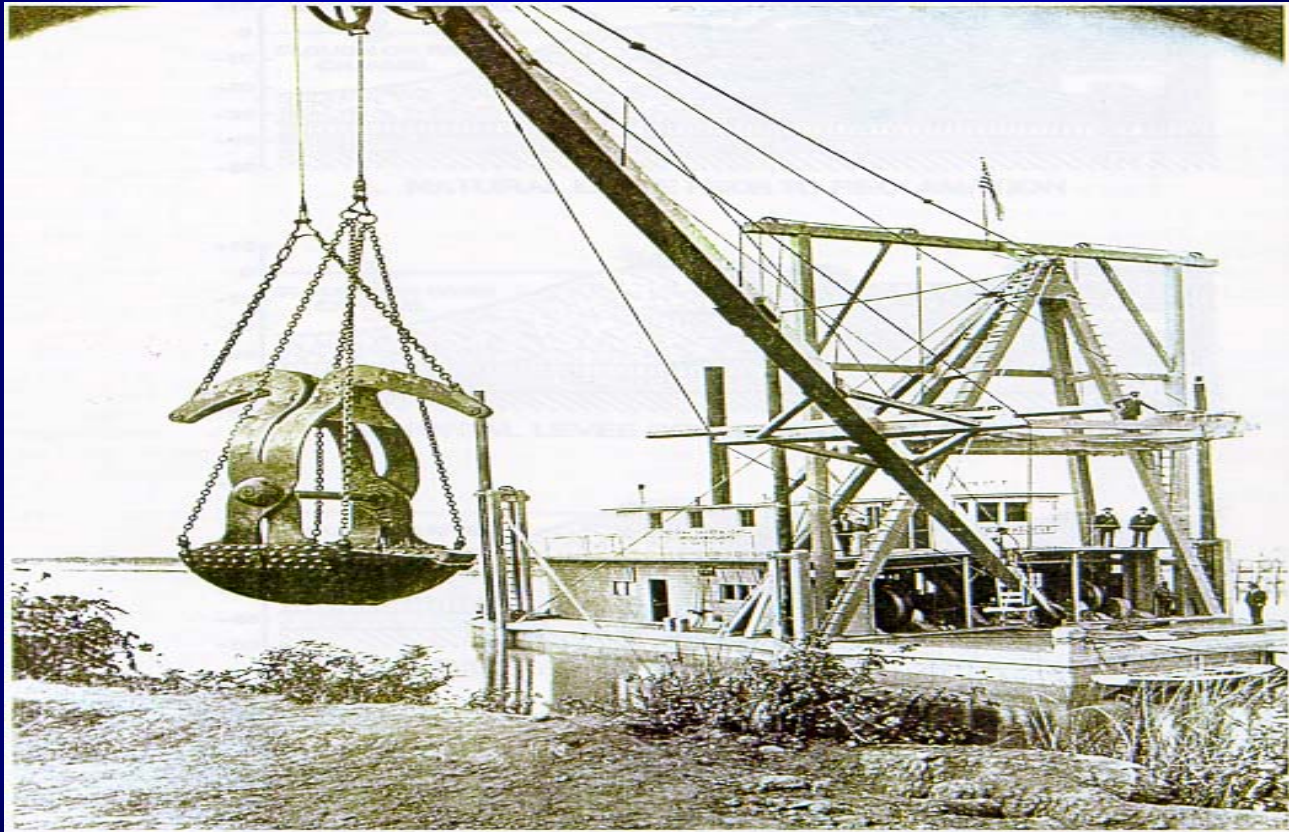


# Natural State

- Series of dendritic “branching” channels
- Seasonal wetland
  - Winter flooded fresh water
  - Summer shallow channels saline water
- Native species adapted to seasonal salinity, flow, and temperature changes

# 1850's Levee Construction

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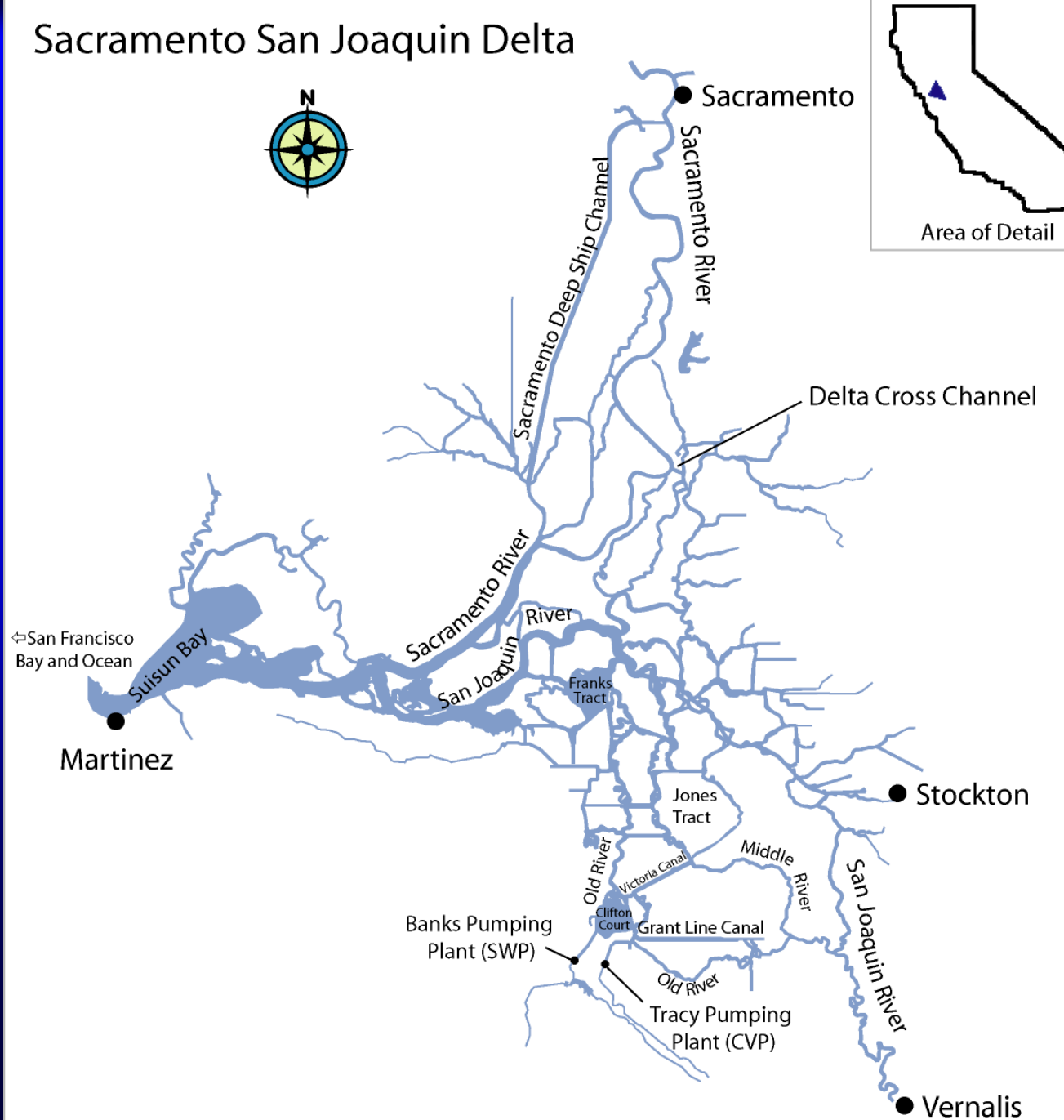
Physical modifications (dredging, levees, pumps, gates, resevoirs, etc)

# Modern Delta

Highly managed

- Reservoirs
- Gates & barriers
- Pumps
- Levees

## Sacramento San Joaquin Delta



# Human Influences

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Commercial shipping:  
Sacramento and San-  
Joaquin Deepwater Ship  
Channels

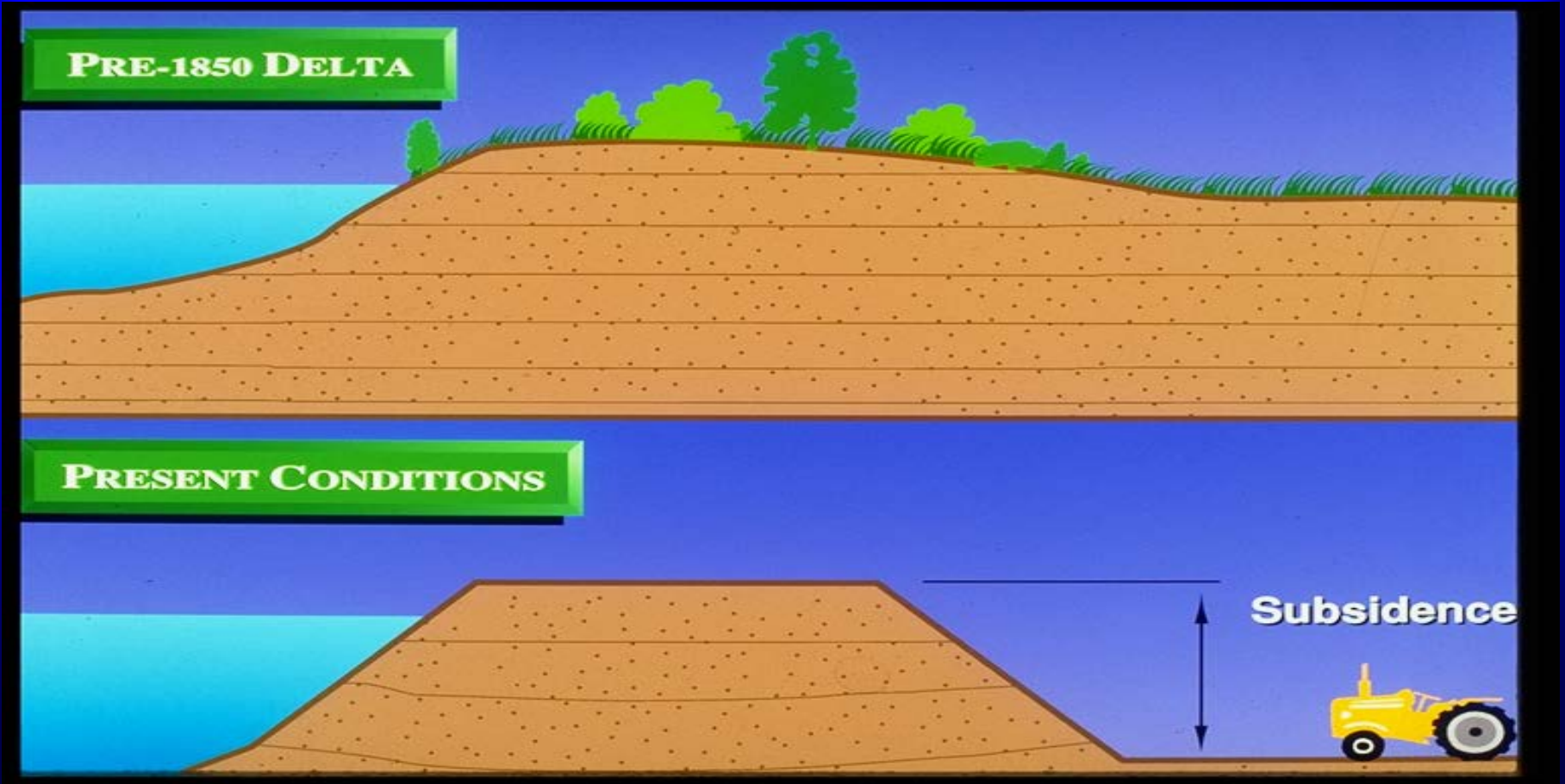


Recreation:

fishing, hunting,  
boating, passive  
enjoyment

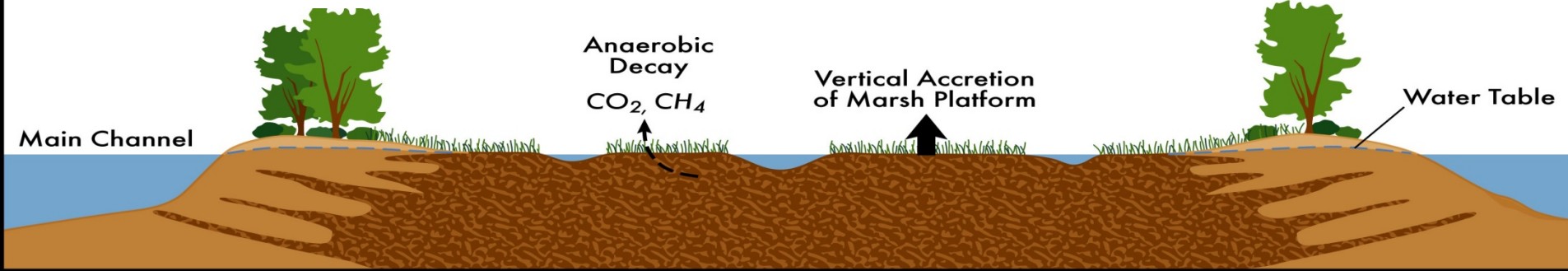
# Subsidence

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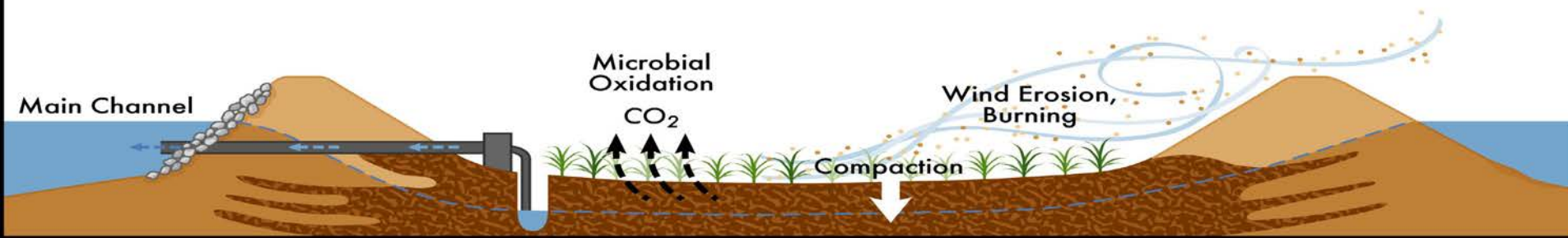


# Land Subsidence: a historical fact

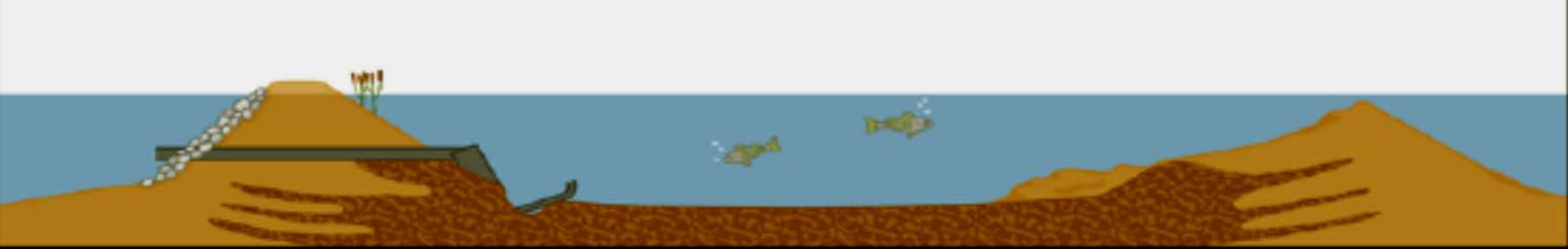
Pre-1880's



Present Time



Levee Failure





# Land Subsidence

Due to Farming & Peat Soil Oxidation

- 25 ft.

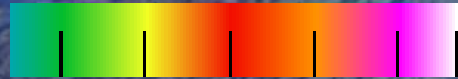
- 20 ft.

- 15 ft.

- 5 ft.

**Below Sea Level**

-30 -20 -10 -5 ft



# Physical Processes

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- **Hydrodynamics**
  - **Hydraulics:**  
flood flows,  
tidal action
  - **Sedimentation**
  - **Erosion**



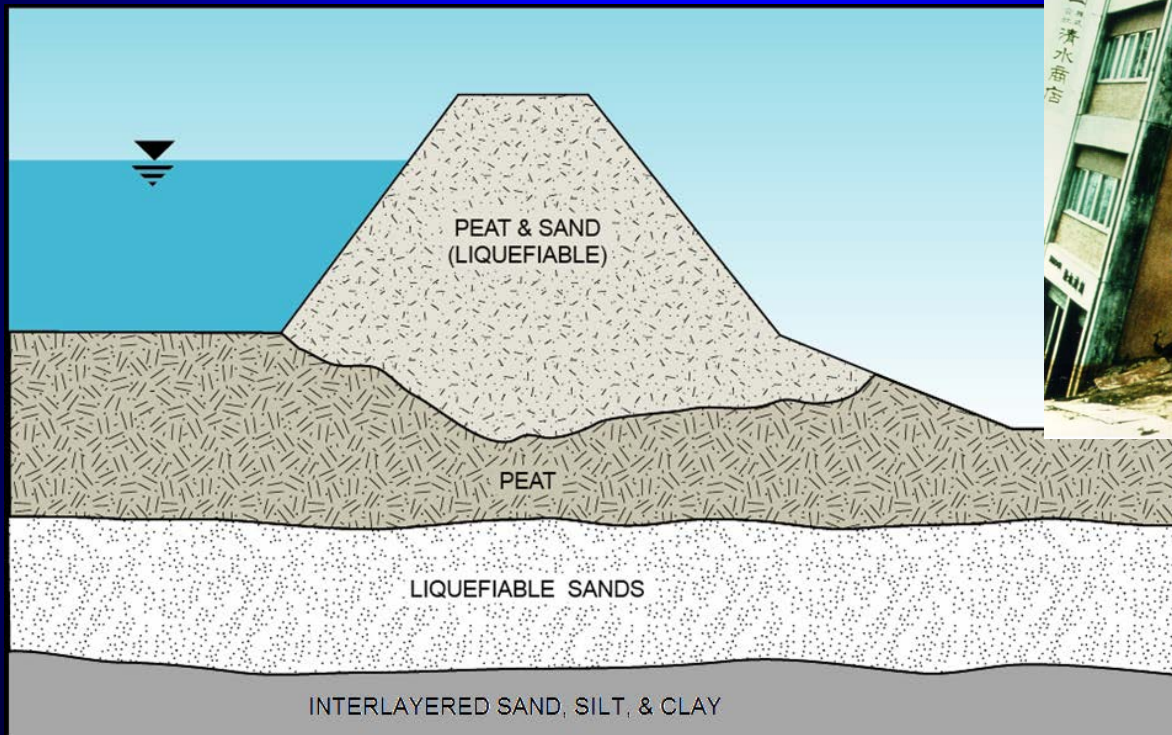
# Seismic Risk



Bay Delta Region Major Faults

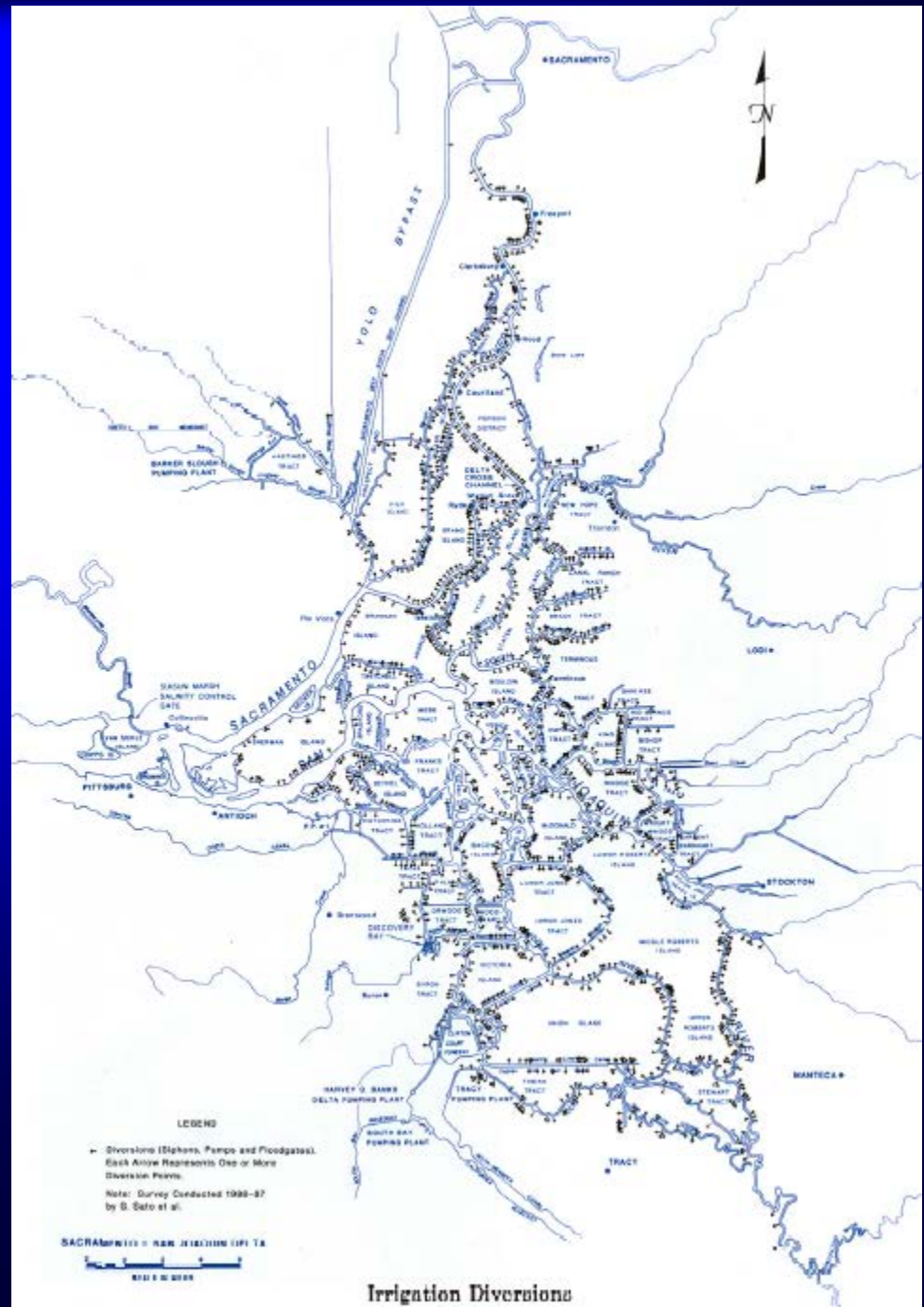
# Levees have risk of failure during a seismic event

- Levees remain susceptible to earthquakes even after PL84-99 improvements are made

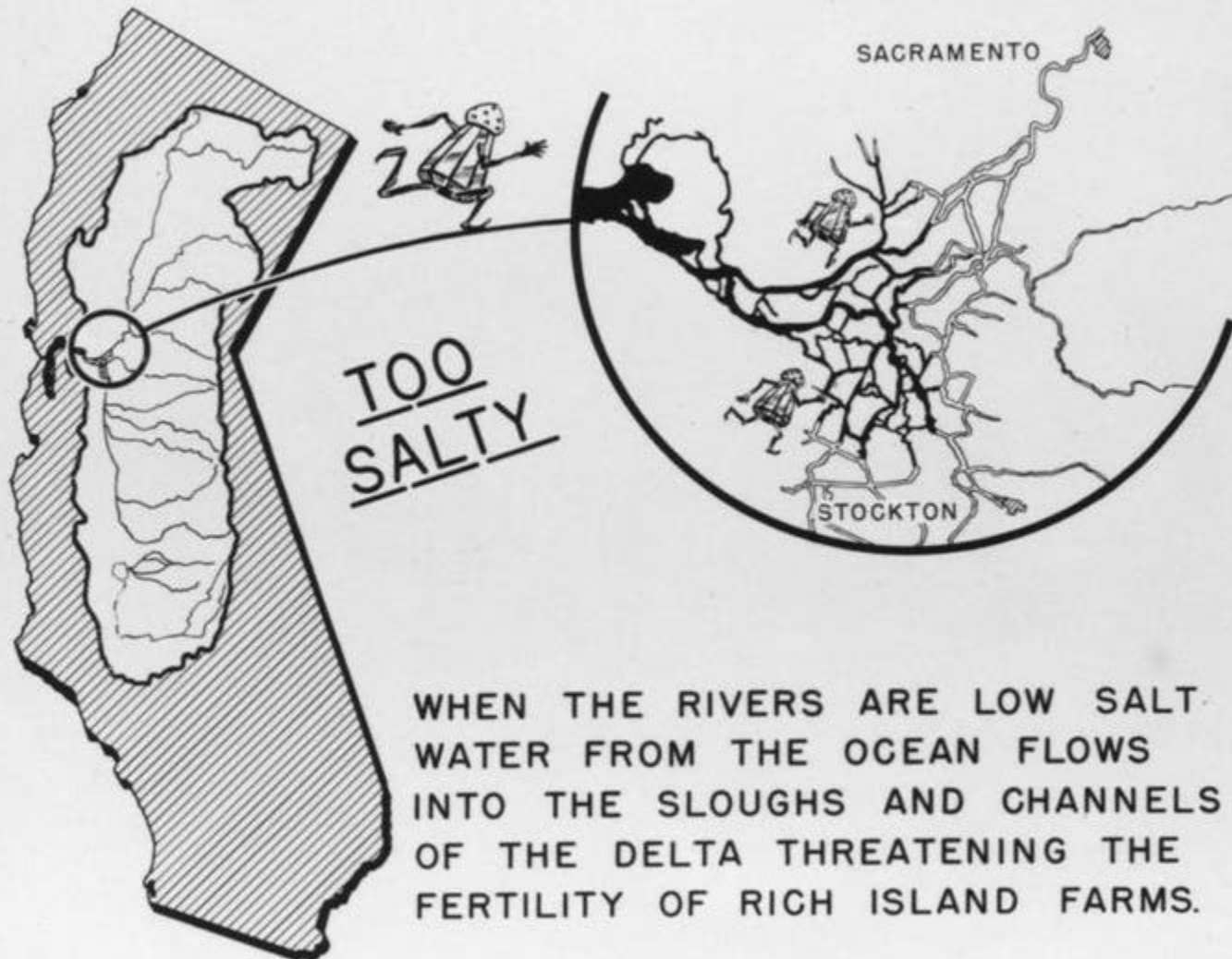


# Agricultural Diversions

- Since the 1850's
- Economy
- Water Quality

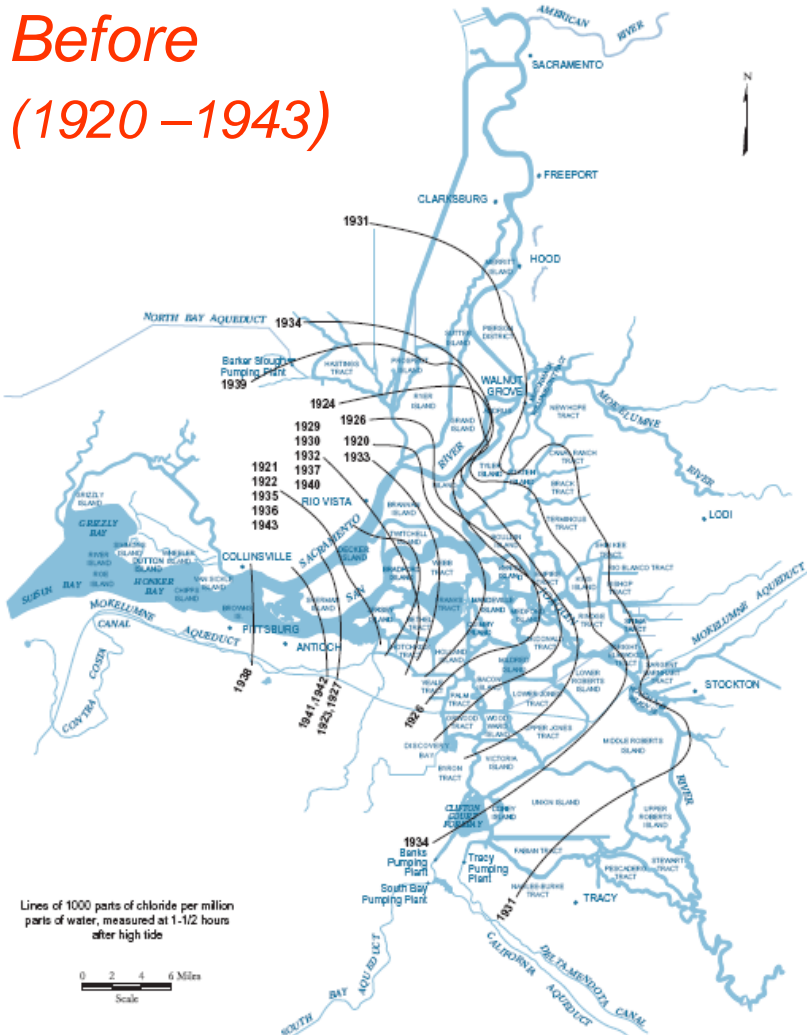


# 1930's Propaganda for CVP



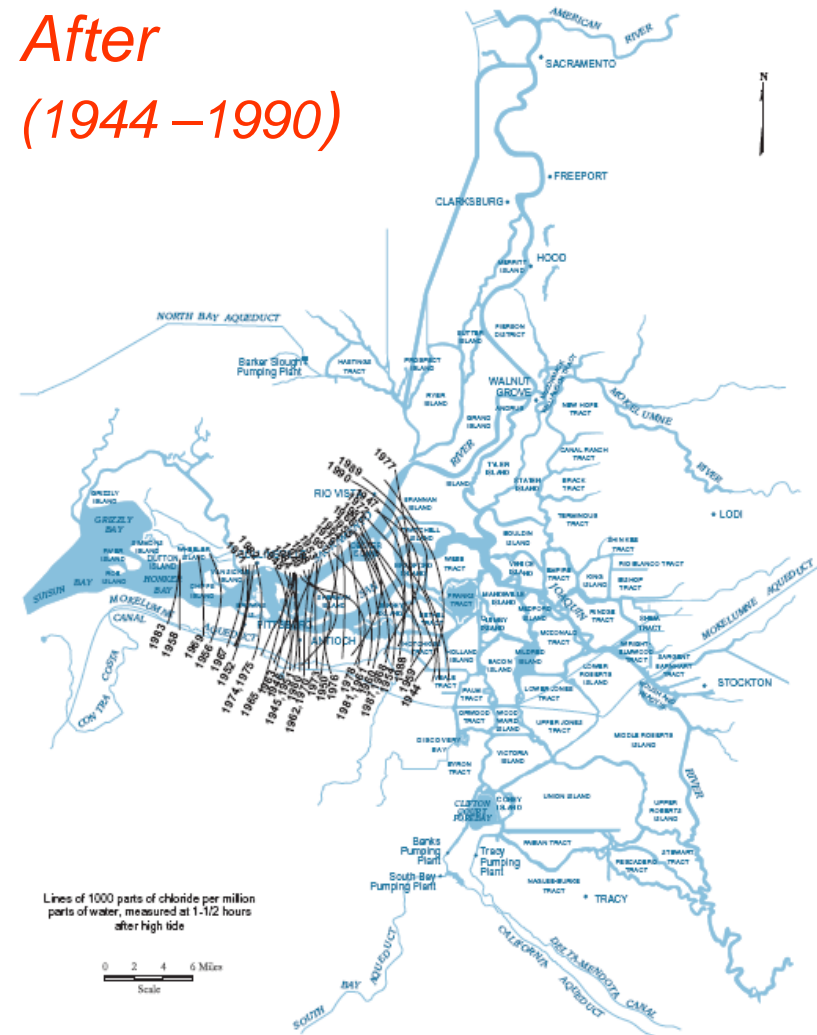
# Salinity Intrusion Before and After Managed Upstream Reservoirs

Figure 4-26 Maximum Salinity Intrusion, 1921-1943



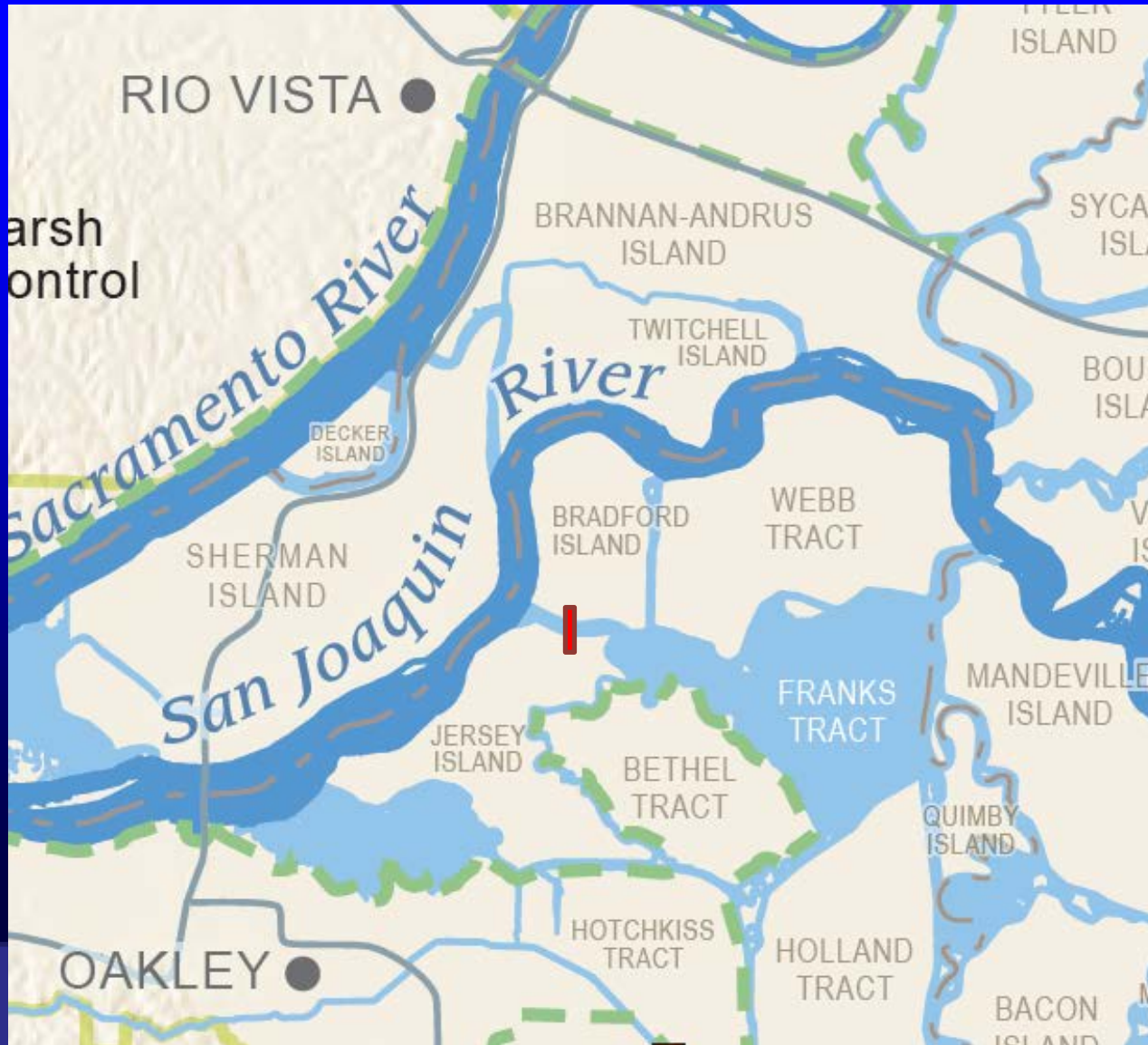
Source: Department of Water Resources, Sacramento - San Joaquin Delta Atlas, 1993

Figure 4-27 Maximum Salinity Intrusion, 1944-1990



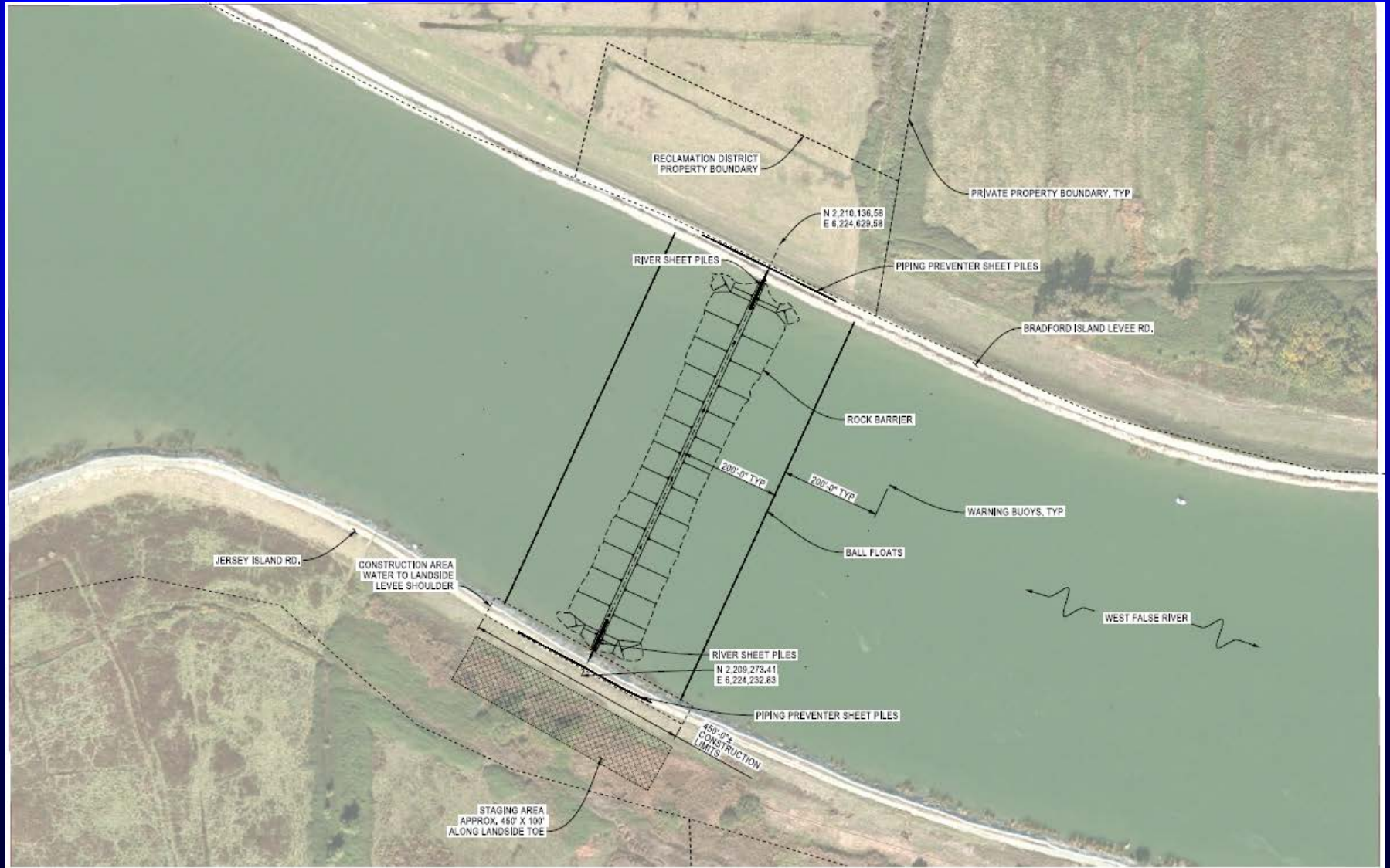
Source: Department of Water Resources, Sacramento - San Joaquin Delta Atlas, 1993

# Emergency Salinity Barrier Location

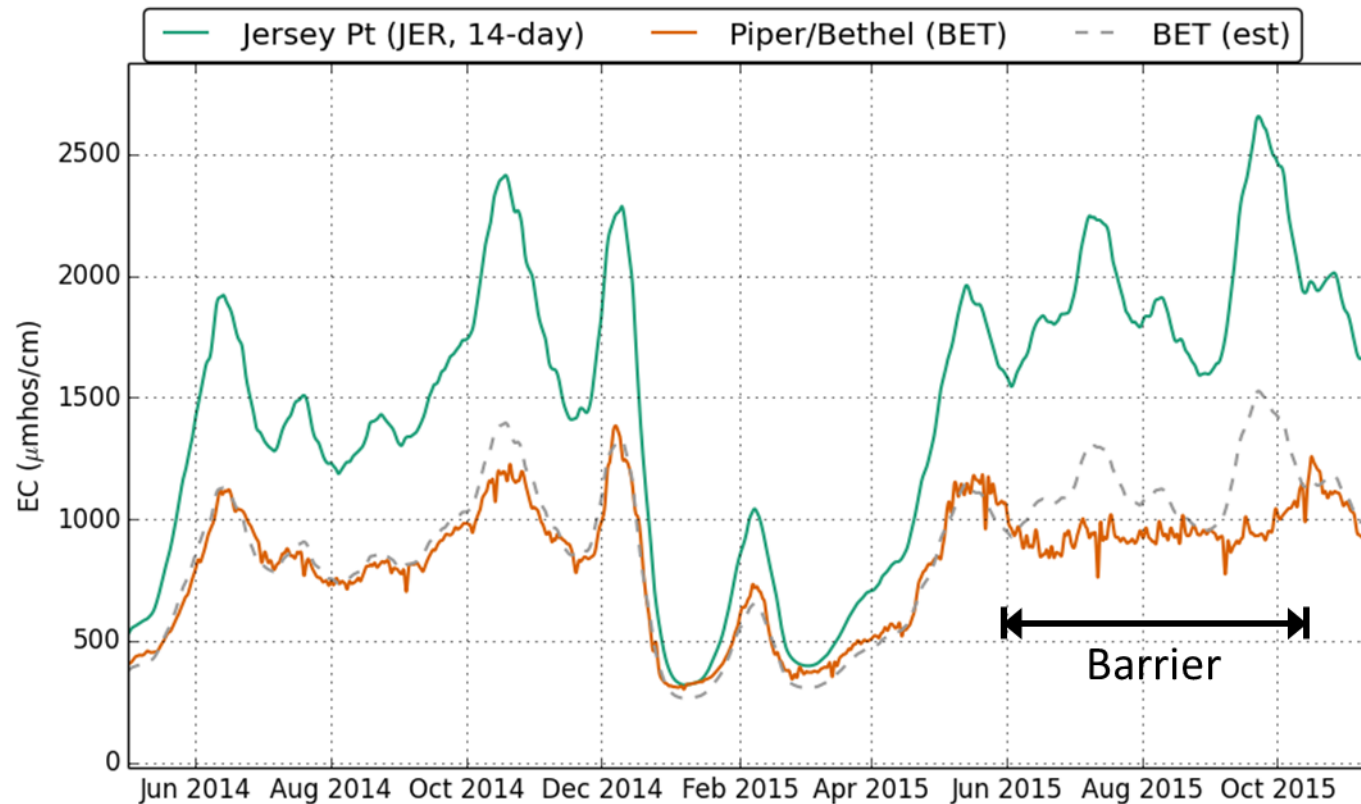




# Plan View of Barrier

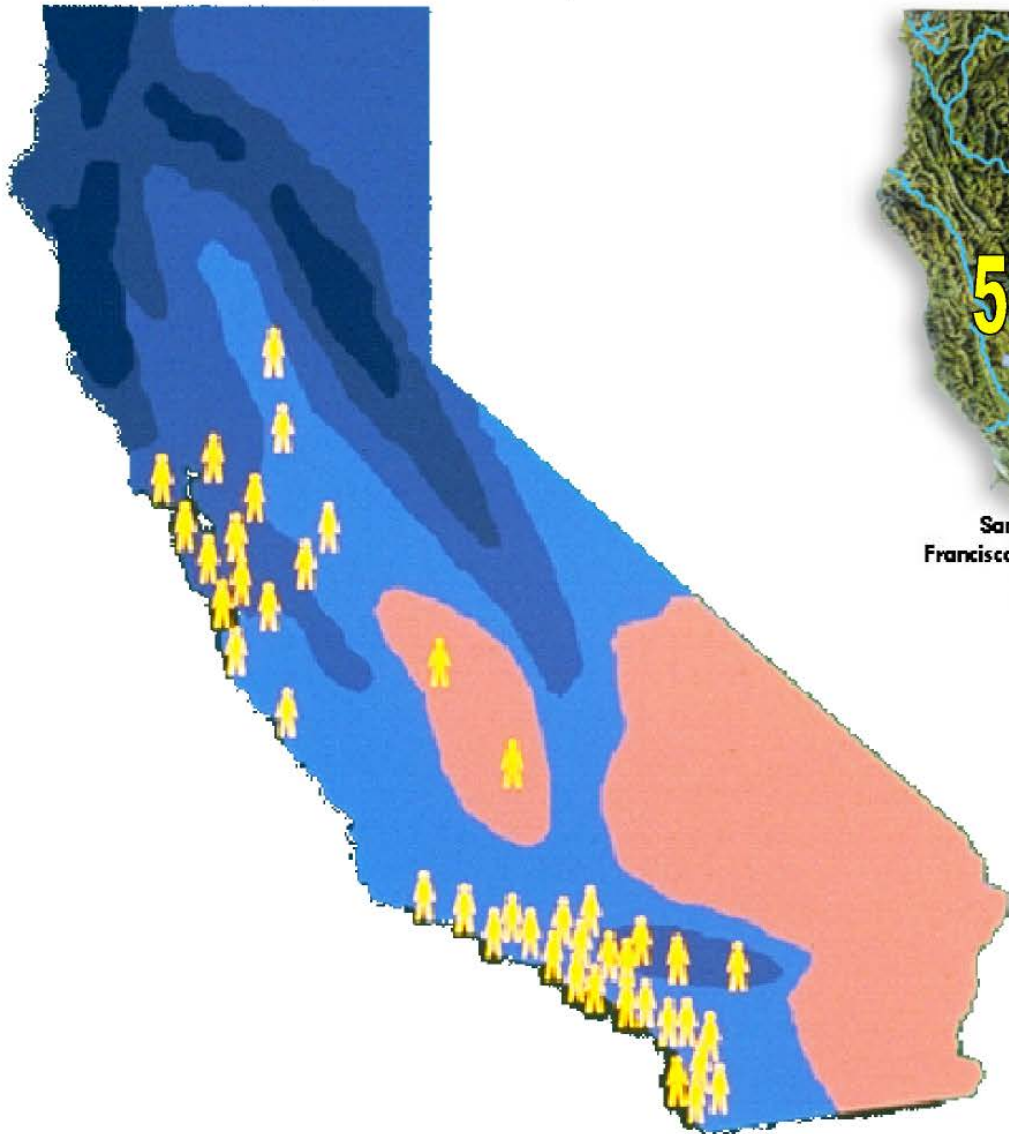


# Drought Barrier Efficacy

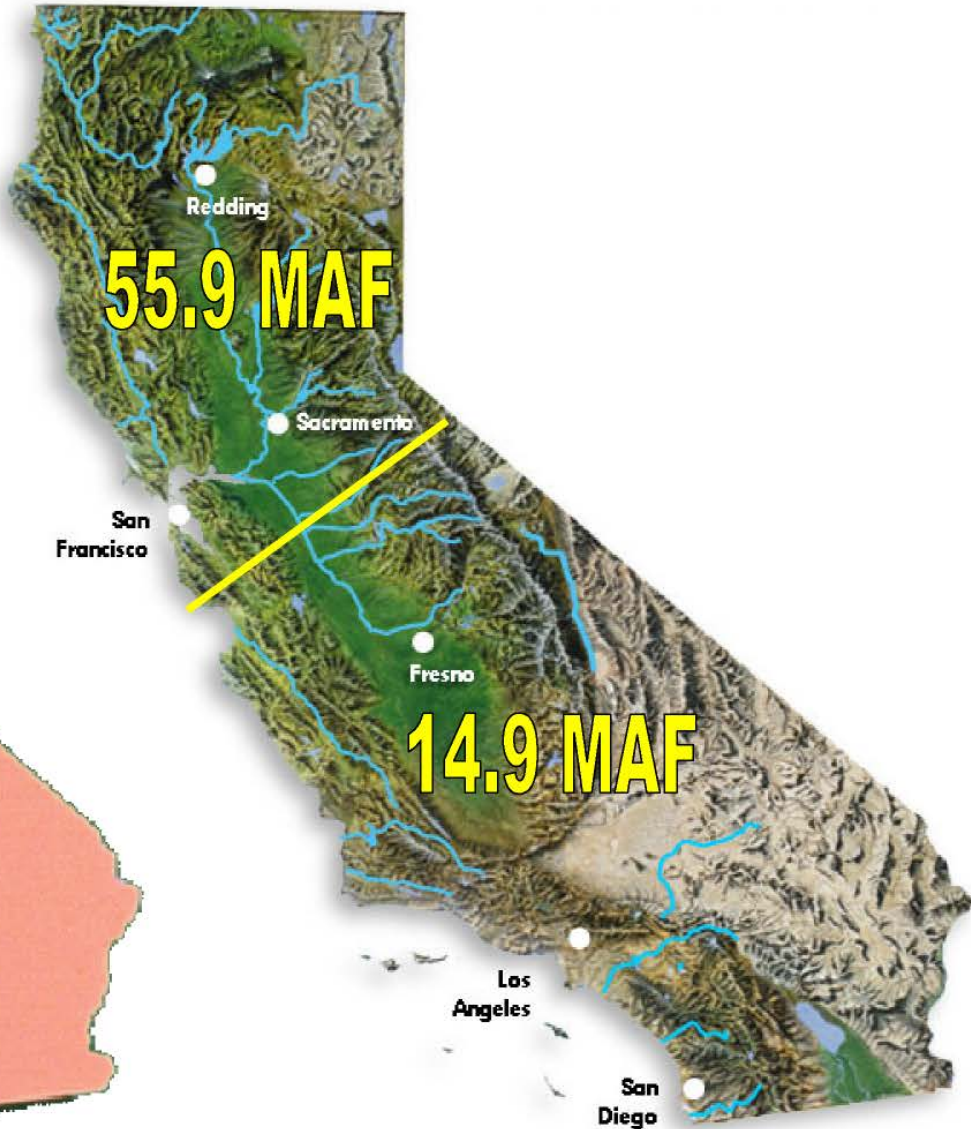


# California's Water Resources

Precipitation (blue contours)  
vs Population (yellow icons)



Total Annual  
Runoff = 70.8 MAF



# Delta Inflow Refresher

## Sacramento River

~80% Inflow; good quality

## East Side Rivers

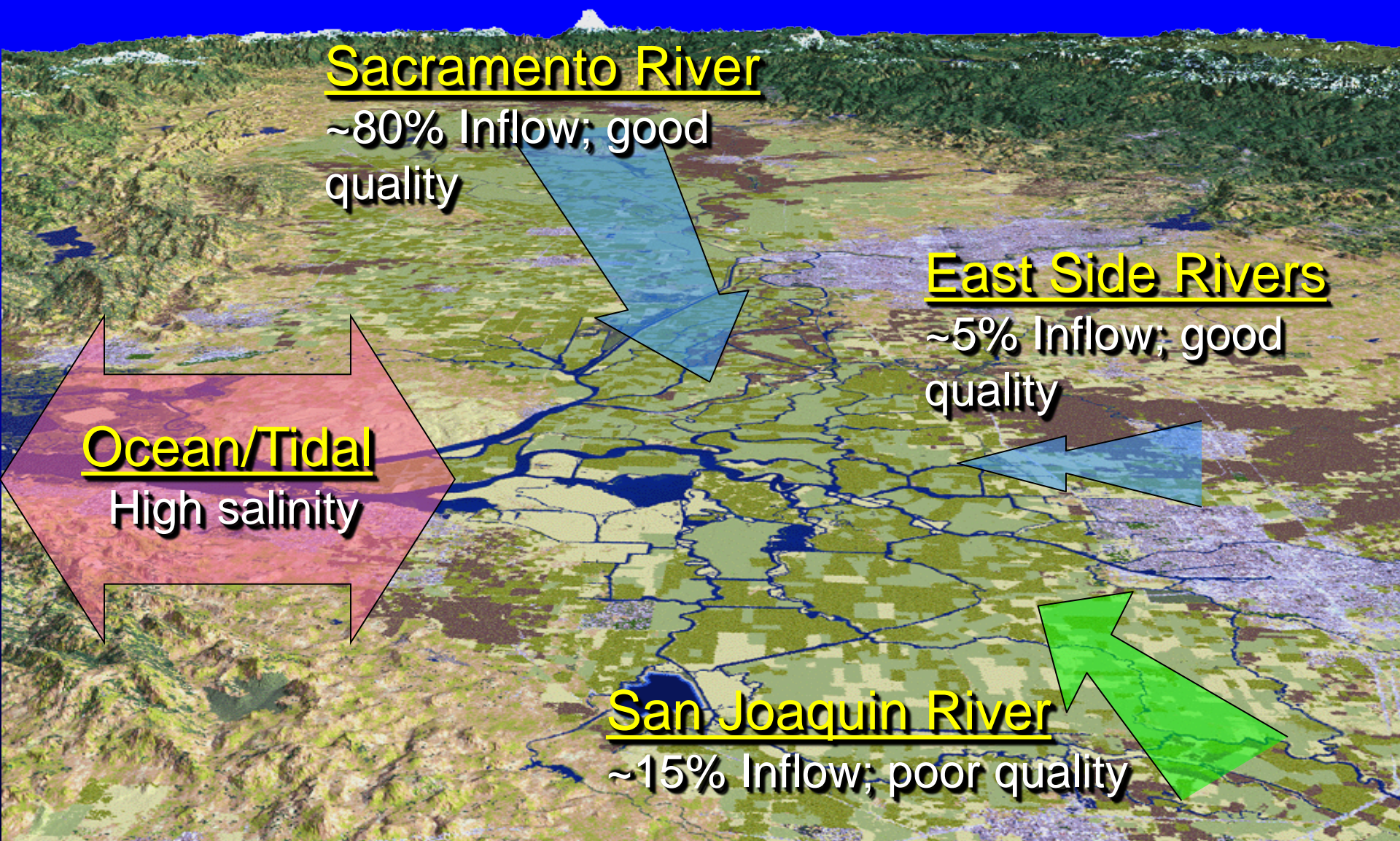
~5% Inflow; good quality

## Ocean/Tidal

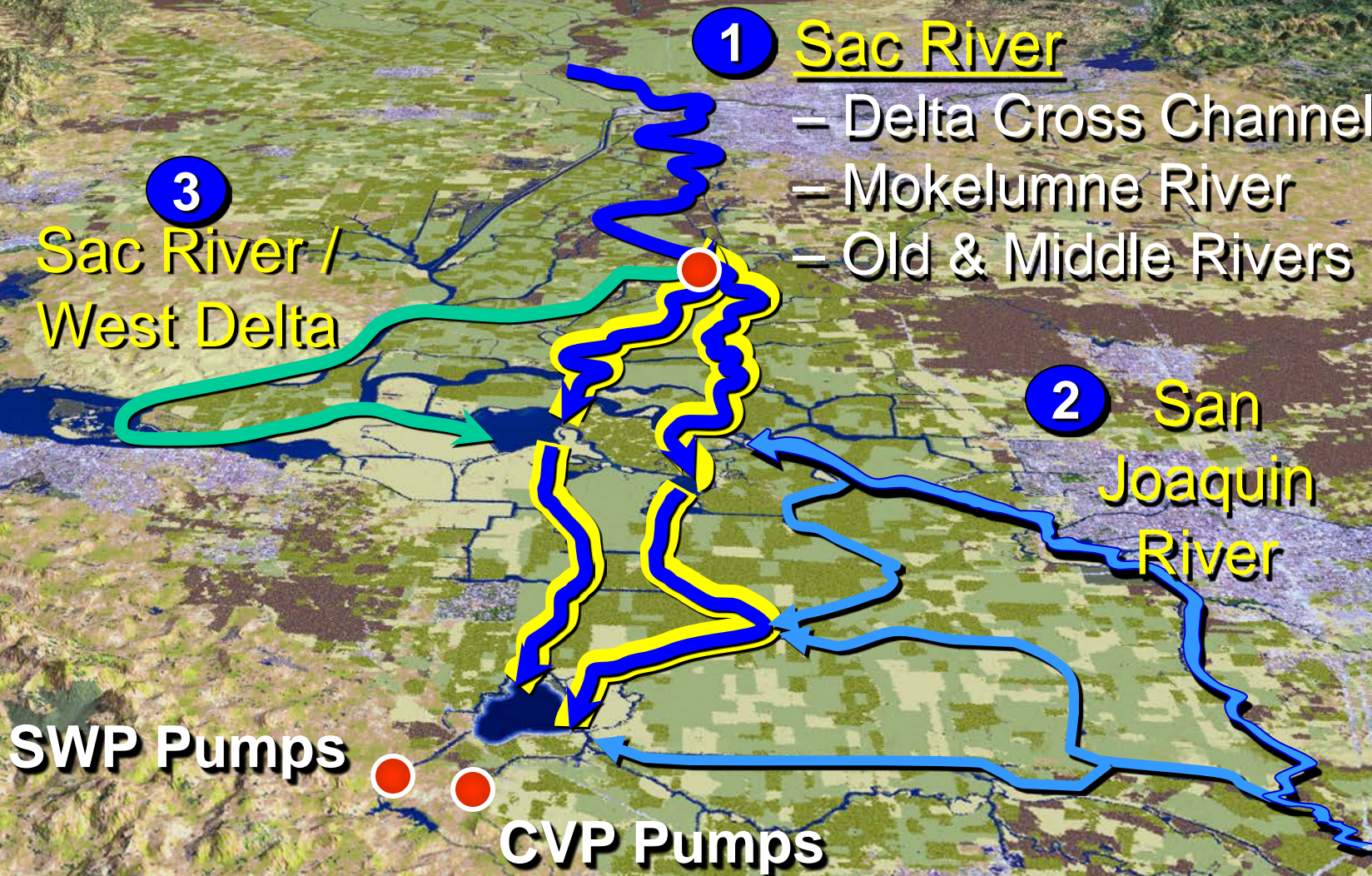
High salinity

## San Joaquin River

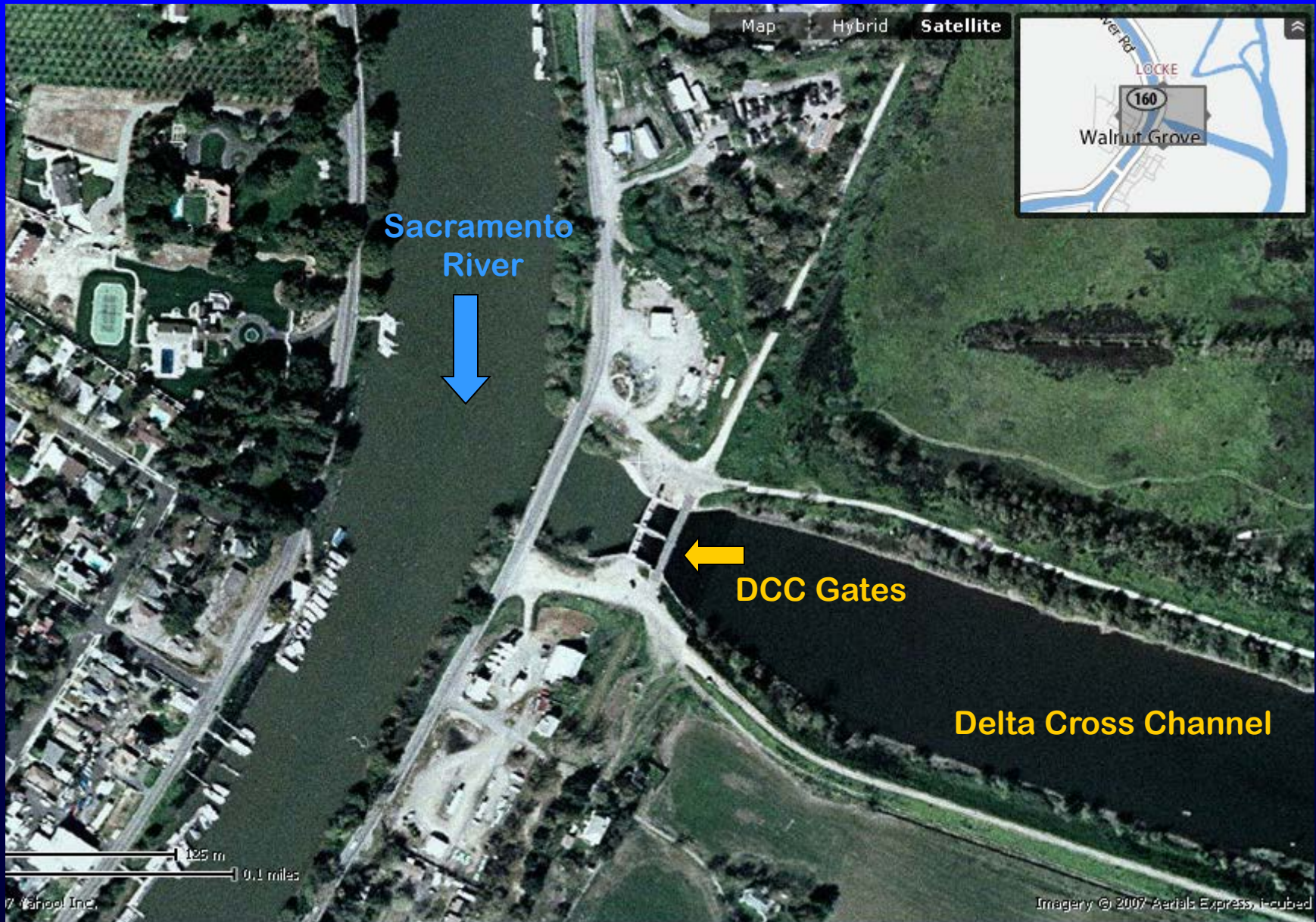
~15% Inflow; poor quality



# Flow of Water for State and Federal Projects



# Delta Cross Channel





Skinner FF

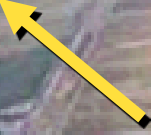


Clifton Court Forebay

CCF Intake



Banks PP



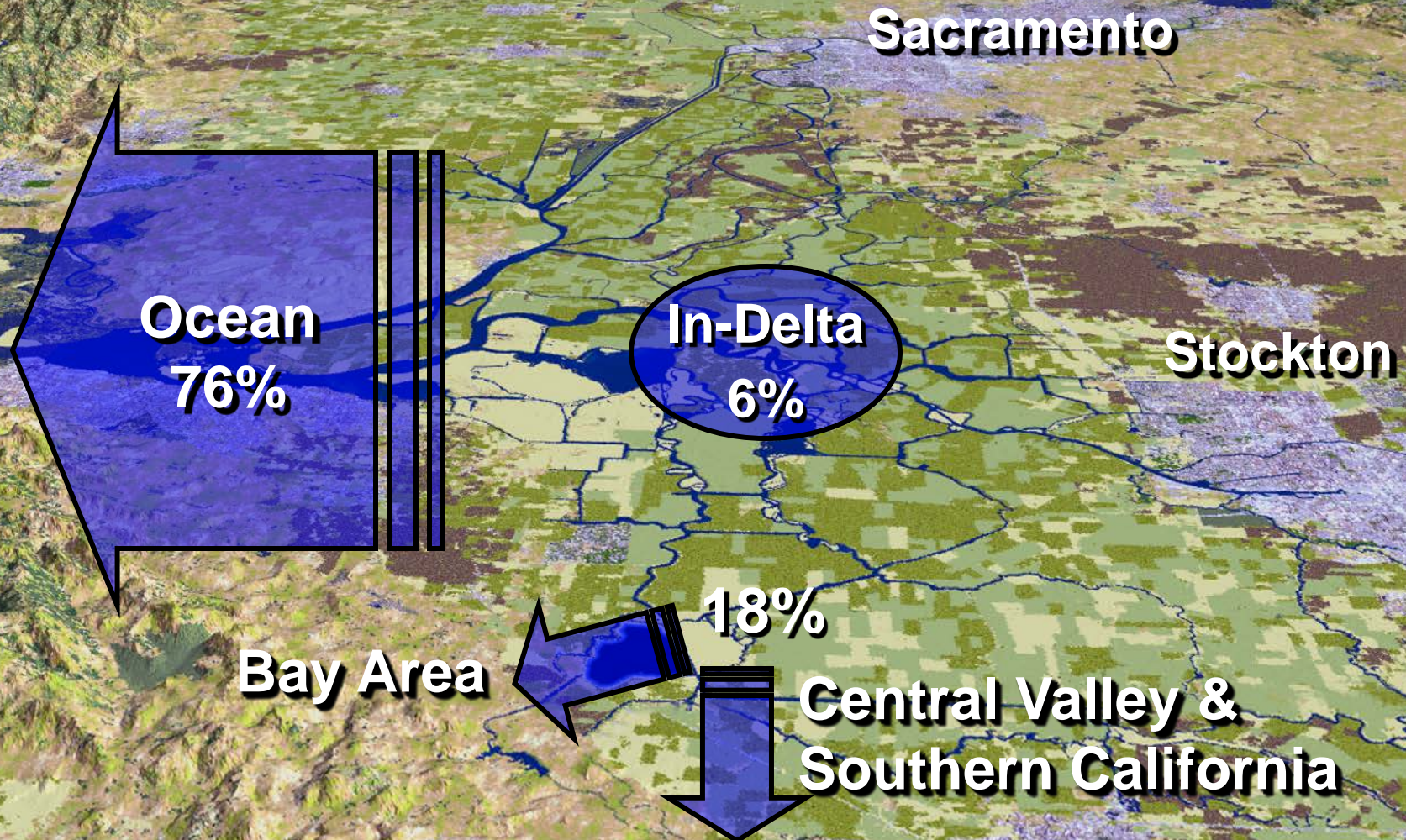
Tracy PP



Tracy Fish Collection Facility

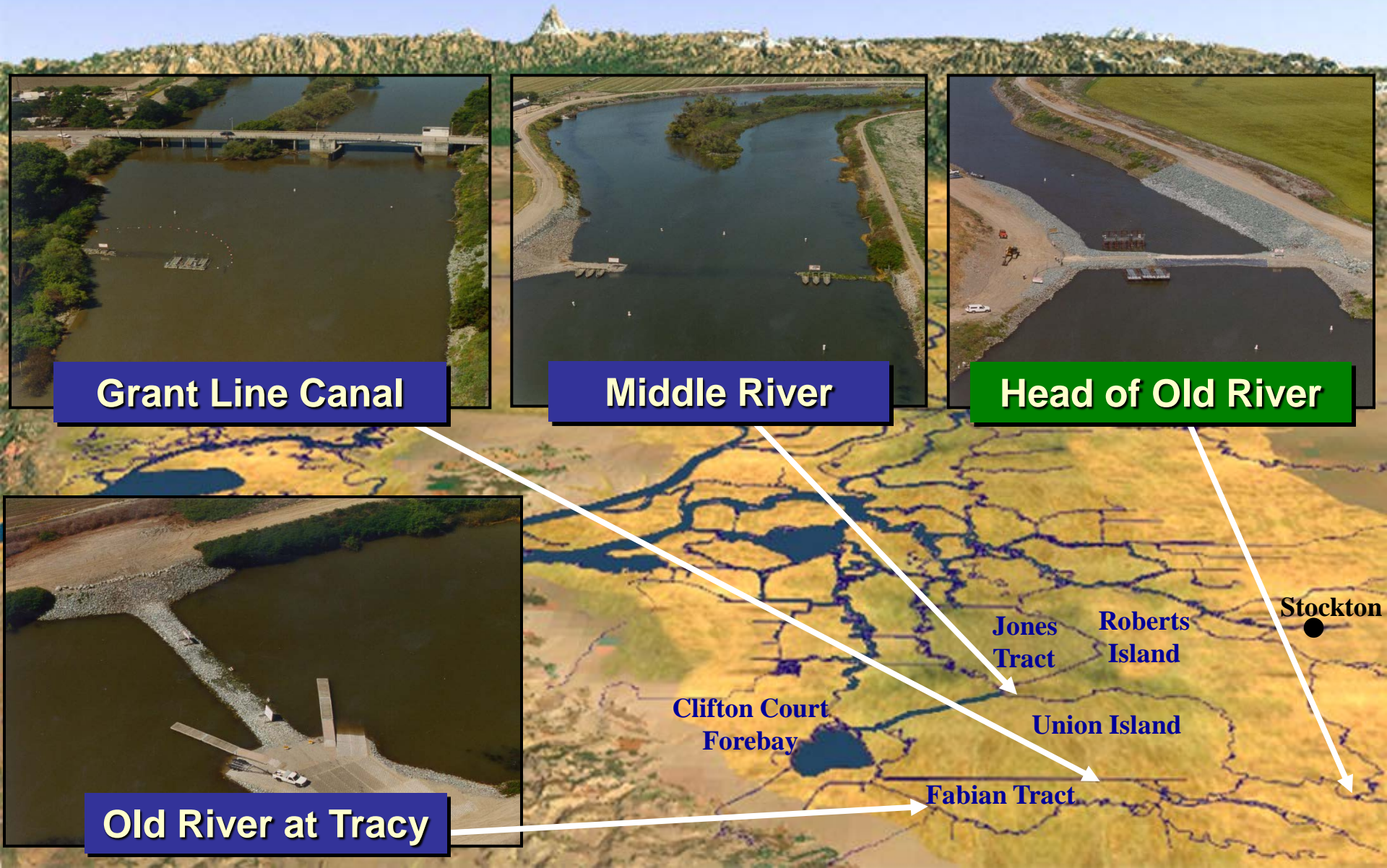


# Delta Water Use





# South Delta Temporary Barriers



**Grant Line Canal**

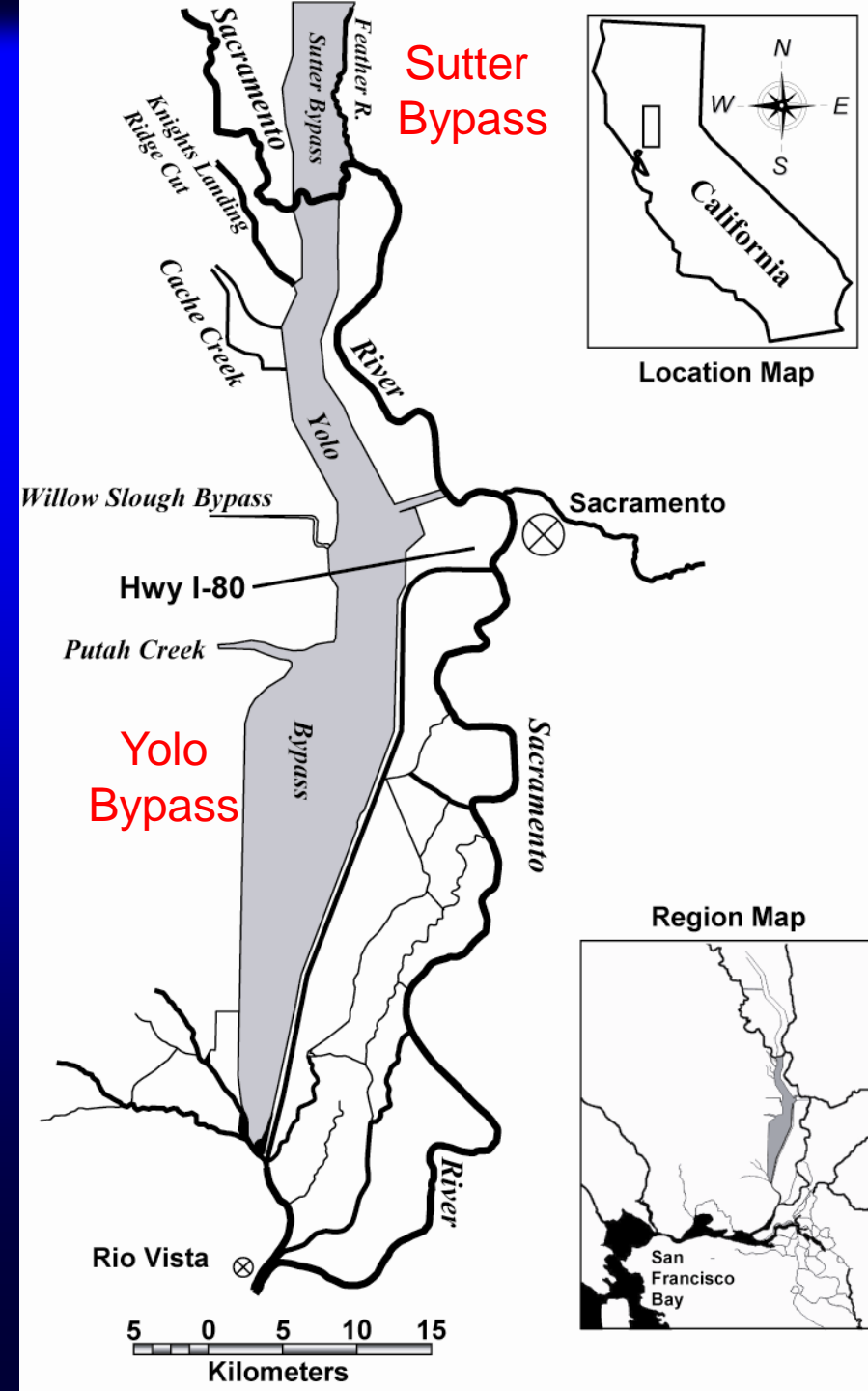
**Middle River**

**Head of Old River**

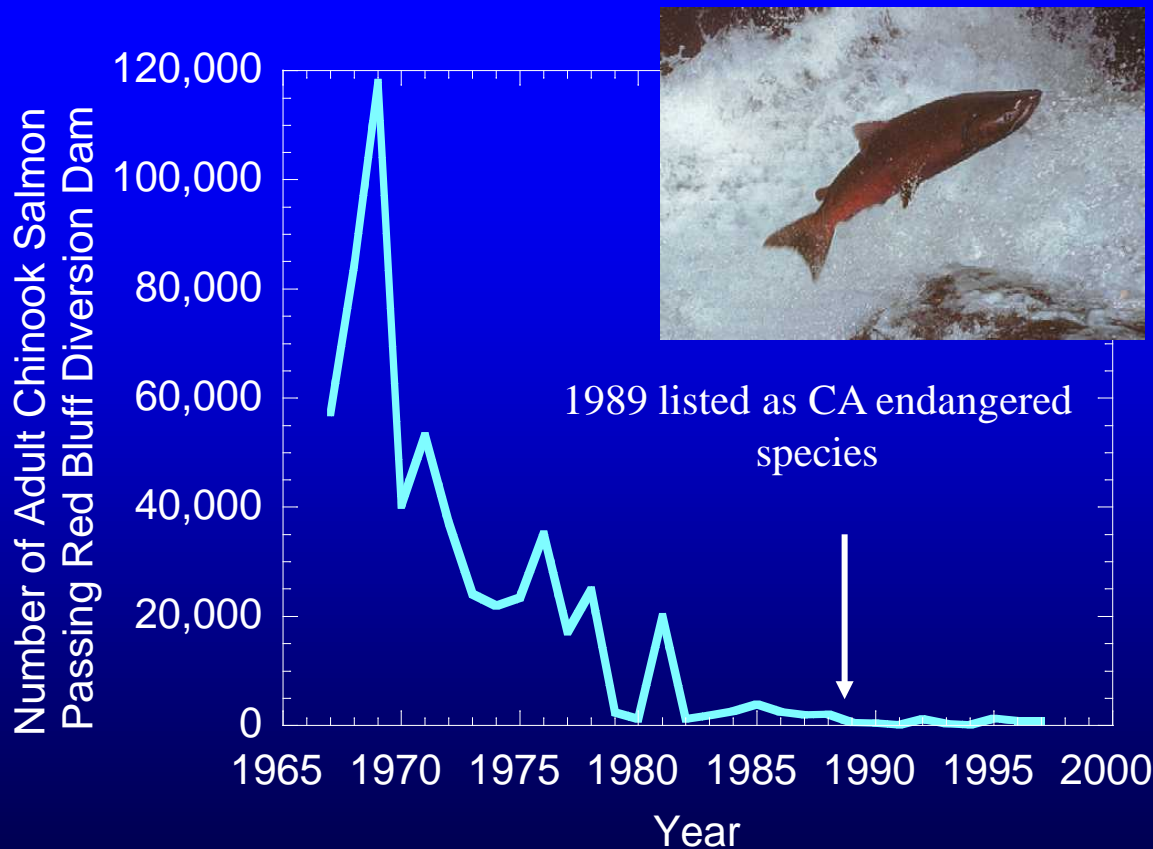
**Old River at Tracy**

# Flood Control and Fish

- Sutter Bypass
  - Tisdale Weir
- Yolo Bypass
  - 59,000 acres
  - Fremont Weir  
33.5 ft crest elev.
  - Vic Fazio Yolo Wildlife Area



# Winter Run Chinook Salmon



- Spawning
- Predation
- SWP/CVP Salvage
- Floodplain
- Disease

# Delta Smelt

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- Listed under Endangered Species Act
- Reverse Flow Constraints
  - Old and Middle River Flows
  - Turbidity Triggers
  - Caps on Exports
- Fall X2
- Food Concerns
- Predation
- Temperature



# Invasive Species



- Competition for plankton
- Increases water clarity
- Changes water chemistry

- Increased predation on native species
- Aided by clear water



- Invasive Aquatic Plants reduce nutrients for phytoplankton
- Increases water clarity
- Provides ambush habitat for predators

