



Metropolitan Water Reclamation District of Greater Chicago

Welcome to the June Edition
of the 2026 M&R Seminar Series

NOTES FOR SEMINAR ATTENDEES

- Remote attendees' microphones are muted at entry to minimize background noise.
For attendees in the auditorium, please silence your phones.
- A question and answer (Q/A) session will follow the presentation.
- For remote attendees, please use “**Chat**” only to type questions for the presenter. For other issues, please send emails to MnRseminars@mwrld.org.
For attendees in the auditorium, please raise your hand and wait for the microphone to ask a verbal question during the Q/A session.
- The presentation slides will be posted on the MWRD website after the seminar.
- This seminar has been approved by the Engineering Society of Illinois (ESI) for one PDH and approved by the IEPA for one TCH. Certificates will be issued only to participants who attend the entire presentation. For PDH certificate seekers, **completing a brief course evaluation and submitting it are required.**

FELICIA MARCUS

William C. Landreth Visiting Fellow
Stanford University



Felicia Marcus is the William C. Landreth Visiting Fellow at Stanford University's Water in the West Program where she brings an unusual breadth of experience as an attorney, policymaker, and organizational manager to western water issues. Prior to joining Stanford, she most recently served as Chair of the State Water Resources Control Board for the State of California. Ms. Marcus also has extensive background as a private sector and public interest lawyer as well as a community organizer. She is an elected Fellow of the National Academy of Public Administration and of the American College of Environmental Lawyers and currently serves or has served in the past on many nonprofit boards and Advisory Councils. She received a Juris Doctor degree from the New York University School of Law and a Bachelor of Arts cum laude in East Asian Studies from Harvard College. She has received numerous awards over the years for her reasonable yet productive approach to making environmental progress with people.



Water Resilience in the Face of Climate Change: California's Rise to Resilience

Felicia Marcus

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June 26, 2026

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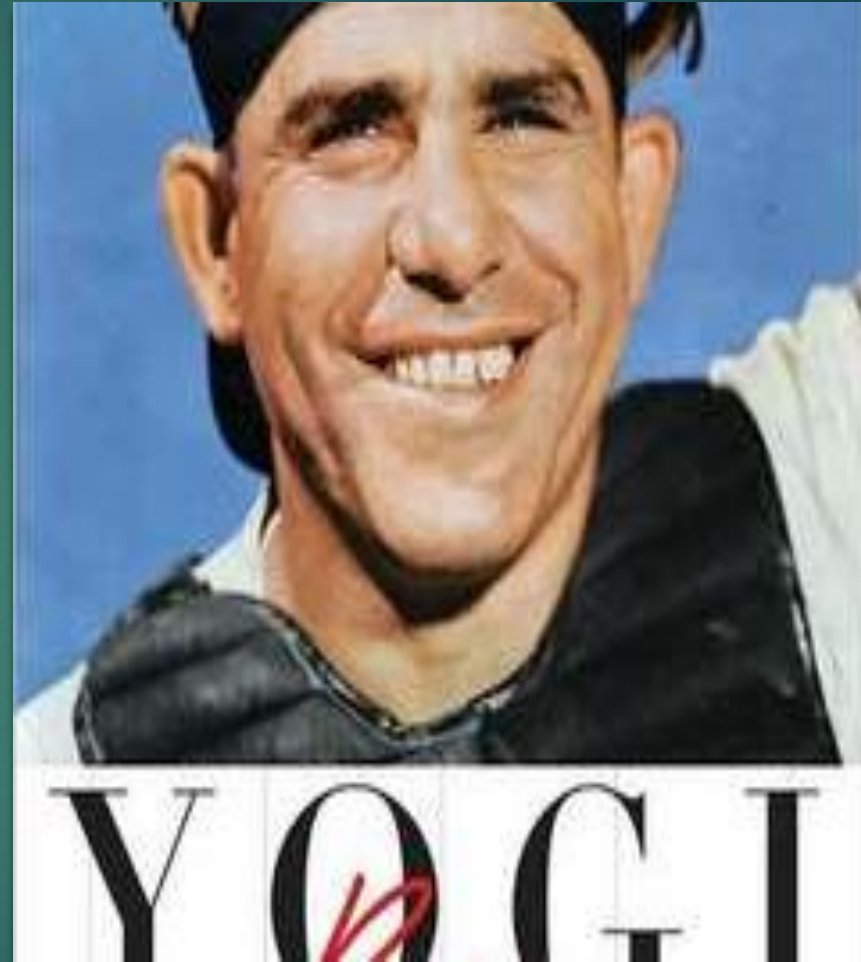
An accidental career

- ▶ Public interest lawyer and organizer in LA. Sewage as entry to water
- ▶ Time in government:
 - ▶ Public Works
 - ▶ EPA – Bay-Delta/rivers
 - ▶ State Board – All of it
- ▶ National non-profits: TPL/NRDC
- ▶ Now—bringing a practitioner's view to the academy; plus work in climate adaptation and water—particularly water recycling and permit speed



The Wisdom of Yogi Berra

"In theory there is no difference between theory and practice. In practice, there is."



Overview

- ▶ Purpose: to give a sense of some of the big lifts being made in California to address climate change.
- ▶ California and the west overview
- ▶ Dealing with a new reality
 - ▶ Selected Water Challenges
 - ▶ Selected policies, projects, programs in process to address them at the state and local level
 - ▶ State
 - ▶ Local

*“Our relationship with
water has to evolve.”* Los Angeles

Mayor Eric Garcetti, October 14, 2014



California Setting—the whole elephant

Most Variable hydrology

- Year to Year
- Location to Location
- Time of Year

Mix of Sources

- Surface Water (local or imported (storage/conveyance))
- Groundwater (intensely local)
- Every locale different mix
- Mix of water rights varies greatly
- Impact of drought varies greatly

Mix of Solutions

- Conservation/Recycling/Stormwater/Desal
- Integrated Water Management in regions and statewide
- Storage, storage, storage, storage

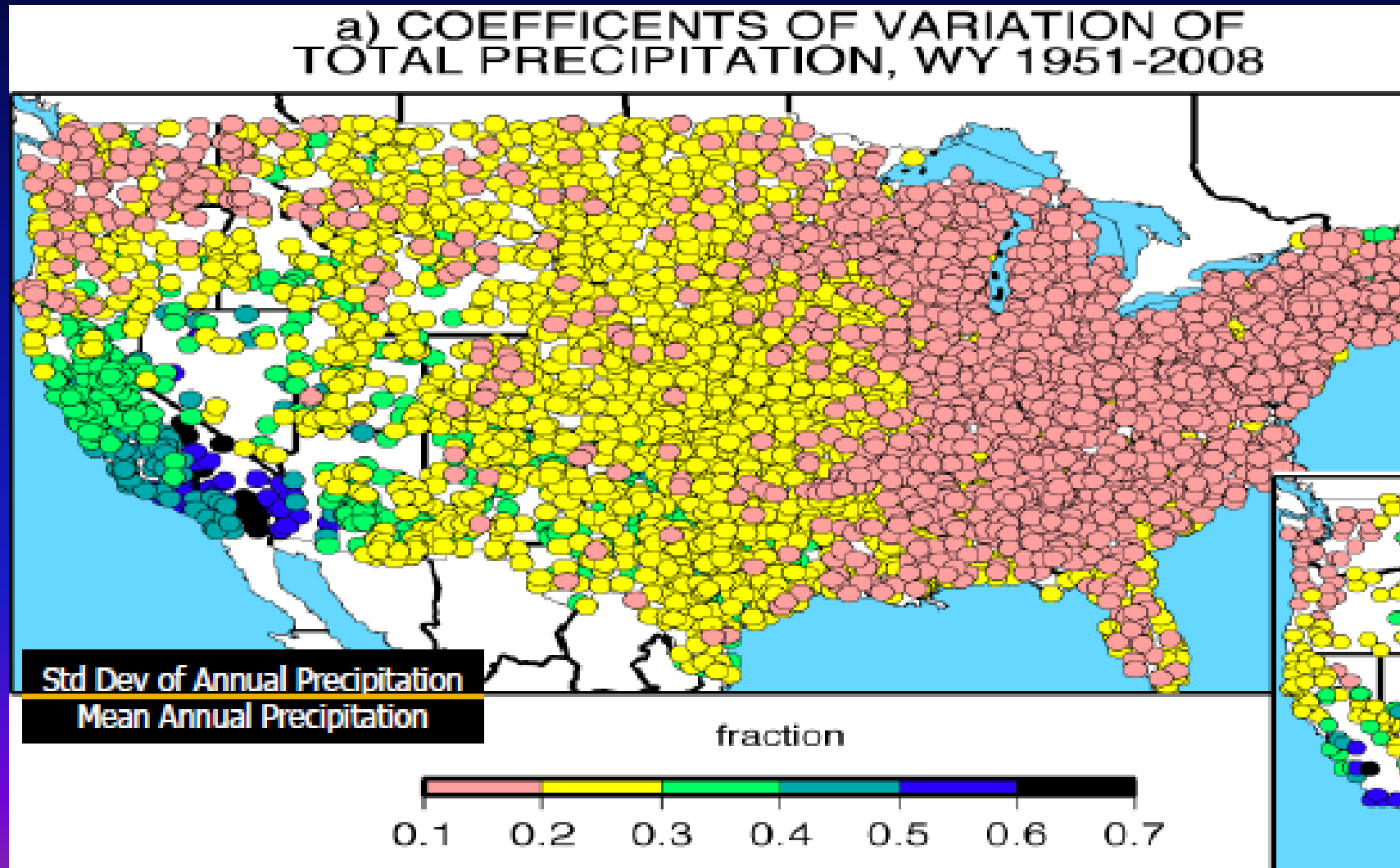
Basics

- 39 million people → 50 million
- 169,000 square miles
- Majority of population lives in large cities 100s of miles from water source
- One of 5 Mediterranean large scale agricultural opportunities in world
- Most biodiversity; losing biodiversity most rapidly
- Institutional Setting: local control; 2,400+ water supply systems; 2,600+ water agencies (41 “large”)



Climate change and other drivers as game changers

California's Precipitation is Uniquely Variable



Managing Hydrologic and Geographic Imbalances



- Precipitation vs. Population
- Feast or Famine



And, let's not forget
the Colorado
River....
Why do we forget
the Colorado?

Major Water Projects

🔹 Federal – Central Valley Project (CVP)

🔹 State – State Water Project (SWP)

🔹 Local – Many other projects throughout state, including Colorado River system, Hetch Hetchy, EBMUD, Owens Valley

Source: Water Environment Foundation

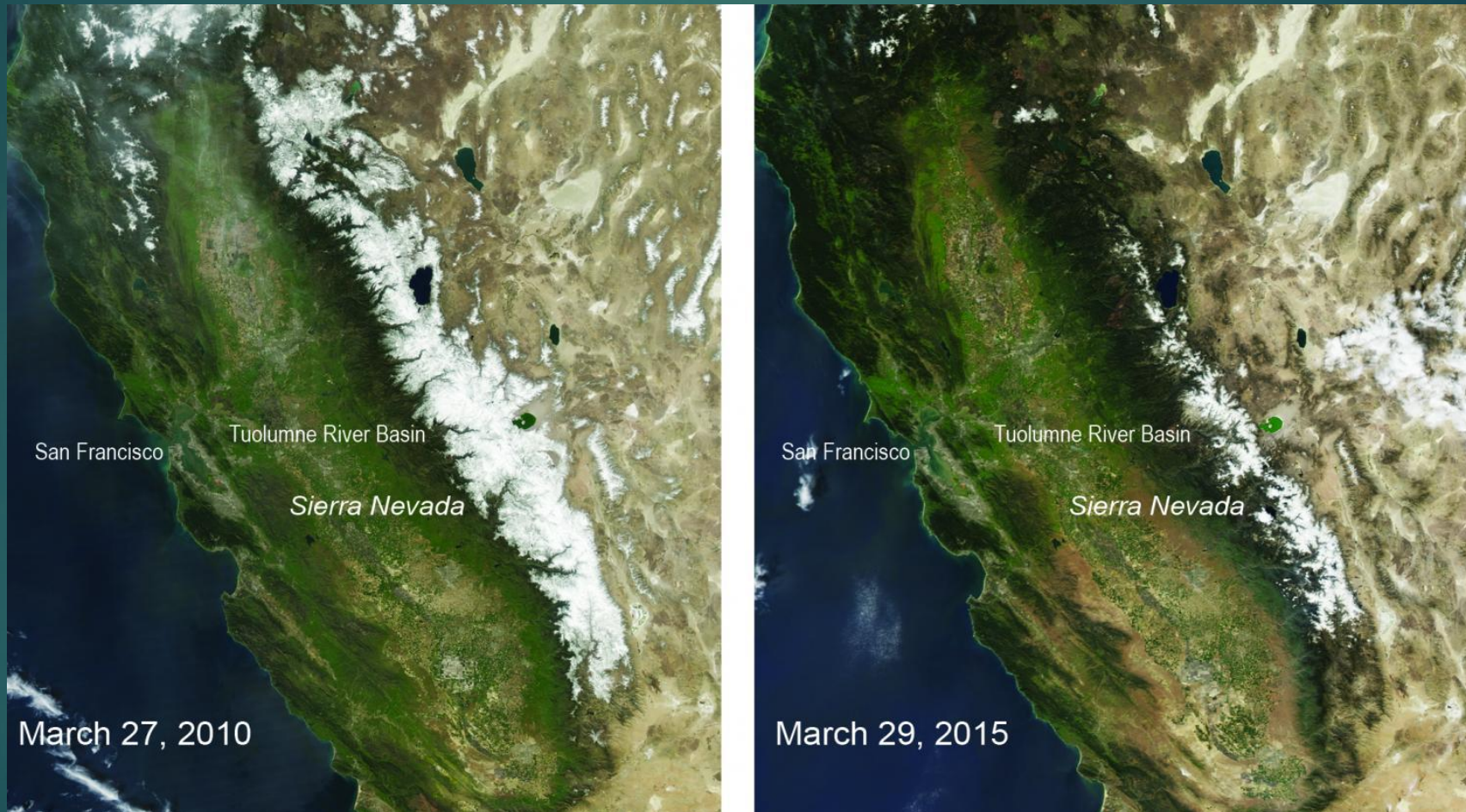




Future drivers require fundamental change in approach vs. “more”

- ▶ Climate change → particularly loss of snowpack but also sea level rise
- ▶ Limitations of looking at “recorded history”
- ▶ Population growth
- ▶ Food security
- ▶ Importance of protecting nature
- ▶ ***Resilience is very different from Sustainability***

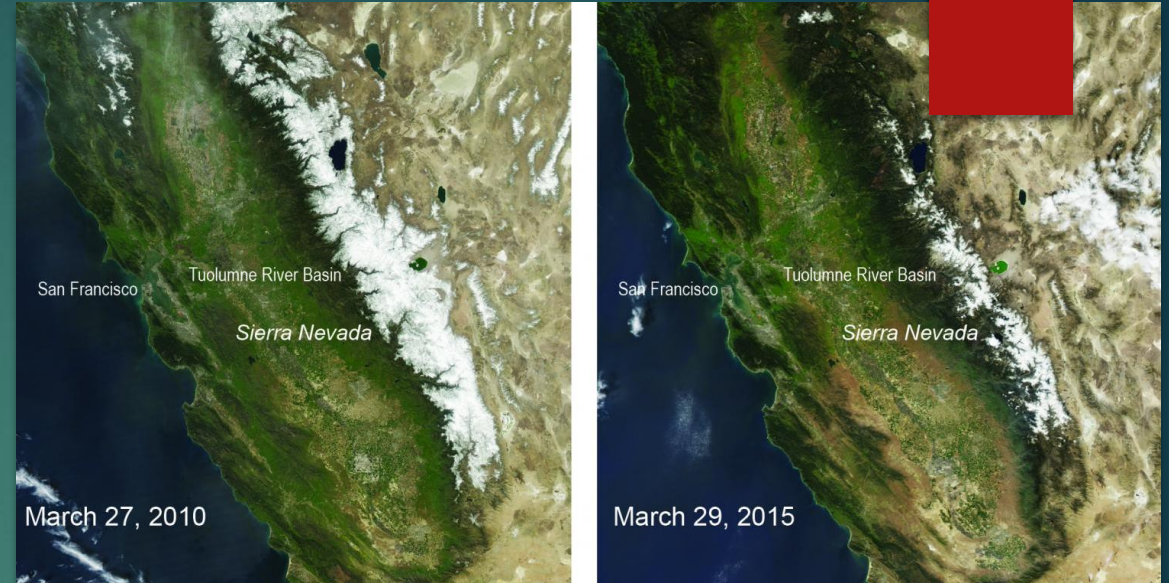
This is California on Climate Change



Source: NASA

California in the crosshairs – drier and more frequent “dries”

- ▶ Region dependent upon imported water from hundreds of miles away for 50-60% of its current water use.
- ▶ Climate change, natural disasters, and need for increased environmental flows threaten that source.
- ▶ Drought on Colorado and Sierra systems punctuated by historic snowpack this year.
- ▶ 120+ years of Agreements all up in 2026!
- ▶ **Key adaptation efforts:**
 - ▶ Conservation/efficiency (over decades)
 - ▶ Water recycling
 - ▶ Stormwater capture + multi-benefits
 - ▶ Groundwater cleanup
 - ▶ Ag/Urban issues



It's a big deal

Wyoming

Utah

Colorado

New Mexico

Arizona

Nevada

California

30 Tribes

Mexico



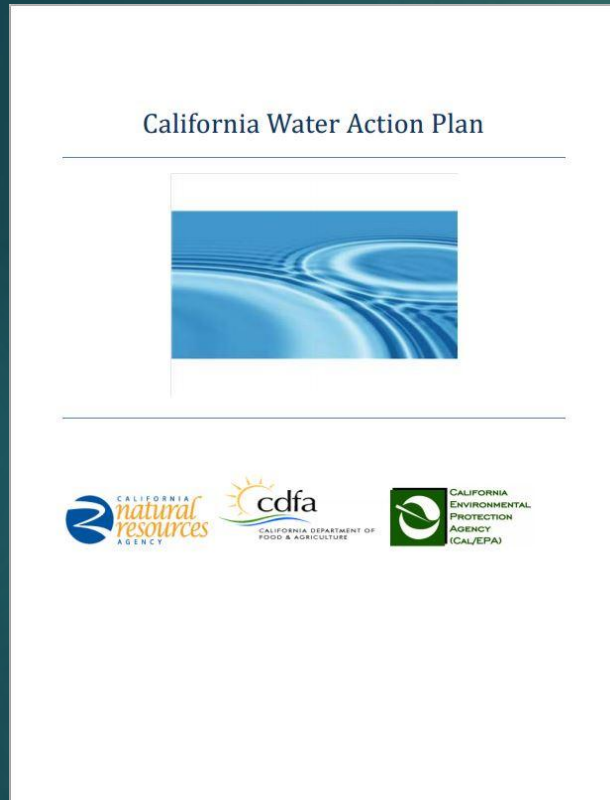
“40 million people”



Wake up call 2013-14

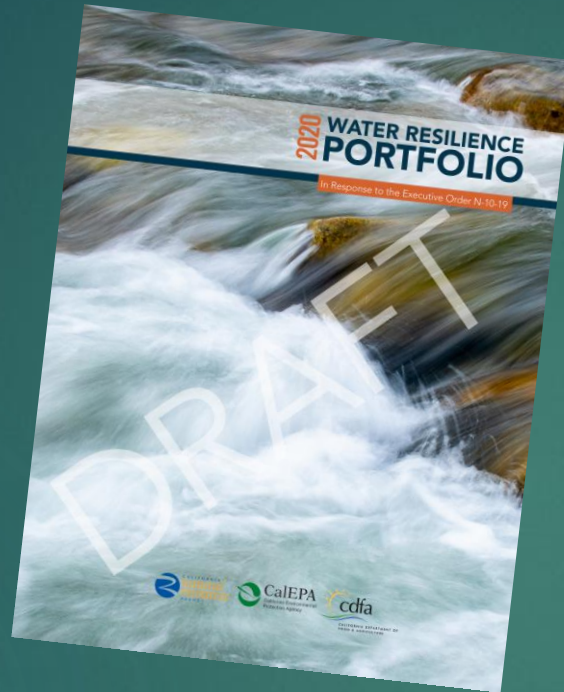


California Water Action Plan—huge approach shift

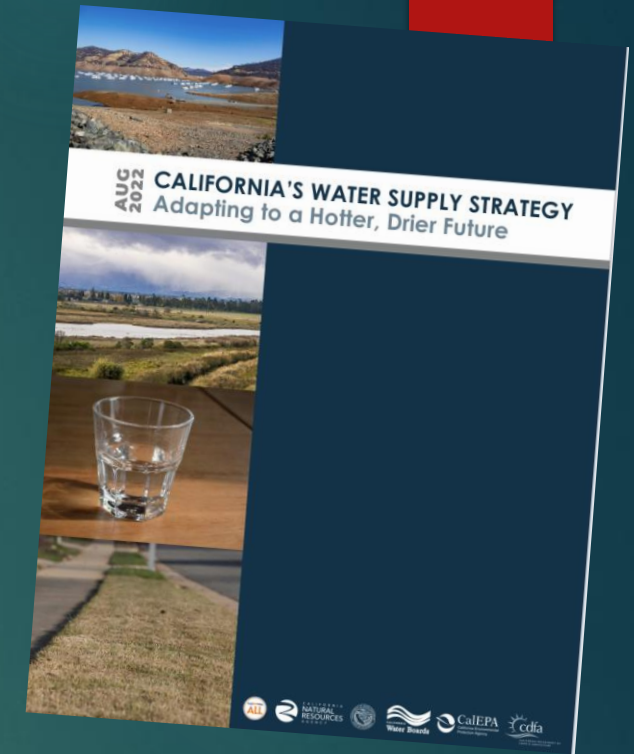


- ▶ Make Conservation a California Way of Life
- ▶ Increase Regional Self-Reliance and Integrated Water Management Across All Levels of Government
- ▶ Achieve the Co-Equal Goals for the Delta
- ▶ Protect and Restore Important Ecosystems
- ▶ Manage and Prepare for Dry Periods
- ▶ Expand Water Storage Capacity and Improve Groundwater Management
- ▶ Provide Safe Water for All Communities
- ▶ Increase Flood Protection
- ▶ Increase Operational and Regulatory Efficiency
- ▶ Identify Sustainable and Integrated Financing Opportunities

Governor Newsom takes the baton...



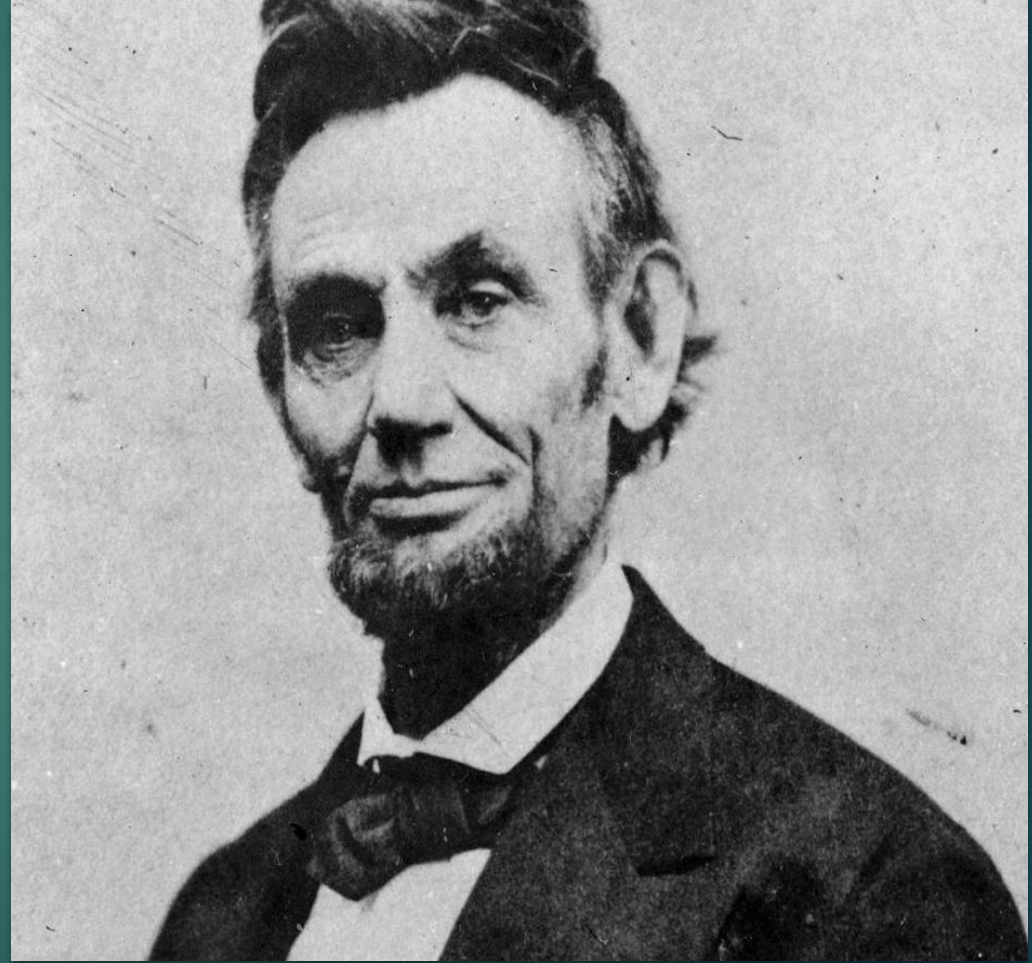
- ▶ Water Resilience Portfolio
- ▶ Based on portfolio approach; “All of the above” too
 - ▶ Regional approach
 - ▶ Multi-benefit prioritization
 - ▶ Tech/innovation/data
- ▶ Climate Smart California Plan and 30x30 (2022)
- ▶ Water Supply Plan 2023



- Water Supply Strategy
A few defining additions, e.g.
- Storage expansion above and **below ground**
 - Expand **groundwater recharge** and **stormwater capture**
 - Expand **water recycling**
 - Increase water **conservation and efficiency**
 - Desalination—especially the **brackish** kind

Dealing with reality

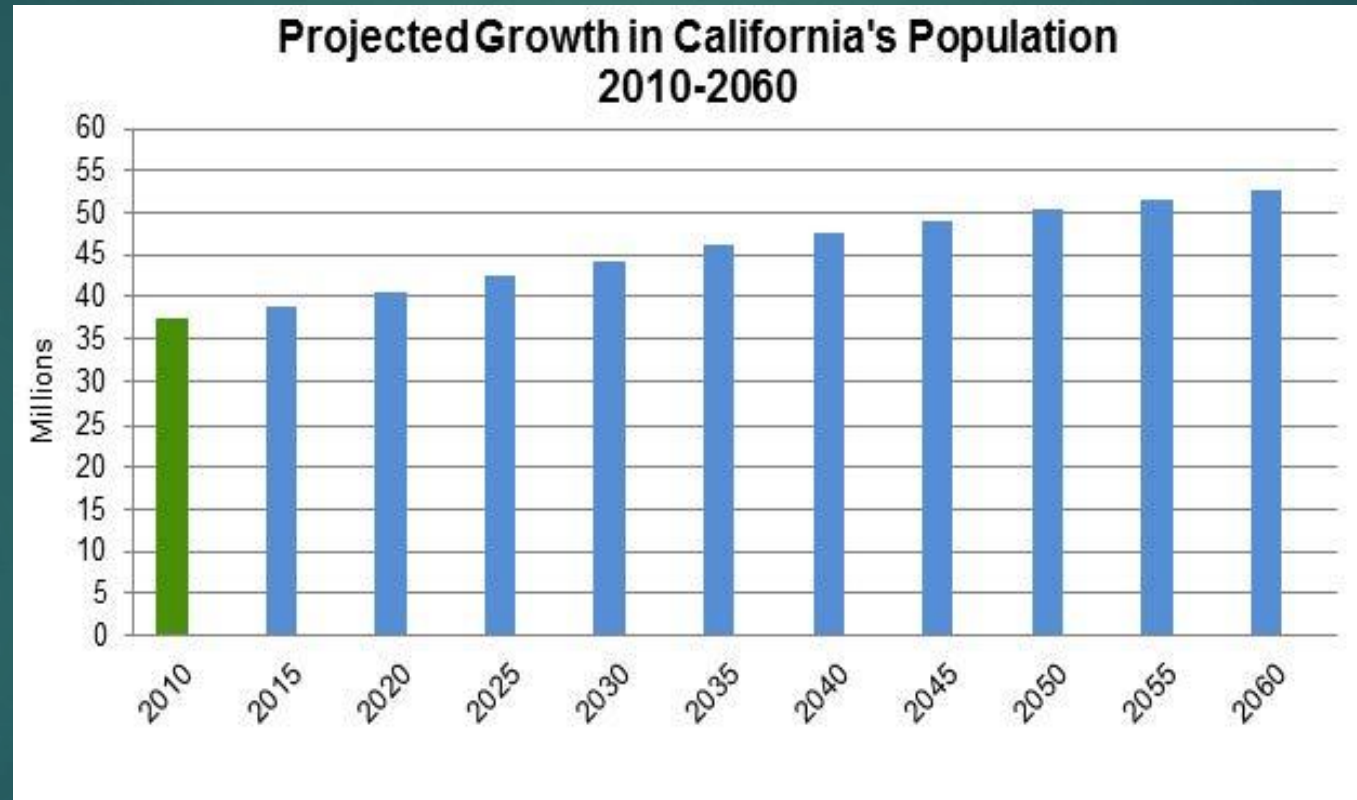
"I am a firm believer in the people. If given the truth, they can be depended upon to meet any national crisis. The great point is to bring them the real facts, and beer."



Reality: Loss of snowpack



Reality: Population will rise



Reality: Sea Level Rise





Reality: The Delta is the central challenge

The Importance of the Bay-Delta (just via the projects). 65% in total in Bay Area



Reality: Our infrastructure is aging and inadequate to the times

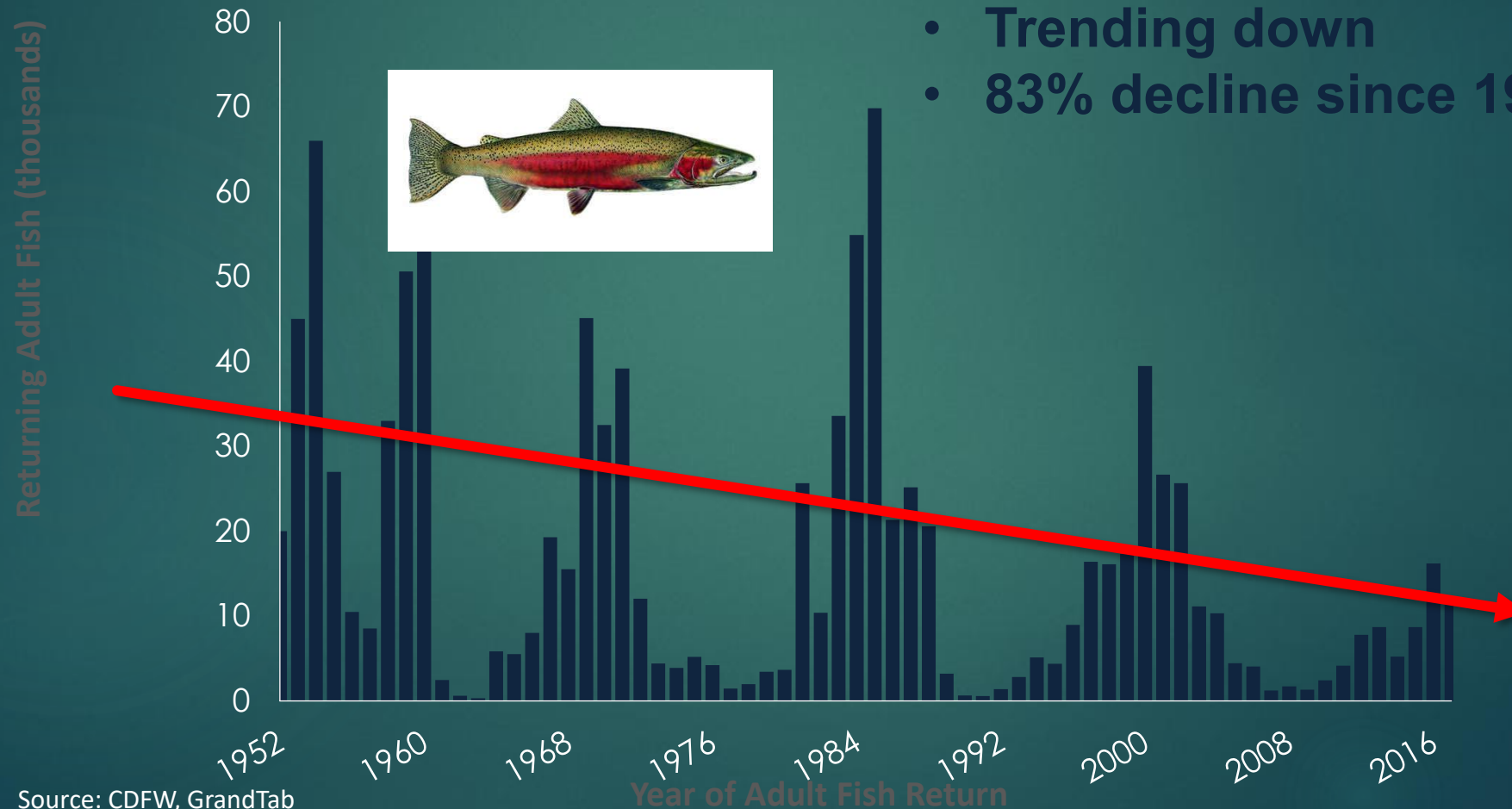


Reality: Ecosystems are in Trouble

26

Chinook Salmon Stanislaus, Tuolumne, and Merced Rivers

- Peaks declining
- Trending down
- 83% decline since 1985



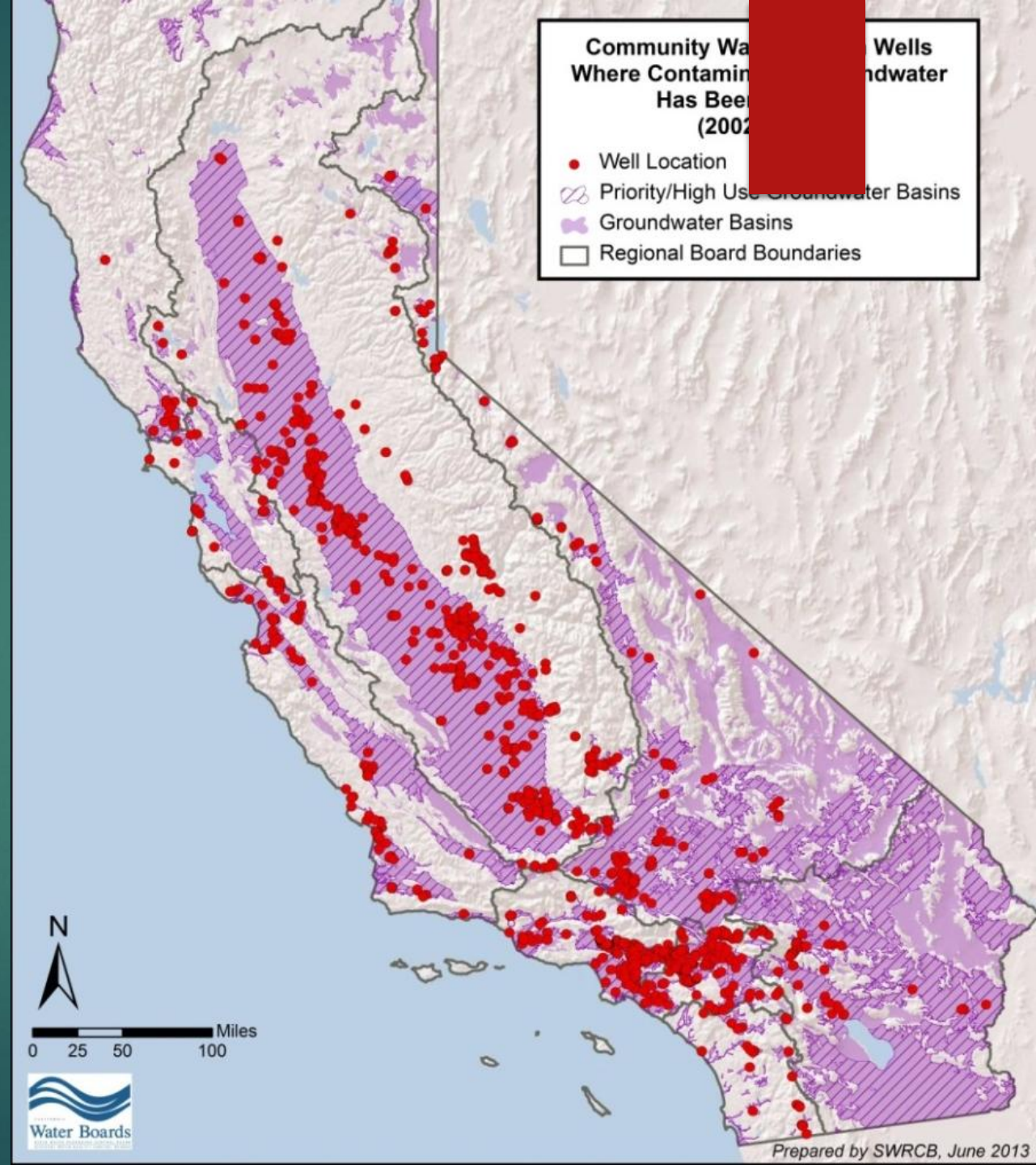
Reality: California
agriculture is precious
resource for all of us



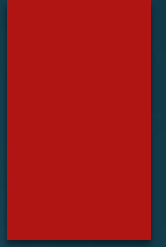
Reality: Lack of statewide groundwater management—Now *changing*



Reality: Community
Well Systems Where
Contamination has
been Detected—*now*
changing

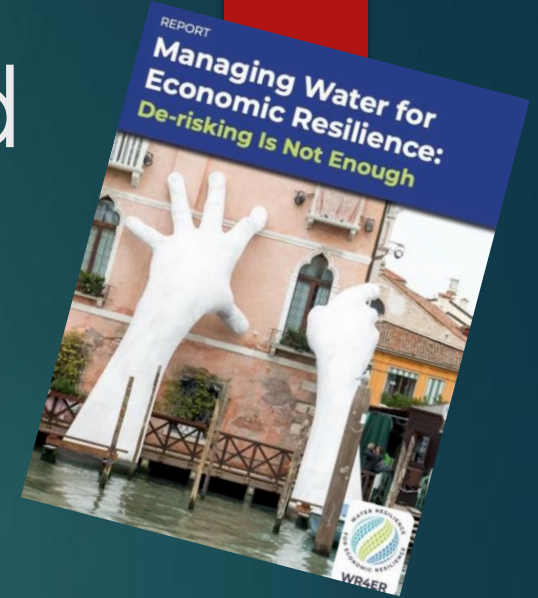


Selected State Policy Programmatic Initiatives and Innovation



State efforts (selected big lifts and innovative approaches)

- ▶ California Water Action Plan described above
- ▶ Focus on Access to drinking water (Human Right to Water)
- ▶ Sustainable Groundwater Management Act (SGMA)
- ▶ Upper Watershed Ecological Restoration for Multiple Benefits—state role but also local water agencies
- ▶ Helping Drive a Paradigm Shift on Conservation and Recycling
- ▶ Encouraging Multi-Benefit Strategic Permitting
 - ▶ Stormwater MS4 Example
- ▶ Encouraging Permitting Allowing for “Collective Implementation”
 - ▶ Sustainable Groundwater Management Act (SGMA)
 - ▶ Irrigated Lands Regulatory Program (ILRP)
- ▶ ***All supported by \$Billions in bond and budget dollars***



Prioritizing Drinking Water



HUMAN RIGHT TO WATER (2012): CLEAN, SAFE, AFFORDABLE

- Legislation/regulation
 - Transition DPH→SWRCB
 - Prop 1+
 - **Consolidation Authority—100!! 900,000 people!!**
 - Operational Funding
 - SAFER program
 - Irrigated Lands Reg. Program (discussed infra)

KEY ACTORS:

- Community Water Center
- Leadership Council for Justice and Accountability
- Clean Water Action
- New Alliance for urban and rural action
- Growth of coalition of agriculture and advocates
- Empowerment movement/equity advocates





Reality 2020/2021/2022 but we dodged a bullet 2023

Water Conservation and Efficiency

Mandatory drought conservation: 24%!

Long term efficiency standards and targets

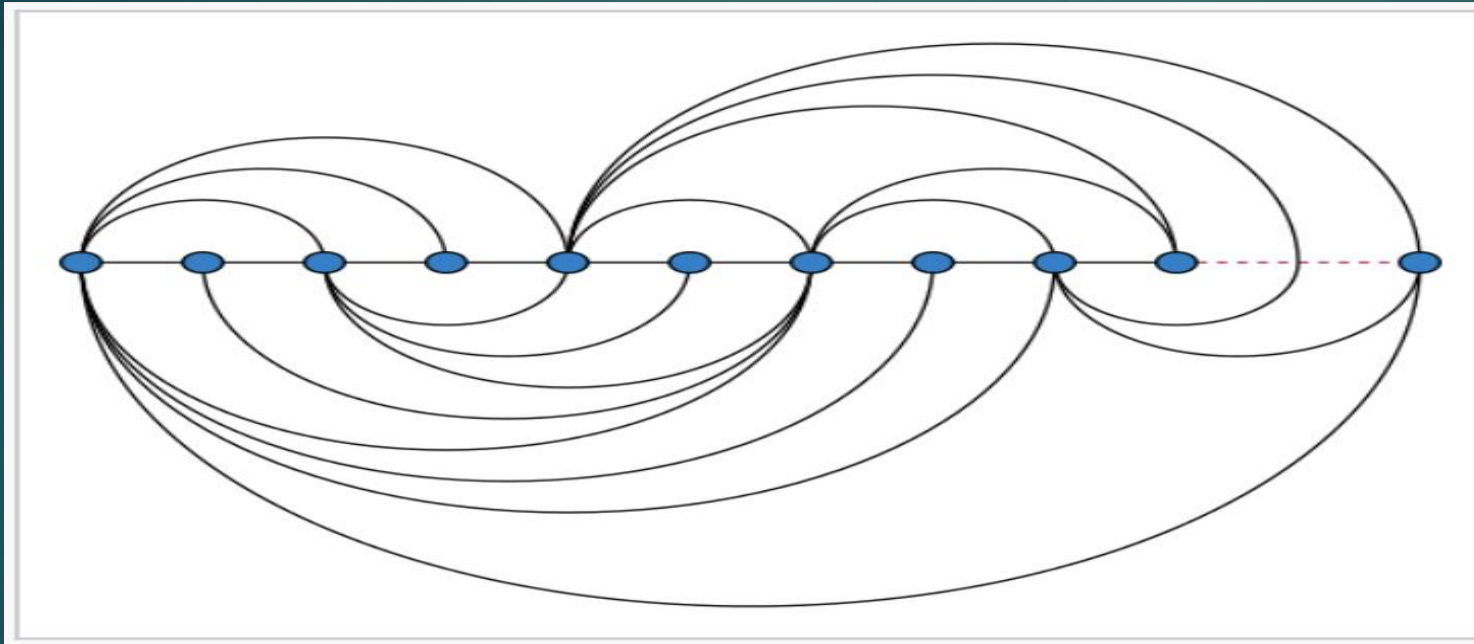
Leak standards and audits



Arc of Progress on conservation

- ▶ The arc of progress is long but it bends towards efficiency*

*With apologies to Dr. King



credit Wikipedia

1970s

- uh oh
- turn off taps
- ...yellow
- ...mellow

Early 90s

- ❖ oh no, not again!
- ❖ turn off taps
- ❖ toilet and shower retrofits

Mid 20-teens

- ✓ holy crap!
- ✓ worst in 500 years, no 1100 years, no. Just no.
- ✓ mandatory urban conservation

Just yesterday

- wait, not again?
- hotter, drier, 1200 years. Sierras and Colorado

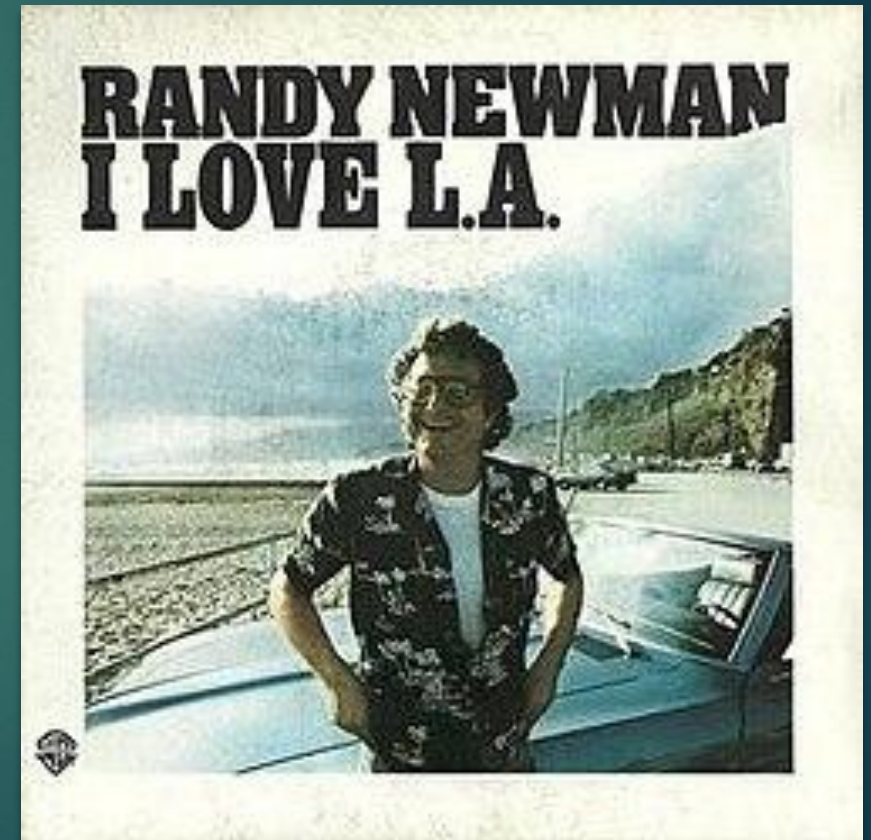
Recycling arc -- on steroids—with a little regulatory help



- ▶ LA County Sanitation Districts (with WRD) since 1962 at inland plants
- ▶ Orange County Water District/Orange County San 130 MGD DONE(IPR)
- ▶ San Diego – Pure Water San Diego (res aug)
- ▶ City of Los Angeles—inland for years, now Pure Water LA 230 MGD (IPR-DPR) + DCT expansion (25-45 MGD) (IPR)
- ▶ Metropolitan Water District/LA County Sanitation Districts 150 MGD (IPR-DRP)
- ▶ And a whole bunch of others from purple pipe to IPR to DPR; Whole SAWPA region
- ▶ Innovative funding in the works (see infra)
- ▶ *Role of state regulation: Timeline, expert panels, public process*
 - ▶ *GW recharge, ag use, IPR, DPR (2023), Onsite on the way. Predictability and scalability*
 - ▶ *Plus \$\$\$\$*

Selected local efforts

- ▶ Big visions—Southern California and San Francisco Bay Area
 - ▶ Wastewater Recycling; stormwater capture/multi-benefits and nature-based solutions
 - ▶ Sea level rise: using nature-based solutions in tandem with sea walls
- ▶ Challenge in all cases is how to deal with governance and finance of expensive, multi-benefit projects necessary to adapt to climate change
- ▶ Will give a taste of broader efforts with more emphasis on LA as example

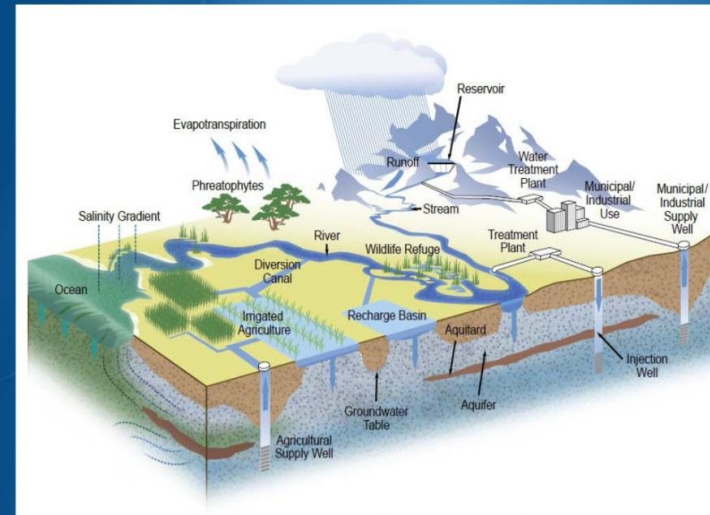


Key to future is integration and local and regional leadership

Efficiency/Recycling/Stormwater Capture/Parks+

- ▶ Santa Ana River Watershed/Orange County
- ▶ San Diego
- ▶ Los Angeles
 - ▶ LA
 - ▶ Met
 - ▶ LA County
- ▶ Sacramento writ large
- ▶ Santa Clara County/SF Bay agencies/Google et al
- ▶ San Joaquin Valley
 - ▶ Del Puerto
 - ▶ Brackish

A Call to Integrate Interconnected Systems Require Integrated Solutions



Greater LA

- ▶ **Greater Los Angeles mega-region:**
 - ▶ Climate adaptation in a **water scarce region**
 - ▶ Three key emerging players: Metropolitan, City of LA, County of LA (building on Orange County lead). San Diego important neighbor on cutting edge.
 - ▶ Largest recycled water projects for potable reuse in the world
 - ▶ Massive stormwater program for multiple benefits of water supply, flood control, water quality, and urban greening.
 - ▶ Above ground LA County will be transformed--and below ground it will too.
- ▶ Relationships have evolved and are central to success
 - ▶ “Ecosystem management” is the key to success
 - ▶ “that woman” to “will you please come to our charrette?”
 - ▶ UNESCO Megacities for Water and Climate (ask Kuldip!)



Greater LA trifecta

► City of LA-4 million

- 4 million
- Mayor Garcetti—Green PLAN, including ambitious water directive with direction to achieve 70% local water by 2035, where it was 5 in 2015
- LADWP and LASan partner for largest recycling facility in the world Pure Water LA. 100% goal.
- 230 MGD potential
- Prop O \$500 m demonstration for stormwater multi-benefit

► Metropolitan Water District of Southern California (w/LA County Sanitation Districts)-19 million

- 20 million served in whole or in part
- Largest wholesale water district in the nation
- Historically the imported water people
- Now shifting to greater overall responsibility, including taking on massive water recycling itself (150 MGD potential)
- Nearly \$400 m for lawn rebates last drought

► County of LA-10 million

- Inspiration from Australia
- \$300 m/yr in perpetuity for multi-benefit stormwater capture and quality. "Safe, Clean Water program. Measure W.
- Flood control, water supply/groundwater augmentation, water quality, and much needed greenspace
- Key element—equity in allocation and governance

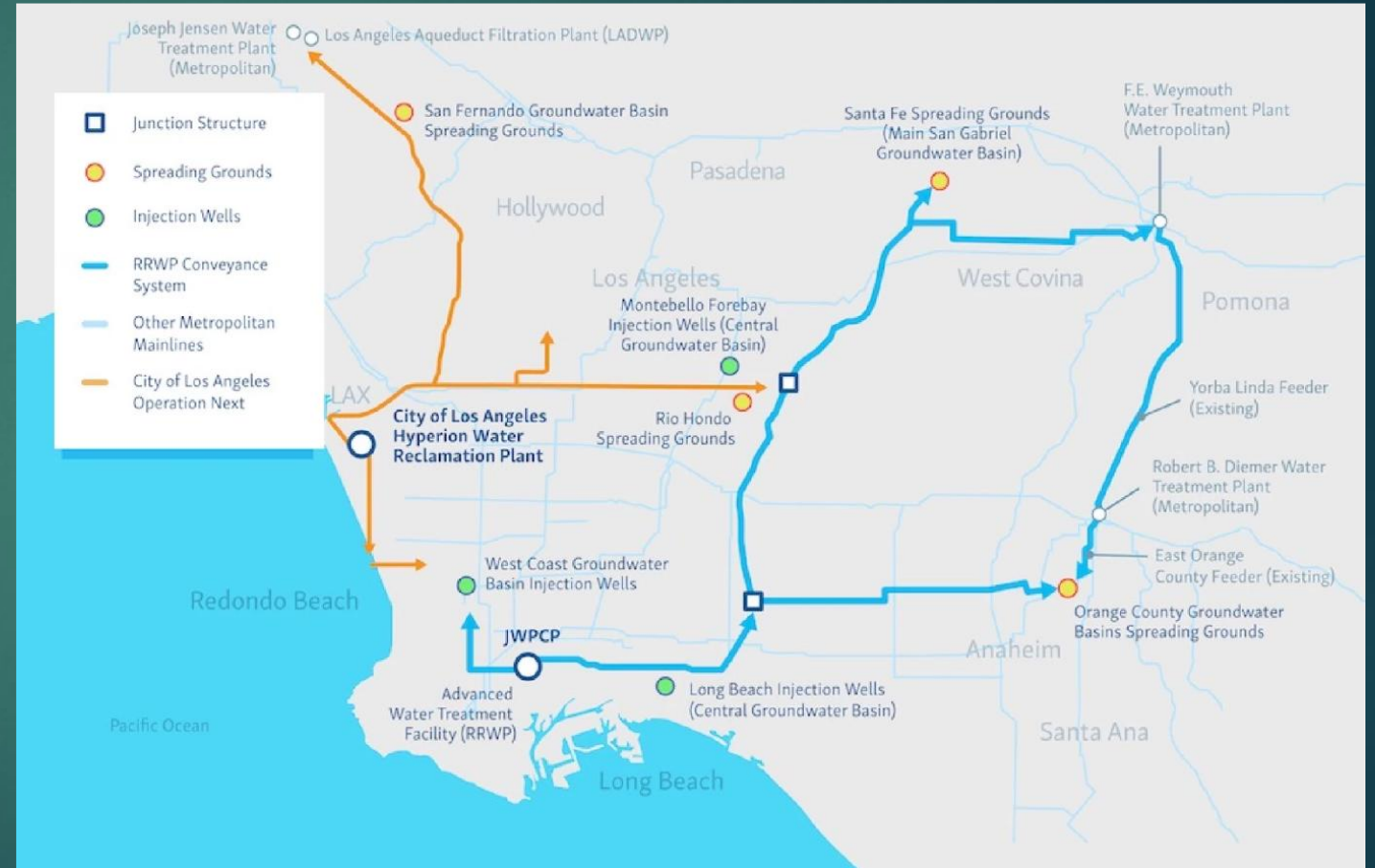
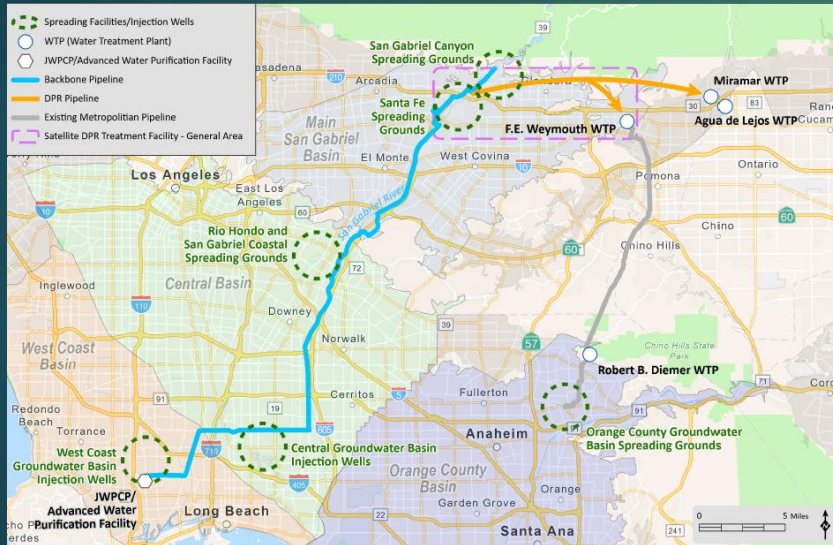
***"Our relationship with
water has to evolve."***

Los Angeles

Mayor Eric Garcetti, October 14, 2014



Potential Full-Scale Regional Program...locally





Not just massive Southern California scale—not to infinity, but beyond where anyone has gone before



Hyperion Treatment Plant

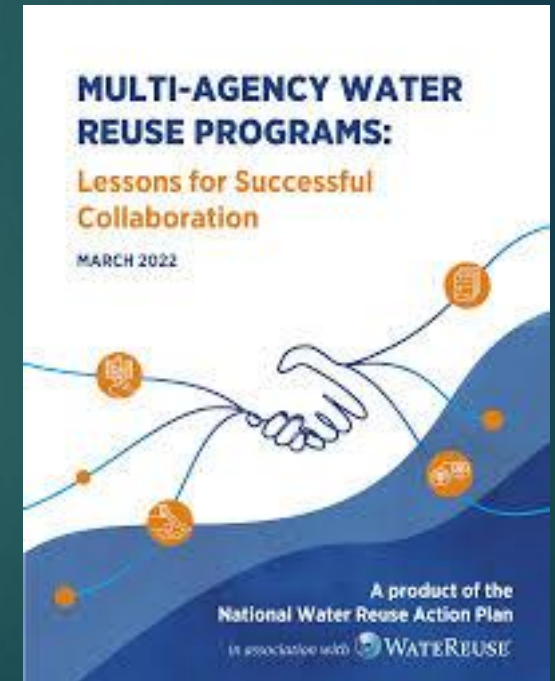
now Hyperion Water Reclamation Plant



- ▶ “Taking care of your business since 1896”
- ▶ Screening plant, 1925
- ▶ Aldous Huxley, *Ode to a Satyr*, 1959
- ▶ Heal the Bay saga, from depths to international acclaim: 1985-1990s
- ▶ 1980s Dry weather overflows to 420 MGD rated facility
- ▶ Current average flow 250-270 MGD; wet weather flow over 700 MGD
- ▶ 2019 Mayor Garcetti—100% recycling by 2035 as part of LA Green Plan update (230 MGD)
- ▶ 2021 spill and recovery ongoing
- ▶ Reboot and reconsideration of optimum size and phasing under Mayor Bass ongoing
- ▶ Serves 3-4 million pop; separated system, but has taken and considering taking some stormwater flow.

But challenging—

- ▶ Collaboration between Wastewater and Water Supply programs
- ▶ Collaboration with neighboring water agencies
- ▶ Issues:
 - ▶ Who pays for what
 - ▶ Who controls the treatment
 - ▶ How to size to balance env and economic issues
 - ▶ Who manages regulatory program
 - ▶ Who manages stakeholder engagement





One example—how to size and phase a 230 MGD program?

- ▶ What are we aiming at?
 - ▶ With Climate Change—all predictions are out the window, such as they were
 - ▶ We do know more frequent and drier dries, punctuated by deluge
 - ▶ And, that we may see extremes that require response and recovery on both ends of the spectrum
- ▶ Approach
 - ▶ DWP “Resilience Plan”—#s and need; plus integrated risk assessment
 - ▶ Feasibility study—to developed “preferred alternative”
 - ▶ **Linkage with DCT 25-45 MGD IPR expansion (photos left)**
 - ▶ Assessing Hyperion’s Hydraulic capacity
 - ▶ Separated system but I&I significant, as is build up through vast system with tremendous conservation gains (2021 spill example)
 - ▶ Treatment types and locations
 - ▶ Where are the “buckets”? E.g., San Fernando groundwater basin, Central/West Basin, LA Filtration Plant. What can they handle and how long will it take to get there.

Stormwater capture and multi-benefit projects at scale—with a little *regulatory help*



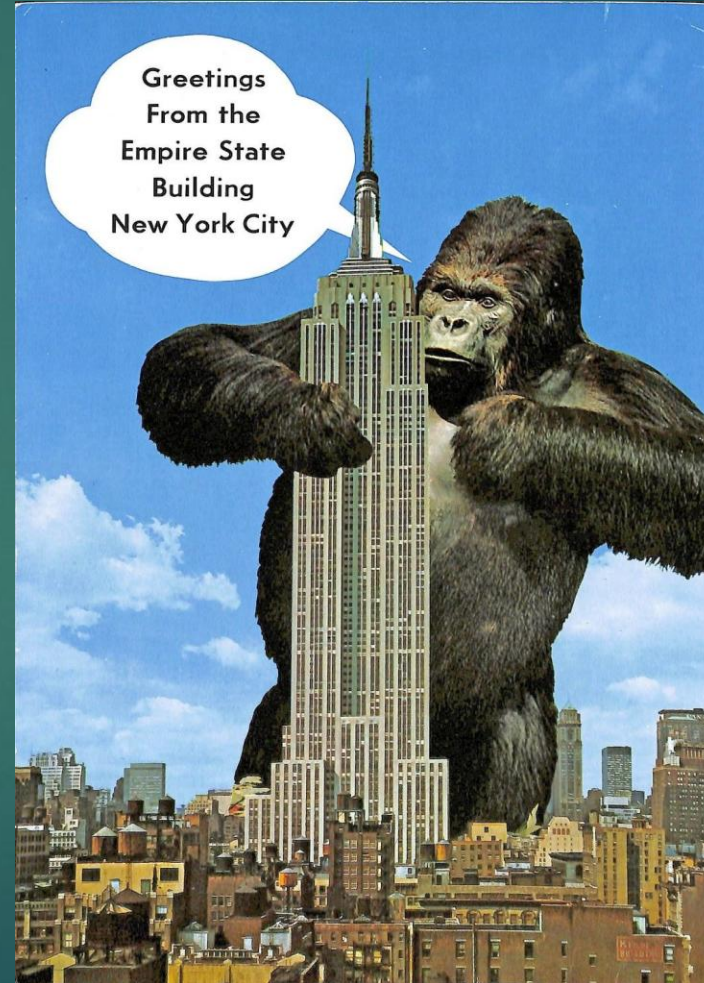
**Save the rain.
Save L.A.**

YES ON W

- ▶ Australia as inspiration—1980s+
- ▶ LA City Stormwater program early 90s
- ▶ TreePeople pilot with LA County Public Works 90s for \$90+million
- ▶ Proposition O – City of LA \$500 million of pilot water supply/water quality projects 2000s
- ▶ Measure W – 2020? \$300 million in perpetuity for multi-benefit stormwater capture for water supply, water quality, flood control, and urban greening. Clean, Safe Water program.
- ▶ Plus:
 - ▶ On top of decades of large scale capture across region LA County, San Gabriel Valley, Orange County
 - ▶ MS4 permit gives some incentives for “enhanced” watershed work that provides multiple benefits. Key will be meeting water quality goals with it.

Urban Sustainability challenge & opportunity : Sea Level Rise

- ▶ 2/3 economic impact of entire state
- ▶ 9 counties; 100 cities
- ▶ Bay Area analog to LA Measure W
- ▶ Measure AA--\$500 million
- ▶ Seawalls vs. wetland restoration
- ▶ 200+ Empire State Buildings of fill in area where any fill was a no-no
- ▶ Bay Restoration Authority



Adaptation Atlas





Integrating natural processes



UC DAVIS & THE DELTA SCIENCE PROGRAM PRESENT

MEETING NATURE HALFWAY ON A FLOODWAY

THE YOLO BYPASS AS A RECONCILED ECOSYSTEM

A SCIENCE SYMPOSIUM
Free and open to the public

SAVE THE DATE

TUESDAY, DEC. 9, 2014
UC DAVIS CONFERENCE CENTER
BALLROOM B
9 AM - 5 PM

The Delta Science Program | UC Davis Center For Aquatic
Biology & Aquaculture (CABA) | UC Davis Center for
Watershed Sciences

Forests and Water in the Sierra Nevada: Sierra Nevada Watershed Ecosystem Enhancement Project

Roger C. Bales, John J. Battles, Yihsu Chen, Martha H. Conklin, Eric Holst, Kevin
L. O'Hara, Philip Saksa, William Stewart

November 29, 2011



Sierra Nevada Research Institute,
UC Merced

Center for Forestry,
UC Berkeley

Environmental Defense
Fund

Data and Technology help on the people side and can bring hope



© Can Stock Photo - csp3794701

- ▶ Atmospheric river predictive capacity
- ▶ Technological breakthroughs for treatment that work better and save energy
- ▶ Measurement and reporting, especially when transparent
- ▶ Sensors
- ▶ Telemetry
- ▶ "Big Data"
- ▶ Long-term planning with
 - ▶ Real numbers! (TX)



How do we get there?

- ▶ Clear-eyed focus on the decades ahead vs. the decades behind us
- ▶ Focus on Reality vs. Rhetoric; Practical vs. Theoretical
- ▶ Embrace complexity—especially multi-benefit approaches
- ▶ Action over Stasis
- ▶ Convergence over Conflict
- ▶ “All of the Above” vs. “Either/Or”
- ▶ Governance and Finance have to be elevated
- ▶ Ag and Urban, Ag and Ecosystem, North and South, the Delta and the Projects, Agriculture and Safe Drinking Water

Sustainability and Resilience Differ; Both differ based on location

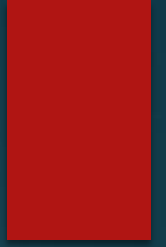
- ▶ You have awesome wastewater and stormwater programs—scale, sophistication.
- ▶ What are the new challenges facing the region under climate change? E.g., we have earthquakes, drought, occasional flooding, and now increased wildfire is seared into our systems. What is it for the Greater Chicago region? Even bigger floods?
- ▶ How have you financed your enormous system and ambitions?
- ▶ What is relationship with water agency?
- ▶ Adaptation to the future requires going way beyond what is required by law—how have you communicated that need?



Thank you!!!



Extra slides



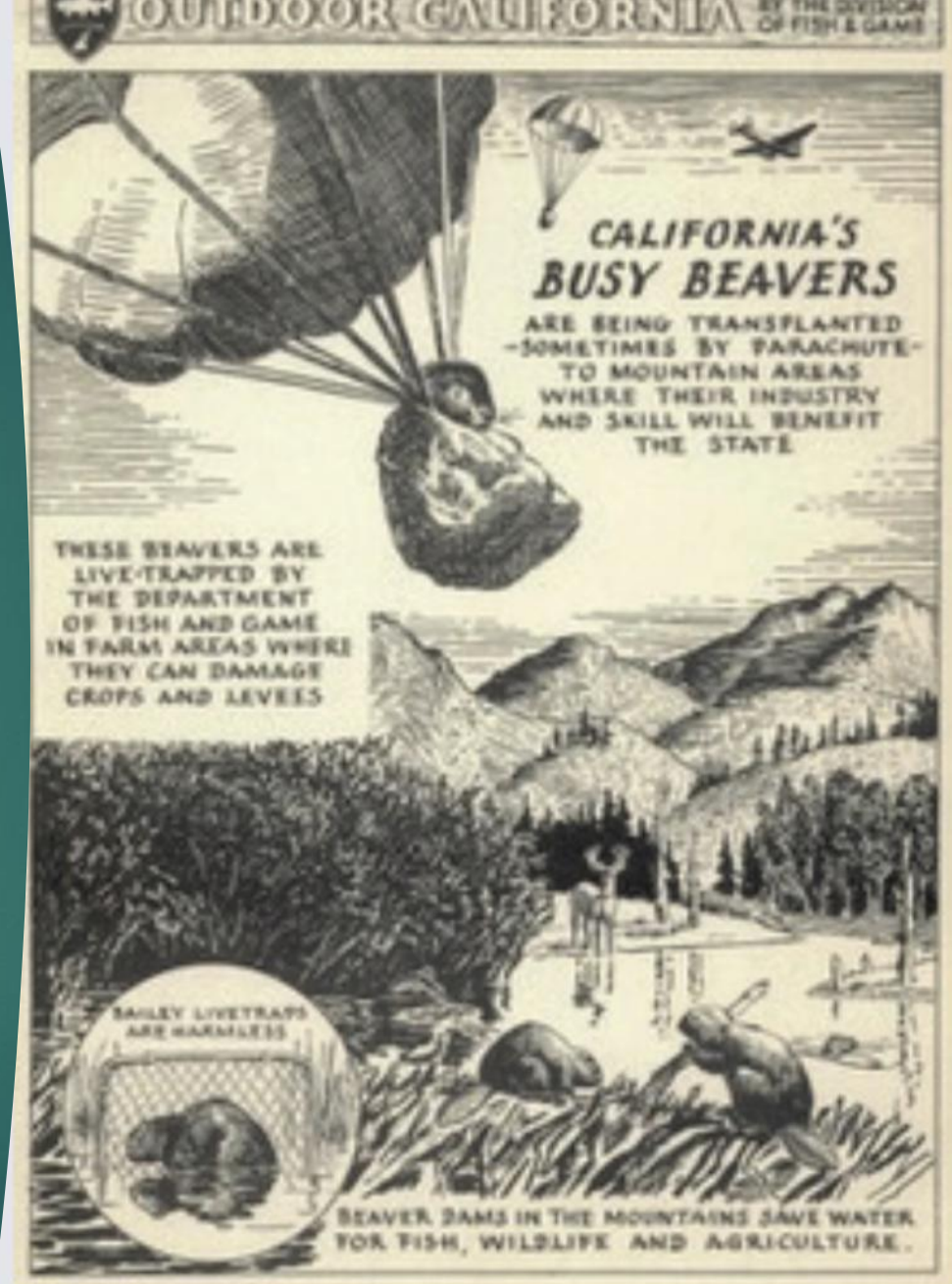
The challenge is as much
“egosystem management” as
“ecosystem management”

Like a chicken talking to a duck...
就像一只鸡和一只鸭子说话



Other distinctive efforts:

- ▶ Nature-based Solutions (NbS)
- ▶ Water Efficiency Regulations (at last!)
- ▶ Consideration of permanent limitations on "non-functional" turf
- ▶ SGMA implementation – the long haul
- ▶ Land Repurposing to deal with SGMA impacts
- ▶ Tribal Co-Management and other efforts
- ▶ Klamath Dam Removal
- ▶ Water Plan Updates
- ▶ Central Valley Flood Plan
- ▶ Water Rights "Modernization"



Occidental, 2022

Reality: We've done a lot about it but still a long way to go

Progress

- ▶ Water conservation public response (24%!) and Water Efficiency Legislation
- ▶ Safe Drinking Water legislation and funding
- ▶ Statewide Groundwater management legislation and progress
- ▶ Recycled Water paradigm shift
- ▶ Stormwater Capture acceleration
- ▶ Updated standards for preventing pollution in agriculture
- ▶ Modest Bay-Delta progress?

Much much more to do

- ▶ Water quality HUGE needs—PFAS/PFOA, Chromium 6, Lead, Nitrates, Salinity, vestigial contaminants/ongoing contaminants
- ▶ Water rights 19th century, infrastructure 20th century; problems 21st century
- ▶ Ecosystems in crisis
- ▶ Water system fragmentation/politicization
- ▶ Bay-Delta, Safe Drinking Water implementation, SGMA implementation
- ▶ Climate adaptation in face of drought, catastrophic wildfire, and inevitable record floods

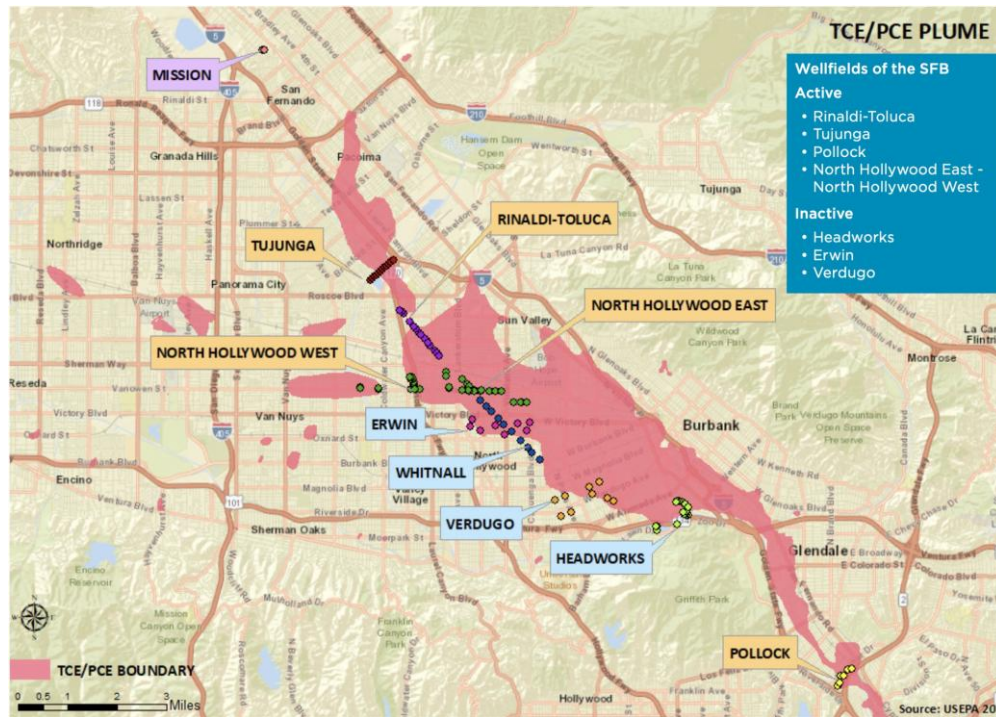
Spotlight: Bay-Delta

BAY-DELTA:

- *CONFLICT OF THE AGES BETWEEN AG/URBAN/
ENVIRONMENT/COMMERCIAL FISHERIES
- *ALSO *BETWEEN* WATER USERS
- *PLUMBING, SURE, BUT ALSO TRUST AND OPERATIONS
- *WATER QUALITY CONTROL PLANS/ STATUS/"VOLUNTARY
AGREEMENTS"
- *TUNNELS, CANALS, ALTERNATIVE CONVEYANCE



Groundwater Remediation and Recharge



San Fernando Valley Groundwater Plume Remediation






"Water is the
driver of nature."
Leonardo da Vinci
Artist and Engineer

Pure Water
San Diego

Pure Water
San Diego



safe, reliable, sustainable

Goal:
producing
1/3 of our
water supply

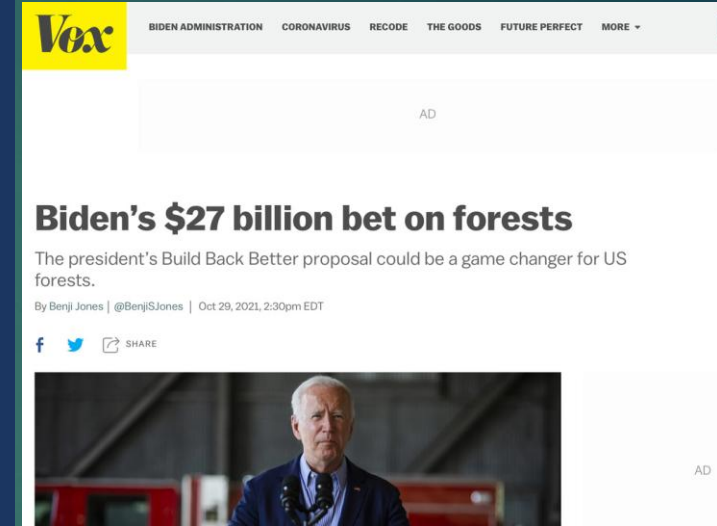
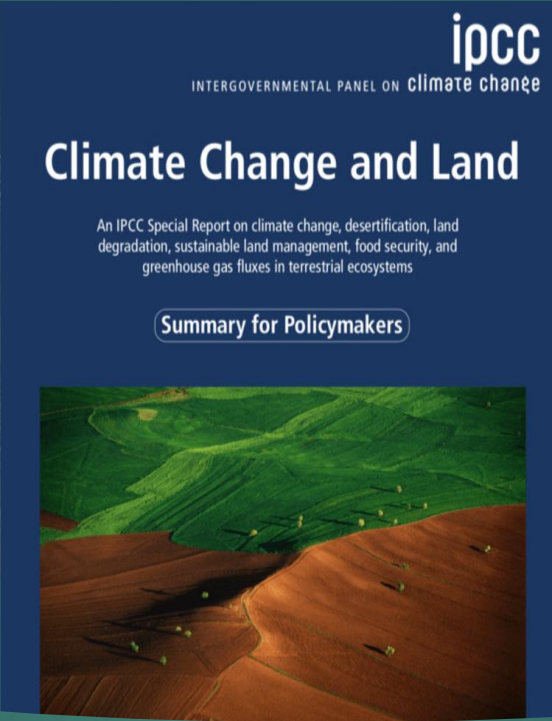


Regional Projects



Distributed Projects

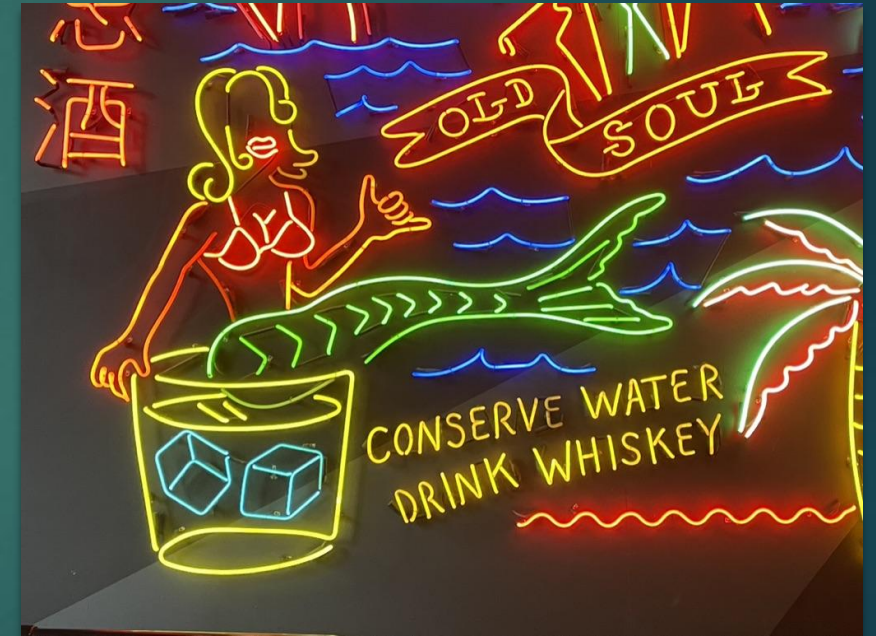




International and National levels see NBS as critical to meeting climate targets

California dreamin'

- ▶ Cap and Trade: Billions to forest projects, millions to mountain meadow/wetland restoration, healthy soils.
- ▶ 2019 Natural Working Lands Draft Plan
- ▶ 2022 Scoping Plan Update
- ▶ 2022 Climate Smart California Plan
- ▶ Current process: Going for it
 - ▶ Inspired by international
 - ▶ Acknowledging land-based emissions exceed fossil fuel emissions—can't get there from here without it
 - ▶ Scoping plan update (ongoing)
 - ▶ Finalized Climate Smart California Plan (CNRA)
 - ▶ Both explicitly relying on multiple benefit solutions as good public policy
 - ▶ Still long way to go



Forests are the ultimate multi-benefit: carbon, water,
life and limb

Learn more about this TNC partnership win: bit.ly/yubaforest.



SYRCL and 6 others

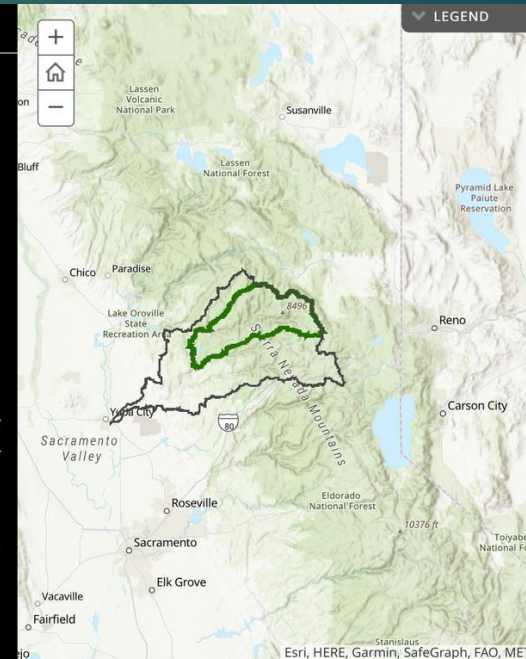
10:29 AM · 9/16/21 · [Twitter Web App](#)

A Story Map

North Yuba Forest Partnership

Last Updated 2/23/2021

Land Acknowledgement: The North Yuba Forest Partnership recognizes that the North Yuba River watershed resides within the Ancestral and Traditional homelands of the Nisenan Tribe and intertribal regions of the Mountain Maidu, Konkow and Washoe. These Tribes exist today and retain their relationships with the forest. We commit to the continued inclusion of their voices in this project.





Treated forest (left) and untreated forest (right), Greyhorse Valley, California. Part of French Meadows Partnership program, central Sierra Nevada. Treated forest on left still approximately 2X more dense than pre-fire suppression.
Credit: Roger Bales, UC Merced.

“...a billion burnable acres”

For PDH Certificate seekers,

The link to the new on-line course evaluation form has been posted in the Chat. The link is also available on the District website. The form will **only** be available online until the start of next month's seminar. Please be sure to fill it out and submit promptly.