

Reclamation Staffing Needs

California Central Valley Project Water Resources Planning and Management

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Outline

- California Water Resources
- Reclamation's Central Valley Project
- Modeling and Technical Analyses
- Staffing Needs

Please Note: Many general facts and figures in this presentation were sourced from the Water Education Foundation website (www.watereducation.org) creativecommons.org, and through the gracious collaboration of MBK Engineers.

California Water 101



Climate

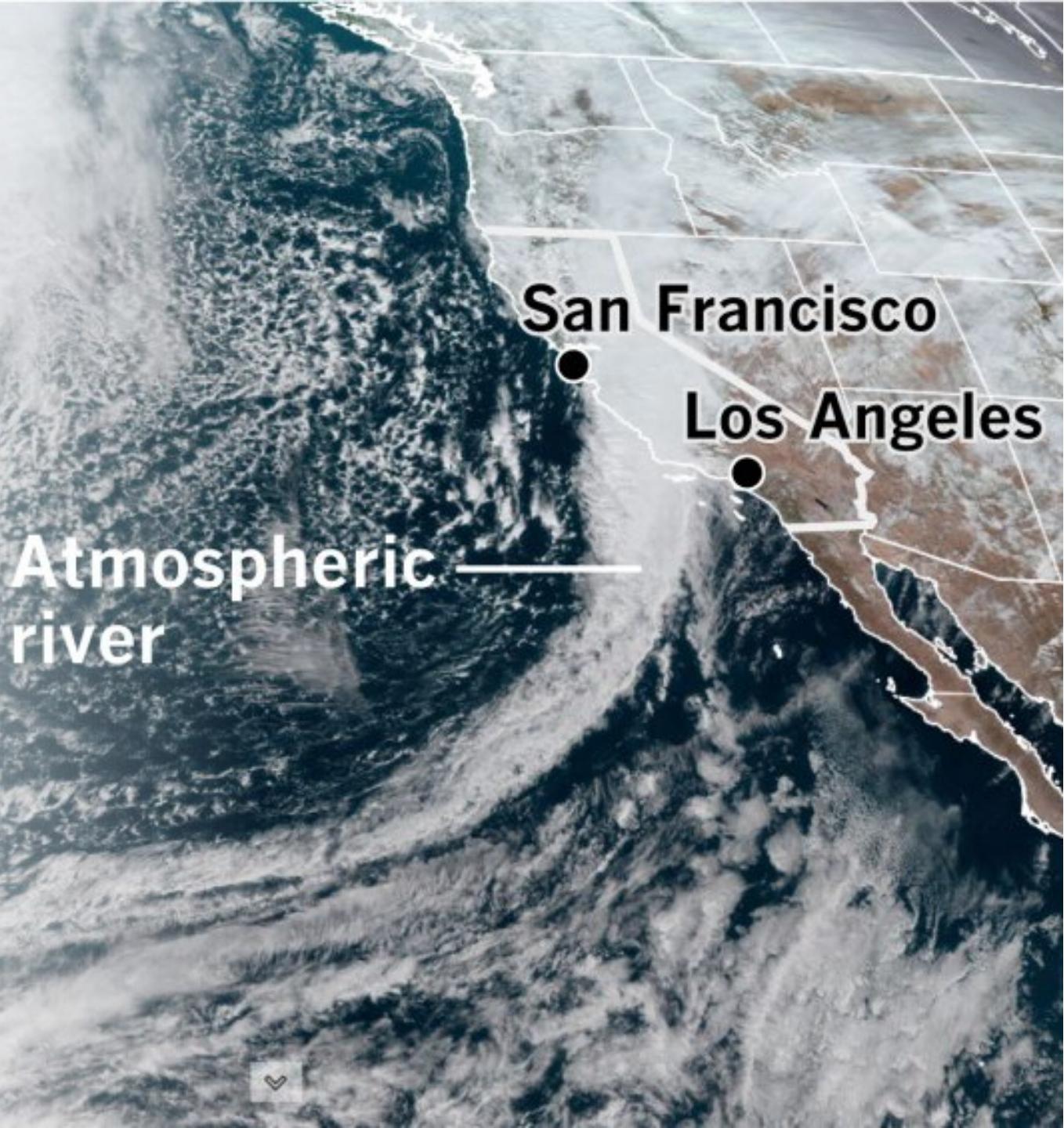
- Mediterranean climate : warm, dry summers and mild winters.
- Most of the precipitation falls in the winter as rain and snow.
- Mostly atmospheric rivers: variable hydrology year to year

Total precipitation: About 200 million acre-feet

Evapotranspiration: about 60%

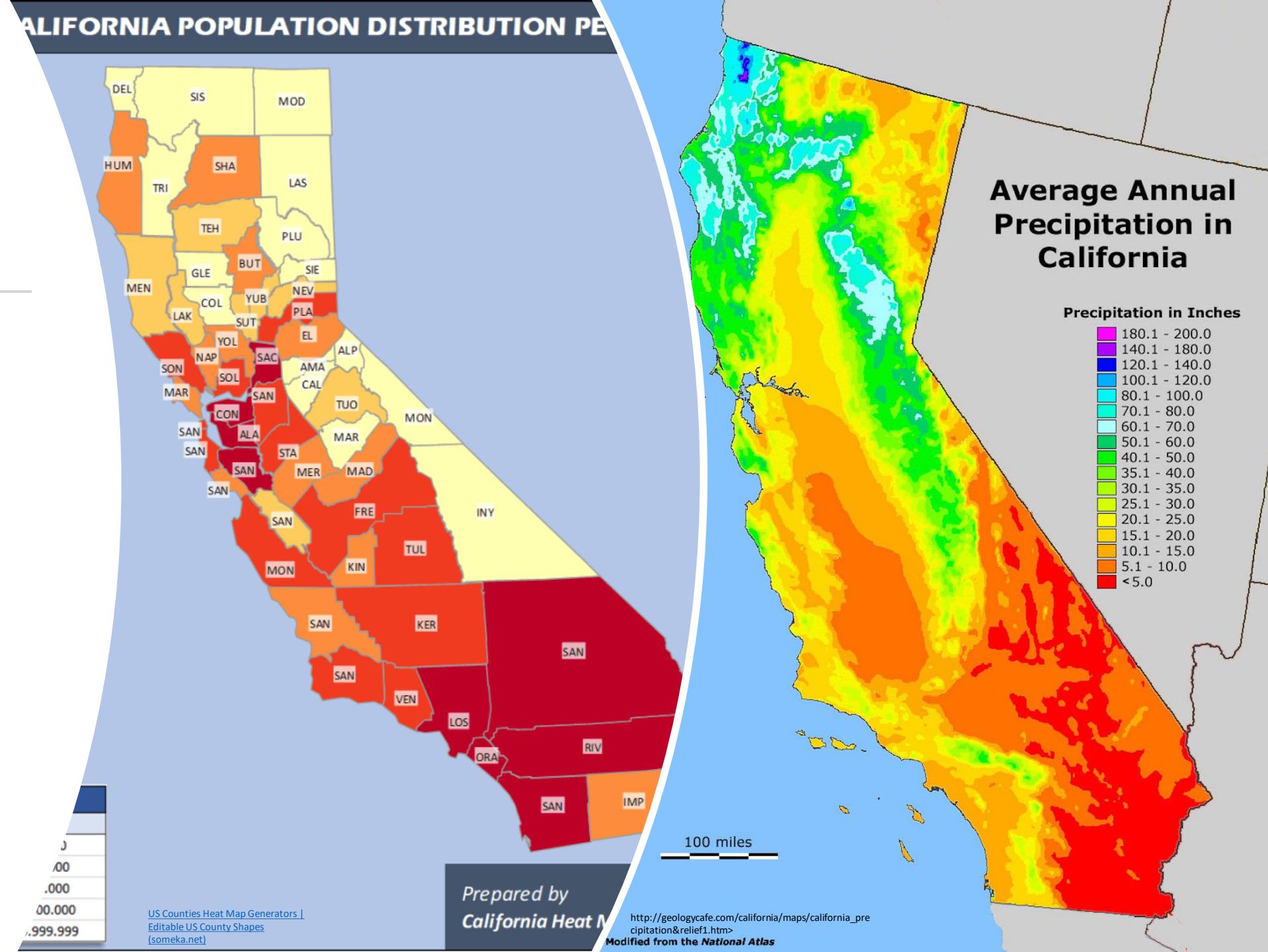
Total precipitation available for use : 75 million acre-feet per average (total sw and gw)

1 acre-foot = 1233.48 cubic meters



Water Supply / Water Demand

- 75 percent of California's available water is in the northern third of the state (north of Sacramento), while 80 percent of the urban and agricultural water demands are in the southern two-thirds of the state.
- The state's largest surface 'reservoir' is the Sierra Nevada snowpack (~ 15 million acre-feet on average).



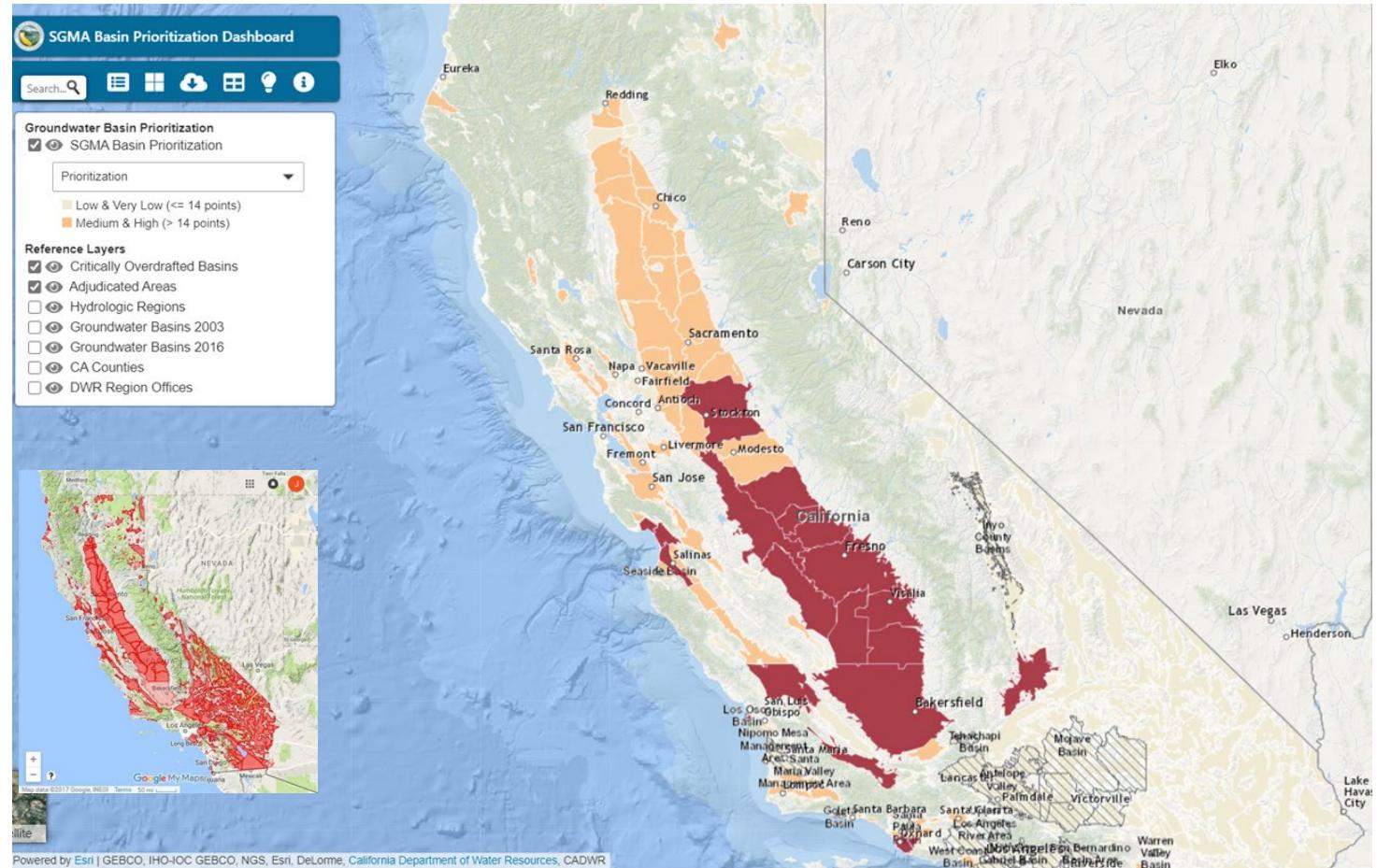
The importance of agriculture

- Nation's leading agricultural and dairy state
- 80,500 farms and ranches
- More than 350 agricultural products
- \$50 billion in sales value in 2019
- More than a third of the country's vegetables and two-thirds of the country's fruits and nuts are grown in California.



Groundwater

- California uses more groundwater than any other state.
- Groundwater supplies about 40% of State's freshwater needs on an average year while the number can go up to 60% or more in dry years.
- California uses about 2 million more acre-feet a year than is recharged.
- California's groundwater has gone unregulated at the state level for decades.
- Sustainable Groundwater Management Act (SGMA) signed into law in 2014.



Sacramento – San Joaquin Delta

- California's most crucial water and ecological resource.
- Largest freshwater tidal estuary of its kind on the west coast of the Americas
- Important habitat for birds on the Pacific Flyway and for fish that live in or pass through the Delta.
- Hub of California's two largest surface water delivery projects, the State Water Project and the federal Central Valley Project.



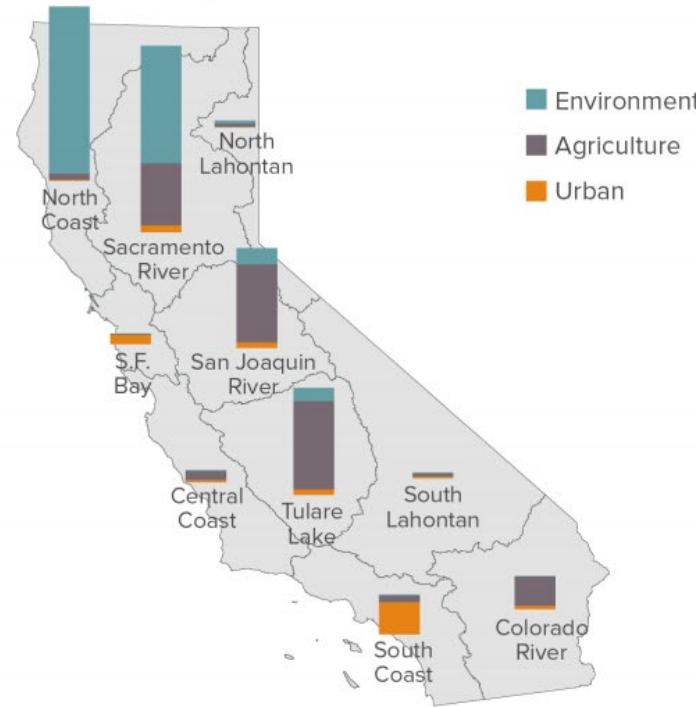
Competing Water Needs

Water fuels the economy of California, and managing it properly is of paramount importance.

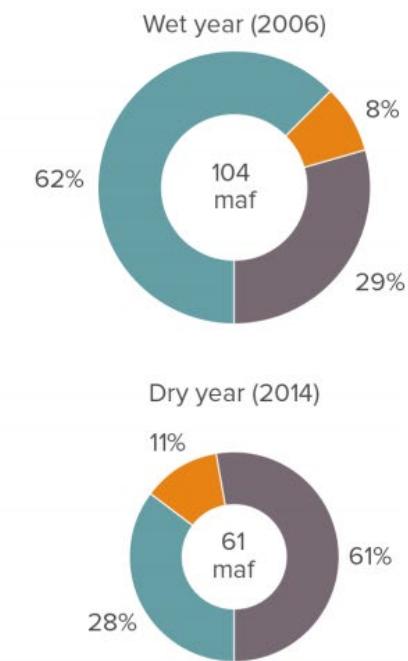
- Growing population
- Agricultural industry
- Municipal and Industrial use: businesses, manufacturers and developers.
- Recreational use
- Water for protecting water quality
- Water for protecting fisheries and wildlife

Water use varies dramatically across regions and between wet and dry years

Average annual applied water use
(1998–2015)



Statewide applied water use,
millions of acre-feet (maf)



Source: Department of Water Resources, *California Water Plan Update 2018 (Public Review Draft)*.

Notes: The figure shows applied water use. The statewide average for 1998–2015 was 77.2 maf. Environment (38.3 maf average) includes water for “wild and scenic” rivers, required Delta outflow, instream flows, and managed wetlands. Urban (7.9 maf) includes residential, commercial, and industrial uses; and large landscapes. Agriculture (31 maf) includes water for crop production. Net water use—i.e., the volume consumed by people or plants, embodied in manufactured goods, evaporated, or discharged to saline waters—is lower. The figure excludes water used to actively recharge groundwater basins (3% for urban and 1% for agriculture on average), conveyance losses (3% for urban and 8% for agriculture), and water used for energy production (less than 2% of urban use).

CA Water Infrastructure

California has 1,400 dams: State, Federal, and Local Projects

Central Valley Project (CVP): As California's largest water supplier, the CVP delivers on average over 7 million acre-feet of water per year. CVP water is used to irrigate 3 million acres of farmland in the San Joaquin Valley, as well as provide water for urban use in Contra Costa, Santa Clara, and Sacramento counties.

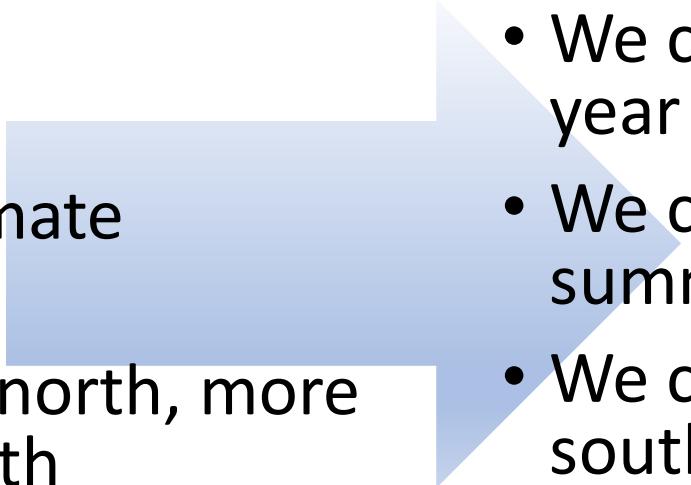
The State Water Project (SWP): The largest state-built water and power project in the United States, the SWP spans 600 miles from Northern California to Southern California, providing drinking water for 23 million people and irrigation water for 750,000 acres of farmland.



In Summary:

Condition

- Variable hydrology
- Mediterranean climate
- More water in the north, more demand in the south



Outcome

- We carry water from year to year
- We carry water from winter to summer
- We carry water from north to south

CA Water Management is Complex and Challenging



**NOAA
FISHERIES**



Water Boards
STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS

**California Department of
Fish and Wildlife**



Climate Change

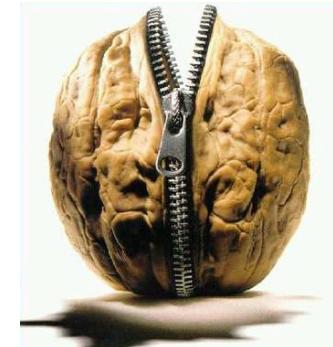
Endangered Species

Spatial/Temporal Variability
in Water Supply and Demand

Existing Facilities

Need for sustainability: SGMA

Bureau of Reclamation's Central Valley Project -in a nutshell-





The mission of the Bureau of Reclamation
is to manage, develop, and protect
water and related resources in an
environmentally and economically sound manner
in the interest of the American public.



US Bureau of Reclamation

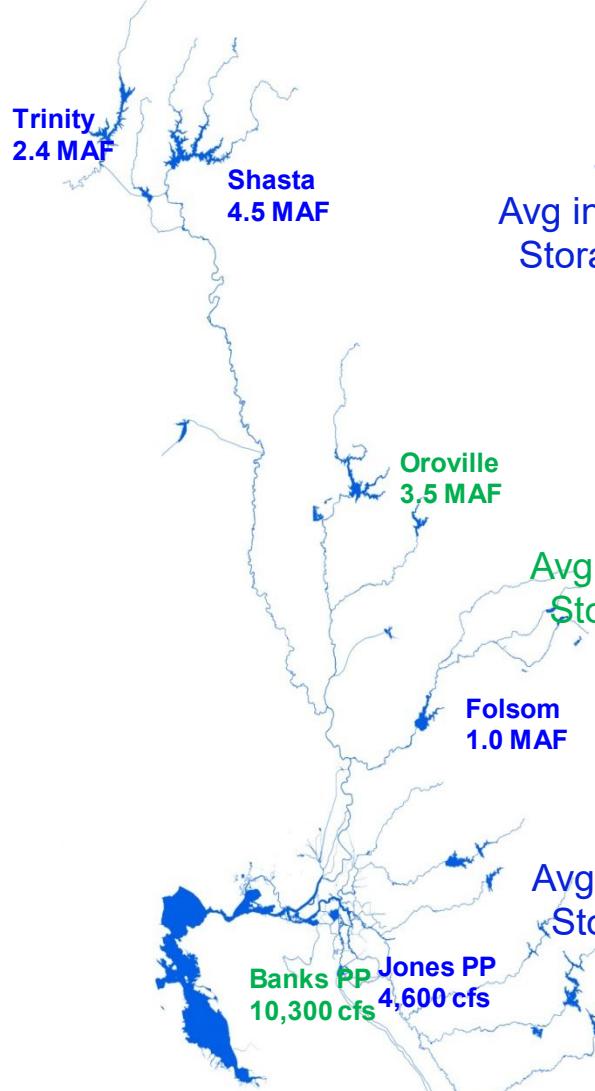
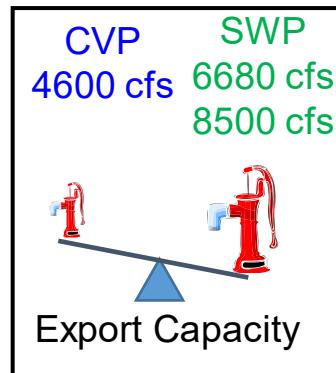
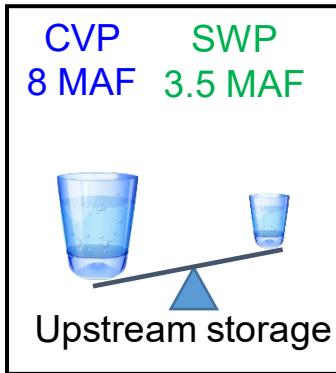
- The nation's largest wholesale water supplier, operating 338 reservoirs with a total storage capacity of 140 million acre-feet
- Provides 1 out of 5 farmers in the 17 Western states with irrigation water for 10 million farmland acres that produce 60% of the nation's vegetables and one quarter of its fresh fruit and nut crops.
- The second largest producer of hydropower in the US; operates 53 hydroelectric powerplants that generate 15% of the nation's hydropower.



Central Valley Project

- CVP Facilities – 20 dams, 11 power plants, 500 miles of major canals
- CVP Contracts provide
 - 5 MAF/yr to irrigate ~3 million acres (~1/3 of CA ag land)
 - 600 TAF/yr to urban water users in ~1 million households
- Central Valley Project Improvement Act (1992) dedicates
 - 800 TAF/yr of project yield to fish and wildlife habitat
 - 410 TAF/yr to State and Federal Wildlife Refuges and Wetlands
- CVP Meets Regulations
 - State – DFG standards; SWRCB water rights decisions (flow/WQ standards)
 - Federal – NMFS/FWS Biological Opinions; FERC licensing req'ts
- CVP shares responsibility for meeting regulatory criteria with the SWP under the Coordinated Operating Agreement (1986/2018)

CVP/SWP Resources

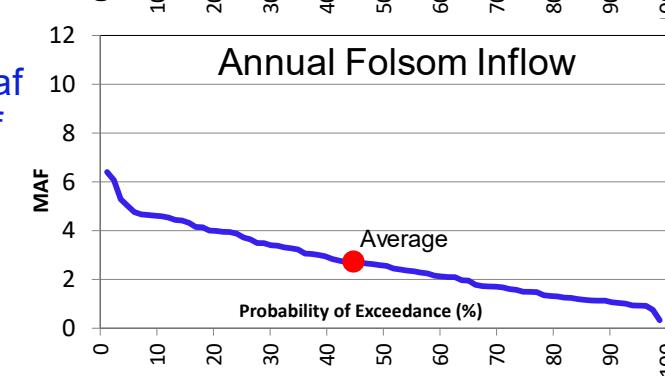
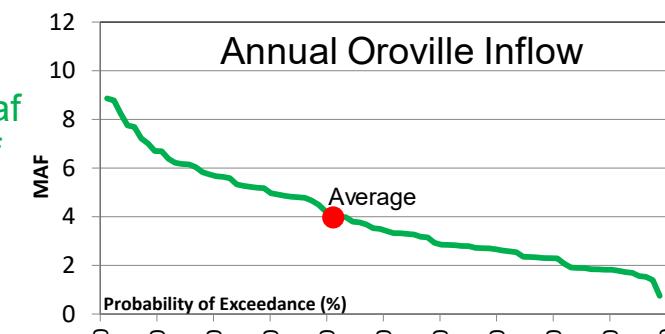
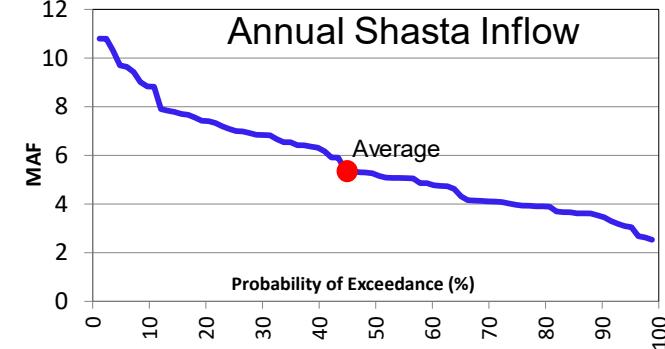
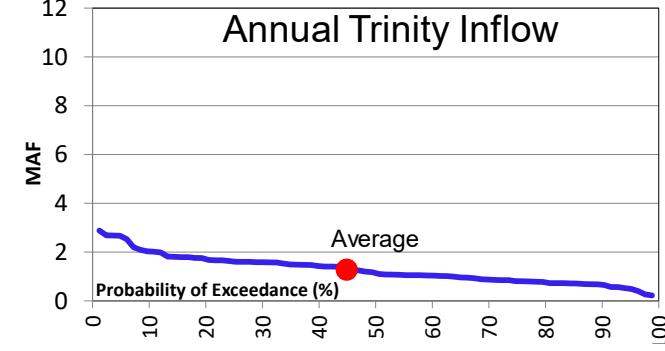


Trinity
Avg inflow = 1.3 maf
Storage = 2.4 maf

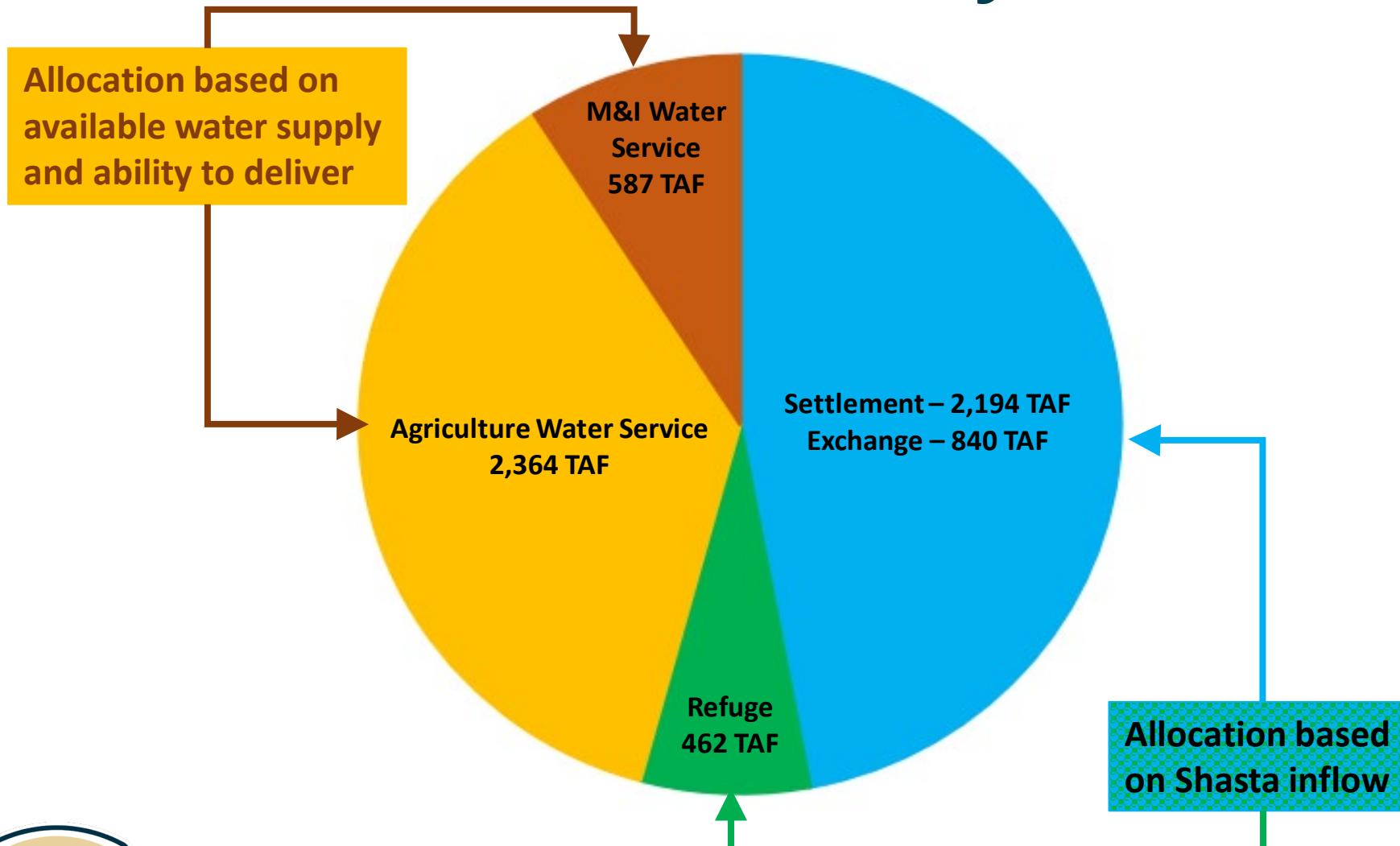
Shasta
Avg inflow = 5.7 maf
Storage = 4.5 maf

Oroville
Avg inflow = 4.0 maf
Storage = 3.5 maf

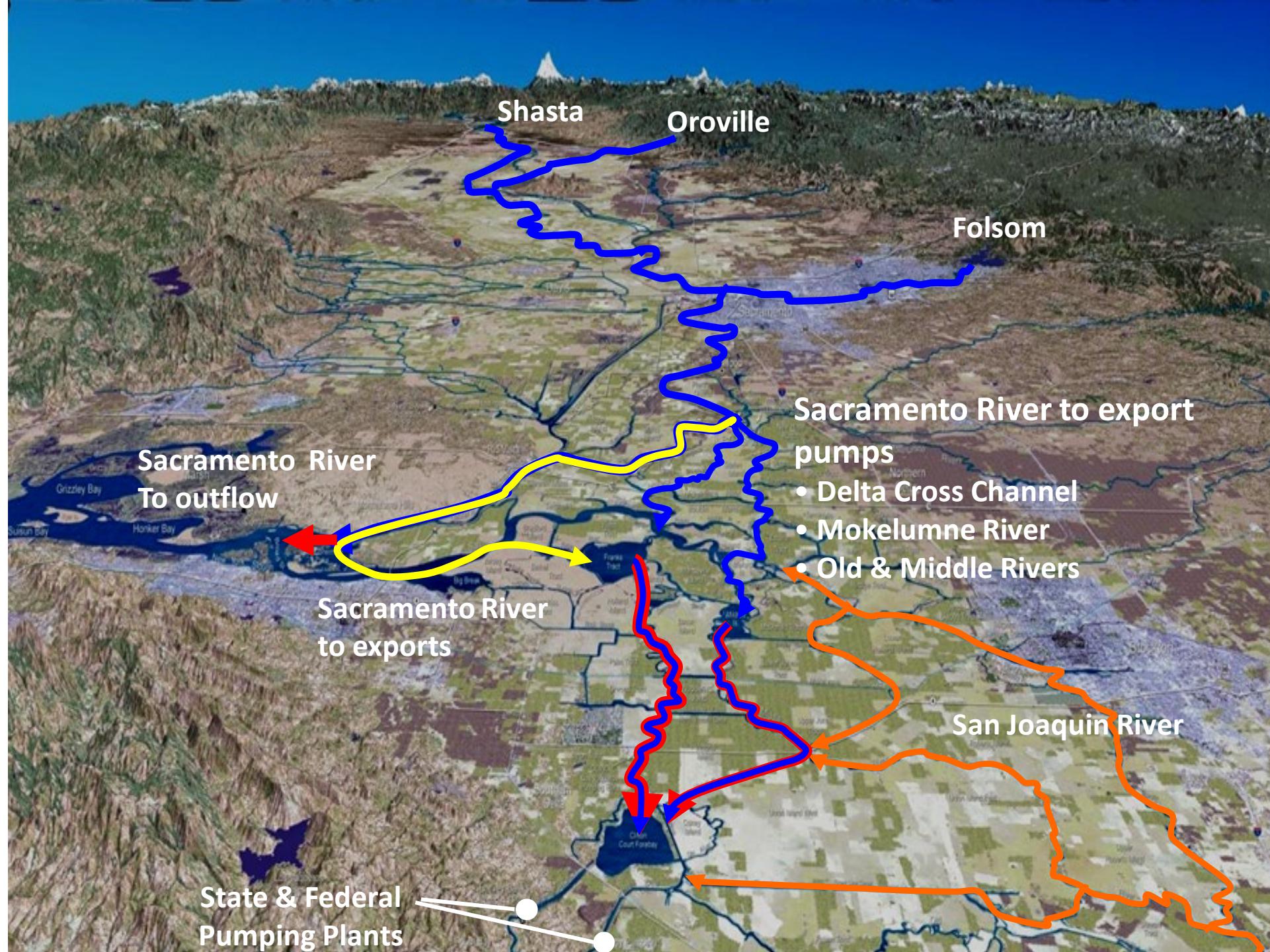
Folsom
Avg inflow = 2.7 maf
Storage = 1.0 maf



CVP Contract Summary



Settlement/Exchange Contracts do not include Schedule II water rights or Tri-Dams
Includes assumptions on split between agricultural and M&I amounts for mixed use contractors
M&I does not include dry year contract for up to 133,000 acre-feet with EBMUD
Graphic Design courtesy of MBK Engineers



Regulations Everything is Relative to the Delta Pumps

- Upstream Control
- Flow requirements
- Pulse flows
- Temperature requirements
- Delta outflow
 - NDO (D1641)
 - X2 position
- Export Control
- Limit negative flows in Old and Middle River
- Cross channel gate closure criteria
- Export/Inflow Ratio
- Vernalis based export limits – April/May, IE



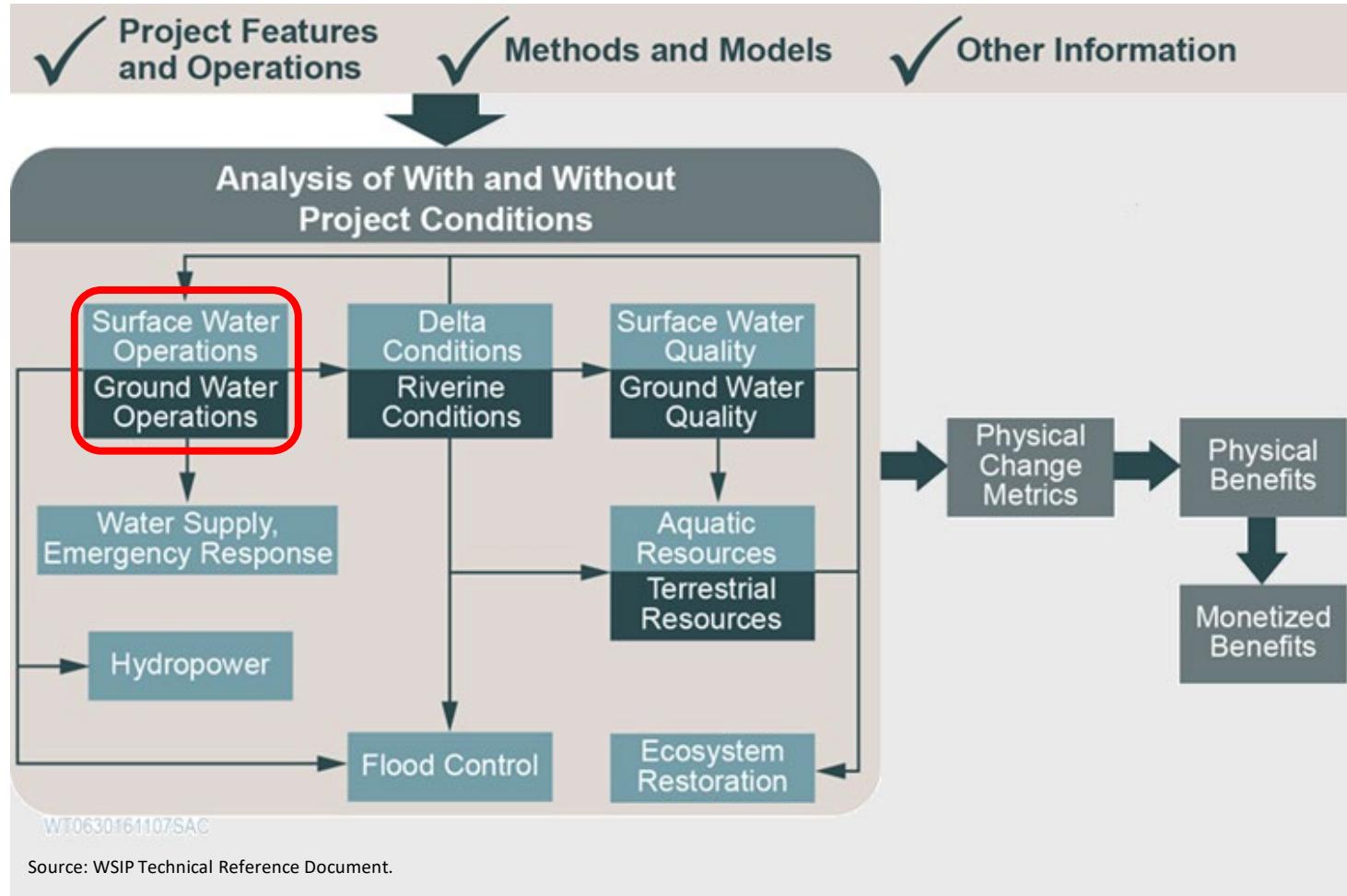
Take-Home Messages

- The Central Valley Project is a cornerstone of California water operations with a National footprint on agriculture and hydropower
- Reclamation is obligated to meet all contractual and regulatory requirements
- CVP facilities are managed collectively to best meet system-wide needs and obligations
- The CVP and SWP cooperate on many levels, including operations and system analysis



Technical Analyses

Analysis Framework



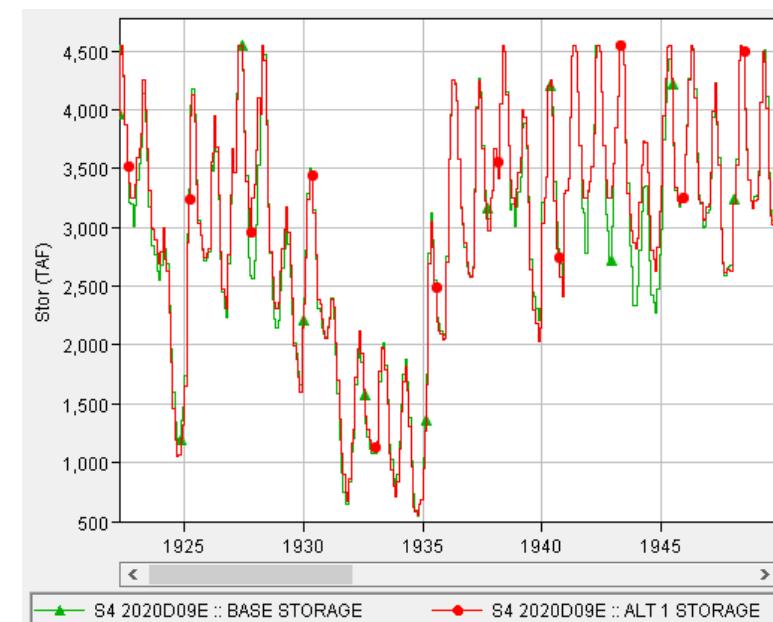
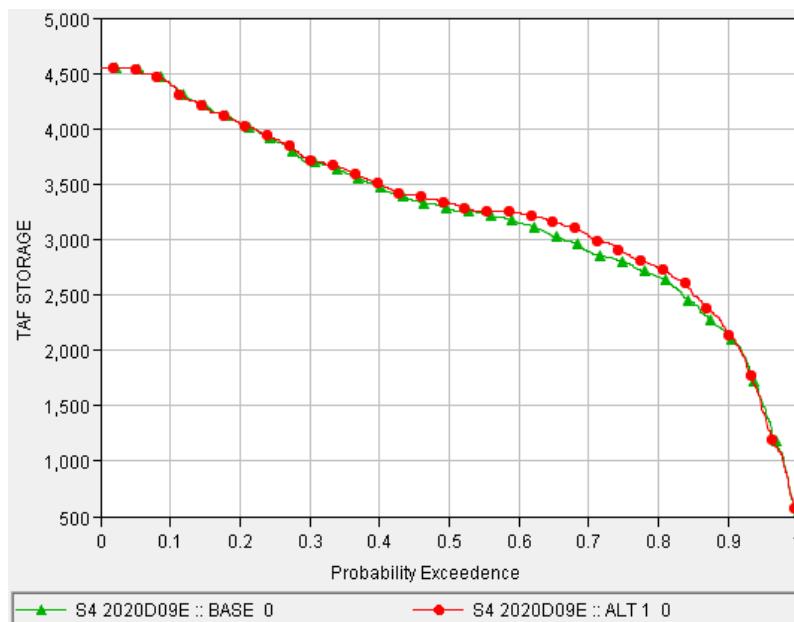
Modeling CVP/SWP Operations

- “All models are wrong; some are useful”. (George Box)
- Problems are hard; models shouldn’t make them any harder.
- The CVP/SWP system is intensely complex.
- DWR/BOR collaboration on WRIMS/CalSim development and maintenance mirrors the close coordination of CVP/SWP operations.



CalSim is an Analysis Cornerstone

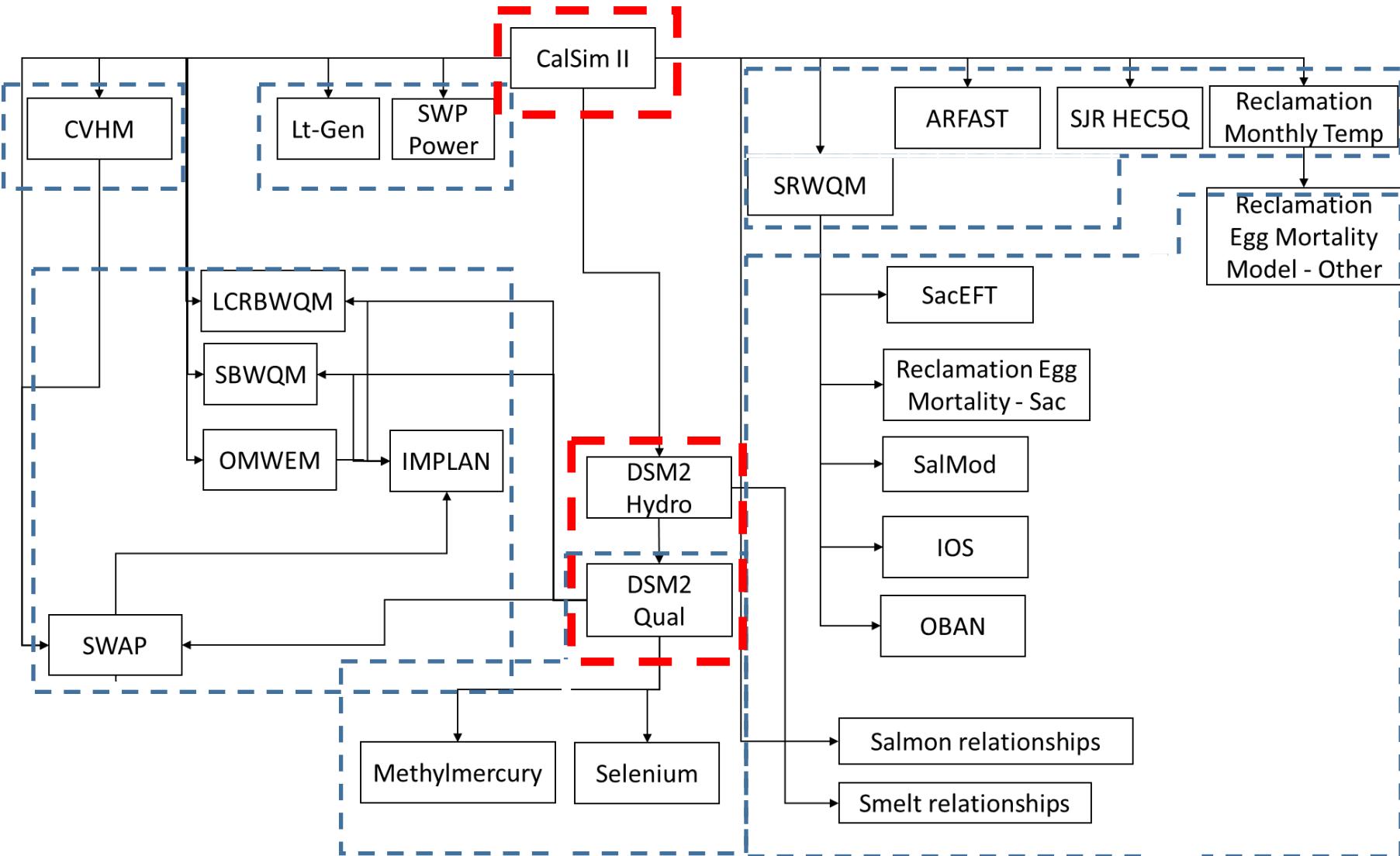
- Enables Comparison of Alternative(s) to Base Study
 - Exceedence Probability – shows range of results
 - Time Series – shows sequence of results
- (plots below show Shasta Storage comparison for two studies)



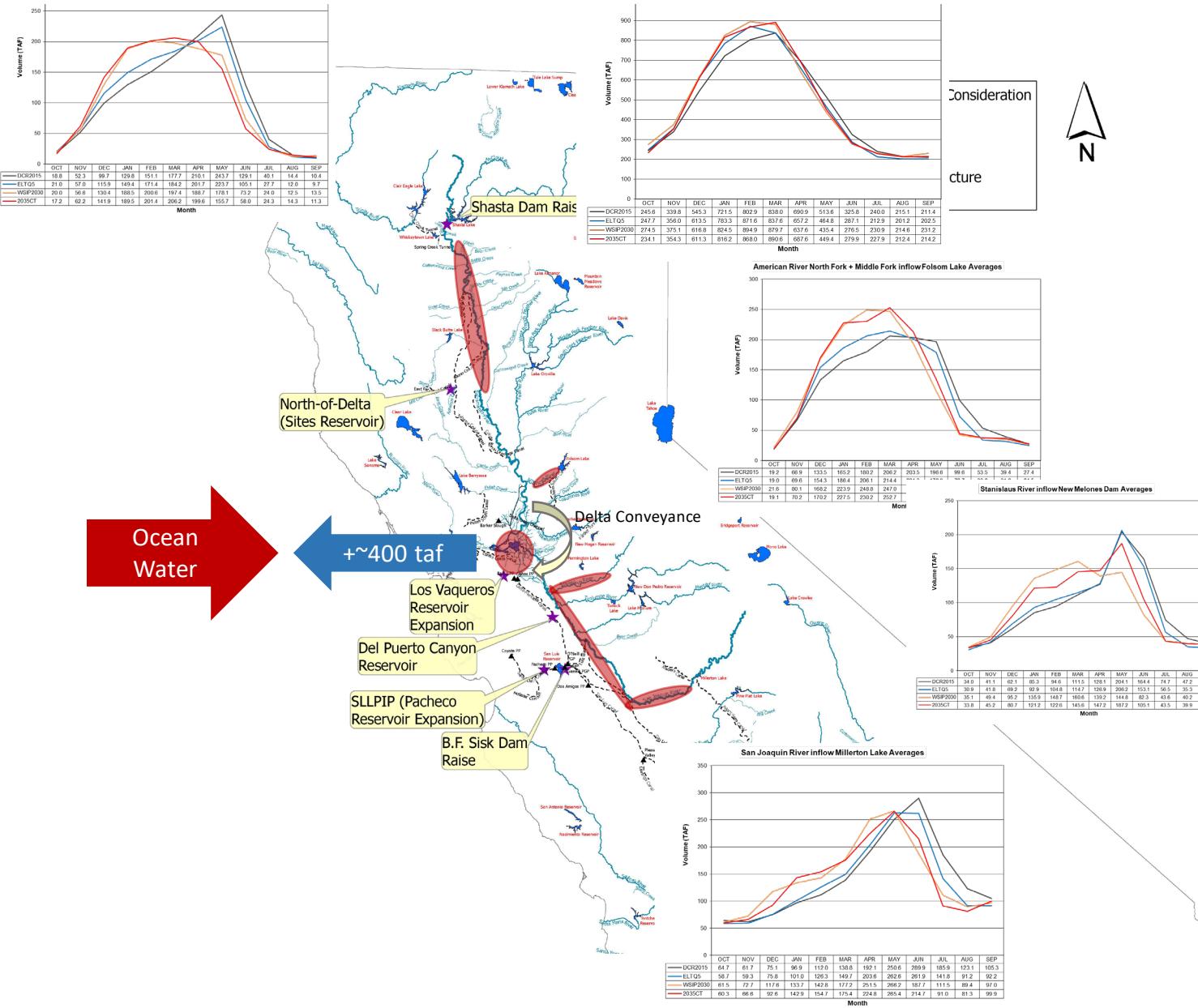
Modeling analysis helps to answer “What if...”

- ... there was a new or modified facility (storage, conveyance)?
 - Range of potential benefits to water supply, habitat, water quality
- ... operations/regulations changed?
 - Tradeoffs between water supply reliability and regulatory criteria
 - Explore bounds of operational flexibility, risk, and uncertainty
- ... climate and/or sea level changed “this way”?
 - Global Circulation Models/Emissions Pathways/Growth Scenarios
 - Explore water supply/demand imbalances under a range of hydrology and regulatory combinations

Integrated Model Package



Looking into the Future



Reclamation Staffing Needs

Modeling Needs Are Growing

Driven by.....

- Climate change; Evolving regulations; Fish; Water Quality
- Increased challenges = increased opportunity to address challenges
- Planning Modeling – long-term analysis of operations under a given climate, land use, and regulatory environment
- Operations Modeling – short-term analysis of operating decisions and projected conditions
- Reclamation is building in-house capabilities to perform technical analysis



Are you:

- Fascinated by California water resources issues and challenges?
- Energized by the associated analytical opportunities?
- Holding a resume focused on water resources sciences or engineering, with exposure to numerical methods and/or computer programming?
- Dedicated to developing knowledge and expertise?
- Interested in joining a growing team of young professionals?



The Job – Produce unassailable technical analysis that helps water resources managers make decisions

- A range of skills and interests are useful in this job



- Keen interest in CA Water Resources + willingness to learn
= Good Modeler Potential



Some Examples of Recent Work

- If Shasta Dam were raised 18 feet
 - Are river temperatures improved?
 - How is CVP water supply reliability enhanced?
- Sites Reservoir proponents want Federal Investment
 - What is the cost/benefit ratio of potential benefits to CVP stakeholders?
- Suisun Marsh Salinity Control Gates can be operated to facilitate seasonal habitat for smelt
 - What are the Delta water quality implications?
 - What are the CVP/SWP water costs of new gate operating criteria?



Federal Government Hiring Process

- It Takes Time; Please Be Patient
- To make interviews fair, we use the same questions for every candidate, with limited ability to follow up.
- We can answer your questions, so please ask them.

