



Navigating the Delta: Comparing Futures, Choosing Options

The Sacramento–San Joaquin Delta is part of the largest estuary on the West Coast, providing a home to a diverse array of fish and wildlife. It also serves as the major hub of California's water supply, channeling water from Northern California's watersheds to two-thirds of the state's households and millions of acres of farmland in the Central Valley.

This important region is now in a serious, long-term crisis. Many of the Delta's native fish populations are experiencing rapid declines—five are listed as either endangered or threatened species. Many Delta islands—artificially protected by aging levees—have become hollowed-out bowls that lie below sea level. And the aging, fragile levees protecting these islands are subject to increasing water pressure from tides and floods. A major earthquake would cause a catastrophic failure of the levee system, jeopardizing water supplies from the Bay Area to San Diego.

The Delta's water supply system is also in trouble because of environmental issues. Currently, this system draws water from the Sacramento River in the north, sending it through the Delta to enormous pumps at the Delta's southern edge.

The pumps deliver this water to users in the Bay Area, the southern Central Valley, and Southern California. This system has been in place for over 50 years, but recent federal court rulings—reacting to the decline in native fish populations—have cut the water exported from the Delta substantially, with further reductions likely. The water supply system California has depended on for so long is becoming less reliable.

Climate change will bring additional pressures to the Delta. Sea level rise and increased river flows from the Sierras as the climate warms will, over time, threaten the existence of many Delta islands by making them more vulnerable to failures by floods, earthquakes, and other causes. In addition, new invasive species are arriving regularly, with unpredictable effects on the ecosystem and water delivery system. It is likely that the Delta's landscape and waterways will be significantly altered by these natural forces in just 50 years.

Today, the Delta is at a tipping point—its systems are unstable and headed for major change.

Given these conditions, a PPIC report issued in 2007 concluded that the Delta is no longer sustainable and that the need for a new Delta strategy is urgent and critical. A follow-up report, *Comparing Futures for the Sacramento–San Joaquin Delta*, now takes a closer look at the viable range of options for the Delta. Among the central findings: A peripheral canal—conveying water around the Delta instead of through it—should be part of a long-term strategy for the Delta to serve both water supply and environmental objectives.

The report is authored by a multidisciplinary team of experts, including PPIC's Ellen Hanak and, from the University of California, Davis, Jay Lund, William Fleenor, William Bennett, Richard Howitt, Jeffrey Mount, and Peter Moyle.



Sources: Harold E. Malde, courtesy of The Nature Conservancy

Wetland at Lost Slough, Sacramento–San Joaquin Delta

New Directions for the Delta

Among several policy initiatives now underway to address the Delta's problems, the Delta Vision initiative has been established by Governor Arnold Schwarzenegger; this initiative is being led by an independent Blue Ribbon Task Force charged with developing a strategic long-term plan for the Delta by fall 2008. The Task Force has set out co-equal goals for future Delta management: conservation of the ecosystem and creation of a reliable water supply for California.

In light of these goals, the new PPIC study considers four central options for Delta water exports:

- Continue to pump water through the Delta.
- Build a peripheral canal, conveying water around the Delta.
- Operate a "dual conveyance" system, combining the two previous strategies.
- End water exports altogether, weaning much of California from the Delta as a water source.

Risks and tradeoffs accompany each option. However, a peripheral canal appears to be the best way to maintain a reliable, high-quality water supply and to improve conditions for fish and other wildlife. In contrast to continuing through-Delta pumping or to operating a dual conveyance system, a peripheral canal would be more responsive to the Delta's changes over time. Although ending all exports may be best for the fish, it is an extremely costly solution for California. If some of the economic benefits of a peripheral canal are used to support ecosystem investments in the Delta, the tradeoffs might be easier to make. Figure 1 shows potential canal alignments and proposed reinforcements of through-Delta channels for dual conveyance.

Choosing a water export strategy is just one step in enacting a comprehensive, long-term solution for the Delta. Clearly, implementation details will be critical to the success of any

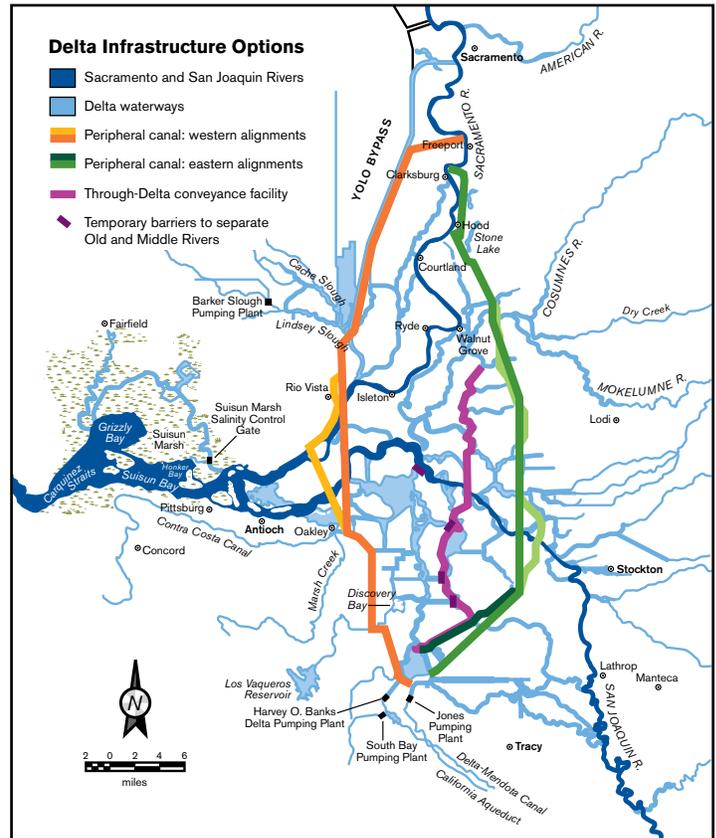


Figure 1—Possible Locations for Peripheral Canal and Through-Delta Conveyance

option. In addition, climate change—and the enormous shifts it will cause—must be considered now, as a critical factor in managing the Delta's future.

Managing the Inevitable

Today, the Delta is at a tipping point—its systems are unstable and headed for major change. Land subsidence, sea level rise, earthquakes, and changing inflows of water—along with the escalating costs of resisting these processes—are shifting the Delta toward a markedly different state. During this century, these physical and economic drivers of change will radically transform the Delta, shifting it from a network of levee-lined tidal channels that surround subsided islands to an estuary system with large tracts of open, deep water. Within 50 years, it is highly likely that numerous islands will flood permanently (Figure 2, next page).

Given these conditions, the ongoing cost of maintaining the current levee system will be extremely high, outstripping the value of many Delta islands, exceeding all available bond funds, and, most likely, going beyond the willingness of the public to pay for repairs. It is more cost-effective to invest selectively in Delta levees to protect high-value lands, critical infrastructure, ecosystem goals, and, depending on water conveyance choices, those islands that support acceptable



Delta Flooding, January 1997

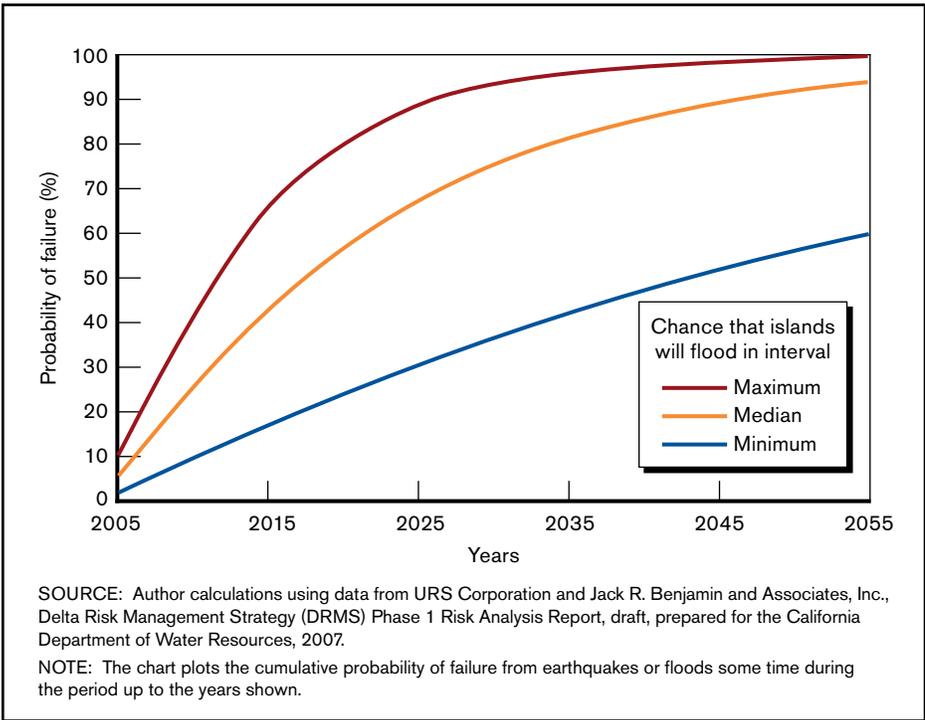


Figure 2—Many Delta Islands Likely to Flood within 50 Years

export water quality. Lower-value islands, without compelling state interest, should eventually be allowed to flood and return to aquatic habitat.

These shifts, and the uncertain responses of the Delta’s many aquatic and terrestrial species, pose unprecedented management and policy challenges. How should California proceed? What might the future look like under four different Delta management options?

Evaluating Alternatives

As noted, the PPIC–UC Davis research team considered the four water export strategies in terms of water supply reliability and environmental sustainability. To focus the analysis, estimates of water supply reliability included statewide economic costs and benefits, and estimates of environmental sustainability centered on the viability of desirable fish species. Figure 3 presents the likely range of economic costs and population viability for one of the Delta’s endangered species, the delta smelt.

As the figure shows, some clear contrasts emerge. In terms of statewide economic costs, the favorability ranking of the options from best to worst is: peripheral canal, dual conveyance, continued

through-Delta exports, and ending all water exports.

The order is quite different for fish viability. Again from best to worst: ending all exports, peripheral canal and dual conveyance (tied), and continued through-Delta pumping.

How do the options compare when considered in light of the Delta Blue Ribbon Task Force’s co-equal objectives of sustaining both the ecosystem and a reliable water supply?

- The peripheral canal and dual conveyance alternatives are very likely to perform better than continued through-Delta export pumping.
- A dual conveyance system is not a better choice than a peripheral canal over the long run.
- A clear tradeoff exists between a peripheral canal or dual conveyance and ending all exports. The canal and dual conveyance are better in terms of costs to the economy. Ending exports is better for fish.
- Selecting between building a peripheral canal and ending all exports will require a value judgment. The tradeoff may be easier to make if some economic benefits of a canal-based alternative are used to enhance ecosystem investments and improve environmental conditions in the Delta.

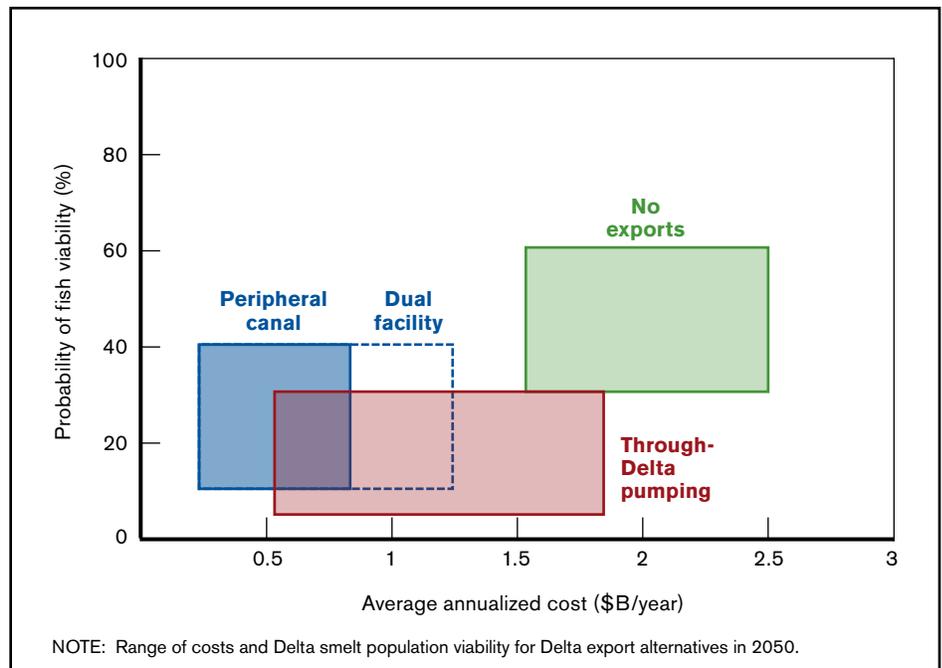


Figure 3—Peripheral Canal More Cost-Effective, Better for Fish than Current System

Table 1. Summary Comparison of Water Export Alternatives

Alternative	Performance
Continued through-Delta exports	Increasingly unstable and costly solution
Dual conveyance	Interim solution for transition to peripheral canal
Peripheral canal	Potential to provide both cost-effective water supply and improved fish viability
No exports	Best for fish but most costly to the economy; ultimate outcome without a peripheral canal

Table 1 summarizes the options. However, choosing a water export strategy does not, in itself, solve the Delta's problems. It is only a necessary step toward a solution, providing a framework that will help improve subsequent decisionmaking. Many technical, regulatory, financial, governance, and policy decisions must accompany the implementation of a long-term strategy for a new Delta. The range of costs and the relative likelihood of restoring fish populations indicate that the implementation details will be at least as important as the specific strategy selected.

The Peripheral Canal . . . Again?

Reintroducing a peripheral canal option into a discussion of the Delta's future is highly controversial. The last time California considered this option, in June 1982, it was soundly rejected by a large majority of Northern California voters. Today, some continue to have serious concerns about a canal, in particular the potential for a "water grab" by Southern California and the effects of a canal on the ecosystem.

What has changed? The most urgent and precipitous change has been in the Delta's ecosystem, which has deteriorated badly. Sending water through the Delta for export purposes appears to be bad for the fish—worse than was previously thought. In addition, it is now understood that the Delta's levees, and the water supplies and land uses that depend on them, are highly vulnerable to failure. Furthermore, the Delta's water supply dynamics have changed. The San Francisco Bay Area now depends much more on Delta water exports than it has in the past, and Sacramento Valley farmers and irrigation districts now benefit from selling water south.

Still, Sacramento Valley residents are sensitive to how much water can be exported from their watershed without causing local harm. And environmentalists want to ensure that enough water is available for the Delta's habitat needs. These concerns are important. However, at this point, some form of a peripheral canal is likely to aid in rehabilitating the Delta. And many regulatory and legal tools are available to provide safeguards around the use of a peripheral canal: for

example, creating a constitutional protection of water export limits or building a public/private partnership for managing the canal.

Central Themes

Solutions for the Delta will unfold over a long time line. But this does not mean that California can wait. As the state plans for a sustainable future for the Delta, several important points must be considered, including:

1. *Fundamental changes are inevitable in the Delta.* "Restoring the Delta" is an unrealistic notion, given the historical changes that have occurred in the Delta and the immutable forces that will be operating there for decades to come.
2. *Conditions can be improved for the Delta's fish.* As islands become permanently flooded, naturally occurring improvements will take place as aquatic habitat expands. Active restoration and management of key regions along the Delta's borders will also greatly improve conditions for fish. Changes in water operations and habitat management that create more variability in the Delta will improve conditions for wildlife as well.

Water Quality in the Delta

Salts and organic compounds in Delta waters raise drinking water treatment costs and health risks for urban users in the Bay Area and Southern California. Delta salinity also diminishes the productivity of agriculture within the Delta and much of the southern Central Valley. Current Delta management keeps water relatively fresh, flushing the system with water from the Sacramento River to support through-Delta pumping and in-Delta farming. But ocean and bay tides as well as saline drainage water from the San Joaquin River still limit some uses of Delta waters.

This salinity will increase significantly over time as a result of the physical forces acting on the Delta—sea level rise and the flooding of western Delta islands. Increased salinity will make the use of Delta water much more costly and eventually unviable for farming. By mid-century, the additional costs of Delta salinity could range from \$300 million to \$1 billion per year, even in the unlikely event that all islands remain intact.

A peripheral canal that diverts Sacramento River water upstream of the Delta could prevent these costs for export users and some Delta farmers. It would also facilitate the management of more variable flows and salinity levels to support the Delta's fish and wildlife, which cannot be achieved with year-round through-Delta pumping.

3. *A peripheral canal is a necessary component in a long-term solution that serves both economic and ecosystem objectives.* Ongoing natural forces of change in the Delta will make the continuation of through-Delta pumping less reliable and more costly over time but would have relatively little effect on a peripheral canal.
4. *The current regulatory framework is not prepared to deal with the Delta of the future.* A successful long-term Delta solution will require new and different governance, regulatory, and finance arrangements, which recognize the influences of climate change, land subsidence, and earthquakes. Establishing these arrangements will require the involvement of the governor and legislature.

Recommendations

The report makes several recommendations:

1. *Move away from levees as the primary means of managing Delta land and water.* Prepare for island failures: Not all islands are necessary to maintain a reliable water supply and not all islands are worth saving. Provide major state levee investments only for those islands that present a cost-effective statewide interest. Devise mitigation strategies for affected Delta landowners.
2. *Transition from through-Delta pumping to other export strategies.* Through-Delta exports are already demonstrably harmful to the environment, and with time they will hurt the state's economy as well. The transition away from through-Delta pumping will occur over time, whether planned for or not. A more expeditious, planned transition would be less susceptible to the rapid, costly changes accompanying earthquakes, floods, and levee failures.
3. *Build a peripheral canal to satisfy both economic and environmental objectives.* Though controversial, a canal is the most promising strategy for meeting co-equal long-term economic and environmental objectives. This strategy should include the following elements:
 - Export water users should commit up front to pay for a peripheral canal and water export facilities.
 - Export water users and those who divert water upstream of the Delta are both partially responsible for declines in the Delta ecosystem. They should contribute funds and/or water to help improve the ecosystem.
 - Do not place limitations on canal size. Better environmental and water supply performance is possible if safeguards on the operation of a peripheral canal are provided through governance and ownership institutions rather than physical size limits.
4. *Actively plan and prepare for a changing Delta ecosystem.* Delta managers should plan for climate change, rising sea



Delta Water Exports Support a Multibillion Dollar Farming Industry

levels, permanent levee failures, and new invasive species. A rigidly negotiated habitat conservation plan is unlikely to succeed. Experimentation and detailed modeling studies will be needed to inform a decision-capable governing framework.

- Ecosystem management should favor diverse habitat and flow conditions for multiple species.
- An experimental ecosystem restoration program should be launched and should include flooding of at least one Delta island.

Choosing a water export strategy does not, in itself, solve the Delta's problems.

5. *Develop a new framework for governance and regulation of the Delta.* In addition to developing workable governance and finance institutions for water supply and ecosystem management, Delta planners need to anticipate regulating a very different Delta environment.
 - The number, importance, and urgency of problems associated with a Delta transition require a governance and regulatory system that is decision-capable and more centralized than the current, highly decentralized situation.
 - Pursuit of a grand consensus solution for the Delta's many issues is likely to continue the deteriorating status quo. Local and regional stakeholders are unlikely to be able to negotiate such arrangements on their own in a timely way, given the numerous interests involved.
 - The regulatory consequences of rising sea levels and island failures need to be addressed now, so that flexible water management tools are readily available to help Delta planners meet environmental and economic goals.

Charting the Future for a Changing Delta

The ongoing and increasingly rapid changes in the Delta pose a long-term challenge to California as a whole. Maintaining the status quo—through-Delta water exports—is not sustainable. California needs to begin charting a new strategic direction for the Delta.

All parties seeking to achieve the Delta Vision's co-equal objectives of water supply reliability and environmental sustainability should have an interest in making a peripheral canal part of a long-term solution for the Delta. This option must be embedded in a broader set of actions to improve the greater watersheds of the Sacramento and San Joaquin Rivers and the aquatic environments in the Delta.

A long-term solution must also include governance, regulatory, and financial arrangements to ensure that various goals are well served, including water supply, environmental management, and the state's local interests in the Delta. Leadership from the governor and legislature is needed to create conditions for reasonable governance of the new Delta.

The future of one of California's critical ecosystems, and much of its water supply, depends on decisions made today. Controversy and tradeoffs are inevitable. But the cost of inaction is too high to wait much longer. Done right, as part of a balanced governance, infrastructure, and operating solution, a peripheral canal offers the best promise for successfully managing the inevitable transitions of the Delta.



Great Egret in Flight Over the Delta

This research brief summarizes a report by Jay Lund, Ellen Hanak, William Fleenor, William Bennett, Richard Howitt, Jeffrey Mount, and Peter Moyle, Comparing Futures for the Sacramento–San Joaquin Delta (ISBN 978-1-58213-130-6). Copies of the full text and its technical appendices are available at www.ppic.org. The Public Policy Institute of California is a private, nonprofit organization dedicated to independent, objective, nonpartisan research on economic, social, and political issues affecting California. This study was supported with funding from Stephen D. Bechtel Jr. and the David and Lucile Packard Foundation.
