Preliminary Climate Change Impacts Assessment for the Sacramento-San Joaquin Delta

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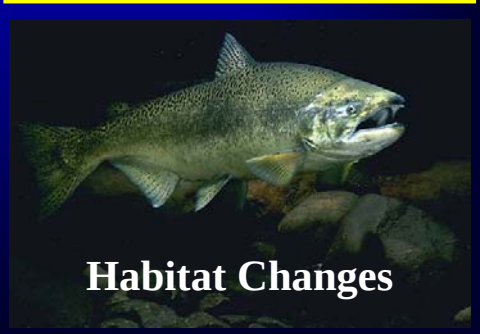
Modeling Support Branch
Bay Delta Office

Potential Climate Change Impacts on the Delta

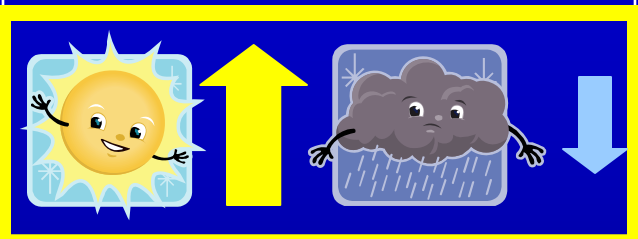
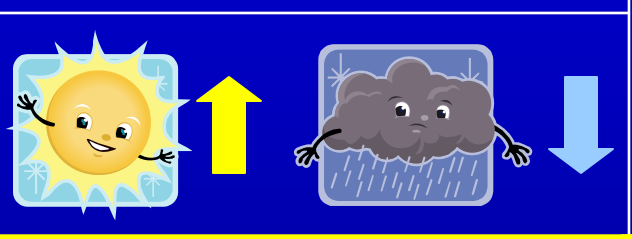
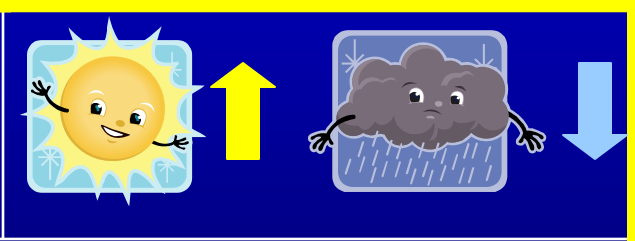


Delta Facts

- Largest Estuary on West Coast
- ~490,000 acres
- 57 leveed islands, many below sea level
- +1,100 miles of levees
- Water supply for 2/3 of Californians
- Irrigation water for millions of acres of farmland
- Habitat for hundreds of species

Focus on **Delta water levels and salinity** considering changes in reservoir operations and exports to mitigate for climate change

Precipitation and Air Temperature Projections

Scenario/ Model	A2	B1
GFDL		
PCM		

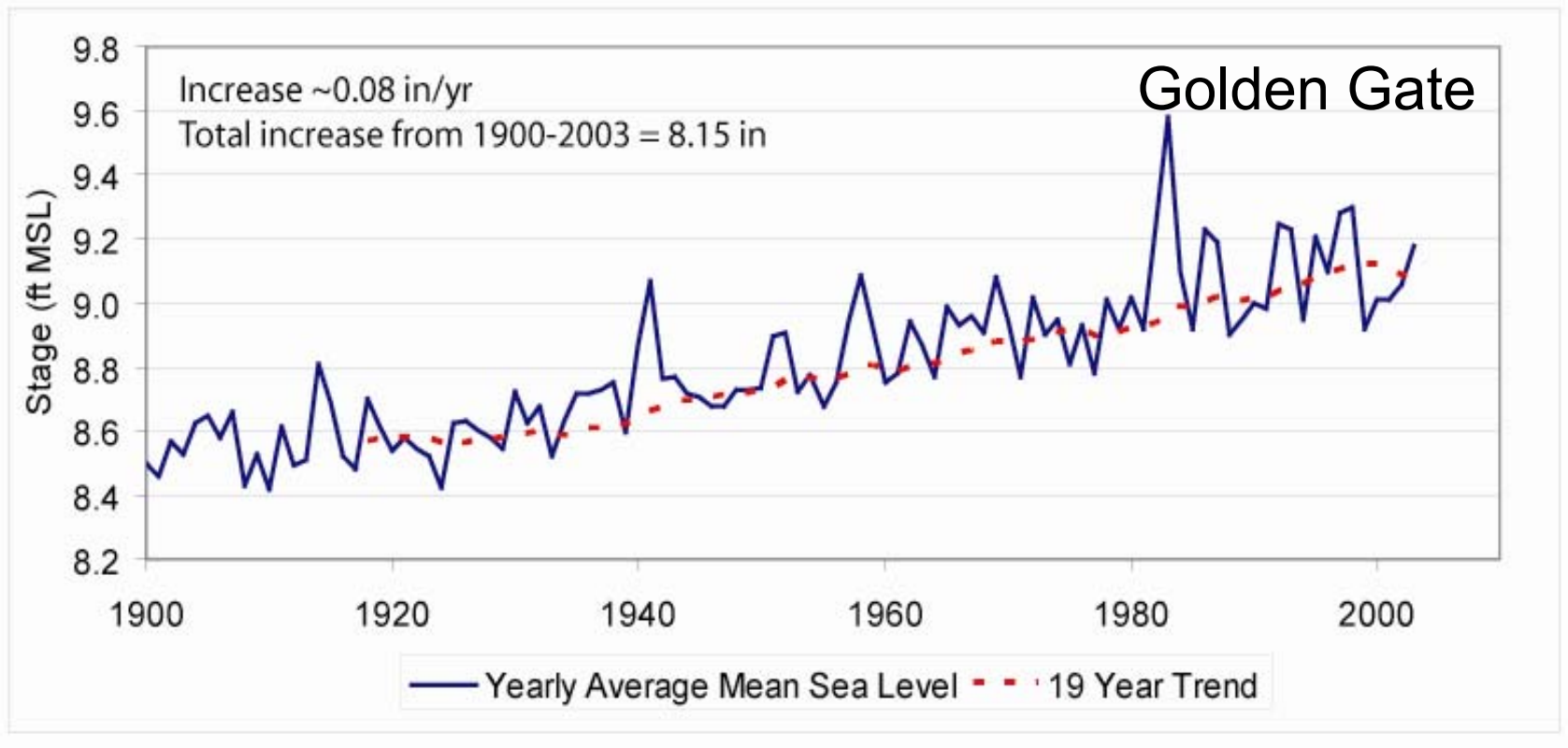
Four scenarios:

2 GCM models x 2 GHG emissions scenarios

Projections centered around 2050

Sea Level Rise (SLR)

- Projected global increase by end of 21st century 0.3ft to 2.9 ft
- Initial studies assume either no SLR or 1ft SLR
- No operations changes for SLR to reduce salt intrusion



Preliminary Delta Simulations

- Use Delta Simulation Model 2 (DSM2)
  - 16-year analysis period wy1976-1991
  - Flow, water levels and salinity
- Base case and four 2050 climate change scenarios
  - Present sea level
  - 1ft sea level rise

Analysis Process

Global Modeling	Regional Downscaling	SWP & CVP Operations	Delta Flow & Water Quality
			
GFDL or PCM	VIC	CalSim-II	DSM2
Air Temperature Precipitation Humidity Radiation	Streamflow Snowpack Snow melt Soil Moisture	Reservoir Ops Deliveries Storage Delta Outflow	Flow Water Level Salinity

No operations changes for sea level rise

Changes in Salinity

- Changes in flows and exports
- Salt water intrusion from sea level rise

Water Quality Analysis

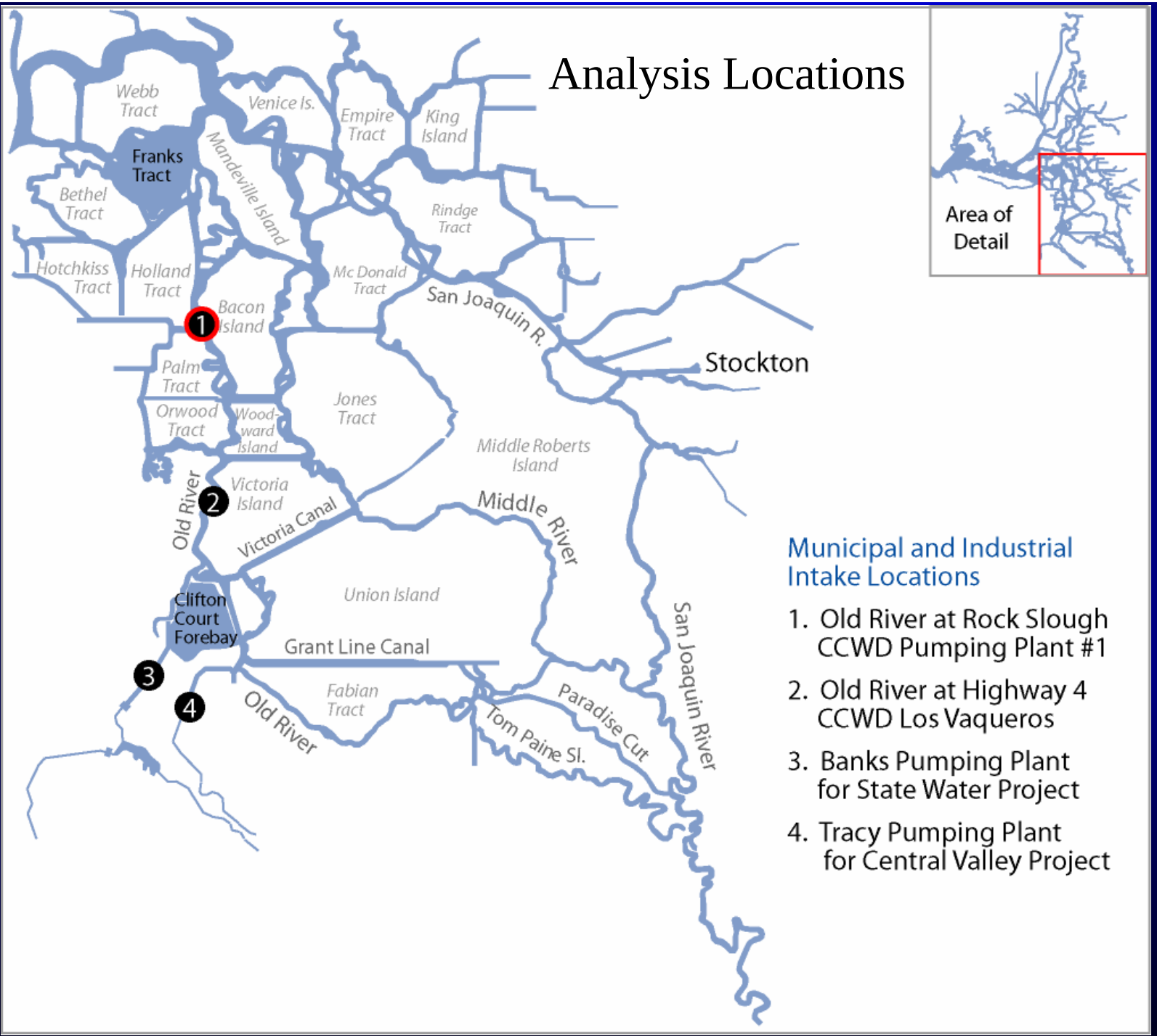
- Selected D1641 Water Quality Standard

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Municipal and Industrial Compliance Locations	Daily average Cl < 250 mg/l											

- Chloride Mass Loadings at M&I Intakes

  Mass loading = Concentrations *Export rate

Analysis Locations

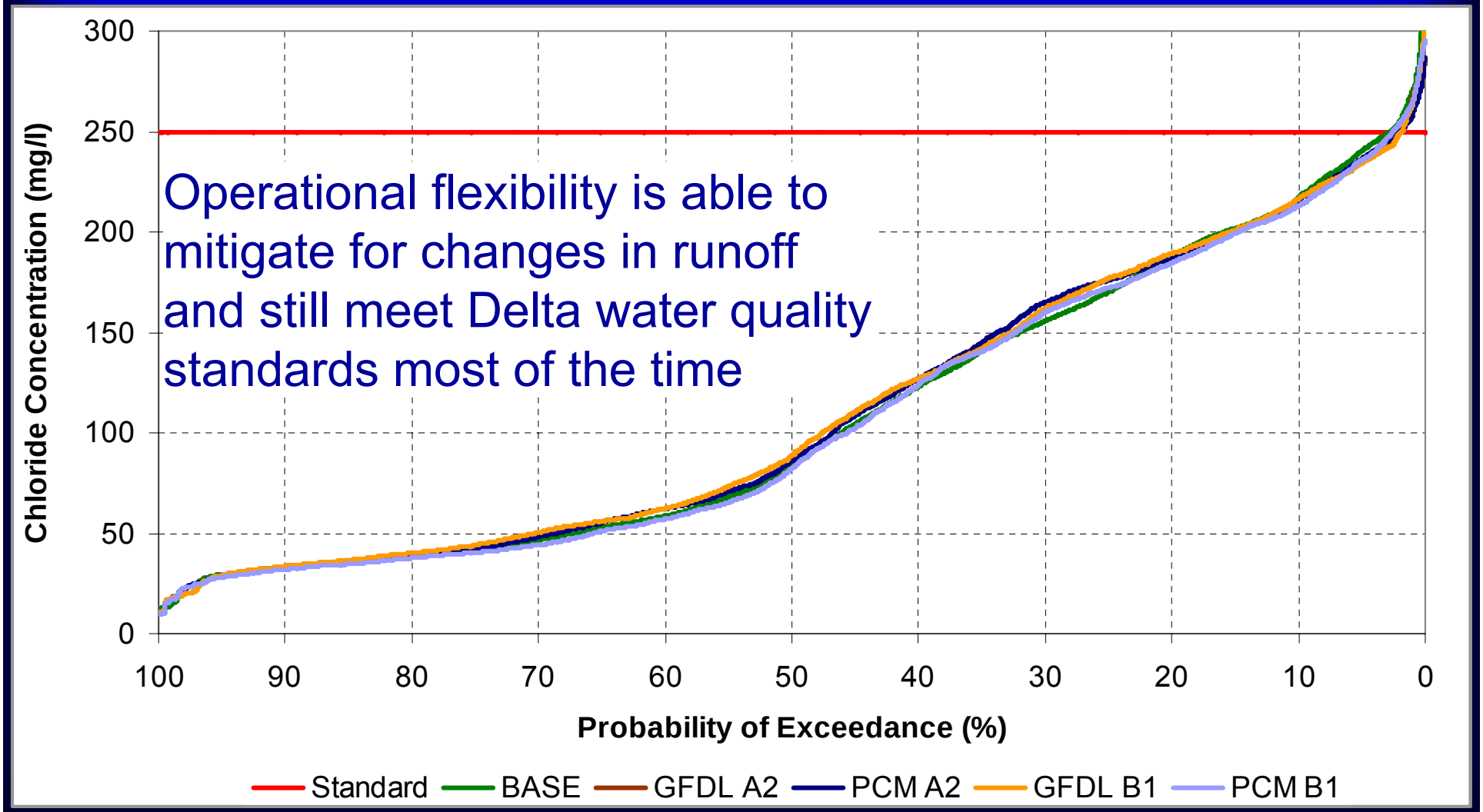


Municipal and Industrial Intake Locations

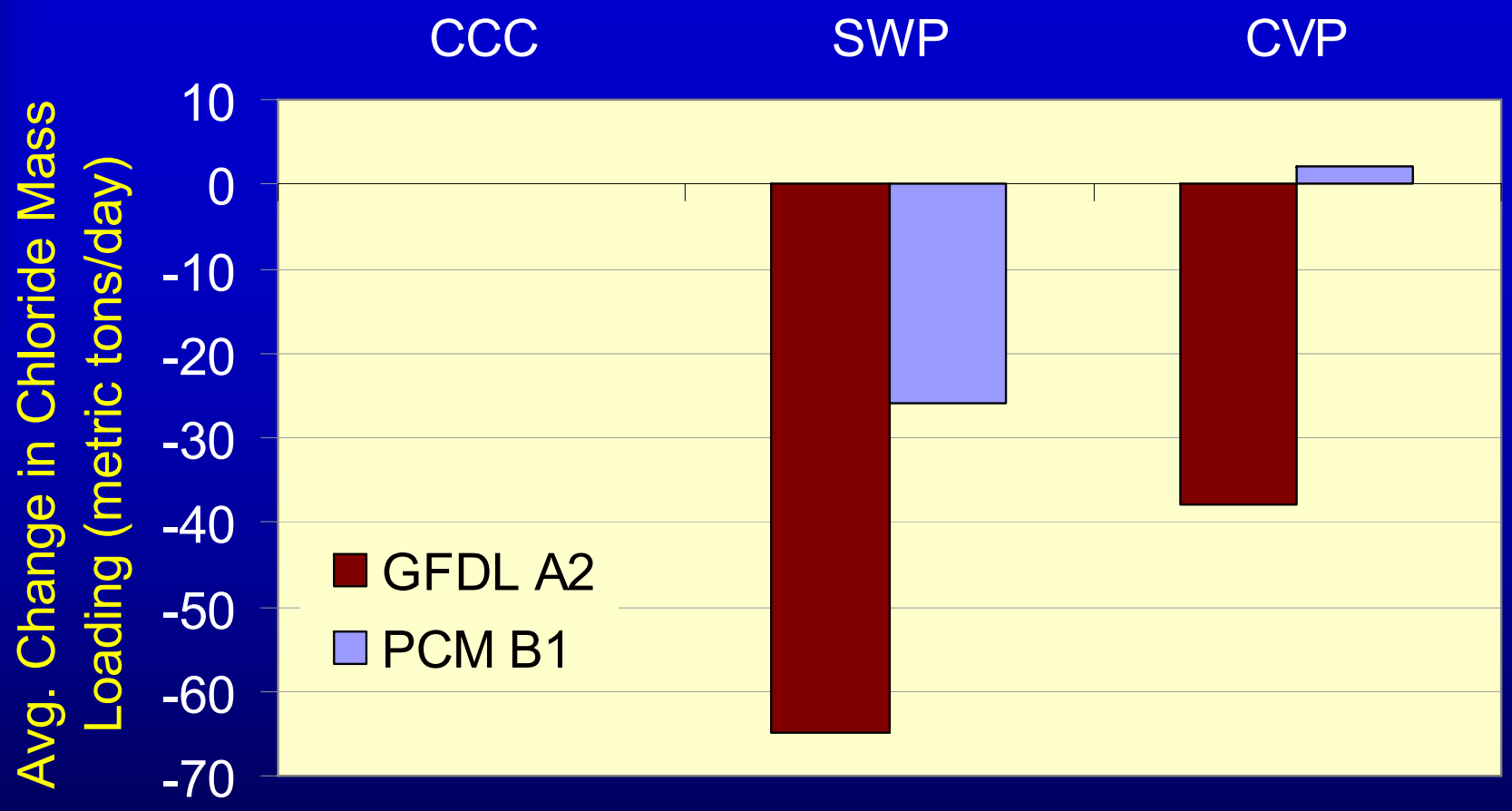
1. Old River at Rock Slough CCWD Pumping Plant #1
2. Old River at Highway 4 CCWD Los Vaqueros
3. Banks Pumping Plant for State Water Project
4. Tracy Pumping Plant for Central Valley Project

Preliminary Results
2050 Climate Change Only
Present Sea Level

Old River at Rock Slough
Chloride Exceedance Curves



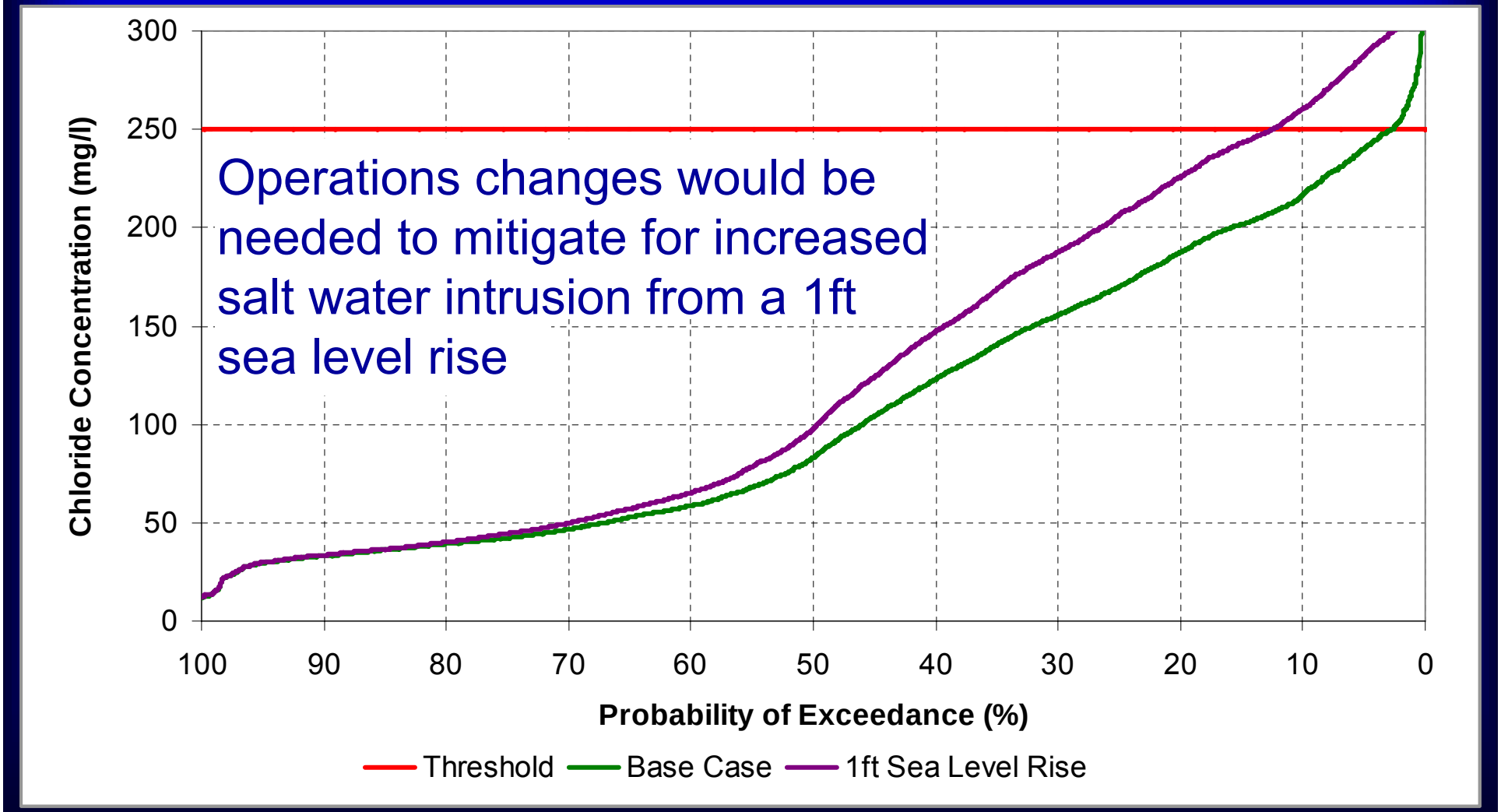
Chloride Mass Loadings



Reduced exports lead to reduced chloride mass loadings

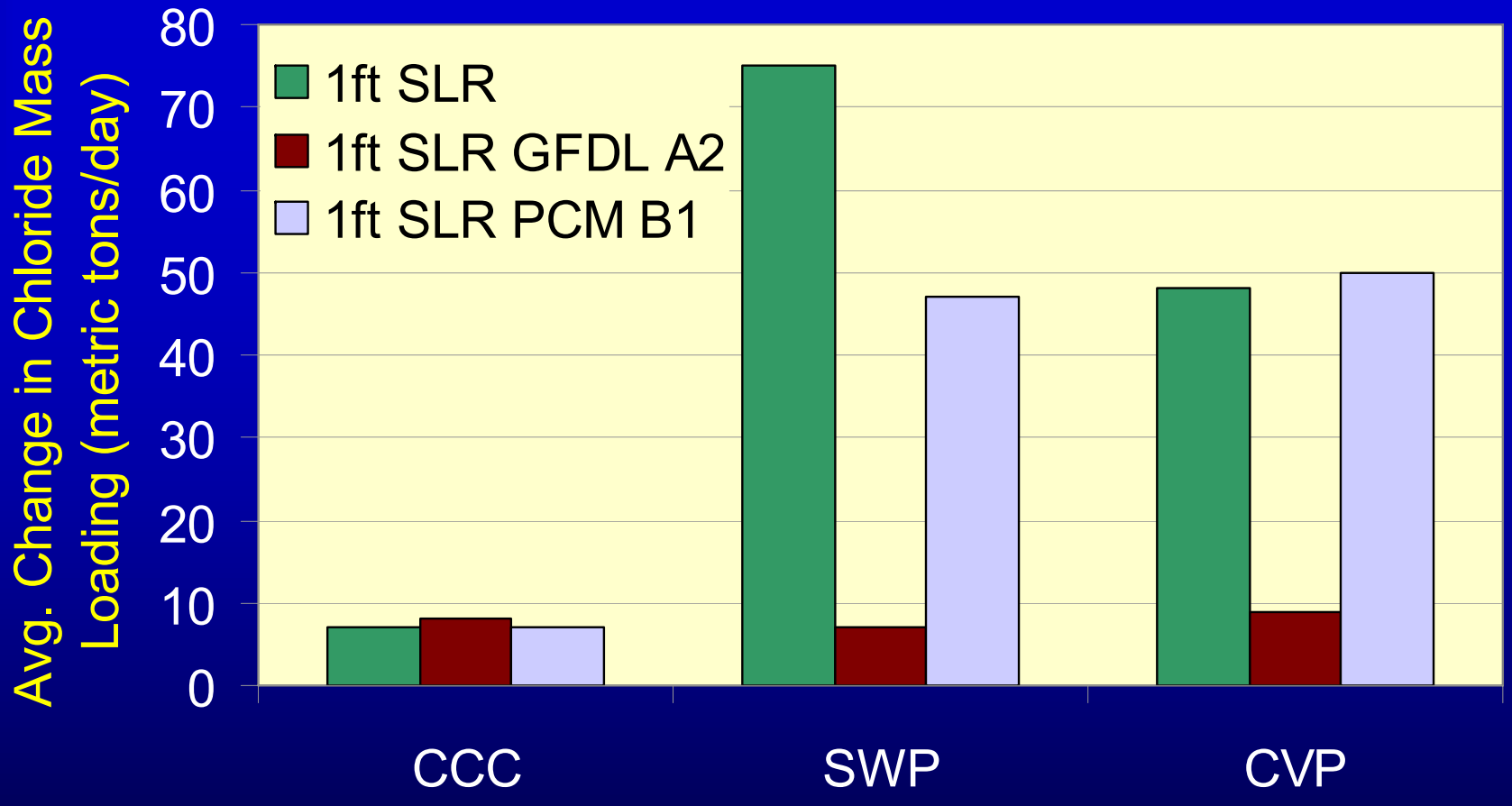
Preliminary Results
1ft Sea Level Rise Only
with no changes in operations

Old River at Rock Sl
Chloride Exceedance for 1ft SLR



Operations were not changed for SLR

1ft SLR Chloride Mass Loadings

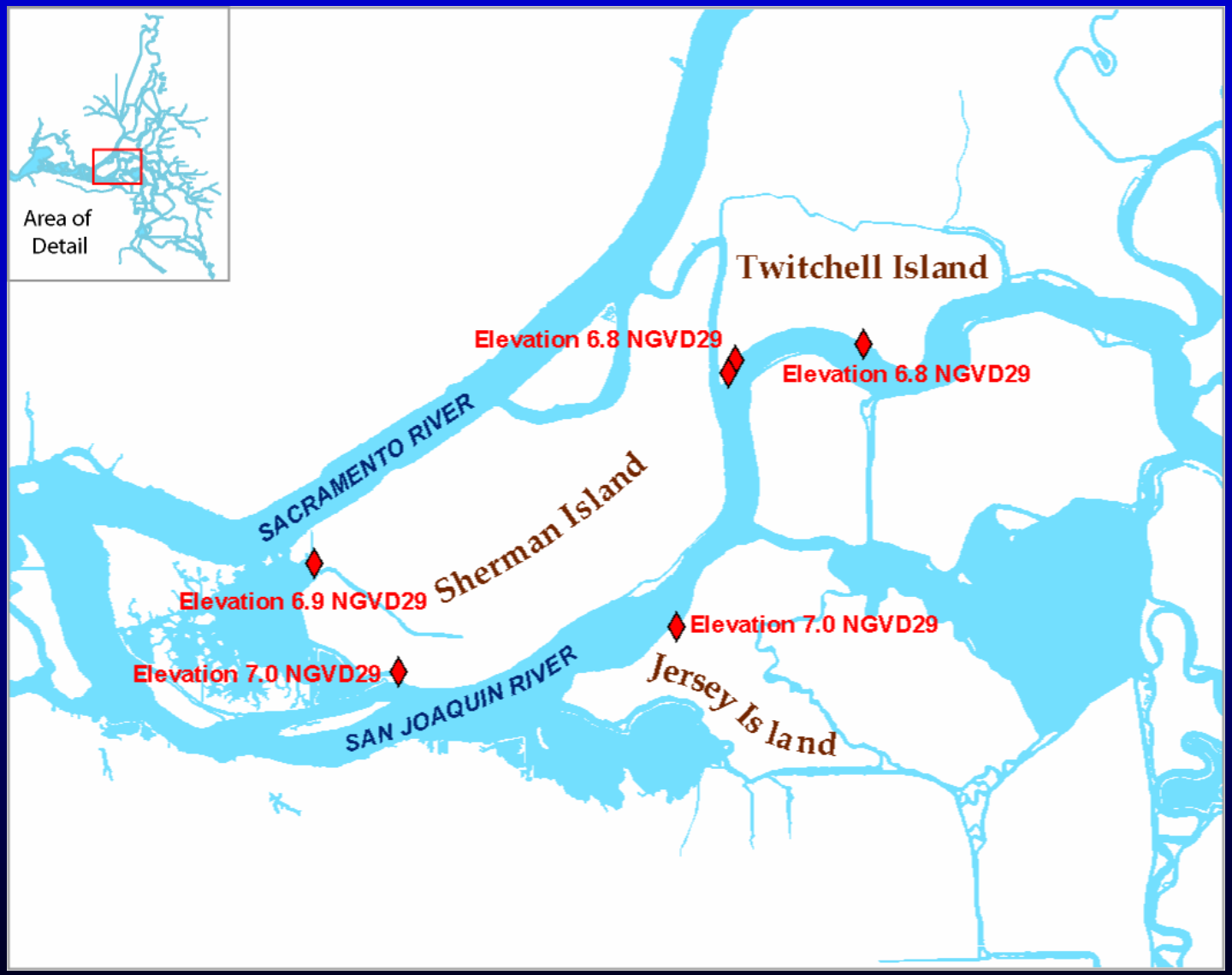


Increased salinity intrusion increases chloride mass loadings even when exports are decreased

Sea Level Rise Impacts on Levee Overtopping Potential

Photo by Rob Duvall Jan 1, 2006

Minimum Levee Crest Elevations



Levee Overtopping Potential

Overtopping potential: simulated channel water level ≥ crest elevation

Location	# of Potential Overtopping Events in 16 yrs			
	Base	4 Climate Change Scenarios	1 ft SLR	4 Climate Change Scenarios +1ft SLR
Sherman Is	0	0	2	2
Twitchell Is	0	0	2	2
Jersey Is	0	0	2	2

Climate change scenarios reflect historical variability

Take Home Message

Preliminary studies show:

- Existing system flexibility maintained water quality standard compliance
- Sea level rise increases water quality above threshold values; changes in operations are needed
- Chloride mass loadings decrease if exports are reduced and increase for a 1ft sea level rise
- A 1ft sea level rise leads to two potential levee overtopping events in 16-years

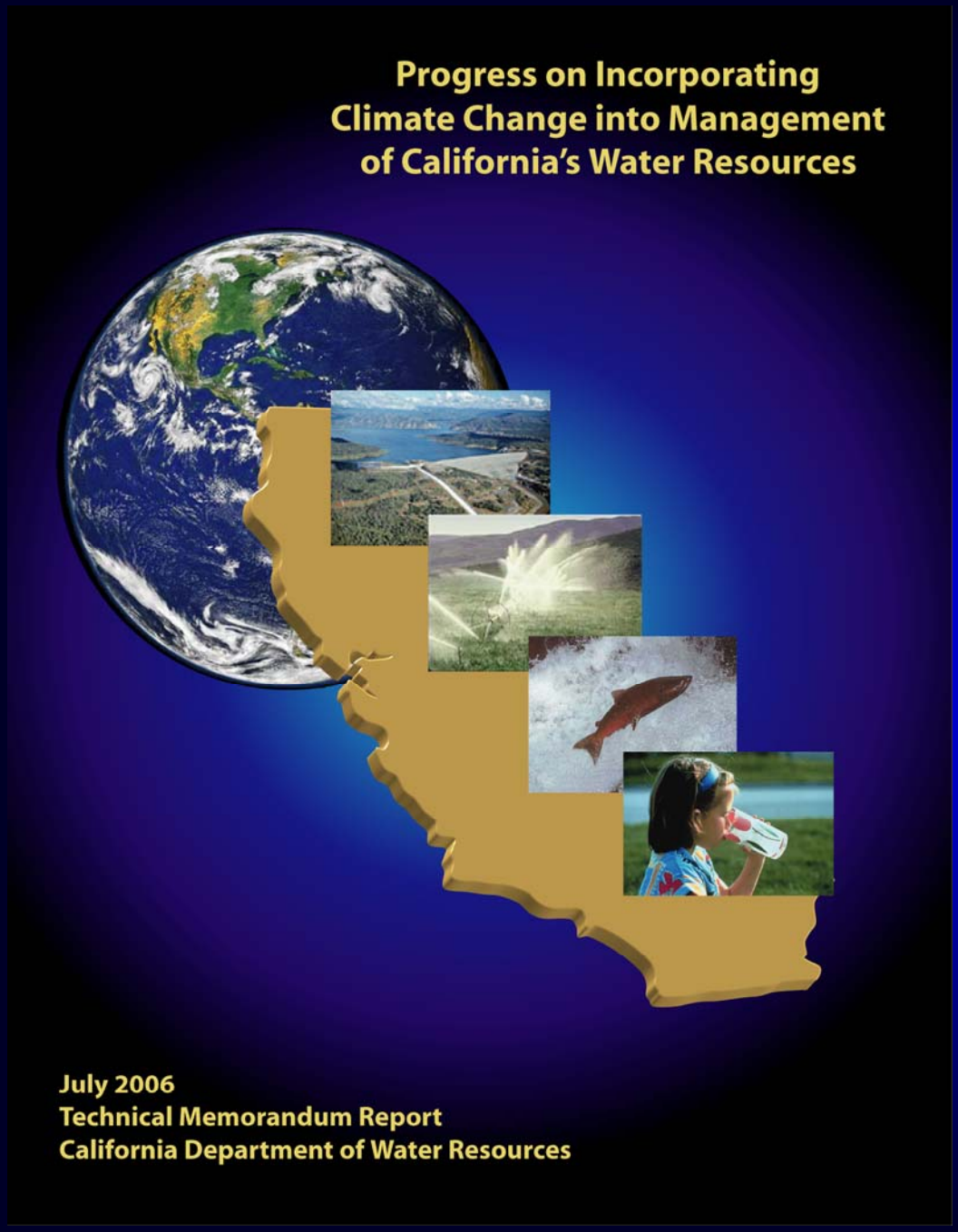
Future Directions

Investigate mitigation measures

- Operations changes for sea level rise
- Changes in operating rules

Extend analysis to risk assessment

What are the relative likelihoods of the climate change and/or sea level rise impacts?



CH1 Introduction

CH2 Background

CH3 DWR Studies

CH4 SWP-CVP Impacts

CH5 Delta Impacts

CH6 Flood Management

CH7 Evapotranspiration

CH8 Future Directions

Peer reviewed chapters

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