CALIFORNIA’S WATER SYSTEM
HOW IT WORKS AND WHY IT DOESN’T

SARGE GREEN, PROJECT DIRECTOR
CALIFORNIA WATER INSTITUTE
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USGBC CENTRAL CALIFORNIA CHAPTER
Water Variability

Yearly Total Delta Outflow
(Calendar Year)

Average annual runoff (land area)
- 66% (20%)
- 24% (20%)
- 9% (20%)
- 1% (10%)
- 0.1% (30%)
BACKGROUND

• FRESNO STATE WATER PROGRAMS
  • CIT
  • CWI
  • ICWT
FOUNDATION OF WATER USE

- HOW MUCH DO YOU PAY FOR WATER?
- USUFRUCT – ROMAN TERM
- PRINCIPLE IN COMMON LAW – ARTICULATED BY JEFFERSON IN 1789 IN LETTERS TO MADISON DURING CONSTRUCTION OF THE CONSTITUTION
- CONCISELY ARTICULATED IN NAPOLEONIC CODE OF 1804 WHICH INFLUENCED CALIFORNIA CONSTITUTION AND COMMON LAW
APPROPRIATIVE RIGHTS

- STARTED WITH GOLD MINING – MINERS APPROPRIATED BOTH THEIR MINE CLAIM AND WATER TO SORT FOR GOLD

- FIRST IN TIME, FIRST IN RIGHT ESTABLISHED

- LIMITED TIME OF MINING ERA DID NOT ESTABLISH MANY LONG TERM WATER RIGHTS OR EXTINGUISH THE WATER AS IN THE CASE OF EVAPORATION IN AGRICULTURAL CROP GROWING
RIPARIAN RIGHT

- FROM ENGLISH COMMON LAW
- USE OF THE WATER ON ADJACENT LAND ONLY WHEN WATER IS FREE FLOWING, NO STORAGE OR DRY SEASON USE
- STAYS WITH THE PROPERTY UNLESS SEVERED BY PROPERTY DIVISION THAT CUTS OFF A PARCEL FROM THE ADJACENT STREAM
- NOT ORIGINALLY LIMITED IN USE, TOTAL FLOW COULD BE TAKEN WITHOUT REGARD TO WASTE – CONSTITUTIONAL AMENDMENT CHANGED TO “REASONABLE AND BENEFICIAL USE”
APPROPRIATIVE V. RIPARIAN

• IN 1850 CALIFORNIA CONSTITUTION ADOPTED WITH ENGLISH COMMON LAW AS FUNCTIONAL BASIS

• DOCTRINE OF APPROPRIATION ADOPTED ONE YEAR LATER AS PRIMARY WATER RIGHTS SYSTEM

• CONFLICT AROSE IN KERN COUNTY BETWEEN RIPARIANISTS MILLER AND LUX V. APPROPRIATOR HAGGIN

• MILLER AND LUX WON BUT QUICKLY SETTLED WITH A PLAN TO SHARE THE KERN RIVER FLOW WITH HAGGIN
PRE-1914 AND POST-1914 WATER RIGHTS

• In 1914 new law set up permit process for obtaining a water right

• Focused on appropriation

• Riparians are superior to all but a few appropriators but also subject to the correlative right or “proportionate share” requirement

• Appropriators are categorized from senior to junior, junior get cut off first
GROUNDWATER RIGHTS

• Right of use, not ownership, related to overlying land
• Shared among all users equitably if shortages occur
• If water is available beyond the needs of shared users, groundwater can be appropriated but is junior and can be stopped to protect correlative users
• Same reasonable and beneficial use requirements as surface water
• No permit system in CA as for surface water
THE WRIGHT ACT OF 1887

• FORMED PUBLIC IRRIGATION DISTRICTS WITH EMINENT DOMAIN AND BONDING ABILITY – 49 STARTED

• FIVE OF THE ORIGINAL DISTRICTS SURVIVE TODAY
  • MODESTO
  • TURLOCK
  • BROWNS VALLEY
  • ALTA
  • TULARE
THE ALAMO RIVER AND THE ALL-AMERICAN CANAL

- ALAMO RIVER - DIVERTED COLORADO RIVER WATER TO THE IMPERIAL VALLEY THROUGH MEXICO = PRE-1914 RIGHTS FOR IID
- CANAL FAILURE CREATED THE SALTON SEA IN 1905 TO 1907
- US BUREAU OF RECLAMATION FORMED UNDER RECLAMATION ACT OF 1902
- BUREAU CONSTRUCTED IMPERIAL RESERVOIR/DAM AND RE-ROUTED CANAL INSIDE THE BORDER = ALL-AMERICAN
California Water Supply Systems

1998-2010 average Applied Water. Does not include reuse or recycling. Quantities vary by year.
Los Angeles Aqueduct (1908)
Mokelumne Aqueduct (1929)
Colorado River Aqueduct (1932)
Lake Mead and Lake Powell Storage

Water Years 2000 - 2007

Lake Mead

Full Domestic Surplus

Lake Powell
AVERAGE RIVER FLOW COMPARISON

• SACRAMENTO = 38 MILLION ACRE-FEET/YEAR

• COLORADO = 15 MILLION ACRE-FEET/YEAR

• SAN JOAQUIN = 10 MILLION ACRE-FEET/YEAR
Central Valley Project (1937)
State Water Project (1960)
Importance of the Bay-Delta

- Supplies Bay Area, Central Valley & So. California

- Bay Area – 33%
- Kern County – 23%
- Southern Cal – 30%

Some regions up to 100% dependent on the Delta
Importance of the Bay-Delta

- 2/3 of California (22 million residents) rely on Delta water
- Supplies Bay Area, Central Valley & So. California
- Irrigates 45% of the fruits & vegetables produced in US
- 80% of the state's commercial fishery species live in or migrate through the Bay-Delta
- Habitat for 500 species, including 5 ESA listed species
How Water Gets to the California Economy

1. Sac River
   - Delta Cross Channel
   - Mokelumne River
   - Old & Middle Rivers

2. San Joaquin River

3. Sac River / West Delta

SWP Pumps

CVP Pumps
Land Subsidence
Due to Farming & Peat Soil Oxidation

Subsidence
- ~1.5 ft. per decade
- 30 ft. in some areas

Elevation Color Codes
- 30 feet
- Sea Level
Key Delta Risks

Fishery Declines
Delta smelt


Seismic Risk
Bay Area Faults

Flooding Risk
Jones Tract (2004)
Climate Change Uncertainty

Golden Gate Annual Average and 19-Year Mean Tide Levels

Past (1900 – 2000) + ½ ft sea level rise

Future (2000 – 2100) ½ to 3 ft sea level rise
GROUNDWATER

- LOCATIONS
- CONDITIONS
- WATER QUALITY
- NITRATES AND THEIR IMPACTS ON USES
- GROUNDWATER MANAGEMENT STRATEGIES
California’s Groundwater Basins

- 515 alluvial basins/subbasins
- About 30 to 40% of state’s water supply
- Basins, precipitation, population, and demands are not evenly distributed
Statewide Groundwater Use

2005-2010 Average Annual: 16,567 (TAF)

- Agriculture: 12,656 TAF
- Urban: 3,658 TAF
- Managed Wetlands: 253 TAF

Source: California Water Plan Update 2013
GROUNDWATER CONDITIONS

Figure B9. Simulated cumulative annual changes in aquifer-system storage between water years 1962 and 2003 for the Central Valley, California.
REGIONAL GROUNDWATER CONDITIONS

Depth To Groundwater Spring 2009

Legend
GWSW 2009 Spring ft.
High : 14.7353
Low : -1340.96

GW Rechargeable Soils

Cities
Counties

Map produced by California Water Institute and Geospatial Information Center at California State University, Fresno. August 2011
GROUNDWATER QUALITY

• Salinity, boron and sodium are the main issues for agriculture

• Drinking water regulations have made groundwater less attractive for community systems – arsenic, uranium and chromium will continue to cause issues for systems, especially in disadvantaged communities because treatment costs are unaffordable
ARSENIC
NITRATES

- NITRATES ARE ALSO A CONCERN FOR DRINKING WATER

- HIGH NITRATES HAVE RESULTED IN NEW REGULATORY PROCESSES FOR IRRIGATED AGRICULTURE SINCE IT HAS BEEN IDENTIFIED AS THE SOURCE IN MANY SHALLOW GROUNDWATER AREAS
Factors Contributing to Uncertain Water Supply

• Increasing population
• Aging infrastructure
• Groundwater overdraft
• Degraded ecosystems
• Increasing conflict
• Uncertainty due to climate change
Chronic Under-investment in Water Infrastructure

Much of CA’s water infrastructure over 100 years old

- More than 1,300 local, state, and federal reservoirs
- 2 major water development systems
  - SWP: 34 reservoirs, 25 dams, 20 pumping plants, 4 pumping-generating plants, 701 miles of canals and pipelines, 1,595 miles of levees
  - CVP: 20 dams and reservoirs, 11 power plants, 500 miles of major canal as well as conduits, tunnels, and related facilities

California has a $12 billion annual deficit in funding for critical water infrastructure
Solving California’s Water Crisis

• No region’s water supply is self-sufficient
• Water management actions and issues are interconnected
• No single strategy can meet all needs
• Integrated, diverse strategies needed
Achieving sustainable water management through:

1. **Efficiency**: Make every drop of water count
2. **Groundwater**: Improve groundwater management
3. **Rivers**: Protect and restore river systems
4. **Integrated Management**: Promote regional solutions
Improve Water Use Efficiency

• Advance water use efficiency practices and technologies
  – Agricultural efficiency
  – Urban efficiency

• Promote new regional water supply opportunities
  – Recycled water (purple pipe)
  – Stormwater capture
WATER MANAGEMENT OPPORTUNITIES

- WATER USE EFFICIENCY – 5.0 MAF
  - URBAN EFFICIENCY – 2.1 MAF
  - AGRICULTURAL EFFICIENCY – 0.6 MAF (0.33 MAF)
  - REUSE AND RECYCLING – 1.5 MAF
  - STORMWATER CAPTURE - 0.8 MAF

- CONJUNCTIVE MANAGEMENT AND GROUNDWATER STORAGE – 1.0 MAF

- ESTIMATED COST TO ACHIEVE 6 MAF – $4-7 BILLION
IMPROVE GROUNDWATER MANAGEMENT

- IMPROVE REGIONAL MANAGEMENT
- ELIMINATE OVERDRAFT
- INCREASE SUPPLIES
RESTORE RIVER SYSTEMS

- INTEGRATED FLOOD MANAGEMENT
- RESERVOIR RE-OPERATION
ADVANCE INTEGRATED WATER MANAGEMENT

• PROMOTE NEW AND BROAD-BASED COALITIONS

• DEVELOP LONG-TERM FUNDING

• SUPPORT INTEGRATED RESOURCE PLANNING

• PROMOTE INNOVATIVE TECHNOLOGIES
Why IRWM?

- Water management actions and issues are interconnected
- Issues don’t obey political boundaries
- A variety of entities are responsible for different actions
- IRWM promotes a sustainable, efficient approach to water management by bringing together interests, issues, and solutions
Integration Considerations

- Water quality and quantity
- Demand management and supply enhancement
- All beneficial water uses
- Upstream, downstream, and instream effects
- Land use, energy, and other resources
- Broad societal costs and benefits
THE 2011-2014 DROUGHT

• THE CURRENT DROUGHT IS HISTORIC

• NUMEROUS AGRICULTURAL AREAS IN THE SAN JOAQUIN VALLEY WILL HAVE A “ZERO” ALLOCATION FOR THE FIRST TIME EVER

• EVEN WATER RIGHTS AREAS WILL BE AT THE LOWEST ALLOCATION LEVEL SINCE THE MODERN RESERVOIRS ADDED STORAGE TO METER OUT WATER
Public Water Agencies
South Central Region
California Department of Water Resources
Groundwater Elevation Differences Between 1980 and 2009

Blue colors indicate that 2009 groundwater level is higher than 1980 groundwater level. Red colors indicate that 2009 groundwater level is lower than 1980 groundwater level. The result was interpolated based on the wells common in both years.

Legend

Groundwater Elevation Difference
1980 - 2009

- less than 150 ft
- less than 100 ft to 149.9 ft
- less than 30 ft to 99.9 ft
- 0 to less than -29.9 ft
- 0 to greater than 50 ft
- greater than 50.1 ft to 100 ft
- greater than 100.1 ft to 150 ft
- greater than 150.1 ft

Map created by Geospatial Information Center and CWI at Fresno State, Dec, 2012
CALIFORNIA’S NEW WATERSCAPE

- Competition for water will increase
- Urban use will set the stage
- Agriculture and the environment will continue to compete for supplies in the new water management setting
FUTURE WATER MANAGEMENT

• COMPREHENSIVE AND INTEGRATED STRATEGIES WILL BE NEEDED TO PRESERVE CALIFORNIA WATER SUPPLIES FOR ALL BENEFICIAL USES

• THE STRATEGY HAS TO INCLUDE INTEGRATION OF LOCAL, REGIONAL AND STATE-WIDE SYSTEMS

• THE CA WATER SYSTEM DOES NOT WORK NOW BECAUSE WE NEED TO REACH AN UNPRECEDENTED LEVEL OF COOPERATION AND COMPROMISE

• SOME OF THE NEEDED STRATEGIES INCLUDE THE FOLLOWING
FUTURE NEEDS

1) IMPROVE THE EXISTING WATER CONVEYANCE SYSTEM TO INCREASE FLEXIBILITY, WATER SUPPLY AND QUALITY.

2) IDENTIFY AND REDUCE RISKS TO WATER SUPPLIES AND ENVIRONMENT.

3) DEVELOP ADDITIONAL GROUNDWATER AND SURFACE WATER STORAGE.

4) SUPPORT LOCAL EFFORTS TO EXPAND RECYCLED WATER USE AND IMPLEMENT BMP’S FOR URBAN AND AGRICULTURAL WATER USE EFFICIENCY.
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5) IMPROVE THE QUALITY OF DRINKING WATER SUPPLIES.

6) OVERCOME CONSTRAINTS TO DEVELOPING SEAWATER AND BRACKISH GROUNDWATER DESALINATION.

7) EXPEDITE THE APPROVAL PROCESS FOR VOLUNTARY WATER TRANSFERS.

8) EXPAND THE STATE’S ROLE IN FLOOD CONTROL.

9) SUPPORT INTEGRATED REGIONAL WATER MANAGEMENT PLANS.
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