

# 10. Conclusions and Recommendations

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“The problem is not that there are problems. The problem is expecting otherwise and thinking that having problems is a problem.”

*Theodore Rubin*

## Conclusions

This report has five major conclusions:

1. The current management of the Delta is unsustainable for almost all stakeholders.
2. Recent improvement in the understanding of the Delta environment allows for more sustainable and innovative management.
3. Most users of Delta services have considerable ability to adapt economically to risk and change.
4. Several promising alternatives exist to current Delta management.
5. Significant political decisions will be needed to make major changes in the Delta.

We summarize each of these conclusions below and then offer some additional thoughts and recommendations.

### ***Unsustainable Delta: Getting Worse Together***

As we saw in Chapter 3, the Delta’s future is unsustainable in its current form. Some key drivers of change in the Delta are largely beyond the control of stakeholders and policymakers. For example, climate warming is expected to contribute to sea level rise and to increased winter flows into the Delta, raising the likelihood of extreme flood events and levee failure. The increasing likelihood of a large earthquake affecting the Delta compounds this risk. Invasive species are posing increasing risks to the survival of key native species. Some invasive species, such as the Brazilian waterweed and the mitten crab, also pose growing risks to water supply. Furthermore, continued human population growth in California

will raise the pressure on the Delta's land and water resources for recreation, housing, and water supply.

Other key drivers of change are more amenable to human intervention but only with major policy shifts. Land subsidence—compounding risk for levee failure—will continue with current farming practices. The accumulated effects of a century of land subsidence can only be reversed slowly. Urbanization in and around the Delta dramatically raises the potential damage from levee failure. It also poses a threat to the Delta's wildlife, by removing habitat. Contaminants from both agricultural and urban land use both within the Delta and in the upstream watersheds of the San Joaquin and Sacramento Valleys are major sources of water quality problems and concerns. New invasive species will continue to be a major threat to native species in the Delta, and current policies to prevent their arrival and limit their expansion are inadequate.

Any of these factors individually would cause great concern about the future of the Delta. In combination, they make the Delta's future look bleak. Given the potentially catastrophic nature of failure, we should prepare for a soft landing that allows us to accommodate and adapt to large-scale changes in the Delta, while allowing users of the Delta to extract themselves from their current untenable situation. The combined risk of Delta catastrophes for the state and for regions that depend on the Delta is too important to ignore any longer. Although crisis-response tools will be important, given the ever-present risk of levee failure, they are not a substitute for a new long-term solution. A sustained effort is needed to avoid such crises and their draining effects on the state's budget and economy. Without concerted action directed toward long-term solutions, all interests will be getting worse together.

### ***Improved Understanding of the Delta Ecosystem***

The common perception of the Delta as a stable freshwater habitat is wrong (see Chapters 2 and 4). The Delta is naturally a tidal system that historically has had salinities, water velocities, water clarity, and other characteristics that fluctuated widely across years, seasons, and tidal cycles, particularly in its western portions. Even today the volume of water moved daily by the tides far exceeds the amount of freshwater inflow, except under extremely wet conditions. This tidal influence is constantly moving salt

water into the Delta. Thus, keeping the western Delta fresh during the dry summer months and in dry years requires greater reservoir releases to the Delta. In this way, saltwater intrusion is limited because most water in the Delta is confined to narrow leveed channels.

Given this artificial water regime, it is not surprising that the Delta's ecosystem is also highly altered and that many of its key native species are in decline, some to crisis levels. Restoring more natural fluctuations in salinity and other water quality and habitat conditions may be one of the most important ways to combat the many invasive species in the Delta. Many of these invaders are best adapted to stable freshwater or saltwater regimes, not to the fluctuating conditions to which many native species are adapted. A Delta that is heterogeneous and variable across space and time is more likely to support native species than is a homogeneously fresh or brackish Delta. Accepting the vision of a variable Delta, as opposed to the more commonly held vision of a static Delta, will allow for more sustainable and innovative management.

### ***Economic Adaptations to a Changing Delta***

Changes in the Delta will cause significant costs and some dislocations (see Chapters 6 and 8). However, most users of Delta services have considerable ability to adapt economically. As a result, these costs and dislocations need not be catastrophic for California's economy or society. However, these costs and dislocations will be much easier to handle if they are anticipated and dealt with in a systematic fashion, rather than in reaction to crises, such as levee failures.

For some, risk-mitigating investments and strategies can considerably diminish the costs of a catastrophic levee failure. One example is PG&E's strategy to increase redundancy of gas transmission lines with a new underground line in the Delta. Other examples include the plans of various water exporters to reduce dependency on the Delta by augmenting local sources and regional interties. For urbanizing Delta lands, strategies to increase flood protection may be able to reduce flood risk to acceptable levels (which need to be more realistically defined). Recreational users, such as duck hunters, are likely to have opportunities to relocate within the Delta as their current locations flood or otherwise change. In general, the Delta's role as a major recreation site will no doubt continue to expand, as

the Northern California population grows. But the forms of recreational activity are likely to change and adapt with changes in the ecosystem and water management. Farming within the Delta is the economic interest with the least ability to adapt, because it relies on water and land uses that are unsustainable in many locations, even with substantial investments in the levee system. Even so, many farmers will be able to adjust to changes in water quality through alterations in their crop mix and irrigation practices. Public policies could help ease the transition away from Delta lands as they become economically unfarmable. Because they have nowhere else to go, the most vulnerable users of the Delta are the native species that rely on it for survival. Unlike human interests, their ability to adjust will depend entirely on society's stewardship decisions.

### *Alternative Management Strategies*

Fortunately, the situation is not hopeless. There are promising alternative futures for the Delta (see Chapters 7 and 8). Some, like those based on the construction of a peripheral canal, have been proposed in the past. Others, like the Opportunistic Delta scenario involving only seasonal exports, are relatively new. No alternative will be ideal from all perspectives; some alternatives would preclude some current uses of the Delta entirely. Our analysis suggests that alternatives seeking to maintain the entire Delta as a freshwater system—along the lines of the current levee-centric policy—are incompatible with giving the Delta's native species a fighting chance to survive and prosper. The freshwater alternatives are also the least responsive to the drivers of change currently acting on the Delta. Various other alternatives would allow improvements in Delta habitat while permitting a variety of other beneficial uses.

The key to these alternatives is to use different parts of the Delta for different purposes. The most promising alternatives we discuss share similar strategies in this regard. Ecosystem restoration would be concentrated in the western Delta (where salinity would be allowed to fluctuate), Suisun Marsh, and the Delta's northwestern reaches, including the Cache Slough system and the Yolo Bypass. Agriculture would remain viable toward the north, east, and south; many of these areas could also contain urban development behind higher and stronger levees. These alternatives also provide the ability to continue water exports, either

seasonally (Opportunistic or Eco-Delta) or year-round through one of several aqueduct alternatives (Armored-Island Aqueduct, Peripheral Canal Plus, or South Delta Restoration Aqueduct). All of these alternatives have different costs and risks, but each seems preferable to current conditions. Detailed knowledge, analysis, and discussion will be needed before identification of a “best” and politically viable alternative can be justified.

In each of these alternatives, some landowners and some water users would face particularly high adjustment costs, whereas others would benefit. Public policies would need to ensure that mitigation is available to distribute the costs equitably and reasonably (see Chapter 9). Mitigation could take the form of cost sharing for those whose adjustment costs are particularly high. This might be appropriate, for instance, if western Delta water users need to construct new pipelines or storage units to allow for ecosystem-based water quality fluctuations. Mitigation could also include policies to prevent further subsidence of agricultural lands or to buy out Delta farmers when their lands are no longer farmable because of flooding or water quality problems, an inevitable outcome in many of the Delta alternatives. With the resolution of major Delta policy issues, it would be easier to establish a more diversified, sustainable, and prosperous economy and ecosystem in the Delta.

### *Facing the Tradeoffs*

A major change is needed in how Californians think about solutions to the Delta. The leitmotif of the approach adopted by CALFED was that “everyone would get better together,” and it was assumed that this goal could be met by managing the Delta as a single unit, simultaneously achieving improvements in habitat, levees, water quality, and water supply reliability within the Delta and for exporters (Chapters 2 and 5). However, that approach was based on an insufficient appreciation of the risks of levee instability, an inadequate understanding of the importance of fluctuating conditions for some key native species, and the expectation of ample federal and state funding. Going forward, Californians will need to recognize that the Delta cannot be all things to all people. Tradeoffs are inevitable; the challenge will be to pursue an approach that yields the best outcomes overall, accompanied by strategies to reasonably compensate those who lose

out. Incremental consensus-based solutions are unlikely to prevent a major ecological and economic disaster in the Delta.

Scientific and engineering studies and analyses can provide guidance on the types of alternatives that can meet the broadest range of goals. However, central to the decisions on a new course for the Delta will be the viability of funding mechanisms and governance institutions (see Chapter 9). Although CALFED fostered the beneficiary pays principle—whereby various economic interests were expected to contribute to program costs in proportion to the benefits they received—the default assumption, more often than not, was that the general public was the beneficiary. To wit, the proposed financing programs in 2000 and 2004 both relied heavily on funds from state and federal coffers. Although the assumption of federal largesse is now widely dismissed, many still look to the state to provide the bulk of the funding for Delta management. State general obligation bonds have funded most CALFED activities to date, and two bonds passed in November 2006 have allocated some \$3 billion to \$4 billion for flood control in the Central Valley and the Delta.

Yet the total initial and ongoing costs of any promising long-term Delta strategy will greatly exceed the availability of state bond funds, given other demands on public resources. (In the area of flood protection alone, great investments are needed to improve the protection of heavily urbanized areas upstream of the Delta, where the state has greater liability for flood damages.) For this reason, it will be essential to hammer out ground rules on funding contributions for both initial and ongoing operational expenses. The beneficiary pays principle will be especially relevant for any collective infrastructure investments that improve water supply reliability and reduce flood risk. The State Water Project was built on this principle. The financial contributions of water users and land development interests are likely to determine the most feasible investment choices. User finance of such investments is essential, given the other demands on public funds, such as ecosystem restoration. Under most scenarios, expenditures to purchase and manage lands for ecosystem restoration are likely to be considerable. Public funds will also be needed to contribute to mitigation solutions for those users who will lose out in whatever strategy is chosen. Creating long-term local dependency on state funding is undesirable from all perspectives, as it represents a great liability and drain on the state's

coffers and provides an unreliable source of revenues beyond the control of local beneficiaries.

To best manage the tradeoffs in resource management within the Delta, there is a need for well-coordinated approaches that take into account not only water but also land use (see Chapter 9). The development pressures on the Delta are great, and the current institutional fragmentation in the Delta fosters piecemeal decisionmaking that will compound flood risks, irreversibly destroy valuable wildlife habitat, and impair water quality. Improved governance of Delta resources is necessary to protect the value of the Delta both for the region's residents and for the broader public interest.

Our analysis also suggests that the environmental community will need to consider new approaches to foster a healthy long-term future for the Delta ecosystem (see Chapter 5). The dominant assumption behind many recent environmental lawsuits—that the Delta's key problem is export volumes—may be only partially correct at best. If the various lawsuits now in play end up mandating reduced exports within the context of a static, freshwater Delta, the native species that policies are now aiming to protect are likely to suffer.

## Recommendations

Our recommendations for the Delta fall into four categories:

1. Technical explorations of long-term solutions for the Delta are needed to inform the political process. Politics should not preempt the creative development, consideration, and comparative evaluation of alternatives.
2. Regional and statewide interests should be more forcefully represented in Delta land use decisions. These decisions have important implications for flood control, ecosystem health, and water supply and quality that extend well beyond the boundaries of Delta cities and counties. The Delta needs a strong regional permitting authority, along the lines of the San Francisco Bay Conservation and Development Commission or the California Coastal Commission.
3. To fund long-term investments in the Delta, the beneficiary pays principle needs to be resuscitated. Water users, urbanizing lands, and infrastructure users should all be expected to pay for investments from

which they benefit. Mitigation funds should be used to help ease the transition for those who will lose out from chosen alternatives.

4. Although it is premature to choose a long-term solution for the Delta without further technical investigation, Californians can take some steps now to move forward. To reduce the costs of a catastrophic levee failure in the Delta, investments in emergency preparedness are needed. To prepare the way for any long-term solution, discussions are also needed to implement some “no regrets” policies.

### *Technical Exploration of Solutions*

1. **Create a technical track for developing Delta solutions.** For the most part, recent attempts to solve the Delta’s problems have been politically driven. Under the rubric of “everyone getting better together,” agencies and other stakeholders sought to negotiate solutions based on what was politically acceptable. Despite considerable investments of time and money, this approach has not resulted in an acceptable or workable solution. Now we are all getting worse together. This failure has led to calls for solutions, largely derived from past proposals, which maintain the Delta in its present configuration. Despite improvements in our understanding of the Delta ecosystem and the economy of California, little in the way of new solutions has been developed or proposed. The political track of any Delta solution is important and necessary, but it can be better informed and seeded with more viable answers by a technical track that would develop and explore new ideas and adapt older solutions to current conditions.
2. **Establish an institutional framework to support the development of solutions to the Delta’s problems and to bring scientifically and economically promising alternatives to the attention of political authorities.** This activity needs to take a long-term view and avoid crisis-driven responses to short-term political thinking. It should have some political independence, an appropriately sized budget, the technical capability to creatively and competently explore and eliminate alternatives, and the management capability to direct multidisciplinary research and development. CALFED was supposed to have these abilities, but its direction, funds, and energy became dissipated in politics and the effort to please all stakeholders. At the turn of the

last century, California's Debris Commission had a similar problem-solving role (see Chapter 2). In taking a long view, it paved the way for fundamentally different and more successful flood management in the Central Valley, leading to the introduction of flood bypasses. The current technical efforts examining the pelagic organism decline and the risks to Delta levees focus rather narrowly on specific aspects of the Delta's problems, and the current policy efforts—including the Delta Vision process—currently lack a substantial technical component. Technical and policy endeavors need some independence within a larger framework.

**3. Launch a problem-solving research and development program.**

The science effort regarding the Delta is in need of an overhaul. The Delta is a multidisciplinary problem, not a single-focus research topic. Much past research on the Delta and its problems has been associated with agency data collection or basic agency, academic, and disciplinary research. Although such efforts have helped improve our understanding of the Delta, they have not provided an efficient or effective process to support decisionmaking. A directed problem-solving research and development program aimed primarily at developing and informing the analysis of promising solutions is needed (see Chapters 4 and 8). This program would include some continued basic research, but most effort would be directed toward developing and evaluating solutions. Ecosystem adaptive management experiments (supported by quantification and computer modeling), levee replacement, island land management, flood control, and integrative system design activities should receive greater attention in a problem-solving framework.

**4. Consider the Delta's water delivery problems in a broad context.** The foremost physical problem in the Delta needing a physical solution is delivery of fresh water through or around the Delta because this water is a key factor driving California's economic engine. And some promising solutions exist. Potential options extend beyond a peripheral canal. Our work suggests that an armored-island aqueduct, a south Delta restoration canal, opportunistic pumping, and perhaps even an environmentally reoriented Delta management scheme all show promise and merit further exploration (see Chapter 8). Any physical

solution for water delivery must be accomplished in the broader context of developing a more sustainable Delta environment.

5. **Eliminate some solutions to the Delta's water delivery problems from further consideration.** To reduce investments in scarce time, expertise, and resources in evaluating Delta alternatives, some potential Delta options are not worth further exploration (see Chapter 8). These include the traditional levee-centric approach, the building of downstream physical barriers to seawater, the large expansion of on-stream surface water storage, and the idea of ending all export pumping. These are physically unreasonable solutions to the Delta's water delivery problems, and they perform so poorly in economic and environmental terms as to be nonviable.
6. **Approach the Delta as a diverse and variable system rather than as a monolith.** A diversified and variable Delta by design is likely to perform better than the freshwater Delta that has been artificially maintained over the last 60 years. Better solutions are likely to emerge if the Delta is not treated homogeneously (see Chapter 4). Historically, the Delta naturally contained diverse habitats that varied across years, seasons, and tidal cycles in terms of salinity, water residence time, turbidity, water velocity, elevation, and other physical habitat conditions. Reintroducing and extending this diversity, by specializing parts of the Delta for wildlife habitat, agriculture, urban, recreation, water supply, and other human purposes, seems promising.

## ***Governing and Financing Change***

1. **Create stronger regional and statewide representation in Delta land use decisions.** Local land use interests in the Delta are well represented by local cities, counties, water agencies, and reclamation districts, but these institutions are fragmented. There is little effective representation of larger regional and statewide interests in Delta land use decisions (see Chapter 9). An institutional disconnect exists between local land use planning and the broader public interest—and considerable public investments—in the Delta.

No current agencies or institutions have broad authority to oversee land use decisions in the Delta. The existing Delta Protection Commission, whose role is to foster continued agricultural,

recreational, and environmental uses of most Delta lowlands, is a weak institution without permitting authority. To date, the State Reclamation Board has taken little interest in the Delta and, under current policies, focuses only on those issues that either directly affect federally authorized project levees or increase regional flood stage. The CALFED Bay-Delta Authority has no direct influence over land use decisions. State and federal permitting agencies, including DWR, the Department of Fish and Game, SWRCB, the U.S. Bureau of Reclamation, the U.S. Fish and Wildlife Service, and the Army Corps of Engineers, have no institutional inclination for regional management of resources of broad public interest.

The “all politics are local” adage applies well to the Delta, yet local land use decisions there affect the entire state. A new approach is needed that, at minimum, provides for *significant* representation of state interests from outside the Delta on decisionmaking bodies (such as the State Reclamation Board or the Delta Protection Commission). Effective management of the Delta in the interest of the entire state will require an organization modeled after the California Coastal Commission or the San Francisco Bay Conservation and Development Commission.

2. **Give direct beneficiaries primary responsibility for paying for Delta solutions** (see Chapter 9). Urban development should pay directly for its own flood protection (including both capital and maintenance costs) with protection set at appropriately high levels (exceeding 200-year average recurrence for concentrated development). It should also contribute substantially to environmental offsets, given the significant, irreversible changes it causes. Direct and indirect exporters of water from the Delta should pay for infrastructure that directly benefits them and should contribute to ecosystem restoration necessary to offset the effects of water exports. Other Delta infrastructure providers (roads, pipelines, power lines, etc.) should be expected to pay for their own facilities. A ballast water fee or tax should apply to shippers who do not undertake significant efforts to preclude the introduction of invasive alien species, and tighter controls should be imposed on horticultural, aquarium, bait, and other industries that deal with live organisms. It should be acknowledged that agricultural activities, though principal

beneficiaries of many proposed Delta improvements, will not be able to raise large quantities of funding to address most Delta problems.

Public funds, such as those raised through general obligation bonds, should be reserved for the truly public components of the investment program, such as ecosystem restoration and mitigation for those who lose out as Delta strategies shift. Public funds can also complement private funds for some investments that have both private and public goods characteristics, such as some flood control or environmental water supplies. Failure to develop an effective funding mechanism is likely to lead to financial catastrophes for state and local interests in the future, in the wake of natural catastrophes.

Funding and control of water export facilities and operations are likely to be intertwined. In the past, concerns over control of major new infrastructure facilities have led to unwillingness to either accept new facilities or pay for them. One potential alternative is to assign shares of capacity of new (and perhaps existing) facilities to different parties with a stake in Delta water quality and water supply (upstream diverters, in-Delta users, exporters, and environmental agencies) (see Chapter 9). Under such a system, each party could affect the use of some infrastructure capacity to protect its interests, but there would be incentives for improved overall operations (e.g., through water exchanges and transfers).

- 3. Establish mitigation and compensation mechanisms to support the implementation of any alternative.** Not everyone will get what they want or what they have been used to getting from the Delta. In some cases, providing money or alternative land might compensate for changing or eliminating uses of water or land that hinder broader progress (see Chapter 9).

### ***Urgent Items for Policy Debate and Action***

- 1. Make essential emergency preparedness investments.** This report has focused on long-term solutions for the Delta, which will take some time to put into place. In the short term, it is crucial to take steps to mitigate the costs of a sudden failure of Delta levees (see Chapter 8). For all agencies relying on Delta waters, this means developing plans to ride out an extended export outage. With measures such as regional

inertias, water sharing agreements, local supply development and drought contingency plans, the costs of losing a year of Delta exports can be reduced by a factor of 10 (see Chapter 6). Other infrastructure providers that rely on the Delta, such as Caltrans, the railroads, and power companies, need similar contingency plans, and should consider making new investments in their networks to make them less susceptible to levee failure. PG&E's investment in a buried gas pipeline is a case in point. The continuation of a program for the rapid repair of critical levees—such as the one launched in 2006—and the development of emergency flood response plans are also key.

2. **Implement a “no regrets” strategy for the Delta** (see Chapter 8). First, given the great urbanization pressures on the Delta, several actions are needed now to avoid irreversible consequences. These include establishing an improved regional governance structure, instituting a program to set aside or purchase key habitat, and creating adequate, coherent flood control guidelines for urbanizing lands.

Second, because not all Delta islands have the same strategic value, in terms of either economic assets (including homes and infrastructure) or water supply, policymakers should develop a “do not resuscitate” list in the event of levee failure. Making such decisions now could avoid costly expenditures on islands that are of low strategic value, while creating opportunities to experiment with a more variable Delta environment. This list could be coupled with insurance or buy-out programs for lost farmlands on these islands.

Third, a substantive improvement in the Delta ecosystem, germane for any long-term Delta solution, could be made with habitat restoration actions in the Suisun Marsh and Cache Slough regions. A variety of other “no regrets” actions were started under CALFED, including groundwater banking, water use efficiency, water marketing, and environmental water account activities (see Chapter 2). These actions should be continued, albeit with support predominantly from water users.

## Forging a New Path Forward

The Delta's many problems have sparked a crisis of confidence on the part of its many stakeholders. The CALFED process, which has been

responsible for crafting solutions in the Delta since the mid-1990s, is now widely perceived as having failed to meet its objectives. That process was forged under the urgent threat of a regulatory hammer—a severe cut-back in pumping to meet federal water quality standards for the Delta (see Chapter 2). CALFED’s failure lay in the course chosen for crafting solutions. Achieving political consensus was favored over making tough choices among alternatives, and it was assumed that taxpayer largesse would foot any bill. In the past, major innovations in Delta management have required dire external pressure—real or threatened—from droughts, floods, lawsuits, or federal or state government. The question going forward is whether today’s crisis in the Delta can spur stakeholders and the state to action with a new strategy that acknowledges the fact that some will gain and some will lose out as the Delta changes. The future of this unique ecosystem and regional land resource and of the state’s water supply system depends on the answer. All Californians are likely to see benefits (and costs) from a comprehensive long-term solution. Otherwise, we will all see only costs.