10 INEVITABLE CHANGES TO WATER MANAGEMENT IN CALIFORNIA

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“Denial ain’t just a river in Egypt” — anonymous

By Jay Lund and Ellen Hanak

Water policy in California has always been about making and resisting change. The gold mining period, the growth of agriculture and cities, and today’s environmental priorities all led to fundamental changes in water and land management, law and regulation. These changes were driven by environmental degradation and the evolution of California’s

economic structure and societal priorities. Change has rarely happened quickly, and it has usually been controversial (Hundley 2001; Pisani 1983; Hanak et al. 2011).

Additional changes are on the horizon, driven by large, long-term physical processes such as sea level rise, climate warming, land subsidence, depletion of groundwater and accumulations of salts and nitrate in groundwater. Other drivers include further introductions of invasive species and the continuing evolution of California's economic structure and governing institutions.

California water policy and management will need to prepare for these seeming inevitabilities and find solutions that support a strong economy and a healthy environment, while easing transitions for vulnerable groups.

Here is our list of 10 changes to come:

1. Parts of the Sacramento-San Joaquin Delta will permanently flood. Land subsidence, sea level rise, increasing seepage and earthquakes — combined with limited agricultural value and high repair costs — make the permanent flooding of many of the most subsided islands in the central and western Delta seemingly inevitable. Public subsidies for Delta levees can reduce this risk for some areas, but it is unrealistic to expect enough state subsidies to maintain all Delta islands (Lund 2011; Suddeth et al. 2010; Mount and Twiss 2005). This change will cause some localized economic hardship and create new recreational opportunities (Medellín-Azuara et al. 2012).

2. Reduced diversions of water from the Delta also seem inevitable. Greater environmental flow requirements are already reducing water available for agricultural and urban uses. New instream flow requirements and changes in climate seem likely to further reduce water diversions. This change will affect not only Delta water exporters – the current focus of policy actions – but also upstream and within-Delta diversions. [(Upstream diverters remove twice the water from the Delta as exporters and Delta water

users combined (Lund et al. 2010)]. Reduced Delta diversions will significantly affect agricultural and urban water users and water management statewide.

3. The Tulare Basin and San Joaquin River regions will have less irrigated agriculture. The Central Valley south of the Delta is a vast and highly productive agricultural region that substantially lives on borrowed water. Local inflows supply only about two-thirds of the 15.3 million acre-feet (maf) that the Valley consumes annually, mostly for crops. The balance comes from Delta imports (4 maf/yr) and groundwater overdraft [(1-2 maf/yr — by far the most overdraft in California) (Hanak et al. 2011)]. (About 2.7 maf/yr of fairly saline drainage water and rare flood waters leave the region from the San Joaquin River, whose natural outflow would be about 6 maf annually.) Long-term reductions in groundwater overdraft, Delta imports and San Joaquin River diversions could reduce water availability to this region by 2-5 maf/year, requiring the permanent fallowing of up to 1-2 million acres of this region's 5 million irrigated acres. Some of this land will leave agricultural production for other reasons: Up to about 500,000 acres lack good drainage and are prone to salinization (USDOI 1990a, 1990b), and continued urbanization will further reduce farm acreage (Teitz et al. 2005). Although shifts to higher value crops (especially orchards) will likely maintain absolute growth in agricultural revenues and profits, some communities will be hard-hit by these transitions (Medellin-Azuara et al. 2011).

4. Urban areas will use less water per capita, reuse more wastewater and capture more stormwater. Growing supply risks and higher costs will drive reductions in urban water use and efforts to capture more local supplies. Urban conservation potential is illustrated by Australian cities, which use much less water than California, while sustaining a similar economy, culture, and climate (Cahill and Lund 2013). Regulations and pricing will help motivate this transformation. Although not costless, this is the easiest change on our list. These adaptations in urban water management will improve urban water supply reliability, and help reduce some other water challenges in California

by freeing up some water for agricultural and environmental uses. But not all actions are equally effective everywhere. Water conservation, reuse and stormwater capture will be more effective in coastal urban areas, with effective conservation in inland areas focusing on reductions in landscaping irrigation (Hanak et al. 2011; Ragatz 2013).

5. Some native species will become unsustainable in the wild despite protective efforts. Changes in the climate, combined with continued stress from human water and land management and the dilution of wild genetic stock by hatchery fish and invasive species, will make survival of some native fish species unsustainable in the wild — despite concerted efforts to improve their conditions (Moyle et al. 2013). The entire range of native plant and animal species in California faces similar risks (Barbour and Kueppers 2012). Not all can be expected to survive. This threat poses immense challenges for our endangered species laws and their implementation (Hanak et al. 2011, 2013).

6. Funding for water system solutions will become even more local and regional. Many local and regional water systems benefitted from state bond funds passed in the 2000s, and many water managers look back with nostalgia to the heavy federal subsidies for water infrastructure that largely ended by the 1980s. Budget problems are likely to further curtail state and federal funding for water problems in the years to come. Federal and state agencies also have diminishing institutional capability for water system planning. Local and regional agencies will be the most motivated to address and fund most water problems, and also the most capable. This change spells a return to the dominant historical pattern in American and Californian water management (Lund 2006; Hanak et al. 2011, 2012).

7. State and federal regulations will increasingly drive water management. Water rights, public health and environmental regulations are under state and federal authority, and will remain important even though state and federal planning and funding declines.

Making these regulations more efficient, effective and supportive of local and regional management to further both local objectives and statewide interests in public health and environmental protection is a major challenge. Defining more positive and effective forms and goals for environmental regulation will be a controversial necessity (Hanak et al. 2011, 2013).

One in 10 people living in California's most productive farming areas is at risk of exposure to harmful levels of nitrate contamination in their drinking water, according to a recent study by the UC Davis Center for Watershed Sciences.

8. Groundwater in many agricultural areas will be increasingly contaminated by nitrate. Modern agriculture applies large quantities of nitrogen fertilizer, much of which enters groundwater as nitrate, a threat to safe drinking water. Although fertilizer application efficiency is improving, farmers often cannot reduce nitrate discharges enough while maintaining profitable farming operations. And even if all nitrate leaching from agriculture ended today, decades of past discharges would continue to flow towards drinking water wells for decades to come. This problem is not unique to California, and it is especially worrisome for safe drinking water in small, low-income rural communities. Addressing this problem should be a focus for state and county governments (Harter et al. 2012).

9. California's groundwater will become more tightly and formally managed. The same economic and environmental pressures that have led to tighter management and accounting of surface water in California will lead to more formalization of groundwater rights and management. Following decades of legal negotiations among users, aquifers in southern California and Silicon Valley are mostly adjudicated with formal pumping rights or managed by special districts with pumping fees (Blomquist 1992). Local efforts elsewhere are slowly moving towards more formal management (Nelson 2011). More defined groundwater rights will be a long and cumbersome process unless state court and

groundwater-rights procedures are strengthened and streamlined. Because pumped groundwater ultimately reduces surface water flows in most places, groundwater use rights will ultimately be tied to surface water rights and environmental impacts, as they are in some other states such as Colorado (Lund and Harter 2013). In the end, all parties will be more secure in their rights, but the transition will lead to reductions in pumping or costs for supply augmentation for some areas.

10. The Salton Sea will be largely abandoned by humans, fish and waterfowl. Every year, 4 million tons of salt enter the Salton Sea and do not leave, raising the sea's salinity over time. Today the Salton Sea is 25 percent saltier than seawater and is becoming uninhabitable for more forms of life (Bali, undated). It is also shrinking, creating regional air quality problems from exposed dust (Fulton 2013; Sculley 2002). A proposed $9 billion solution seems unlikely to receive the state and federal funding needed to make it happen (CRA 2007). The growing value of water for southern Californian and other southwestern cities and for wetlands for migratory waterfowl elsewhere on the Colorado River will encourage the transfer of more water out of the Salton Sea basin, with increased irrigation efficiencies (as now planned) and perhaps also more farmland fallowing. Local beneficiaries of the Sea, particularly for recreation and air quality, will face challenges regarding the reasonable use of these waters and will likely have to help finance any solutions. Much of the Salton Sink – the dry lakebed that existed before the Salton Sea was formed by Colorado River flooding in the early 20th century – will be restored (SDSU Center for Inland Waters).

Most of these changes will be accompanied by prolonged angst, as well as studies, controversies and expense. After all, the details of how each change is managed are worth millions of dollars to individual stakeholder groups. Forward-looking adaptive actions are likely to reduce the pain and improve the prospects for water supporting the kind of society, economy and environment that Californians desire. That will require facing

change head on and planning for the inevitable, rather than wishfully thinking that California can avoid change.

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Scientists, faculty, students and researchers at UC Davis' Center for Watershed Sciences collaborate across the UC Davis campus and with experts from other universities, research institutes, government agencies and NGOs. Together they address critical issues affecting streams, rivers, lakes and estuarine ecosystems within California's Central Valley, the Sierra Nevada and San Francisco Estuary. By working across disciplines, they are at the forefront of providing up-to-date scientific approaches to watershed science and policy to best meet the diverse demands placed on these resources