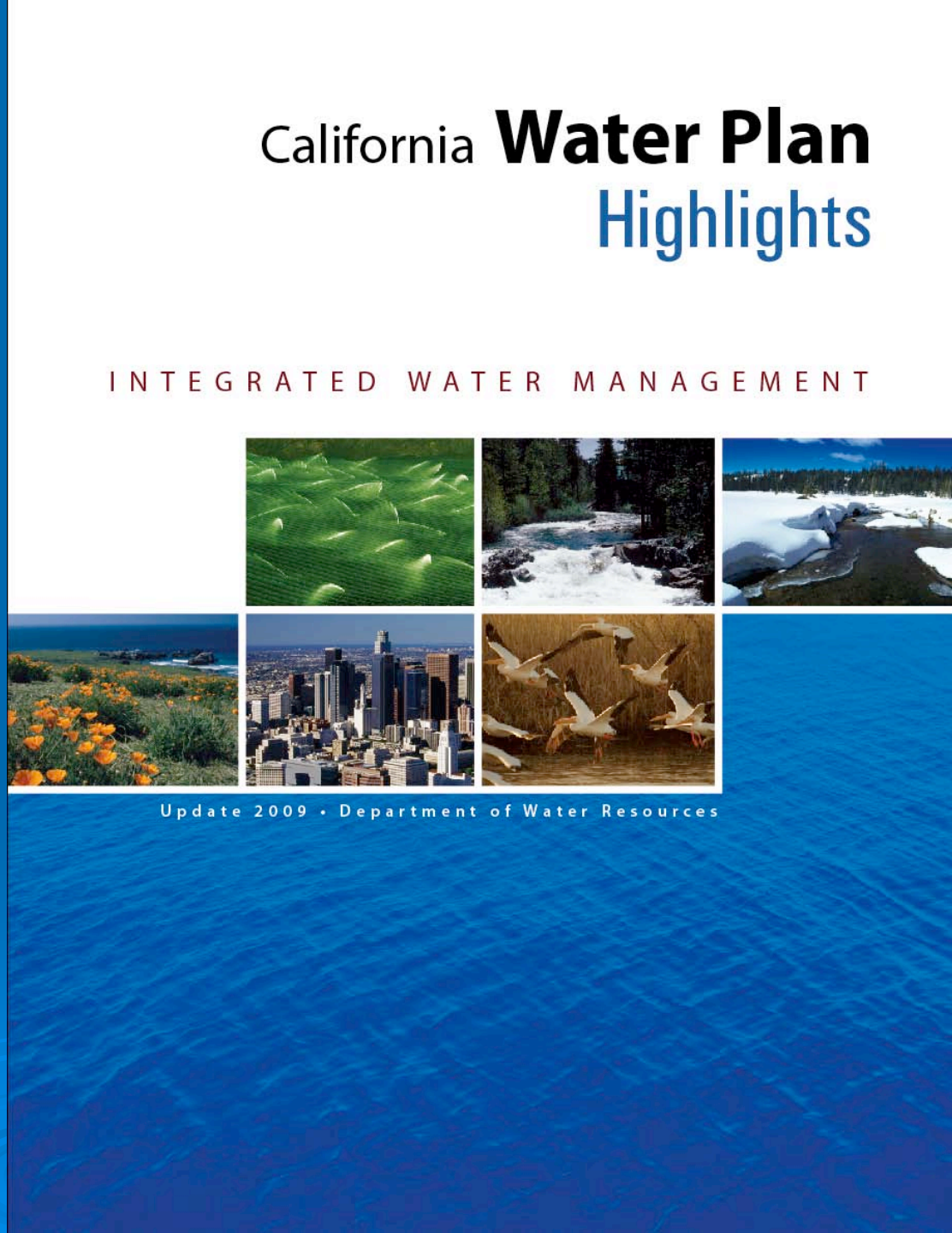
Climate Change & Water Management in California

CDFA/SBFA Climate Change Workshop
November 16, 2011

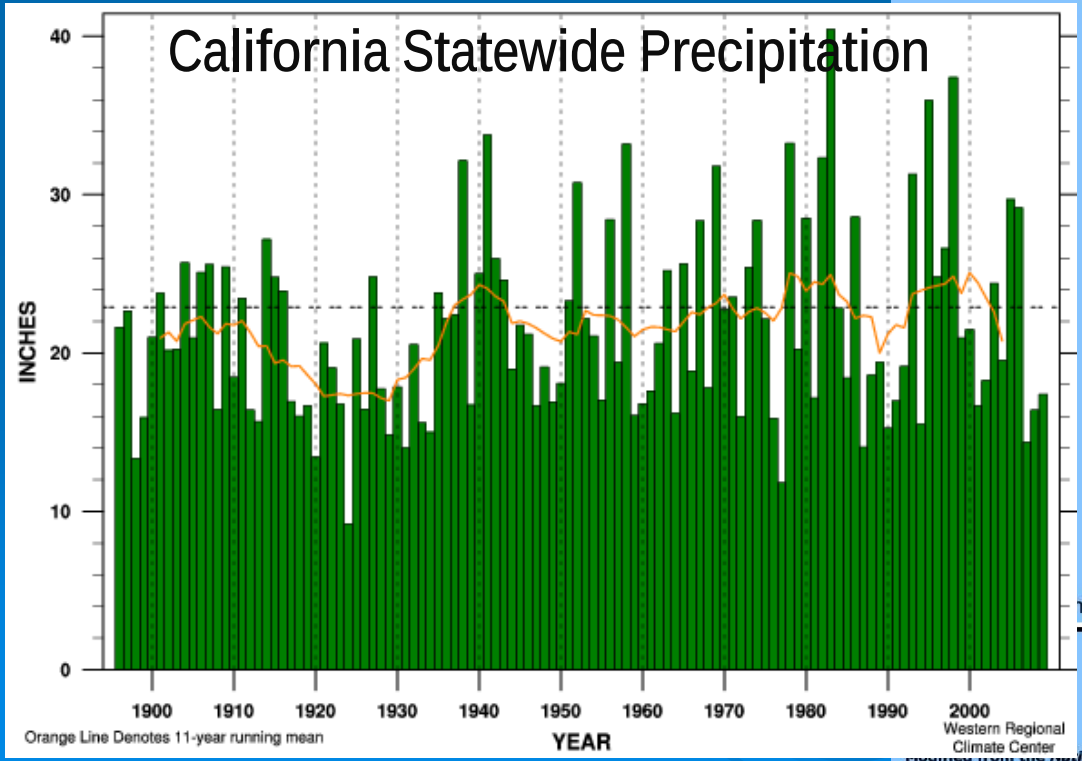


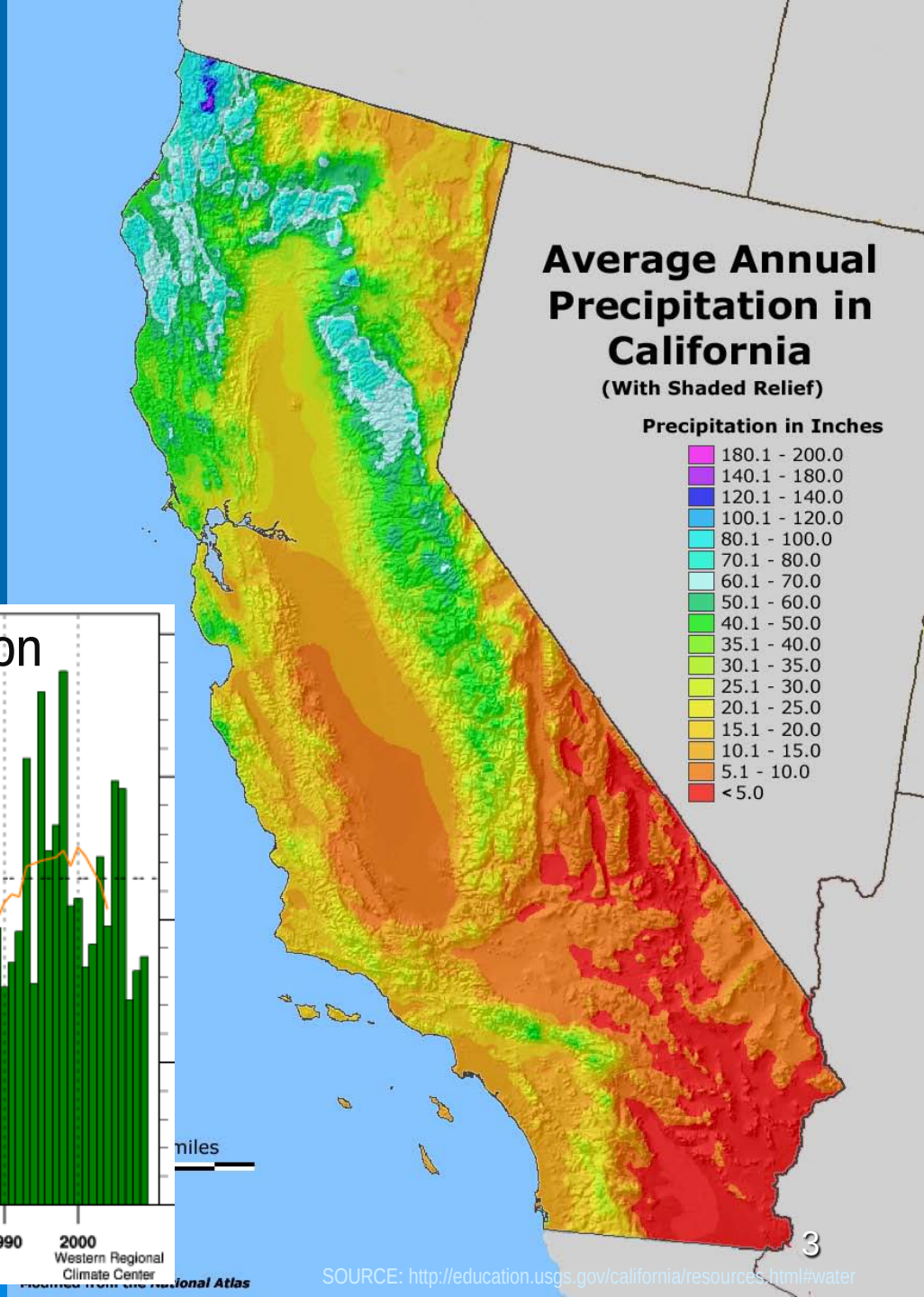
California's Water Resources & Systems

California Precipitation

Variable & Extreme Over Time & Location

Most precipitation occurs November - March



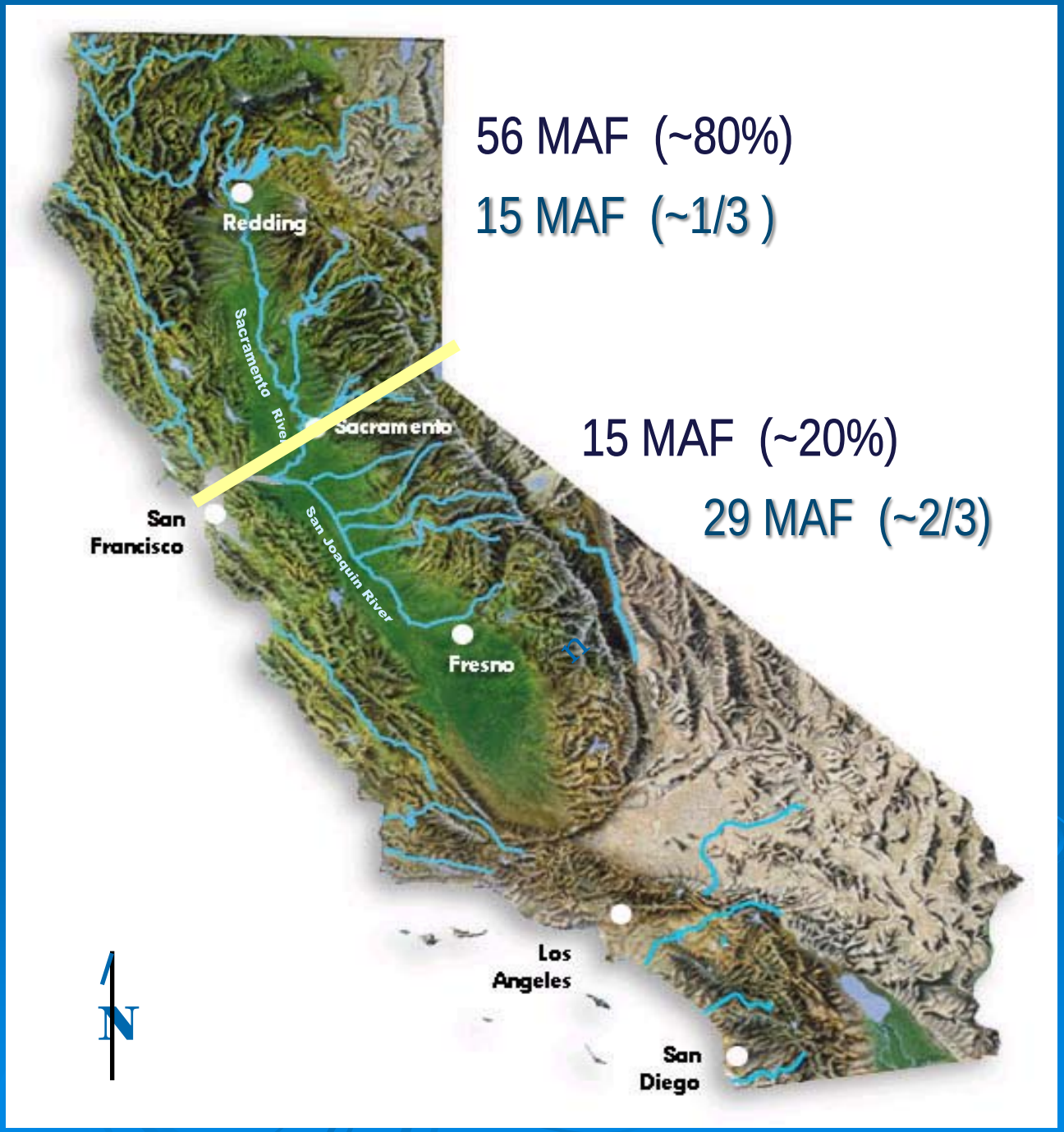


SOURCE: http://education.usgs.gov/california/resources.html#water

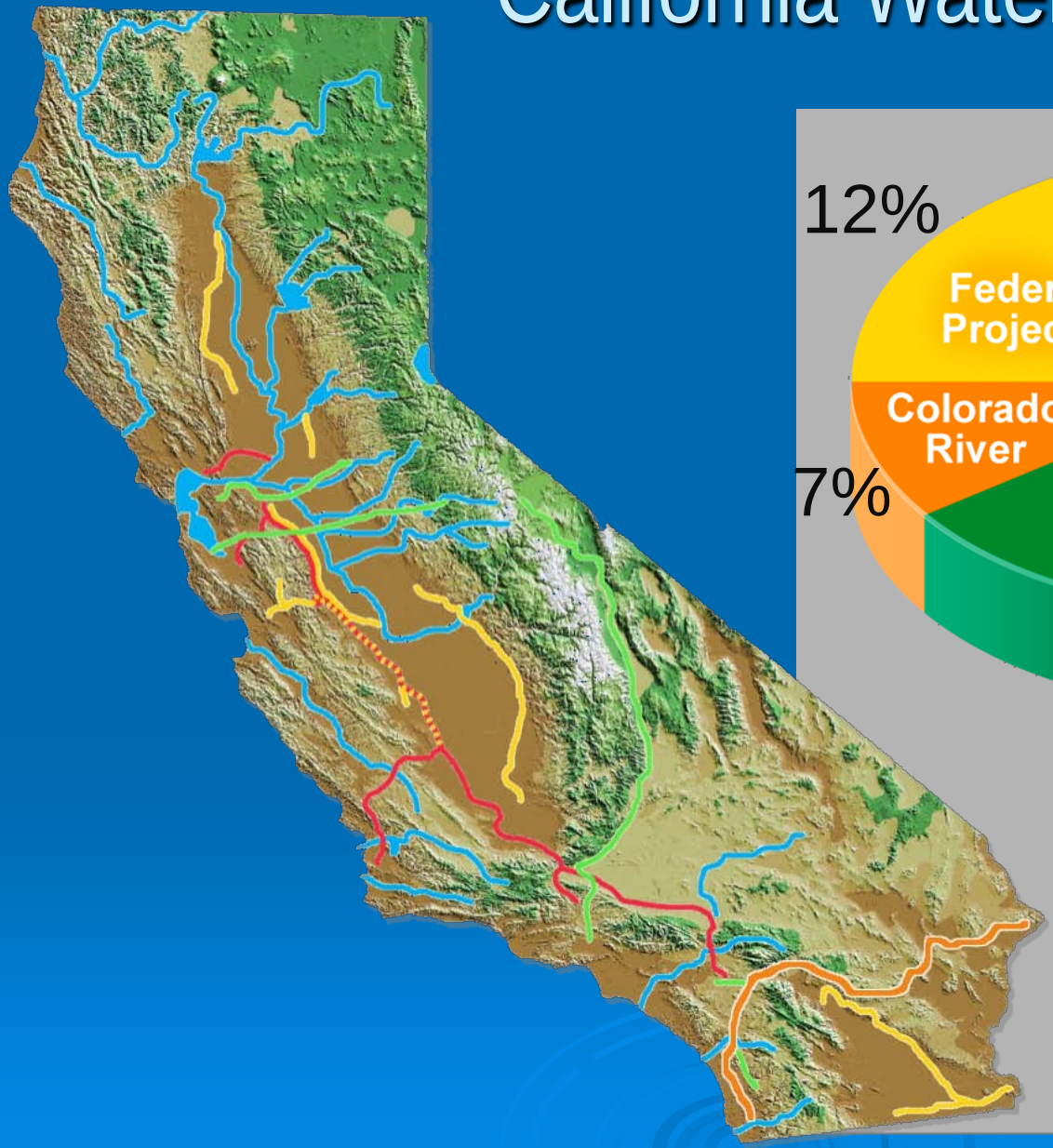
California's Major River Systems

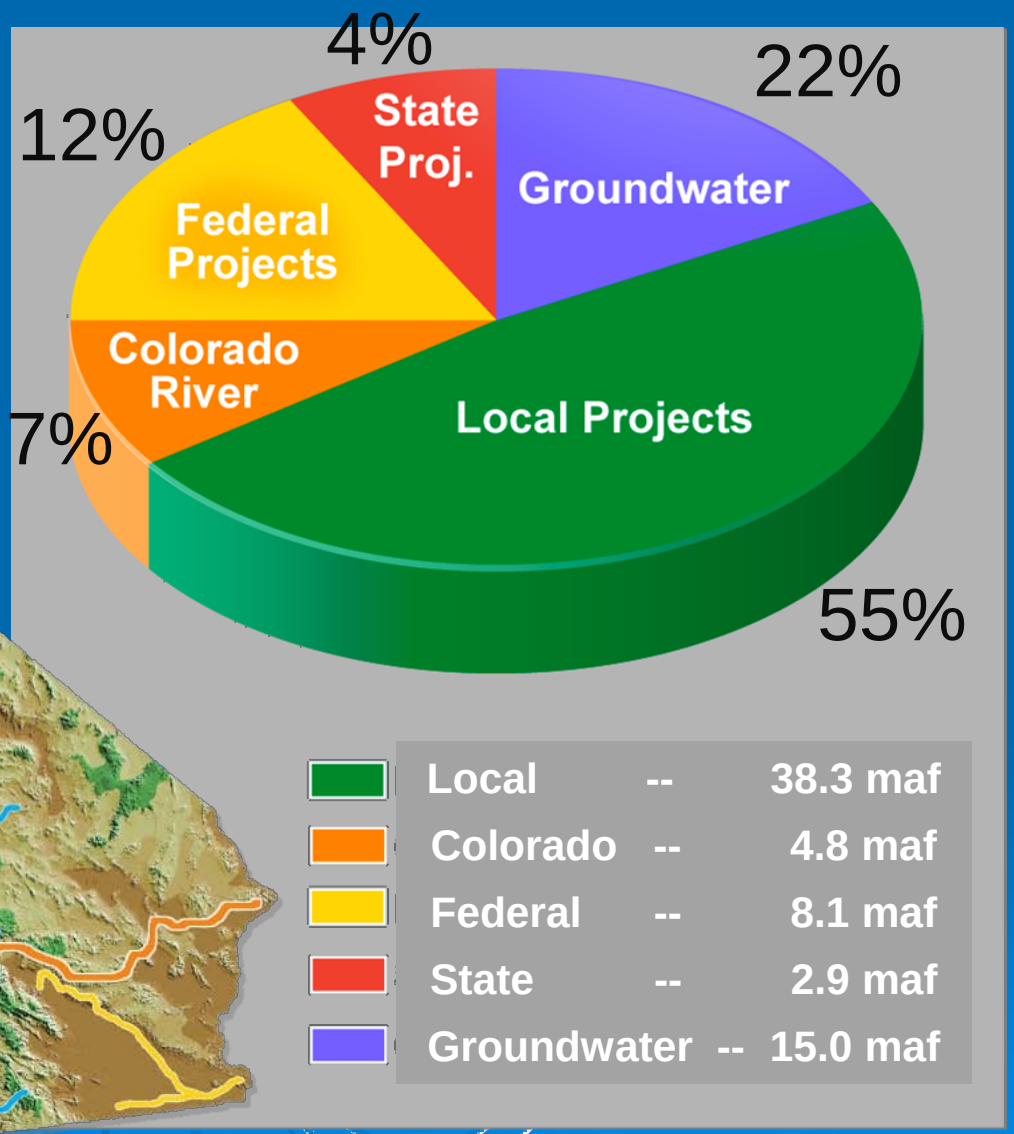
Distribution of Average Runoff

Distribution of Water Use



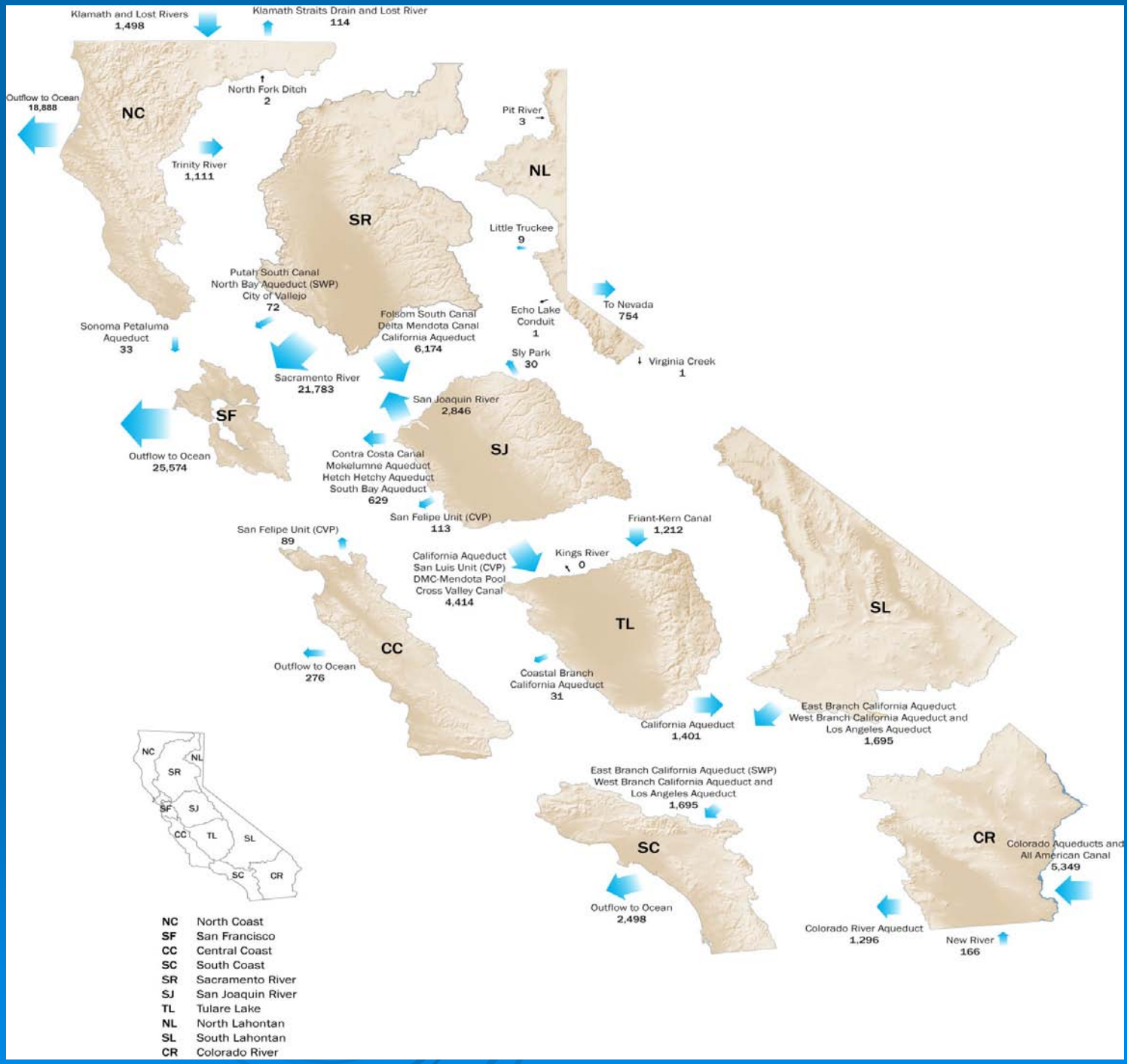
California Water Supply Systems



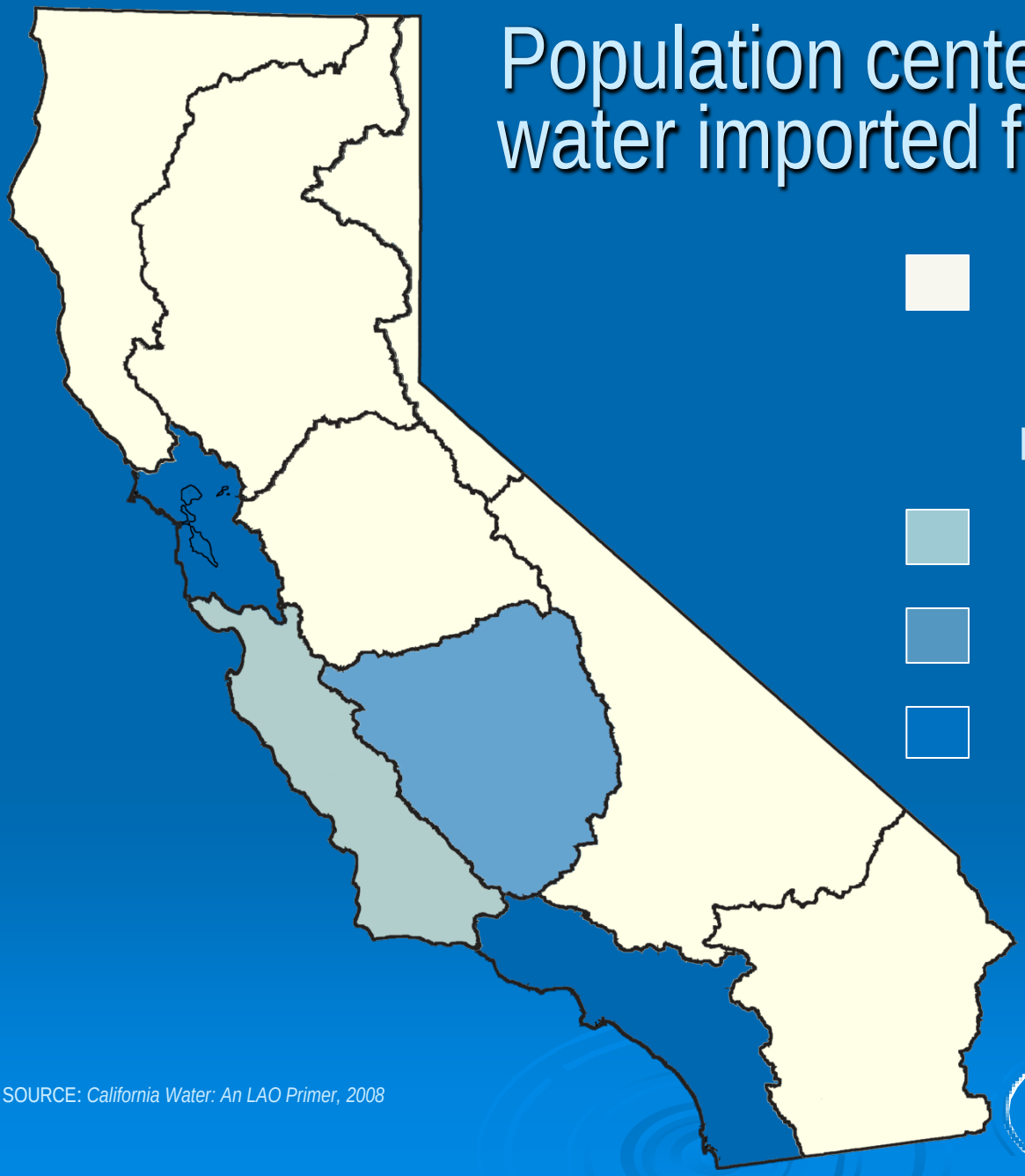


1998-2005 average.. Does not include reuse or recycling. Quantities vary by year.

2005 Regional Inflows & Outflows



Population centers rely heavily on water imported from other regions



Net Exporters*

Net Importers

Percent urban & agricultural water use from Imports

Less than 30%

30 to 60%

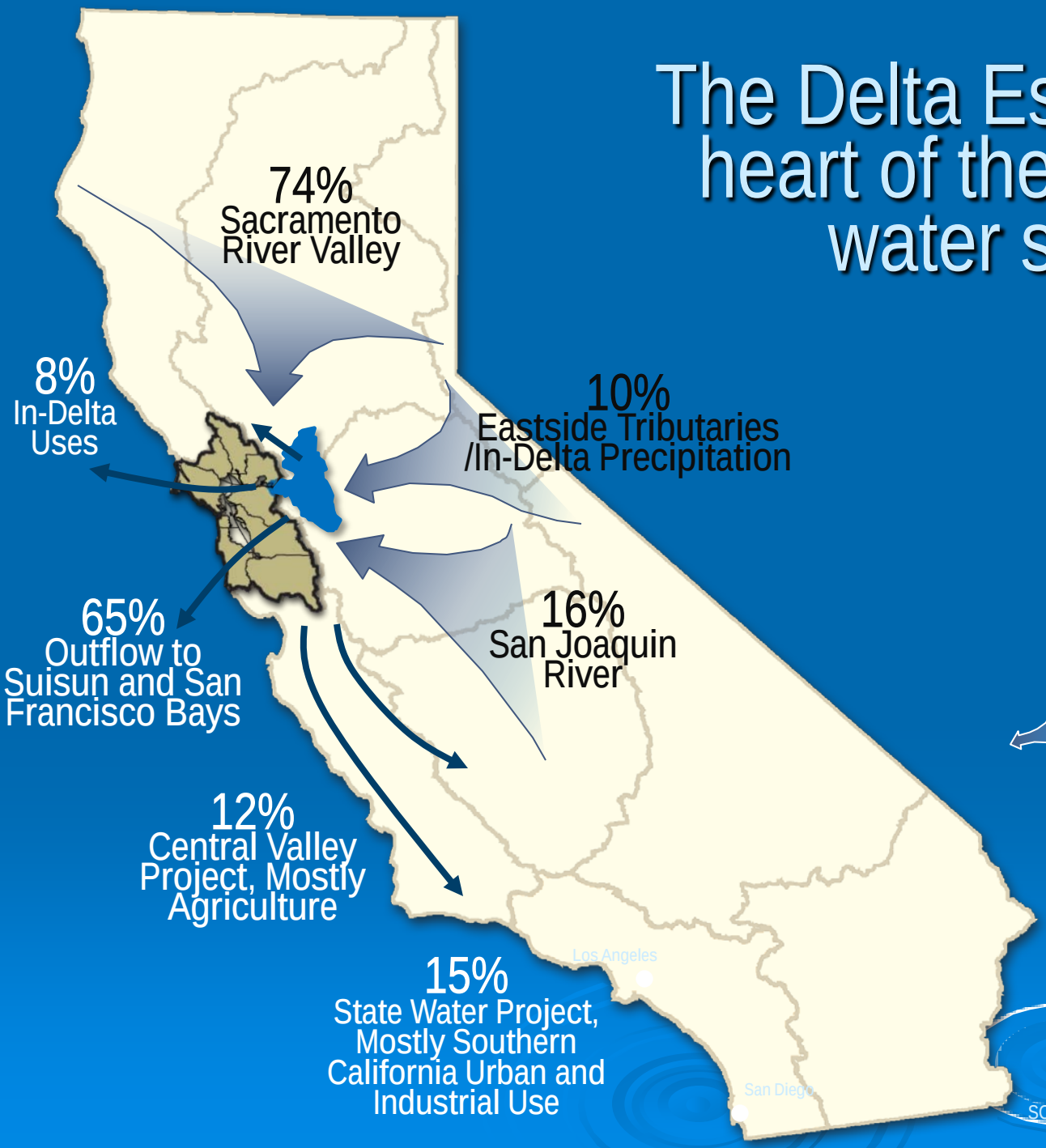
More than 60%

* While the Colorado River is a net exporter of water within California, its main source of water is imported from the Upper Colorado Basin

SOURCE: *California Water: An LAO Primer, 2008*

California Central Valley, Delta & San Francisco Bay

The Delta Estuary at the heart of the California water system



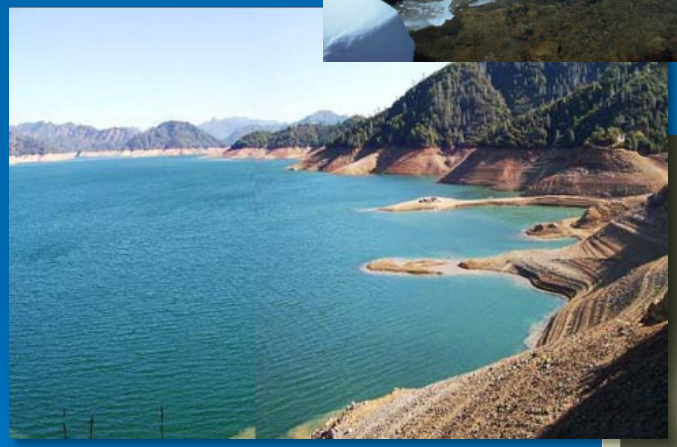
= Sources of Water Into the Delta

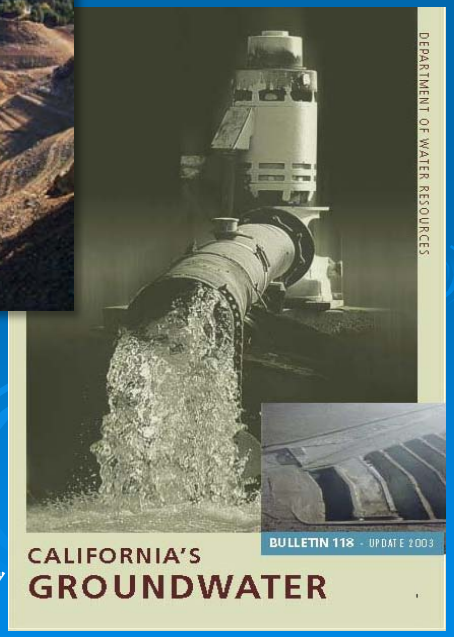
= Water Deliveries and Flow Out of the Delta

SOURCE: *California Water: An LAO Primer, 2008*

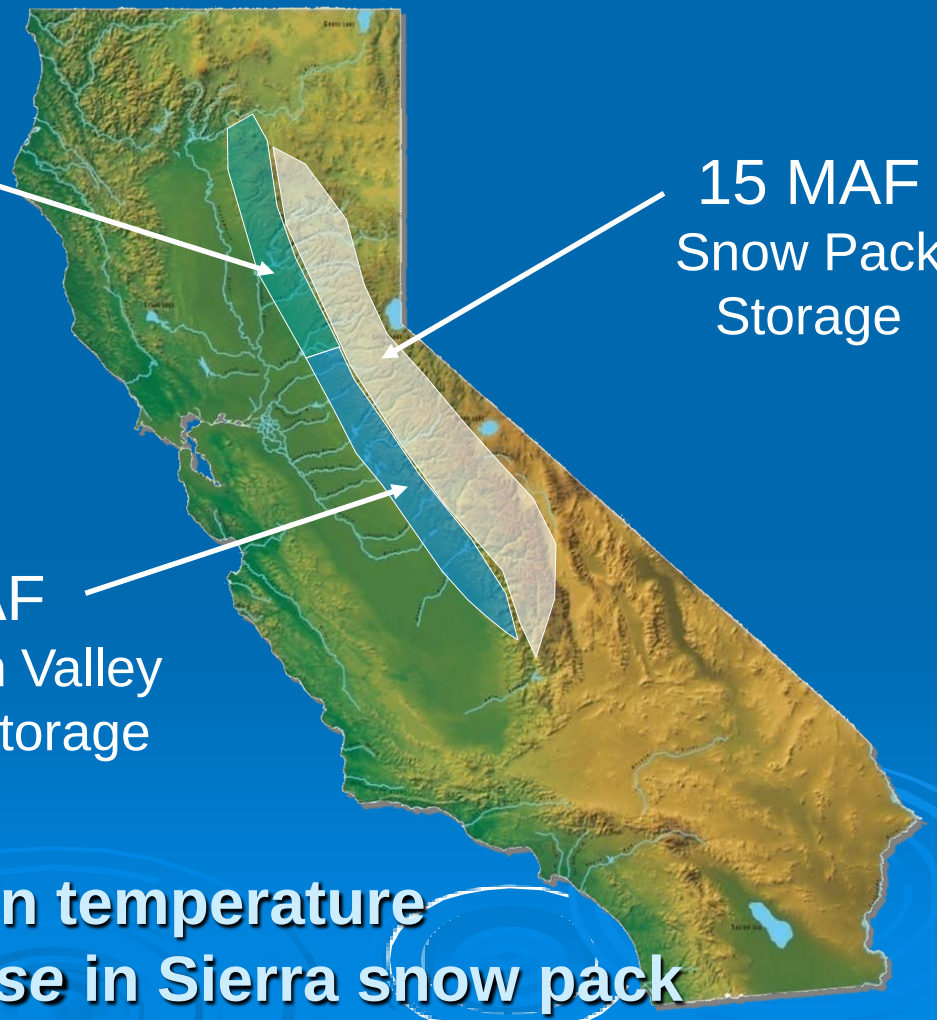
California's Three Reservoirs

- Snow Pack
- Surface Storage
- Groundwater Basins





Snow Pack
California's Largest Surface Reservoir

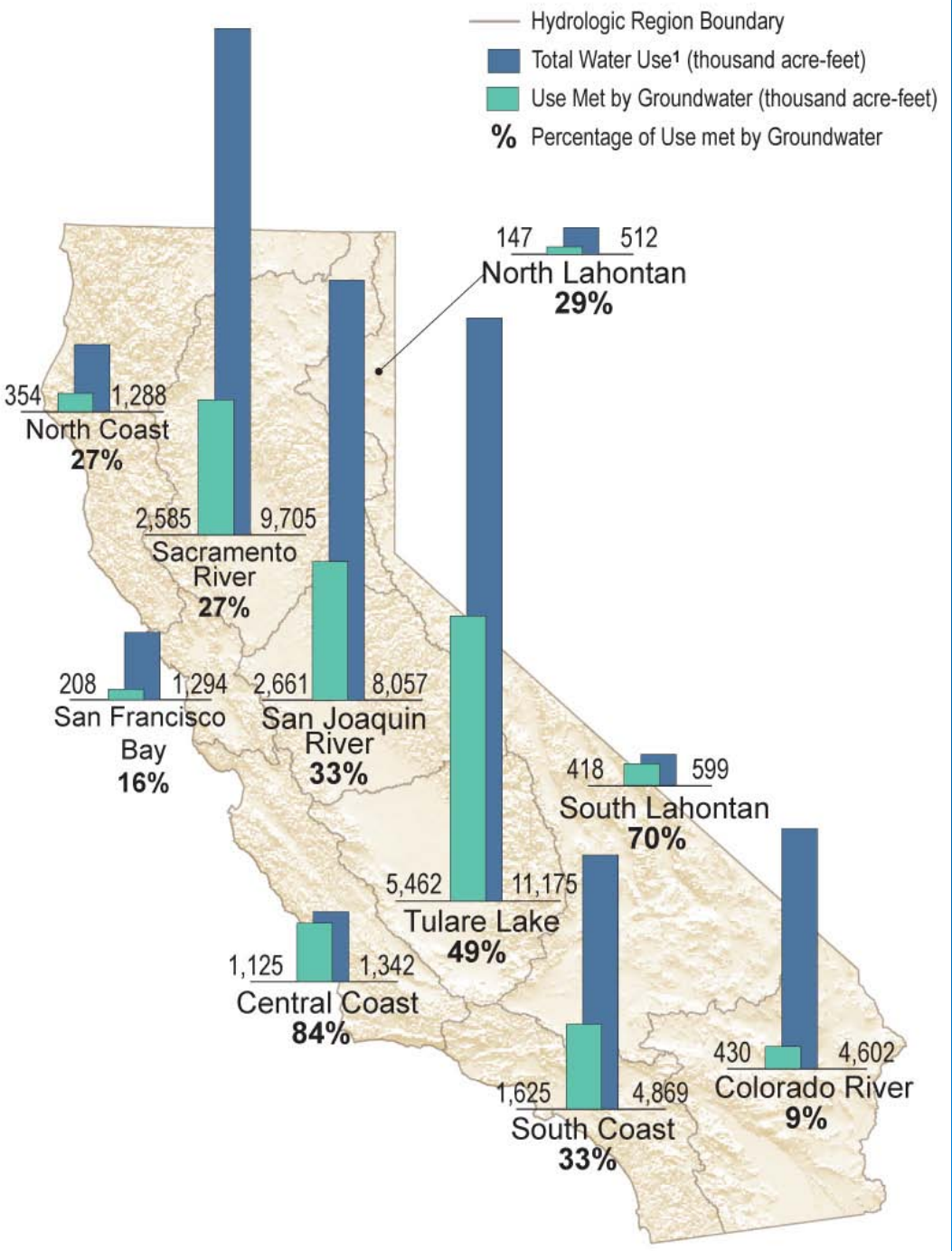


5° F *increase* in temperature
>>> 4 to 5 MAF *decrease* in Sierra snow pack

Average Annual Groundwater Use by Hydrologic Region

(1998-2005 average annual data)

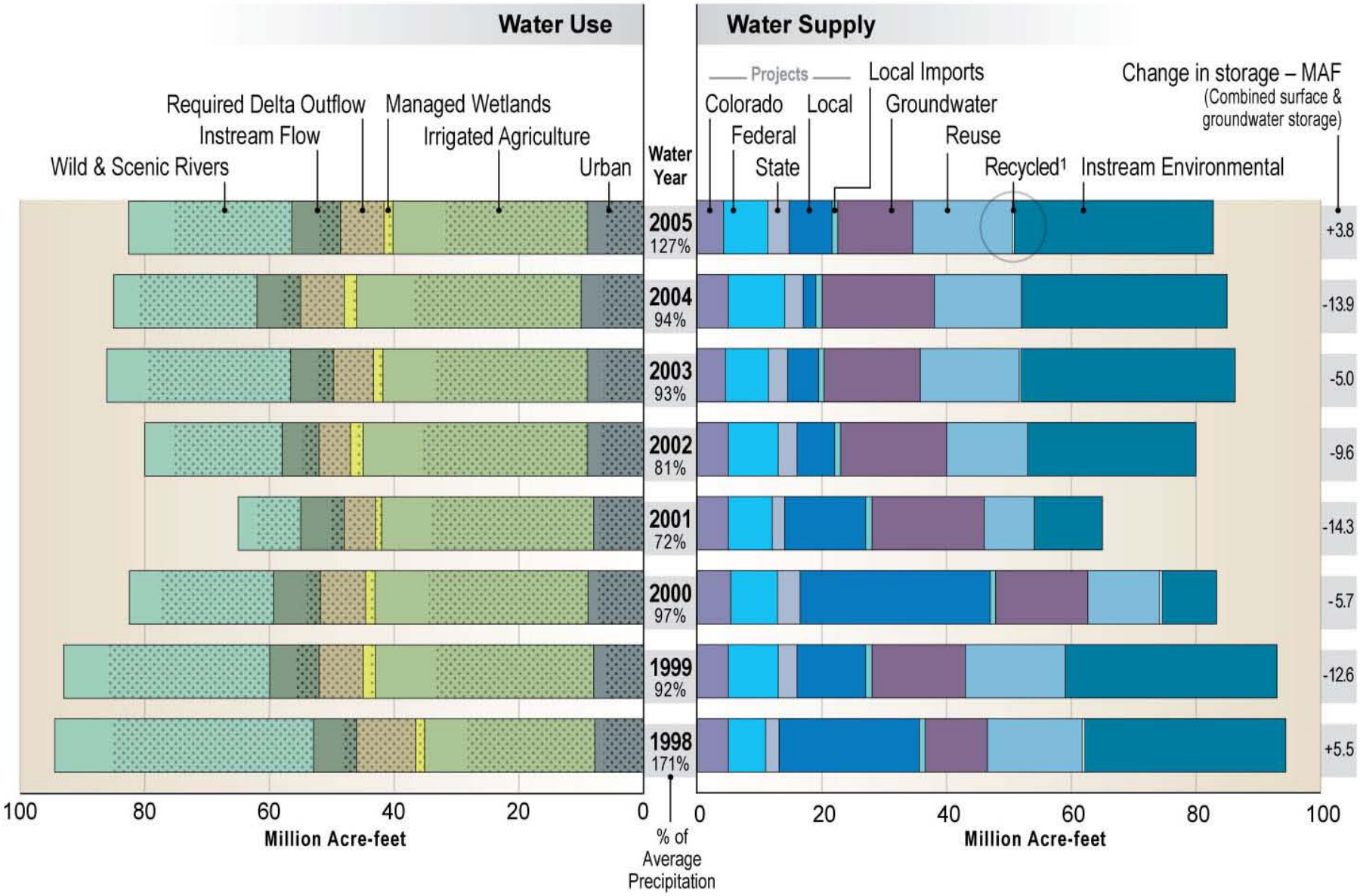
- 15 million acre-feet pumped
- Meets ~30% of uses on avg & higher in dry years
- Regional reliance varies greatly
- Some cities, coastal basins & rural areas entirely dependent
- 1 - 2 million AF annual overdraft



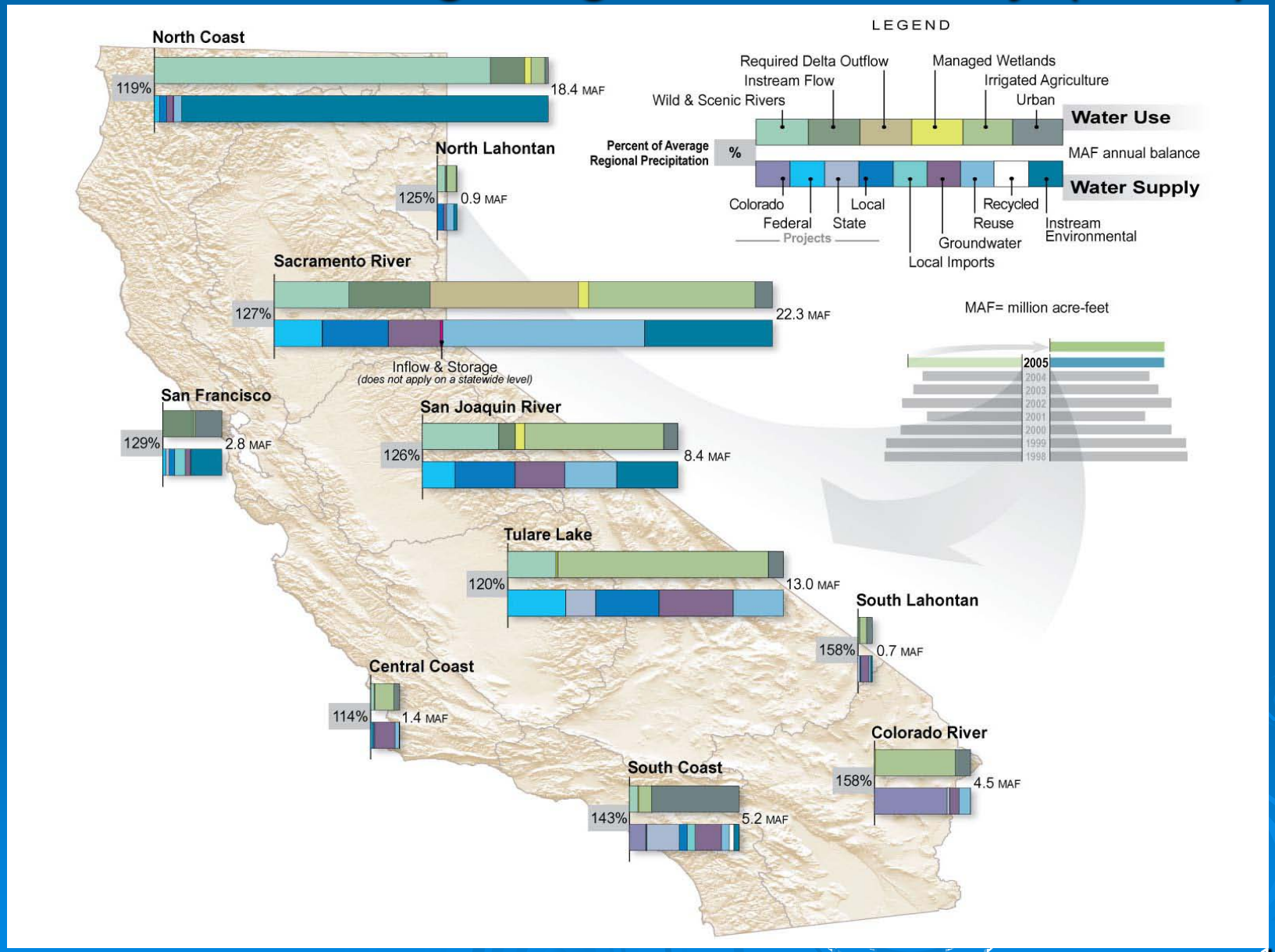
1. *Total Water Use is defined as the sum of water uses for agricultural, urban, and managed wetlands.*

California's Water Resources: Variable & Extreme

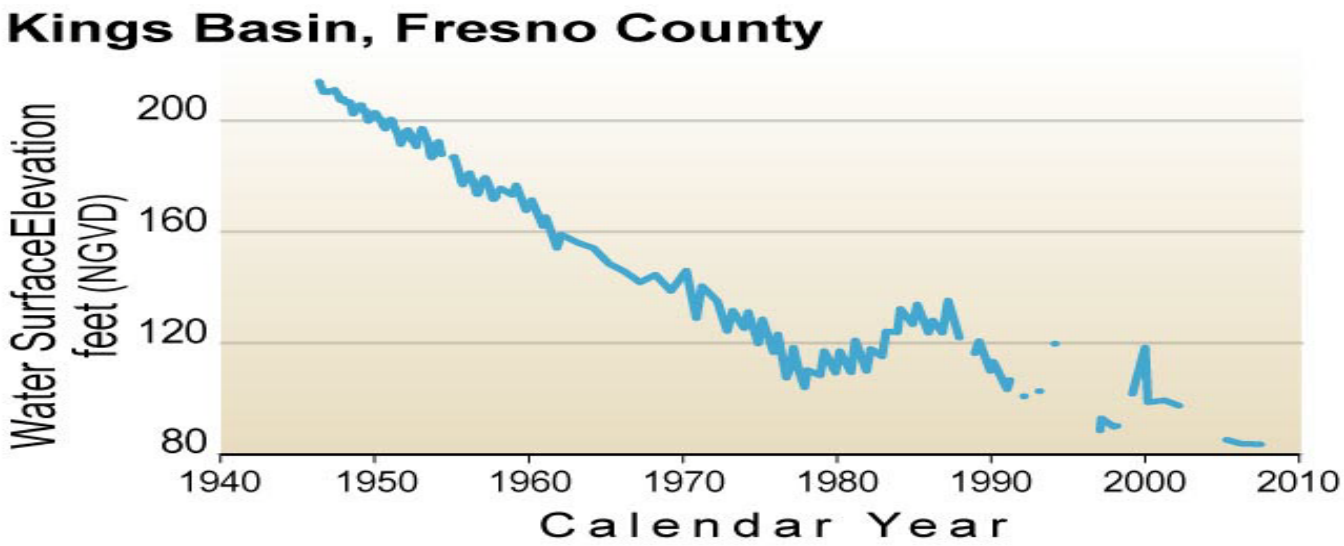
Butterfly Chart for WY 1998 - 2005



Understanding Regional Diversity (2005)



Groundwater Overdraft & Recovery

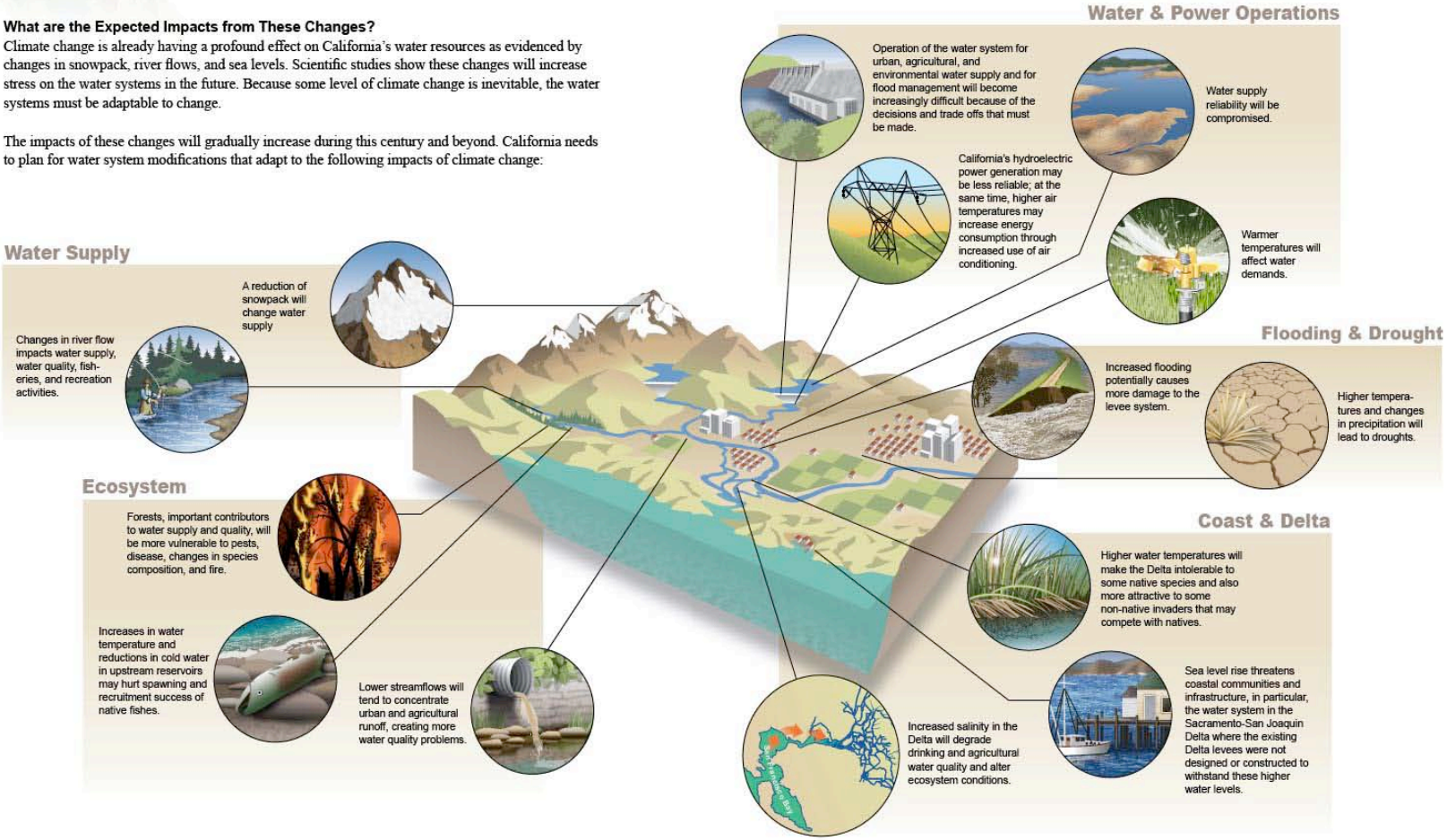


Climate Change: Stressing Our Water Systems

Climate Change: *Stressing Our Water Systems*

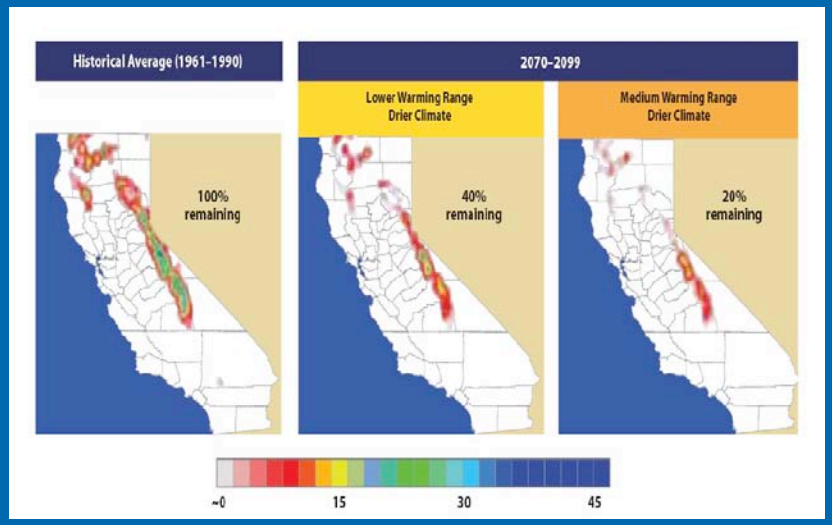
What are the Expected Impacts from These Changes?
Climate change is already having a profound effect on California's water resources as evidenced by changes in snowpack, river flows, and sea levels. Scientific studies show these changes will increase stress on the water systems in the future. Because some level of climate change is inevitable, the water systems must be adaptable to change.

The impacts of these changes will gradually increase during this century and beyond. California needs to plan for water system modifications that adapt to the following impacts of climate change:

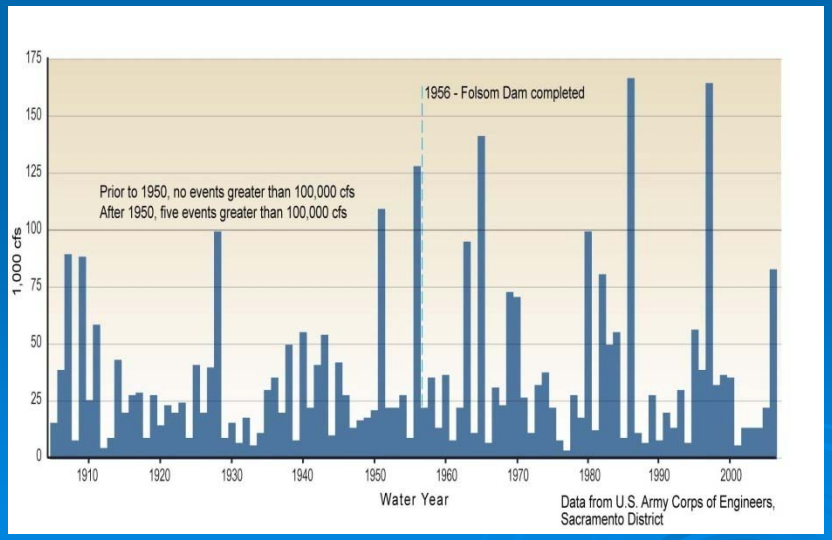


Climate Change: Future Hydrology Unlike the Past

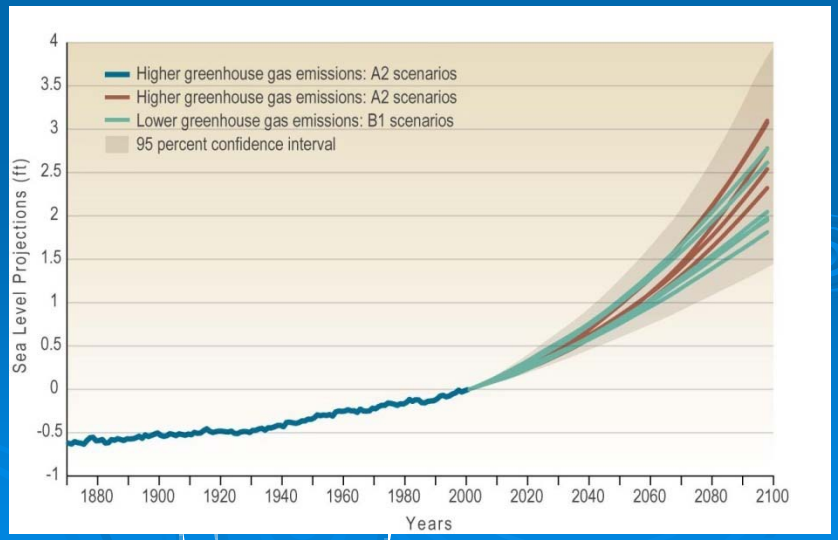
Higher air & water temperature



Early snowmelt & less snowpack

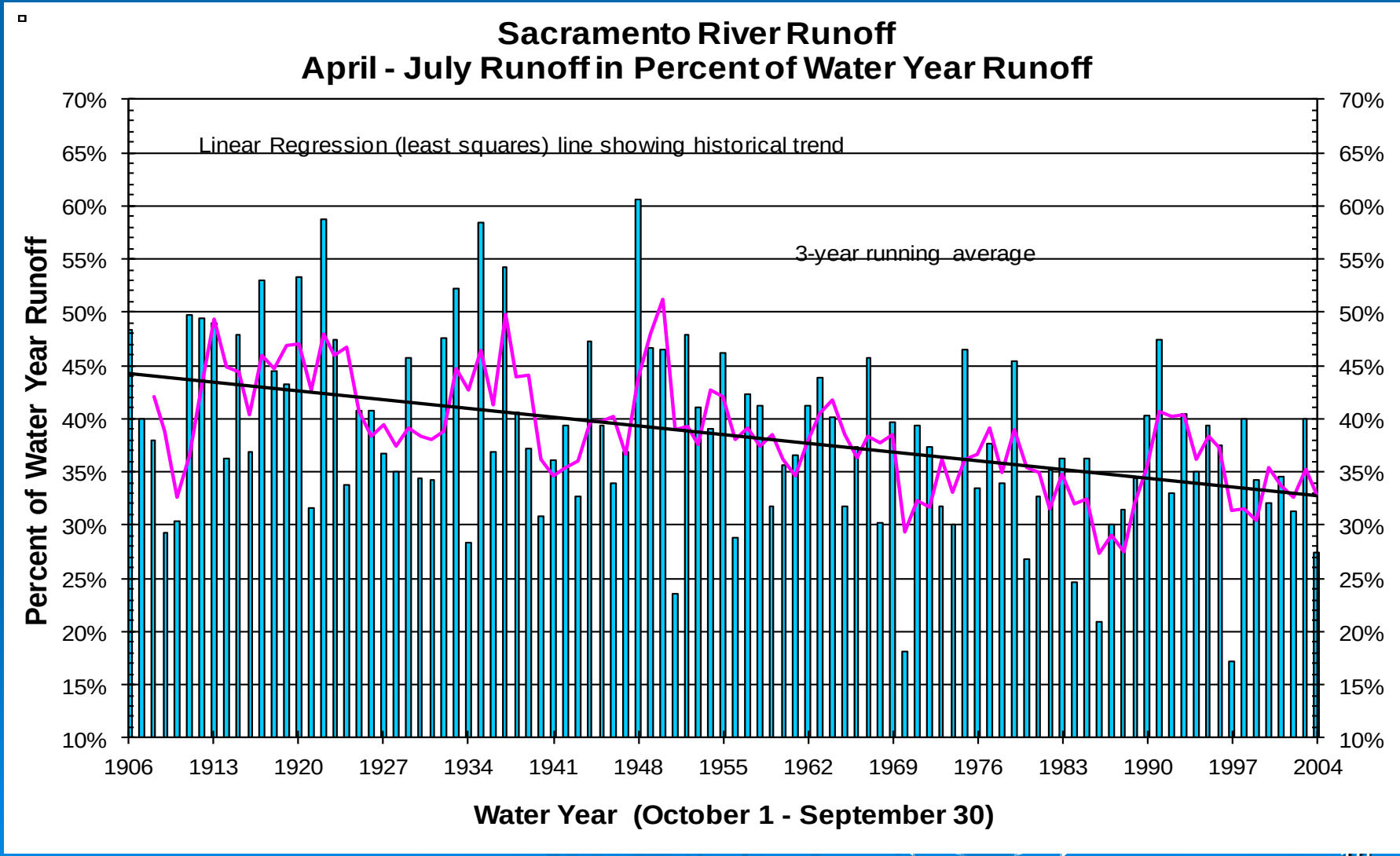


Changing runoff pattern



Rising sea level

Earlier Snowmelt & Change in Runoff Timing



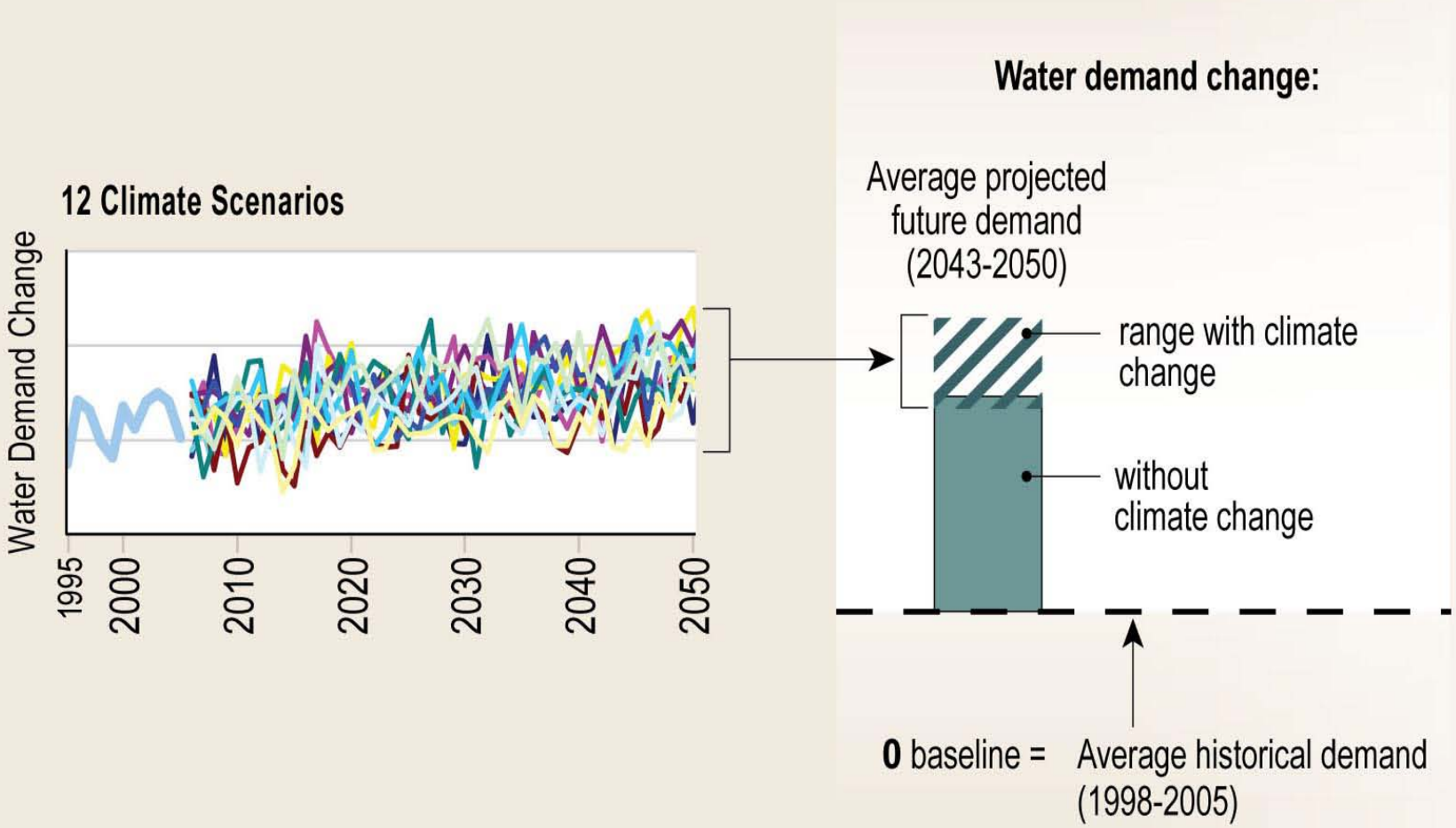
3 Future Scenarios: Key Factors of Uncertainty

2050
Planning
Horizon

Factors of Uncertainty

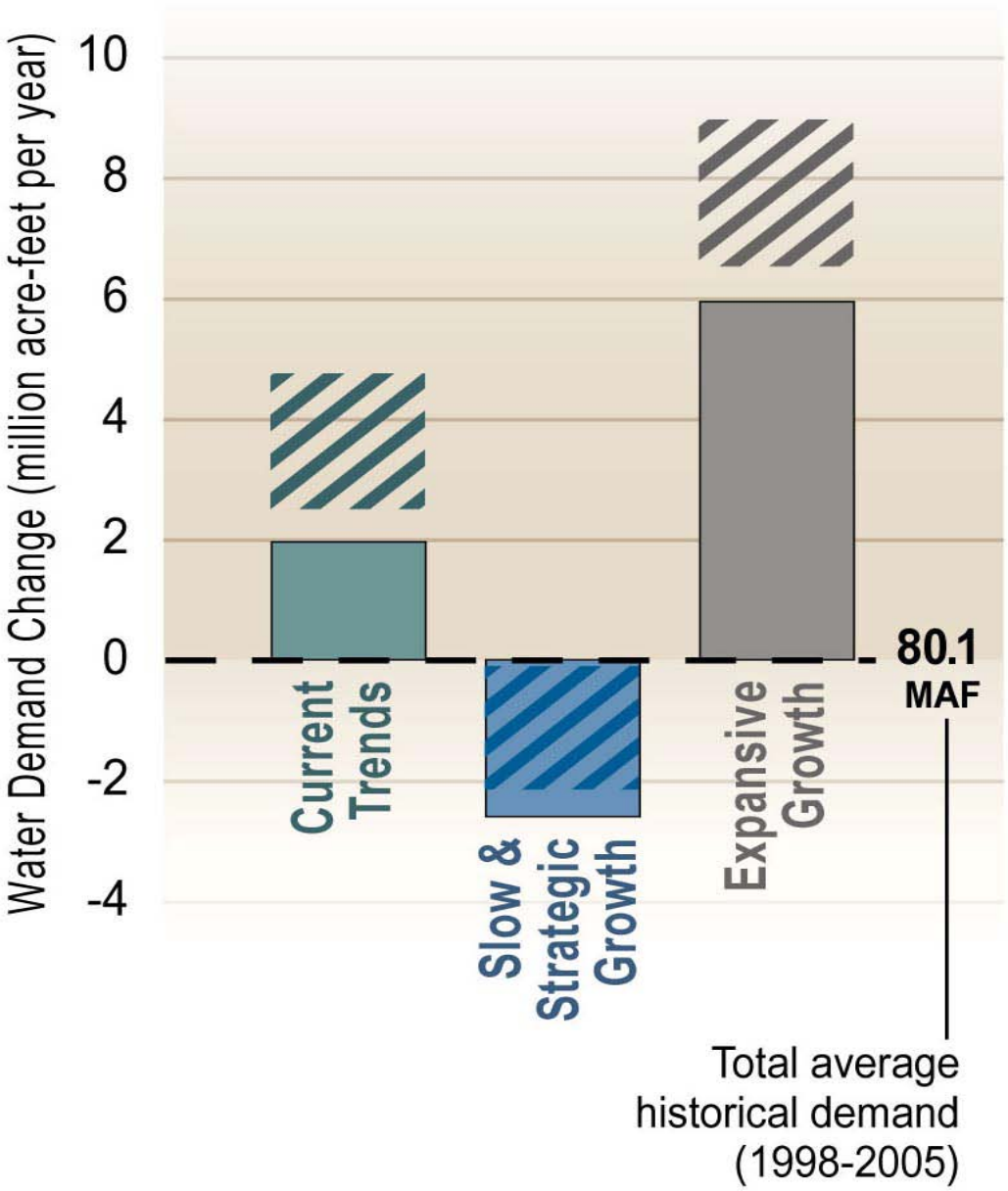
- Population
- Land Use
- Irrigated Crop Area
- Environmental Water
- Background Water Conservation

How Will Climate Change Variability Change Water Demands ?



Statewide Water Demand Change for 2050 Scenarios

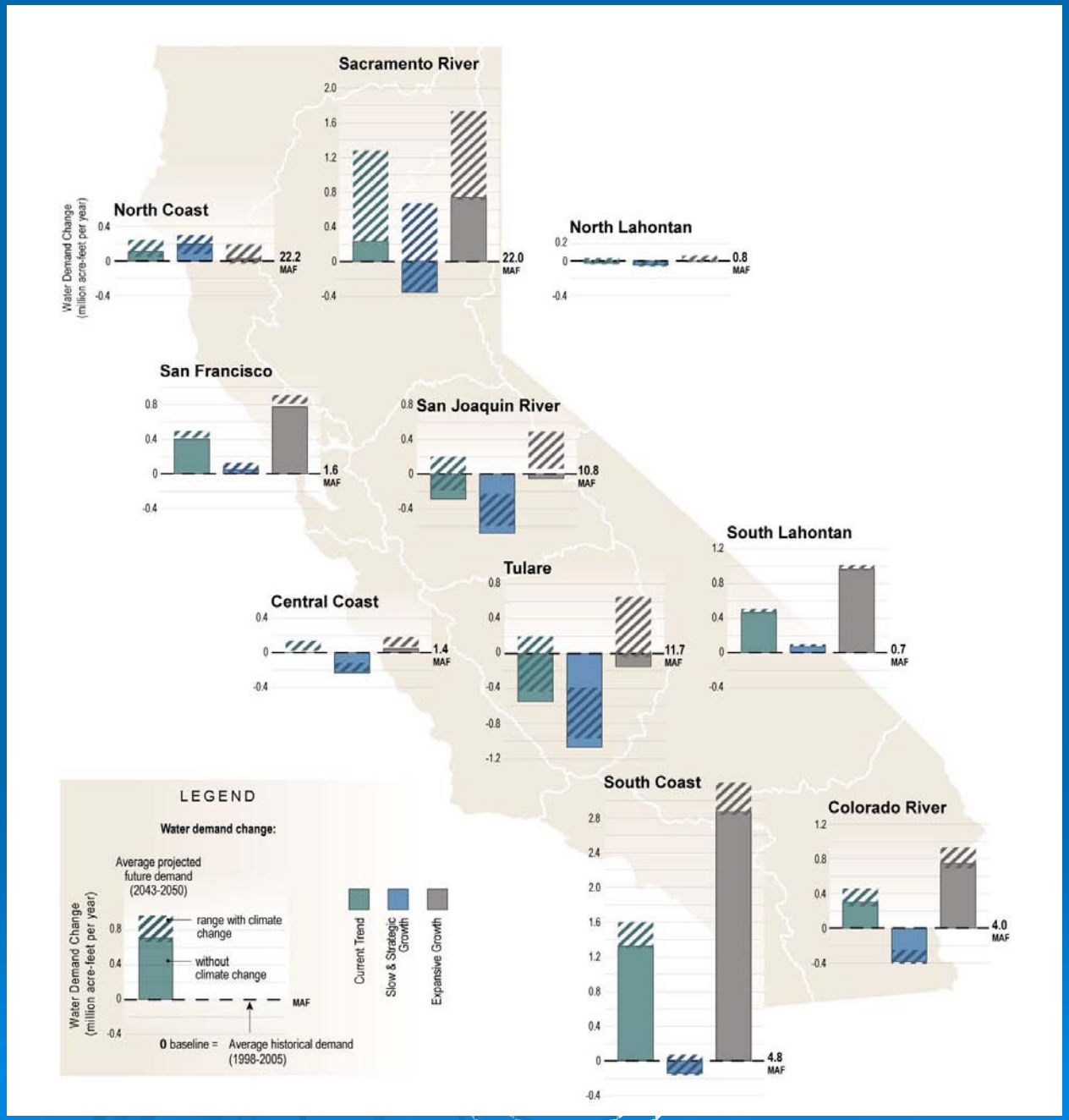
Without & With Climate Change



Water Demand Change for 2050 Scenarios

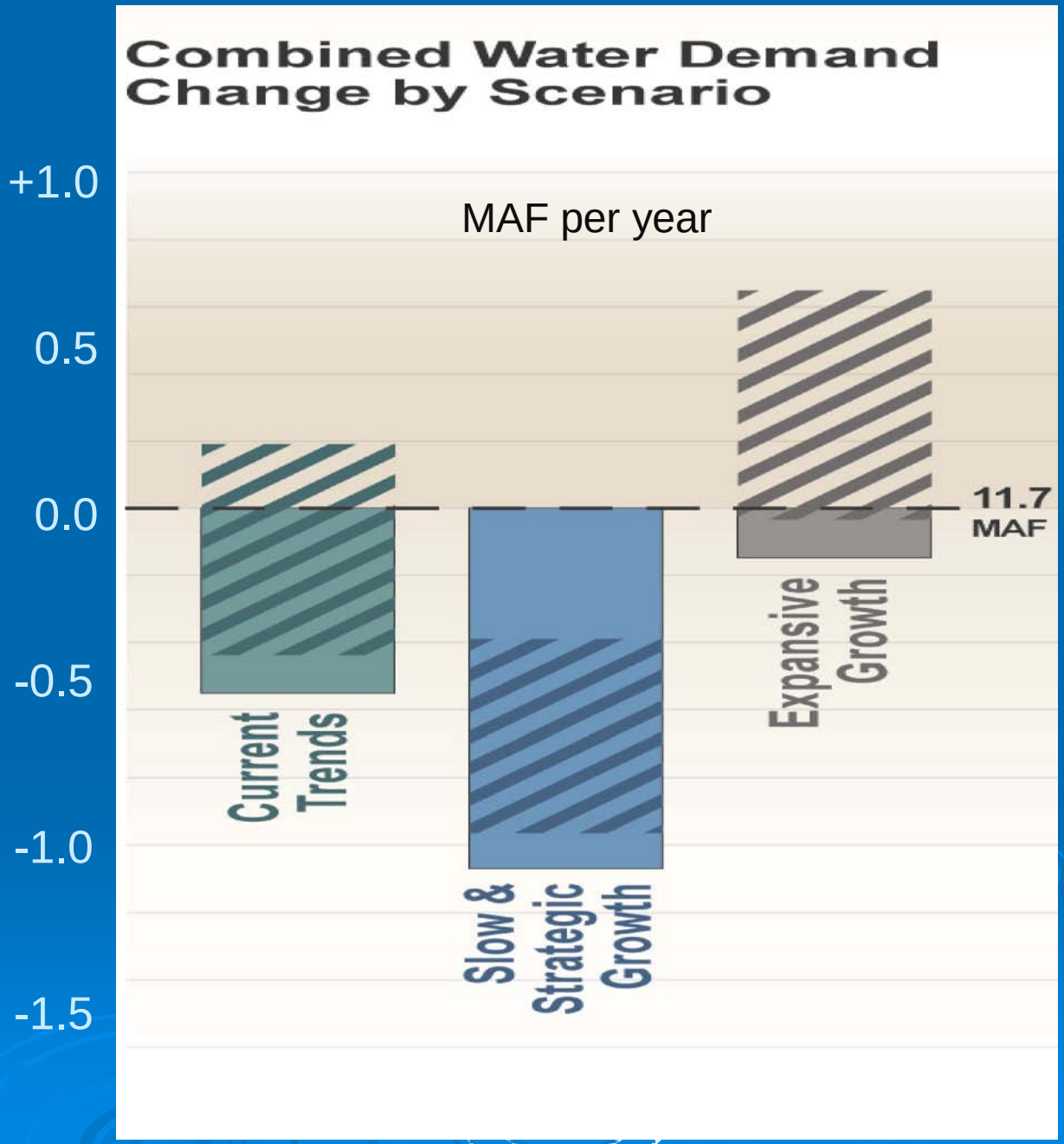
From a Regional Perspective

Wide-ranging climate variability



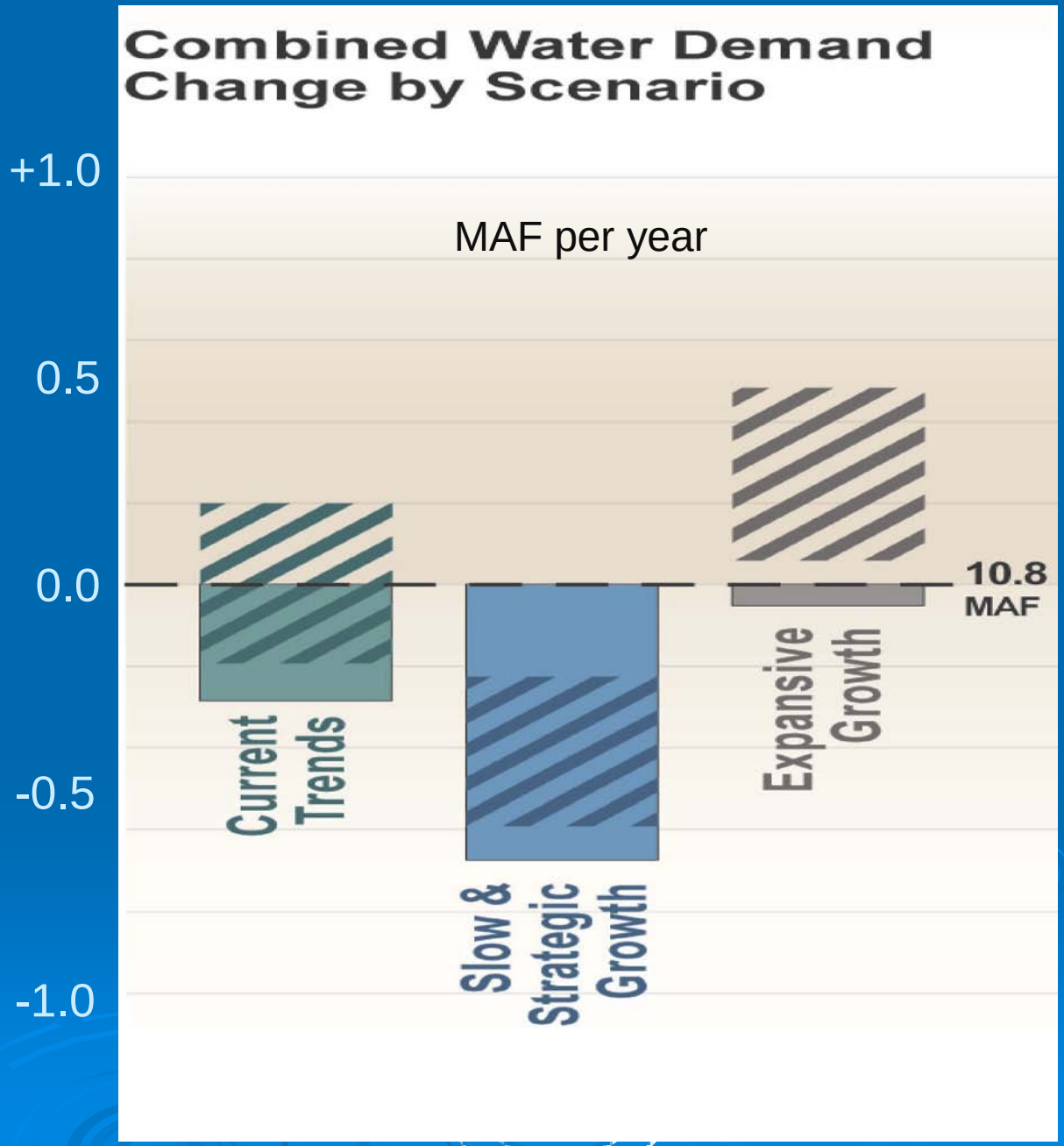
Tulare Lake Region Water Demand Change for 2050 Scenarios

Without & With Climate Change



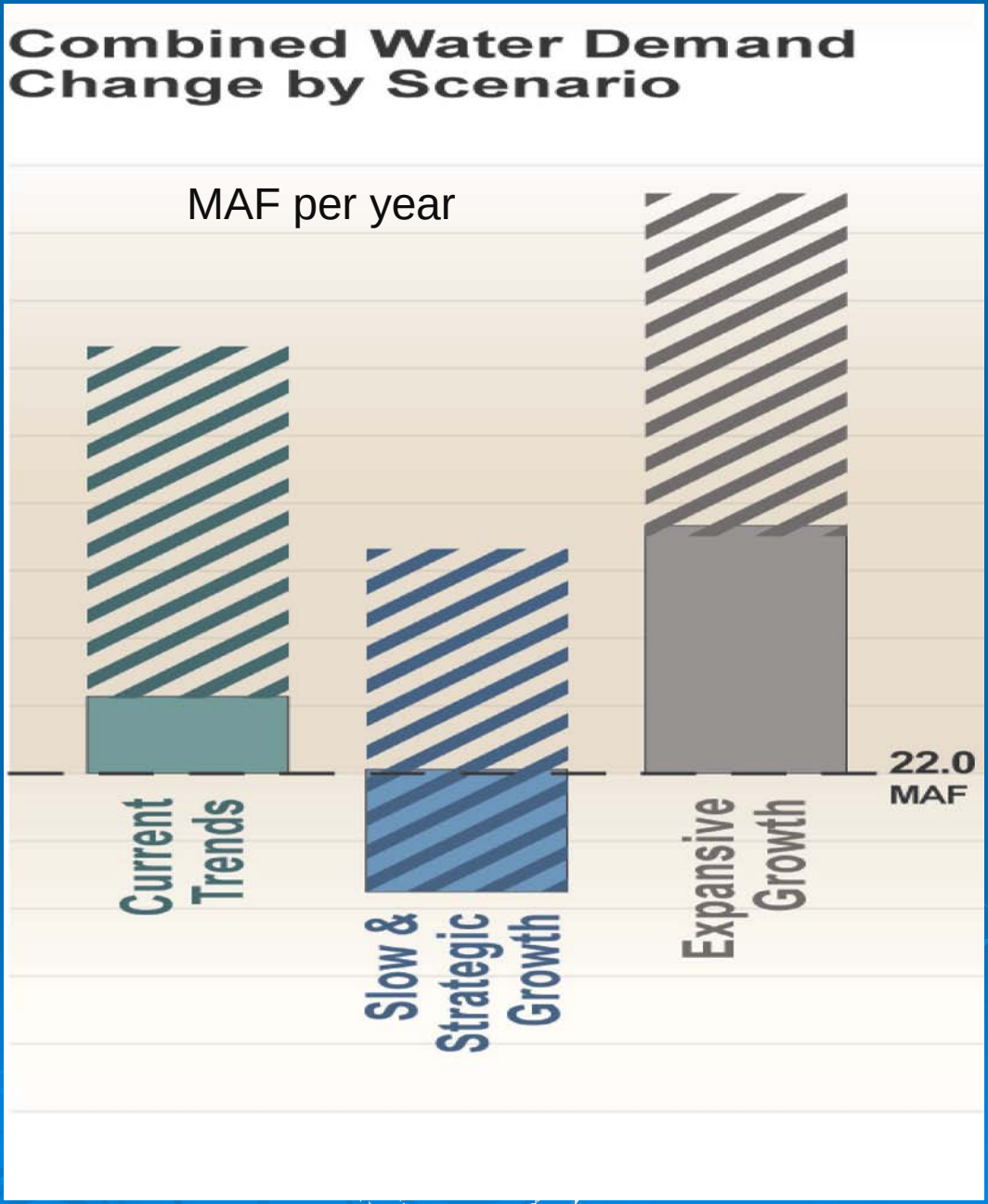
San Joaquin River Region Water Demand Change for 2050 Scenarios

Without & With Climate Change



Sacramento River Region Water Demand Change for 2050 Scenarios

Without & With Climate Change



Climate Reports & California Water Plan Update 2009

Include objectives, strategies & actions to adapt to and mitigate climate change impacts

Update 2009 – State's Blueprint
Integrated Water Management & Sustainability

VISION

- Public Health, Safety, Quality of LIfe
- Vitality, Productivity, Economic Growth
- Healthy Ecosystem, Cultural Heritage

Foundational Actions for SUSTAINABLE WATER USES

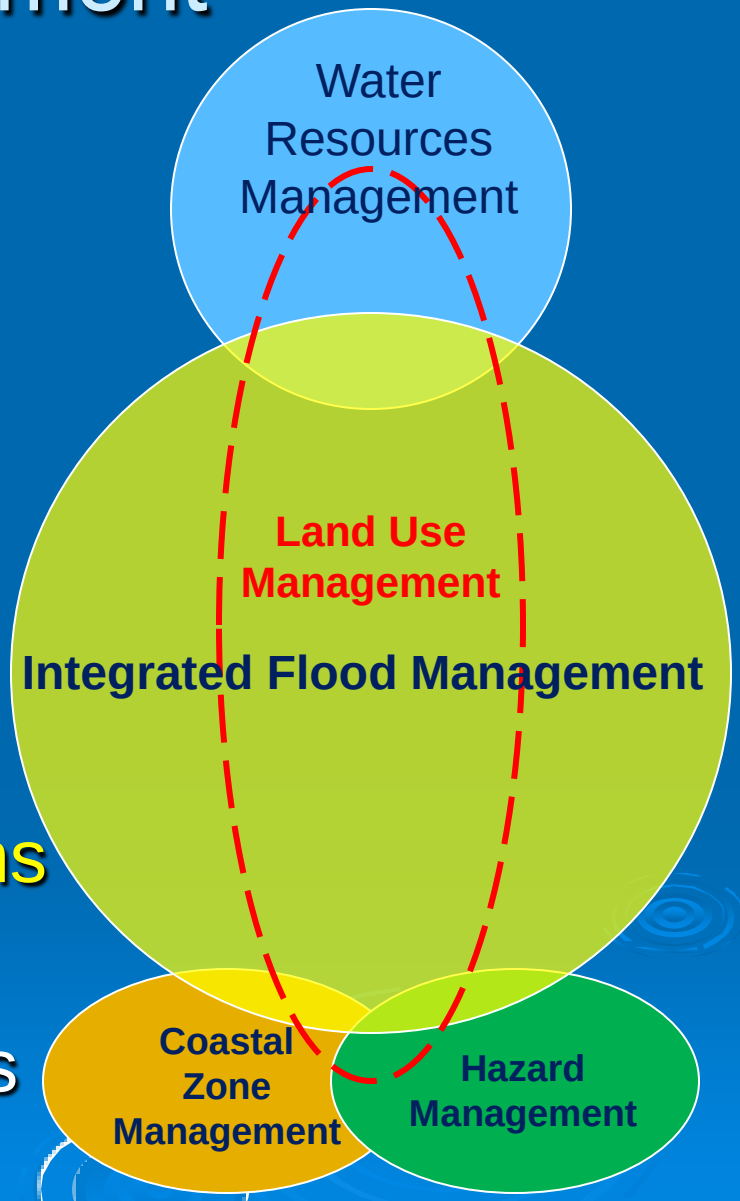
- Use Water Efficiently
- Protect Water Quality
- Expand Environmental Stewardship

Initiatives for RELIABLE WATER SUPPLIES

- Expand Integrated Regional Water Managment
- Improve Statewide Water and Flood Management Systems

Integrated Flood Management

- Comprehensive approach to flood management
- Considers land & water resources at watershed scale
- Minimizes loss of life and property damage from flooding
- Maximizes benefits of floodplains
- Recognizes benefits to ecosystems from periodic floods



Adapted from World Meteorological Organization

Improve Coordination
Land Use Planning & Water Management

- Land use planning controlled locally
- Water management decentralized -- over 2,300 counties, cities, public agencies, and private water companies
- Use IRWM to coordinate land use planning with water supply, quality, flood management, and climate adaptation
- State Government provides technical assistance and financial incentives
- Improve coordination among State agencies and with IRWM Partnerships

Integrated Regional Water Management
48 Regional Water Mgmt Groups

- Foster partnerships & promote regional solutions
- Diversify water portfolios & integrate supplies
- Leverage economies of scale to reduce costs
- Integrate data, tools & resources
- Invest in multi-benefit projects with sustainable outcomes
- Increase regional self-sufficiency

27 Resource Management Strategies

A Range of Choices

Reduce Water Demand

- Agricultural Water Use Efficiency
- Urban Water Use Efficiency

Improve Operational Efficiency & Transfers

- Conveyance – Delta
- Conveyance – Regional / Local
- System Reoperation
- Water Transfers

Increase Water Supply

- Conjunctive Management & Groundwater Storage
- Desalination –Brackish & Seawater
- Precipitation Enhancement
- Recycled Municipal Water
- Surface Storage – CALFED
- Surface Storage – Regional / Local

Improve Flood Management

- Flood Risk Management

Improve Water Quality

- Drinking Water Treatment & Distribution
- Groundwater / Aquifer Remediation
- Matching Quality to Use
- Pollution Prevention
- Salt & Salinity Management
- Urban Runoff Management

Practice Resource Stewardship

- Agricultural Lands Stewardship
- Economic Incentives (Loans, Grants & Water Pricing)
- Ecosystem Restoration
- Forest Management
- Land Use Planning & Management
- Recharge Areas Protection
- Water-Dependent Recreation
- Watershed Management

Other-- Crop idling, dew vaporization, fog collection, irrigated land retirement, rainfed agriculture, waterbag transport

2010 Drought Contingency Plan

Part of the CA Water Plan Objective 8

- Recommends Drought Actions
  - Before --- Preparing for
  - During --- Responding to
  - After --- Recovering from
- Provides Interagency coordination framework
- Promotes efficient & effective resource use

Comprehensive Strategy for Adaptation
Regional Strategies

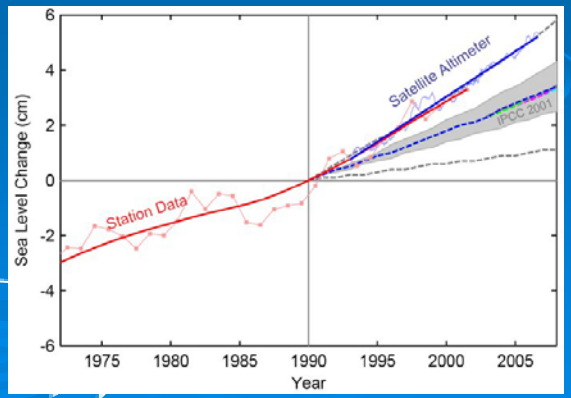
- Fully implement Integrated Regional Water Management (IRWM)
- Diversify water portfolios
- Aggressively increase water use efficiency

Comprehensive Strategy for Adaptation
Statewide Strategies

- Practice and promote integrated flood management
- Enhance and sustain ecosystems
- Advance and expand conjunctive management of surface and groundwater resources
- Fix the Delta

Comprehensive Strategy for Adaptation
Improve Information & Decision-making

- Preserve, upgrade, and increase monitoring and data analysis and management
- Plan for and adapt to sea level rise
- Identify and fund focused research and analysis on climate change impacts and adaptation



Comprehensive Strategy for Adaptation
Investment Strategies

- Provide sustainable funding for statewide and integrated regional water management

We are working on Update 2013

California Water Plan Update 2013

California Water Plan Update 2013 (Update 2013) is currently being developed by staff from the Department of Water Resources (DWR) and other agencies through rigorous public involvement and State and federal agency coordination processes. It will build on the contents of the previous update — the five-volume *California Water Plan Update 2009*, which provided a strategic plan, a suite of resource management strategies, reports on California's hydrologic regions, and reference and technical guides — and will introduce a number of key additions and enhancements in response to stakeholder recommendations and evolving decision-maker information needs.

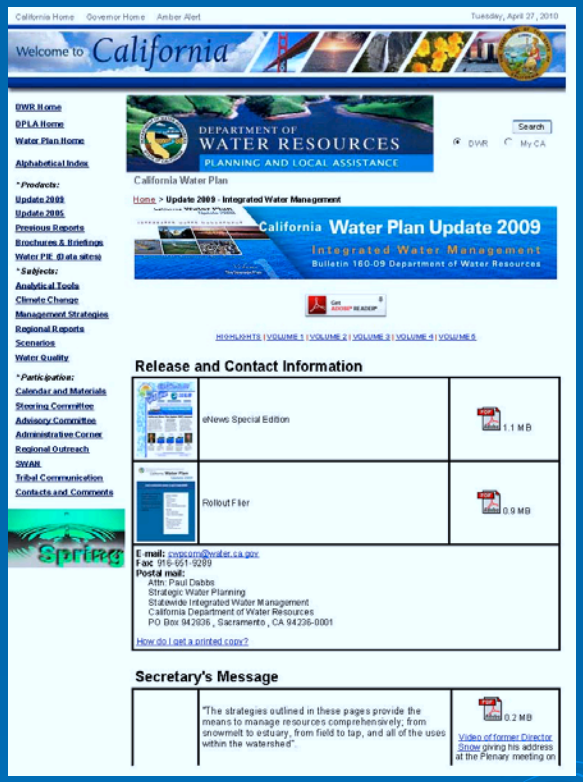
Integrated water management is a collection of policies, practices, and tools applied to water resources planning and management to achieve multiple objectives and enhanced outcomes.

Water Plan Framework for Integrated Water Management and Sustainability

Investing in Innovation and Infrastructure

Ways to Access Water Plan Information

- Visit the *Water Plan Web Portal*
  www.waterplan.water.ca.gov



- Subscribe to *Water Plan eNews*
  a weekly electronic newsletter
  www.waterplan.water.ca.gov/enews

Questions & Comments

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