California Water Crisis

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Assembly Select Committee on Regional Approaches to Addressing the State's Water Crisis

Informational Hearing:
Regional Responses to Climate Change

Wednesday, February 24, 2010
1:30 p.m. – 3:30 p.m.
State Capitol – Room 126

- In the last century, California constructed one of the most sophisticated water systems in the world. Relying on historical hydrological records, California's water pioneers studied, designed, and created a complex water infrastructure to support a robust agricultural and urban economy, now ranking in the top ten of the world. But what happens when the hydrology changes and that historical record no longer supports 21st-century decisions?

- The nature of California's water system makes climate change a central challenge for continued development. Climate change will both affect – and be affected by – the operation of the water system. Changes in hydrology and water use mean that existing water infrastructure, which was designed to address historic droughts and floods, may not meet California's needs. At the same time, movement of water over great distances and treatment requires vast amounts of energy and, therefore, contributes greenhouse gases to the atmosphere and the climate-change cycle. California therefore cannot avoid addressing climate change in the water resource context.

- With the growing scientific consensus on climate change, water policymakers across California have begun assessing how best to respond. These efforts are not uniform, but are concentrated in the large urban water agencies in Southern California and the San Francisco Bay Area. Most agricultural water agencies have not started initiatives on climate change. Some have gathered anecdotal evidence of significant changes in the hydrology and a need to change operations, but others reject any climate change projections. California's Department of Water Resources (DWR) has begun a concerted effort to integrate climate change into all its activities, both water planning and operations. Proposition 84 (2006) included $1 billion in funding for "integrated regional water management," and new DWR guidelines for making regional funding grants now include elements related to climate change.

- Regional approaches to preparing for climate change may offer a key tool for making California resilient to climate change. As climate change may affect watersheds differently, California's water system connecting most of the state will help regions respond when one watershed suffers drought. In the 1990's drought, for example, Metropolitan Water District of Southern California received additional water from the Colorado River when Delta exports dropped. Integrated regional water management policies support regional responses to climate change and the associated uncertainties in water supply.

The Changes in California

- Climate change is not just coming, it has arrived. California's world-class academic and agency resources have documented several changes in the climate in recent decades. Using this data, scientists have forecasted additional future changes, which will have serious impacts on California's water resources.

- *Warming:* California is warming, most dramatically in the last quarter century and over the winter months. In addition, some local officials have reported localized "heat bubbles," arising out of urban development, which have raised adjacent snow elevation 1500 feet since 1980 – less snow pack and more rain.

- *Reduced Snowpack:* The Sierra snowpack provides California with its largest reservoir of water. The National Academy of Science has forecasted reduced Sierra snowpack of at least 29 percent by the end of the century, while other scientists have predicted a more severe drop.

- *Sea-Level Rise:* Sea level in the Delta has risen ½ foot in the last 100 years, advancing more quickly in the last few decades. Additional sea-level rise of this level or more will fundamentally change the Delta by threatening levees, land use, water quality, the ecosystem, and its water conveyance capability.

- *Increased Flooding:* Floods have shown an upward trend, with floods getting worse as each decade passes, particularly in the last couple decades.

- *Earlier River Flows:* River flow is coming earlier in the year, reflecting less retention in snow pack. Late season (April-July) runoff has shown a downward trend over the last century.

- *Drier:* Scientists, using data from the Intergovernmental Panel on Climate Change, have forecasted that the Colorado River basin, on which Southern California relies, will be drier, similar to the droughts of the 1950's or this decade.

- These historic trends lead to projections of substantial climate change in the next 50 years. The most important projection of change for California's water system is the reduction in snowpack, the state's biggest water supply reservoir and winter flood reduction process. Reduction in snowpack means less storage for summer irrigation, larger winter floods, and an increasing hydrodynamic force on the weakened Central Valley levee system.

- Climate change also means changes in California water-use patterns. Higher temperatures may mean less natural soil moisture, requiring greater reliance on irrigation. Higher temperatures also mean increased urban-water demand for household irrigation, which comprises a significant portion of urban- water use. Even current incremental changes in Southern California temperatures/rainfall are reflected almost immediately in water demand. As climate changes, these interconnections may appear more pronounced.

The Challenges for California Water Resources

- Climate change will affect California's water resources in a variety of ways. The diversity of the state's water resources offers both opportunities and challenges in responding to climate change. Conveyance infrastructure between different water sources allows flexibility, but fostering flexibility may require greater collaboration and integration, which may require legal changes.

- **Snowpack and Reservoirs.** California's water system relies substantially on snowpack – from the Sierras to the Rockies – to hold the greatest proportion of water supply, releasing the water in late spring and early summer for irrigation needs of agriculture and urban communities. Forecasts have estimated that climate change may reduce California's snowpack in the range of 29-89%. Reduced snowpack will change the efficiency of the existing water system, particularly reservoirs, which were designed to fill as the snow melted, and then hold water temporarily for flood protection and later use in the summer or the following year. With climate change, reservoirs may not be able to hold the entire amount of water coming down from the Sierras at once, leading to larger releases of flood flows and less water supply storage.

- **Sacramento-San Joaquin Delta.** The heart of the California water system is the Delta, where two large rivers – the Sacramento and San Joaquin – converge and then flow out to the San Francisco Bay. The Delta is the richest estuary ecosystem on the west coast of North or South America, as well as the transfer point for vast amounts of water to the San Francisco Bay Area, Southern California and San Joaquin Valley. The Delta is a unique network of leveed islands, major rivers and small sloughs. Climate change may affect the Delta by sea-level rise, increased flood flows and longer dry periods. Sea-level rise will put greater pressure on – and may overtop – levees surrounding Delta islands, many of which already lie well below sea level. Increased flood flows will also put more hydraulic pressure against Delta levees, leading to greater risk of levee failure. Conversely, reduced water flowing into the Delta can affect both Delta water supply and quality, as greater proportions of the water flowing in comes from upstream discharges and downstream sea water pushing in from San Francisco Bay.

- **Groundwater.** California's water supplies also depend substantially on groundwater, which also can be affected by and can affect climate change. Many groundwater aquifers, particularly in the Central Valley, rely on natural infiltration. Drier conditions mean less natural infiltration. As those relying on depleted aquifers often rely on groundwater pumps with diesel engines to drill deeper for water, their water use requires more energy, leading to greater greenhouse gas emissions.

- **Flood Protection.** California's flood system, particularly the federal-state flood projects in the Central Valley, will suffer perhaps the greatest challenge because of their design. The flood "control" system of narrow channels enclosed by earthen levees was designed to channel flood flows and scour out mining-era sediment. In the last century, the system has worked so well, that flood flows now scour out the levees. In recent years, the state has invested billions of dollars in repairing deteriorating levees. Substantial new Central Valley development, including housing in some of the deepest floodplains, increases risk of substantial flood damage to this new floodplain development. With the flood system already under stress, climate change will challenge every part of the flood system.

- **Energy System.** The complexity of California's water conveyance systems also impacts California's energy supplies. A recent California Energy Commission report estimated the energy use arising out of California's water use is about 20 percent of California's total energy use. This proportion reflects the energy costs of moving water hundreds of miles, including south over the Tehachapi Mountains to Southern California, and treating water both before and after its use. California water use therefore is a significant contributor of greenhouse gases to the climate change-dynamic. In short, water use both affects and is affected by climate change.