California Water Plan – Update 2013

Breakout Session: Groundwater

Groundwater in Integrated Water Management

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“When the well’s dry, we know the worth of water.”
Benjamin Franklin, Poor Richard’s Almanac 1746
Integrated Water Management on the Web

Requires Leadership at the State Level
Integrated Water Management

- Multifaceted, multidisciplinary
- Approaches water management at all fronts on many levels, regionally and statewide
- Multiple benefits and uses
- Various resource management strategies for sustainability
- Weighs risks of uncertain futures
Integrated Regional Water Management

Integrated Flood Management
Integrated Water Management

- Anthropogenic Impacts to Aquatic Biota
- Catchment Connectivity and Physical Processes
- Flood Management Strategies and Ecosystem Responses
- Pollutant Pathway Fate & Transport Hydrologic Modeling
- Multi-Tracer Approach to Assess GW Pollution
- Role of Development & Fragmentation in Ecosystem Restoration
- Policy Role in Social & Economic Change Towards Sustainability
- Natural Variation & Anthropogenic Effects on Hyporheic Zone
- Integrated Water Management

Biology, Chemistry, Social Aspects, Ecology, Physical Processes
Conjunctive Water Management

Coordinated management of surface water and groundwater resources to optimize supplies and reliability

Benefits include:

• Environmental enhancements = increased flows, improved habitats, groundwater dependent ecosystem resiliency
• Reduced overdraft, subsidence and saline intrusion
Connection Is Everywhere

Gaining and Losing Reaches of Rivers and Channels of the Sacramento Valley

Source: USGS Central Valley Hydrologic Model (CVHM)
Values are Average Annual Volumes for 1961 – 2003
Units in Acre-feet per year

Courtesy TNC
Surface Water - Groundwater Connection

Groundwater Affects Stream Flow

“Gaining Stream”

High Groundwater Levels - Groundwater Maintains Stream Flow & Stabilize Surface Water Temperatures
Surface Water - Groundwater Connection

Groundwater Affects Stream Flow

“Losing Stream”

Pumping Lowers Groundwater Levels - Stream Loses Flow to Groundwater
Groundwater Levels Below Stream Channel

Groundwater Affects Stream Flow

Pumping Lowers Groundwater Levels - Stream Loses Flow to Groundwater

“Losing Stream”

Courtesy TNC
Surface Water - Groundwater Connection

Groundwater Affects Stream Flow

Seepage to Groundwater Exceeds Stream Flow
Dry Stream Channel (Intermittently or Year-round)

"Ephemeral Stream"

Pumping Lowers Groundwater Levels - Stream Loses Flow to Groundwater
Dynamic Systems

Courtesy TNC
Conclusions: Groundwater in Integrated Water Management

- Multiple benefits and strategies
- Everything is connected to everything else*
- Groundwater can provide storage, supply reliability, and environmental benefits
- Changes in surface water & groundwater flows and quality effect one another and ecosystems
- There will always be trade-offs
- There is no such thing as a free lunch*

*Barry Commoner

Thanks to The Nature Conservancy (slides 7-12)