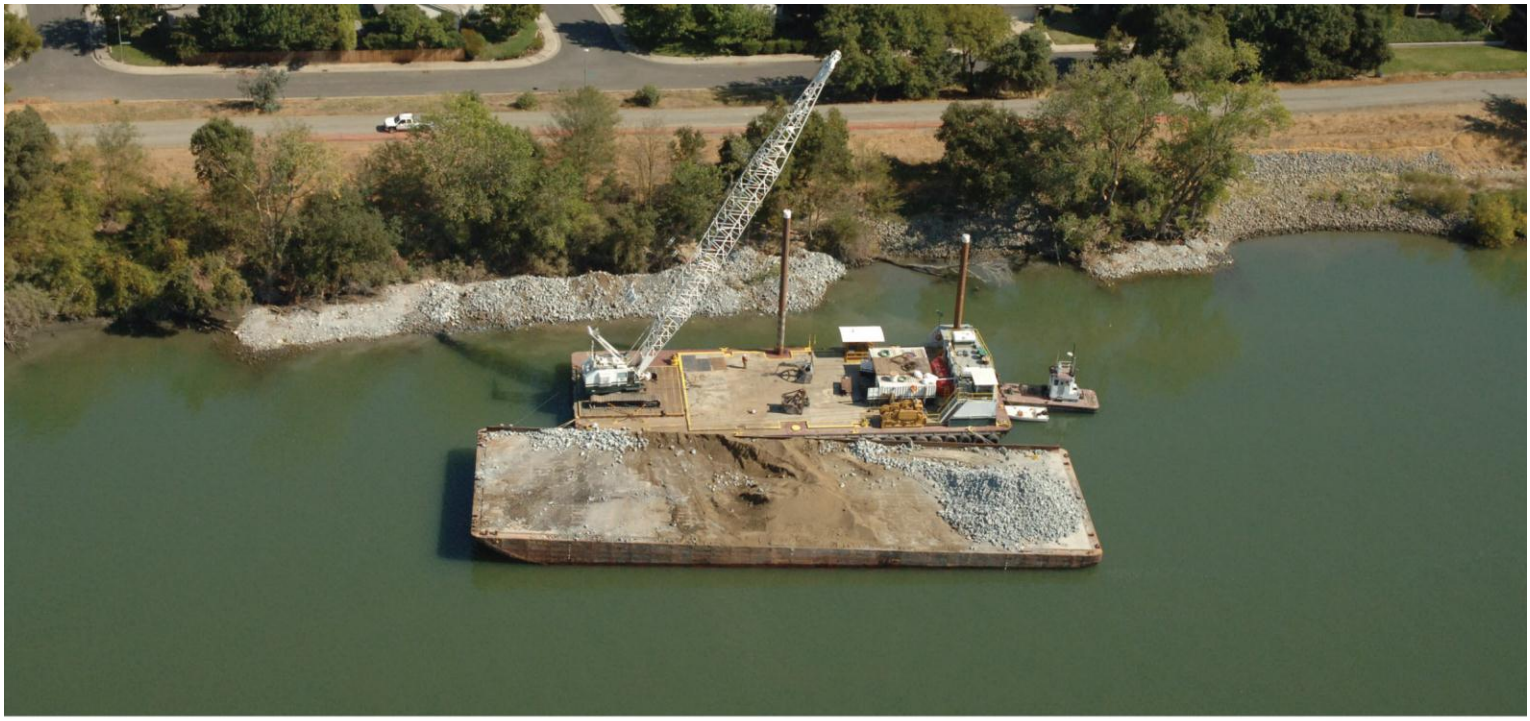
CHAPTER 7

Reduce Risk to People, Property, and State Interests in the Delta



ABOUT THIS CHAPTER

This chapter provides an overview of flood risk in the Sacramento-San Joaquin Delta (Delta), current flood management efforts, and the most pertinent agencies and regulations. It details the Delta Stewardship Council's (Council) core strategies to reduce risk to people, property, and State interests in the Delta. These core strategies form the basis of the four policies and ten recommendations found at the end of the chapter:

- Improve emergency preparedness and response
- Finance and implement flood management activities
- Prioritize flood management investment
- Improve residential flood protection
- Protect and expand floodways, floodplains, and bypasses
- Integrate Delta levees and ecosystem function
- Limit liability

Reducing flood risks in the Delta also relies on locating urban development in the cities where levees are stronger (as proposed in Chapter 5) and retaining rural lands for agriculture, so that development in the most floodprone areas is minimized.

RELEVANT LEGISLATION

Water Code sections 85305, 85306, 85307, and 85309 require the Delta Plan to include or otherwise consider specific components to attempt to reduce risk.

85305(a) The Delta Plan shall attempt to reduce risks to people, property, and state interests in the Delta by promoting effective emergency preparedness, appropriate land uses, and strategic levee investments.

(b) The council may incorporate into the Delta Plan the emergency preparedness and response strategies for the Delta developed by the California Emergency Management Agency pursuant to Section 12994.5.

85306 The council, in consultation with the Central Valley Flood Protection Board, shall recommend in the Delta Plan priorities for state investments in levee operation, maintenance, and improvements in the Delta, including both levees that are a part of the State Plan of Flood Control and nonproject levees.

85307(a) The Delta Plan may identify actions to be taken outside of the Delta, if those actions are determined to significantly reduce flood risks in the Delta.

(b) The Delta Plan may include local plans of flood protection.

(c) The council, in consultation with the Department of Transportation, may address in the Delta Plan the effects of climate change and sea level rise on the three state highways that cross the Delta.

(d) The council, in consultation with the State Energy Resources Conservation and Development Commission and the Public Utilities Commission, may incorporate into the Delta Plan additional actions to address the needs of Delta energy development, energy storage, and energy transmission and distribution.

85309 The department, in consultation with the United States Army Corps of Engineers and the Central Valley Flood Protection Board, shall consider a proposal to coordinate flood and water supply operations of the State Water Project and the federal Central Valley Project, and submit the proposal to the council for considerations for incorporation into the Delta Plan. In drafting the proposal, the department shall consider all related actions set forth in the Strategic Plan.

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CHAPTER 7

Reduce Risk to People, Property, and State Interests in the Delta

Reducing flood risks to people, property, and State interests is critical to achieving the Delta Reform Act's coequal goals and protecting the Delta as a place. The Legislature has found that the Delta is "inherently floodprone," and that further improvements and continuing maintenance of the levee system will not resolve all flood risks (Public Resources Code section 29704). Living with risk, whether from floods, earthquakes, fires, coastal storms, or other hazards, is often part of life in California. The Delta's hazards, however, are exceptional because they affect so many State interests, including the reliability of its water supplies, the health of the Delta's ecosystem, and the qualities that make the Delta an attractive place to live, work, and recreate.

To reduce these risks to people, property, and State interests in the Delta, the Delta Reform Act requires that the Delta Plan promote effective emergency response and emergency preparedness, and promote appropriate land use (Water Code section 85305). The Delta Reform Act also directs the Council, in consultation with the Central Valley Flood Protection Board (CVFPB), to recommend priorities for State investments in levee operation, maintenance, and improvements in the Delta, including both levees that are a part of the State Plan of Flood Control and nonproject levees (Water Code section 85306).

The Council envisions a future in which risks of flooding in the Delta are reduced, despite an increase in sea levels and altered runoff patterns. The Council sees a future where Delta residents, local governments, and businesses are better prepared to respond when floods threaten. The Council envisions a future where bypasses are expanded; channels are improved; and strong, well-maintained levees protect local communities—but also protect State interests in a more reliable water supply for California, and a protected and restored Delta ecosystem. These improvements will include new or expanded floodways and bypasses, maintaining and improving levees, and floodproofing new development. The Council envisions that rural areas and the Delta's legacy communities will also be protected from flood risks by careful land use planning that discourages urban development in flood-threatened areas. The Council envisions that local agencies will be better financed and protected through a locally controlled emergency response and flood protection district, with fee assessment authority. State funds for desired projects will be focused at State interests in the Delta, but some of that activity will protect local interests as well. Eliminating flood risks will be impossible, but prudent planning, reasonable land development, and improved flood management will significantly reduce risk, and serve the coequal goals of a more reliable water supply, and a protected and restored Delta ecosystem.

Delta Hazards Threaten Both Coequal Goals and the Delta as a Place

The risks that flooding, earthquakes, and other hazards pose to the Delta imperil California's water supplies and the health of the Delta ecosystem. The channels that convey water through the Delta to users in the Bay Area, San Joaquin Valley, or Southern California, and the islands that prevent

saltwater intrusion into Delta water supplies depend upon levees for their preservation. Should the levees that protect these channels fail, the impacts on water supplies could be felt statewide. Improving these Delta levees is an investment in water supply reliability. Another way to reduce these risks is for areas that use Delta water to develop plans for possible interruption of these supplies in a catastrophic event, as recommended in Chapter 3. Integrating water supply and flood control efforts is also important to optimize the management of the multipurpose reservoirs that store water for the Central Valley Project (CVP), State Water Project (SWP), and other water users. For example, a potential benefit of wide flood bypasses leading to the Delta may be greater flexibility in these reservoir operations, creating new opportunities to manage water supplies or generate hydroelectric power.

The Delta levees also affect the health of the ecosystem. Many birds, such as waterfowl or sandhill cranes, thrive in areas that depend on levees for their management. In some locations, careful removal or breaching of levees may create new habitats that benefit fish and wildlife and the ecosystem. Setting levees back deliberately, when feasible, can create both more capacity for flood flows and more habitat for fish and wildlife. But unplanned levee failures often create weed-infested depths that harbor nonnative species rather than refuges for smelt, salmon, or other preferred species. Changes in the area protected by levees also alter water circulation through the Delta, changing the benefit of flows released to protect its ecosystem.

The Delta's residents, farms, and businesses also depend on its levees. They shape the Delta landscape, protecting its farms and communities from destruction. The levee system is the foundation on which the entire Delta economy is built, the Delta Protection Commission's (DPC's) *Economic Sustainability Plan* reports (DPC 2012). Delta residents built the levee system over generations, and they are keenly interested in its maintenance and improvement. (See sidebar, Delta Disaster Recalled, for an example of the consequences of levee failure.)

DELTA DISASTER RECALLED

On a moonlit Wednesday night in June 1972, the San Joaquin River flowed slowly after one of the driest winters on record. It gnawed at the Andrus Island levee 6 miles south of Isleton between Bruno's Yacht Harbor and Spindrift Resort, opening a small hole that grew rapidly. By the time sheriff's deputies arrived on scene shortly after 1 a.m., the river had carved a 100-foot break. By 3 a.m., water covered Highway 12. Shortly after sunrise, the breach had grown to 300 feet, and volunteers were hard at work on a 1.5-mile-long bow levee to protect Isleton.

The battle to save Isleton continued throughout the day, but a rising tide and waves created by 30- to 45-mile-per-hour Delta winds hampered efforts. Within a few hours, officials ordered the evacuation of 1,400 Isleton residents and an additional 1,500 residents of Andrus and Brannan islands. At 9:45 p.m. Thursday, the bow levee breached, and a wall of water rushed into the low-lying residential area of Isleton. Although the city's business district was spared, almost all of Andrus Island and portions of Brannan Island were flooded, in some places up to 20 feet deep.

Then-Governor Ronald Reagan declared the islands a disaster area and asked President Richard Nixon to do the same. Over the next 6 months, the levee was repaired, the 12,000-acre lake that had been Brannan and Andrus Islands was drained, and life began returning to normal. A full year after the levee break, however, more than one-third of the residents had neither moved back into their homes nor begun to rebuild.

Officials estimated that damages were $21.8 million, slightly more than half of that from crop loss and saltwater damage to farmland. The cost for levee repairs was put at $800,000, and $500,000 went to pump the 20 square miles of flooded land dry. More than $1.5 million in federal disaster relief was made available. No definitive cause was ever determined for the levee breach, and a subsequent court case absolved the State of liability (DWR 1973, Sacramento River Delta Historical Society 1996).

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Flood Risk in the Delta

The Delta is an inherently floodprone area. This section provides an overview of the causes and risks of floods in the Delta. The Sacramento and San Joaquin rivers collectively drain approximately 42,500 square miles of land. Before the Delta was modified by levees and other human structures, these rivers' natural flows overflowed the Delta's low-lying islands and floodplains for long periods each spring.

The biggest floods occurred when warm Pacific storms swept in from the west and southwest, picking up moisture over the ocean and causing torrential rains when intercepted by the mountains surrounding the Central Valley. The risks of flooding were increased when large amounts of sediment were discharged to Central Valley rivers during the Gold Rush, choking their channels and raising their beds above their natural levels and surrounding lands.

Today, flooding of the Delta's complex labyrinth of islands and waterways is prevented by its levees. This system of flood control is supplemented by the flood facilities of the Sacramento River and San Joaquin River flood control projects and multipurpose reservoirs such as Shasta, Folsom, and Millerton lakes and Lake Oroville on the Sacramento and San Joaquin rivers and their tributaries, which hold back floodwater and provide water supplies and other benefits described in Chapter 3.

Many Delta levees were initially constructed more than a century ago using primitive materials and equipment. History has shown that structural failures of the levee system occur as a result of extraordinary events, imperfect knowledge, and imperfect materials. Delta levees face potential threats such as large runoff events, extreme high tides, wind-generated waves, earthquakes, subsidence, and sea level rise. Individually, each of these threats is enough to cause serious concern; together, they represent the potential for catastrophic disruption of the Delta and its economic and ecological services.

A mass or even partial failure of the levee system would have real life-and-death impacts and property losses that could total billions of dollars. Delta flooding could interrupt the conveyance of water through the Delta for the SWP, the CVP, in-Delta users, the Contra Costa Water District, the cities of Antioch and Stockton, and others who depend on the Delta for reliable water supplies (see Chapter 3 for a discussion of water supply reliability). Levee failures could also damage key features of the Delta ecosystem, including managed wetlands in Suisun Marsh and habitats of wintering greater sandhill cranes at Staten Island and nearby tracts. Unplanned levee failure could also degrade water quality in the Delta, because tidewaters would flood into the bowl created by subsidence of Delta islands. These failures would draw saltwater from San Francisco Bay and pollute Delta water with flood debris, farm chemicals, and other pollutants.

Levee failures also could flood homes, farms, and businesses, including historic structures in the legacy communities, and interrupt recreation and tourism. As noted in Chapter 5, about 116,000 residential structures are located in the 100-year floodplain of the Delta, mostly near Sacramento, West Sacramento, and Stockton. Also, 8,000 residences are below mean higher high water (DWR 2008b). Serious consequences also could result from flood-related damage to critical infrastructure in the Delta, including radio, cellular telephone, and television transmission towers; electrical transmission lines, including Pacific Gas and Electric Company, Sacramento Municipal Utility District, and Western Area Power Administration lines; natural gas pipelines serving local gas fields and regional transmission systems; petroleum pipelines; three state highways; and three interstate highways (DWR 2011a).

In simplistic terms, the concept of flood risk can be described as the likelihood of a flood event occurring and the consequences of that event. To many, flood risk simply means the chance a storm event will overwhelm the flood control system to some extent. Figure 7-1 illustrates the variables, namely the probability of flooding and the financial consequences. However, there are many other causes of flood risk, and the consequences can be far more complicated than the immediate damage to property.

Understanding Delta Flood Risk

Flood risk reflects both the probability of flooding and the consequences that would result from flooding. Flood risk can be calculated as:

R = % x $

Annual Flood Risk = Probability of Flooding x Financial Consequence

The scenario to the right of the river depicts how increasing the value of property, primarily through urbanization, will increase the flood risk in the area. Even though the levees in the urbanizing area have been upgraded to reduce the annual probability of flooding to 1% (or 1 flood every 100 years), by increasing the value of property behind these levees, the aggregate estimated flood risk has increased five-fold (from $200,000 to $1,000,000 per year). In order to maintain a static level of estimated flood risk, levees must be upgraded as the value of the property they protect increases.

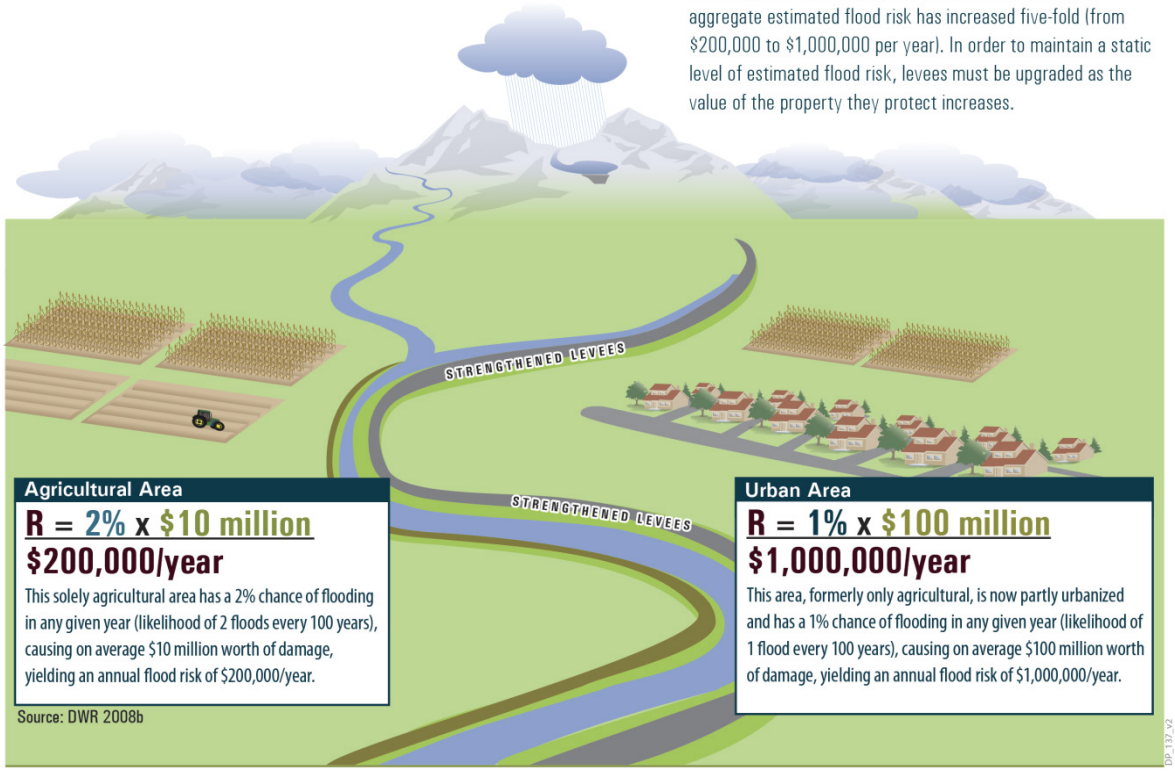

Figure 7-1

The best defense against these risks is first to better understand the Delta's flood hazards, and then manage and control those risks to the extent possible through public awareness; adequate emergency management planning; structural and nonstructural improvements, including enforcement of existing flood management regulations; and repairs, rehabilitation, and improvement of levees (including setback levees) and flood channels. Improving our understanding of risks through further evaluation and analysis of the flood control system and the assets it protects is essential to developing a rational, prioritized approach to flood management and public investment.

Floods

Flooding during winter storms that results in high water surface elevations and high winds has been a common cause of levee failures in the Delta. For example, the Sacramento River at Rio Vista may flow in excess of 300,000 cubic feet per second (cfs) during winter and early spring floods, 30 times typical late-summer flows of 10,000 cfs. Peak discharges place high stress on Delta levees and can create flood conditions, especially when coupled with high tides.

The likelihood of levee failures caused by high water is substantial, based on the historical performance of these

levees over the last century. During the last century, there have been more than 140 levee failures and island inundations, most of which occurred during flood seasons (DWR 2005). High water in the Delta can overtop levees, as well as increase the hydrostatic pressure on levees and their foundations, causing instability and increasing the risk of failure due to through-levee and/or under-levee seepage. Most levee failures in the Delta have occurred during winter storms and related high-water conditions, often in conjunction with high tides and strong winds.

Earthquakes

The Delta's levees are also at risk from the active seismic zones west of the Delta, including the San Andreas and Hayward faults. Less active faults underlie the Delta. A strong earthquake could damage Delta levees because of the potential for liquefaction of levee embankments and foundations. Saturated levees composed of dredged materials in other parts of the country and the world have performed poorly during moderate to strong earthquake shaking (DWR 2009; Delta Stewardship Council Staff 2010a). If a levee failed during high flows or if a flood were to occur soon after an earthquake, the protected area could be inundated.

The risks of earthquakes causing levee breaches and island inundations in the Delta have long been recognized. A California Department of Water Resources (DWR) report begins:

> *There is a long history of levee failures in the Delta that have resulted in extensive economic damage, but no failures of Delta levees are known to be directly attributable to earthquakes. Even so, two factors indicate a possible bleak picture for the future of many Delta levees. First, no serious causative quakes have occurred on the nearby major faults since the San Francisco earthquake of 1906. Second, the Delta levees of today are vastly different than those in the 1906 Delta, which had limited size and extent. (DWR 1980)*

The DWR Delta Risk Management Strategy Phase 1 study evaluated the performance of Delta levees under various seismic threat scenarios, and analyzed potential consequences for water supply, water quality, ecosystem values, and public health and safety. The study concluded that a major earthquake of magnitude 6.7 or greater in the vicinity of the Delta Region has a 62 percent probability of occurring sometime between 2003 and 2032 (DWR 2009). Figure 7-2 illustrates a potential flood scenario in which a 6.5-magnitude earthquake causes a 20-island failure. Although the probabilistic nature of earthquake prediction makes it difficult to quantify the timing and magnitude of seismic threats, it is important to address the threats posed by earthquakes to the Delta levee system because of the potential adverse effects of such events.

High Tides and Sunny-day Risks

Even without an earthquake or flood, Delta levees can fail during high tides or even on sunny days. Generally, these failures may be the result of a combination of high tide, and pre-existing internal levee and foundation weaknesses caused by burrowing animals, internal erosion of the levee and foundation through time, and human interventions such as dredging or excavation at the toe of the levee (DWR 2008b). Examples of sunny-day failures include the Brannon Andrus Tract in 1972 and Upper Jones Tract in 2004. It is estimated that, based on current conditions, a sunny-day failure would occur once every 9 years on average (DWR and DFG 2008).

Other hazards that affect the performance of Delta levees include encroachments, penetrations, and burrowing animals. Encroachments such as structures or farming practices on or close to the levee; penetrations of the levee, such as culverts or pipelines; and burrows created by rodents, especially beavers, muskrats, and squirrels, can weaken the structural integrity of levees. Because of unregulated historical construction, levees also contain many hidden hazards. Active programs of inspection, oversight, and maintenance are essential to minimize these hazards.

Simulation of Delta Salinity after a 20-island Failure Caused by a Magnitude 6.5 Earthquake

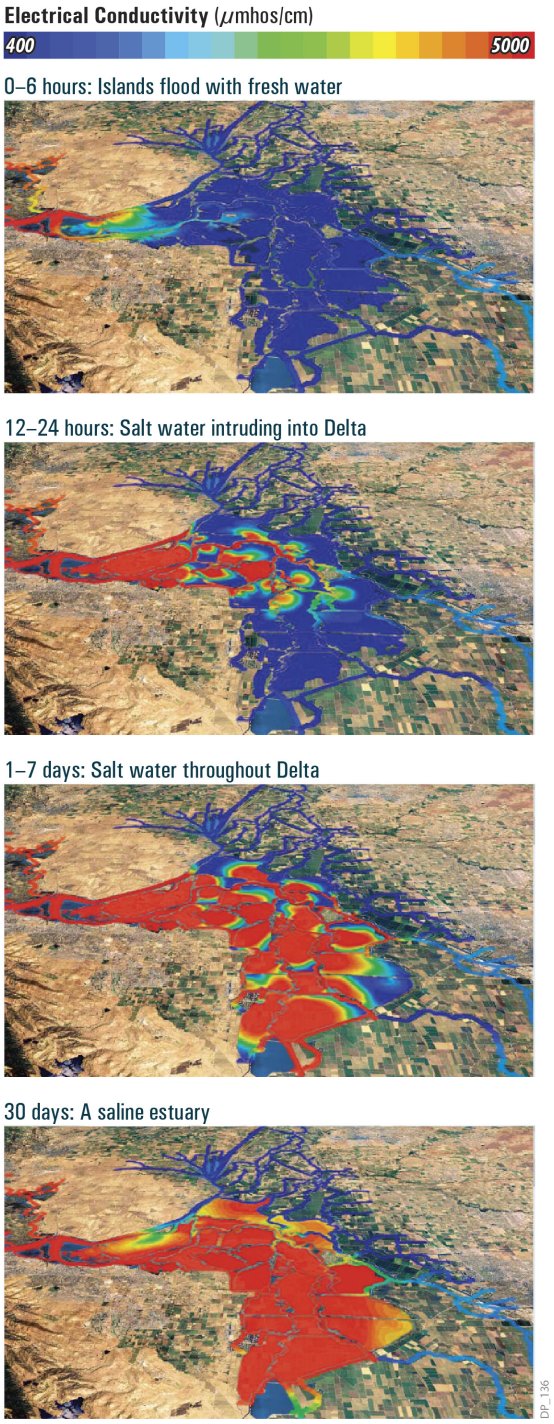

Figure 7-2 *Source: MWD 2010*

Land Subsidence

Because of the land subsidence described in Chapter 5, much of the central Delta is below sea level. Some islands are 12 to 15 feet below sea level, requiring levees 20 to 25 feet in height that act as dikes, holding back water continually rather than only during seasonal floods or extreme tides. As subsidence progresses, accommodation space increases, and levees must be continually maintained, strengthened, and periodically raised to support the increasing hydraulic stresses (Miller 2008, Mount and Twiss 2005). The hydraulic stress also can drive seepage through and under levees, and place levee foundations under more stress. The thinning of the peat soil layer also causes shallow or artesian groundwater conditions. More seepage onto islands will increase the drainage costs associated with additional pumping and decrease levee stability (Deverel and Leighton 2010).

Climate Change and Flood Risk

Climate change has major implications for the Delta, and especially for flood risk management. It is estimated that by the year 2100, sea levels may rise 31 to 69 inches (California Climate Action Team 2010, California Ocean Protection Council 2011), putting additional stress on levees and increasing their risk of failure. Projected changes in the timing and intensity of runoff may increase peak storm runoff and high-frequency flood events (DWR 2008c). Such floods could interrupt water conveyance through the Delta for those who depend on the Delta for water.

Additionally, scientific understanding of large-scale precipitation events is growing, as demonstrated by the ARkStorm scenarios being investigated by the U.S. Geological Survey, which indicate that massive storms and subsequent flooding have occurred and are likely to occur again (USGS 2011). Failure of significant parts of the Delta's flood management system may be unavoidable.

Planning for Flood Management

This section summarizes the current state of flood management planning for the Delta. To reduce the risk of flooding, Delta landowners, local governments, and State and federal agencies have planned and built an extensive levee system in the Delta, and significant flood control works upstream of the Delta. Other government flood control programs plan for emergency response in the event of floods, or help manage flood risks through land use planning, building standards, and flood insurance. The Delta Reform Act refers to these government-sponsored flood control programs in its provisions regarding covered actions (Water Code section 85057.5(a)(4)). The sidebar, What Is a Government-sponsored Flood Control Program?, highlights those programs referenced in statute; and proposed actions in the Delta that will have a significant impact on the implementation of one of these programs may be considered covered actions. Chapter 2 provides details about covered actions.

There are more than 1,000 miles of project and nonproject levees in the Delta and Suisun Marsh. Differences in how levees are classified can influence reports about their length and condition. Approximately 65 percent of the levees in the Delta and all levees in the Suisun Marsh are owned or maintained by local agencies or private owners and are not part of the flood control projects on the Sacramento or San Joaquin rivers. Most of these nonproject levees are maintained by local reclamation districts created and funded by landowners, initially for the purpose of draining ("reclaiming") Delta islands and tracts. The reclamation districts continue to maintain levees and other water control facilities today. These nonproject levees are defined in Water Code section 12980(e).

Many facilities throughout the Delta also drain rainfall runoff from land into Delta channels. Local cities and districts own and maintain urban storm drains in developed areas. Stockton, Sacramento, West Sacramento, Lathrop, Manteca, and Tracy are Delta cities with storm drainage facilities.

WHAT IS A GOVERNMENT-SPONSORED FLOOD CONTROL PROGRAM?

Any State or federal strategy, project, approval, funding, or other effort that is intended to reduce the likelihood and/or consequence of flooding of real property and/or improvements, including risks to people, property, and State interests in the Delta, that is carried out pursuant to applicable law, including, but not limited to, the following code:

- State Water Resources Law of 1945, Water Code section 12570 et seq.
- Sacramento-San Joaquin River Flood Control Projects (Flood Control Act of 1941, Public Law 77–228)
- Local Plans of Flood Protection (Water Code section 8201)
- Central Valley Flood Protection Plan (Water Code section 9600 et seq.)
- Subventions Program, Special Projects Program (Water Code section 12300 et seq.)
- Way Bill 1973 – Subventions Program, Special Projects Program (Water Code section 12980 et seq.)
- Central Valley Flood Protection Board Authority (California Code of Regulations, Title 23, Division 1)
- National Flood Insurance Program (National Flood Insurance Act of 1968, 42 United States Code 4001 et seq., Public Law 90-448)

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Most Delta islands have a network of agricultural drains and pumps to pump runoff into the Delta channels. Some Delta channels have been dredged to increase their capacity to carry floodwater and to obtain material for levee construction and maintenance.

The flood control projects on the Sacramento and San Joaquin rivers include approximately one-third of the Delta's levees. Known as "project levees," they begin on the left bank of the Sacramento River at Sherman Island, and line most of the riverbanks, as well as the Sacramento River Deep Water Ship Channel and some connecting waterways, north to Sacramento and beyond. The Delta Cross Channel's control gates are an important feature of this levee system, closing during high flows to keep the Sacramento River's floodwaters out of the central Delta. The flood control

project also includes the Yolo Bypass, the broad, managed floodplain in Yolo County west of West Sacramento. The wide bypass, which is confined by project levees, draws floodwater through weirs above Sacramento to lower flood heights on the Sacramento River and its tributaries, discharging back to the Delta above Rio Vista. The Yolo Bypass floods about once every 3 years, between December and February. On the San Joaquin River, project levees line the riverbanks from Old River to Stockton. Figure 7-3 shows the locations of project and nonproject levees in the Delta.

Recent evaluations show that some of the flood control project facilities on the Sacramento and San Joaquin rivers are not adequate. Because the system was intended partly to flush Gold Rush-era sediment from rivers and channels, the project levees were often built close to the riverbanks, and are prone to erosion. Many of the system's channels have inadequate capacity to carry the flows for which they were designed, and many levees do not meet contemporary design standards (DWR 2011c).

The CVFPB, as part of its responsibility to oversee the flood control projects on the Sacramento and San Joaquin rivers, has adopted regulations to control encroachments on the project and some of the streams that flow into it. It also regulates encroachments within designated floodways, which are the channels of a river or other watercourse and the adjacent land areas that convey floodwaters (California Code of Regulations [CCR], Title 23, Division 1, Chapter 1, Article 2, Section 4). In the Delta, designated floodways include the Cosumnes River's floodplain and the confluence of the San Joaquin River and the Stanislaus River upstream from Paradise Cut.

Some levees are neither project levees nor nonproject levees. These "unattributed levees" include hundreds of miles of levees in Suisun Marsh and the Delta, and are not part of any State-financed flood control program. They also include some that are unmaintained along the perimeter of permanently flooded islands and no longer serve flood control or drainage purposes.

Multipurpose reservoirs in the Sacramento and San Joaquin river watersheds that play a role in California's water supply also serve critically important roles in managing floods that affect the Delta. The CVP's Shasta, Folsom, and Millerton lakes and New Melones Reservoir; the SWP's Lake Oroville; and other reservoirs are operated in accordance with flood control rules established by U.S. Army Corps of Engineers (USACE), reserving space to capture flood flows that can be released downstream gradually so that channels are not overwhelmed.

Many studies and planning efforts addressing flood management and emergency preparedness, response, and mitigation are under way, and will be considered by the Council for ongoing Delta flood risk management. These studies, efforts, and programs include the following:

- ***Central Valley Flood Protection Plan* (CVFPP).** This strategic plan for improving the flood control projects on the Sacramento and San Joaquin rivers recommends approaches for reducing flood risk and improving the flood control project, including expansion of the Yolo Bypass and construction of a new San Joaquin River Bypass at Paradise Cut (DWR 2011c) (see sidebar, Central Valley Flood Protection Plan).
- **DWR's FloodSAFE Initiative.** In 2006, DWR launched FloodSAFE California—a multifaceted initiative to improve public safety through integrated flood management.
- **DWR's Delta Levees Program.** This program encompasses both the Delta Levees Maintenance Subventions and Delta Levees Special Flood Control Projects programs, which provide State cost-share funding for Delta levee maintenance and upgrades.
- ***Sacramento-San Joaquin Delta Multi-Hazard Coordination Task Force Report.*** This report responds to Senate Bill (SB) 27 (Water Code section 12994.5), which called for the task force to make recommendations to the Governor about Delta multi-hazard emergency response and recovery issues.

- **USACE Delta Islands and Levees Feasibility Study, Long-Term Management Strategy for Dredging and Dredge Material Placement, Periodic Inspection Program, and Levee Safety Portfolio Risk Management System.** USACE has multiple programs addressing Delta-related flood management issues, including levee safety, levee integrity, and the beneficial reuse of dredged material.
- **CVP and SWP Reoperation Studies.** DWR's Forecast-coordinated Operations Program and Systems Reoperation Program address reservoir operational criteria, as noted in Chapter 3.

The Council will consider the findings of these studies and may incorporate them into future Delta Plan updates. The CVFPP and FloodSAFE include many concepts relevant to flood protection in the Delta. At the federal level, the National Committee on Levee Safety (2009) submitted a report to Congress that outlined the critical components of a National Levee Safety Program, and a high-level timeframe and steps for its creation. It is up to Congress to act on these recommendations, which will be monitored by the Council as they relate to the Delta Plan.

The CVFPB, DWR, and USACE each play unique and critical roles in Delta flood risk management. Because of this, the Council's role in facilitation, coordination, and integration of various agencies and other parties is of particular importance. Frequent, ongoing collaboration with other State, federal, and local agencies to improve communication and coordination is essential to meeting the Delta Plan's flood management objectives.

CENTRAL VALLEY FLOOD PROTECTION PLAN

The Central Valley Flood Protection Act of 2008 directed DWR to prepare the CVFPP. The CVFPP is a flood management planning effort that addresses flood risks and ecosystem restoration opportunities in an integrated manner. It specifically proposes a systemwide approach to flood management for the areas currently protected by facilities of the State Plan of Flood Control (SPFC). The CVFPP was adopted by the CVFPB in June 2012. It is expected that the CVFPP will be updated every 5 years thereafter.

The CVFPP proposes a systemwide approach to address the following issues:

- Physical improvements in the Sacramento and San Joaquin river basins
- Urban flood protection
- Small community flood protection
- Rural/Agricultural area flood protection
- System improvements
- Non-SPFC levees
- Ecosystem restoration opportunities
- Climate change considerations

The geographic scope of the CVFPP includes the portions of the Delta covered by the SPFC, including about 65 miles of urban, nonproject levees at Stockton; approximately two-thirds of Delta levees are not addressed in the CVFPP.

The effects of systemwide improvements directed by the CVFPP and the potential of redirected impacts to areas within the Delta will be monitored by the Council to ensure alignment with the coequal goals and the Delta Reform Act. Additionally, the Council may, at its discretion, incorporate those portions of the CVFPP into the Delta Plan to the extent that those portions promote the coequal goals (Water Code section 85350).

The 2012 CVFPP is only a descriptive document, highlighting a planning perspective at a reconnaissance level. Follow-on feasibility studies and project-specific development activities will be conducted over the next several years. The Council will continue to monitor and provide input to those activities to ensure that Delta flood risk issues are considered. Flood system improvement actions undertaken upstream of the Delta are of particular concern if not coupled with in-Delta actions that reduce overall systemwide flood risk.

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The Delta's Levees

The levees within the legal Delta protect approximately 740,000 acres of land. They define the Delta's physical characteristics; influence the reliability of its water supplies and its ecosystem health; and are critical to the Delta's residents, farms, businesses, cities, and legacy communities. Because many Delta levees protect land below sea level, they hold back water all day, year-round, rather than only during floods, and so are called "the hardest working levees" in America.

Levees in the Delta

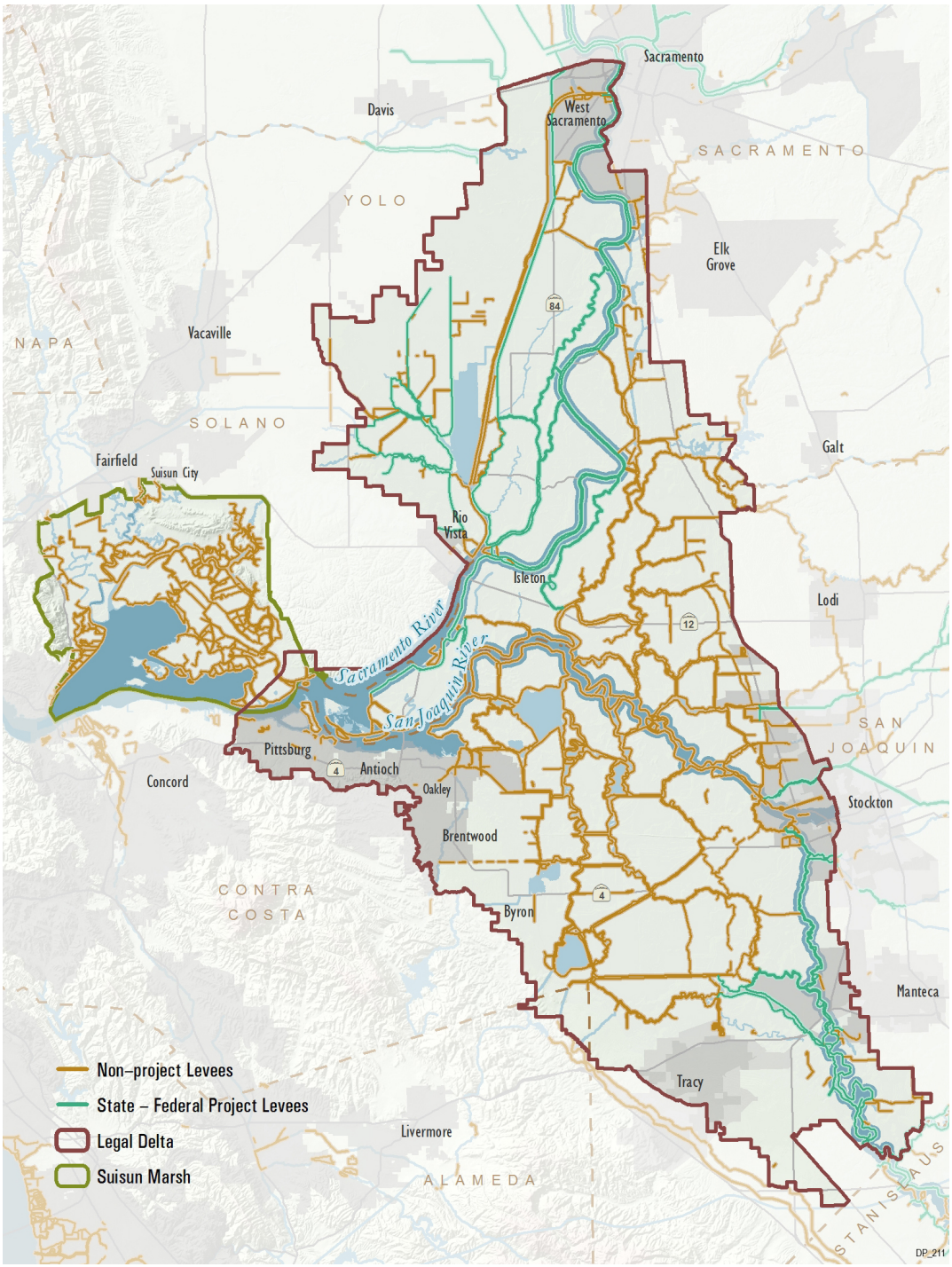


Figure 7-3 *Source: DWR 2011e*

Existing Levee Standards and Guidance

It is more important than ever that the Delta's levees are designed, constructed, and maintained to provide a level of flood risk reduction commensurate with the coequal goals and protection of the Delta's unique values as a place. Over the last few decades, State and federal agencies have developed guidelines and standards for levees. These standards establish minimum criteria for levee design and maintenance. The standards include (1) the level of flood protection California has prescribed for the Central Valley's urban areas, (2) whether sufficient protection is provided by the levees to exempt development financed with federally backed mortgages from requirements to obtain flood insurance, and (3) whether property and infrastructure protected by the levees (including the levees themselves) are eligible for assistance in the event of a catastrophic emergency, including aid from USACE to rehabilitate levees damaged in an emergency or for disaster assistance from the Federal Emergency Management Agency (FEMA).

Four levee standards and guidance applicable to the Delta are discussed below (and shown on Figure 7-4); they are ordered from highest to lowest level of flood protection:

- **DWR 200-year Urban Levee Protection (DWR - 200 Year):** This standard goes beyond criteria for levee height and geometric design to include requirements for freeboard, slope stability, seepage/underseepage, erosion, settlement, and seismic stability (DWR 2011b). It protects against a flood that has a 0.5 percent chance of being equaled or exceeded in any given year (a 200-year level of flood protection). This urban levee standard is the only levee standard that specifically links land uses to levee criteria. State law requires that by 2025, floodprone urban areas with over 10,000 residents must meet this 200-year flood protection standard (Government Code section 65865.5(a)(3)). Compliance likely will be achieved by upgrading levees to meet the 200-year design standard, under development by DWR. Sacramento, West Sacramento, and Stockton are planning levee improvements to attain this level of protection.

  Very few levees in the Delta meet this standard because most Delta levees do not protect urban areas. Under existing law, rural levees are not required to meet this standard.

- **FEMA 100-year (Base Flood) Protection (FEMA – 100 Year):** This "insurance" standard, often called the "1 percent annual chance flood" level of protection, provides criteria that levees must meet to protect against the flooding that is the basis for FEMA's flood insurance rate maps (44 Code of Federal Regulations 65.10). It is often used with established USACE criteria to prescribe requirements for levee freeboard, slope stability, seepage/underseepage, erosion, and settlement. The standard generally does not address seismic stability. In communities where levees provide this level of flood protection, new developments are not required to meet federal floodproofing standards and can obtain federally guaranteed mortgages without purchasing flood insurance.

  Few Delta levees outside of cities meet this standard, and many urban levees need improvement to meet it.

- **Public Law 84-99 (PL 84-99):** The PL 84-99 standard is a minimum requirement established by USACE for levees that participate in its Rehabilitation and Inspection Program (33 United States Code 701n) (69 Stat. 186). Twenty-five Delta reclamation districts, protecting about 31 percent of the legal Delta's land behind about 516 miles of levees, are at or above this standard, according to a recent report to the Council by DWR (DWR 2012). Delta islands or tracts that meet this standard are eligible for USACE funding for levee rehabilitation, island restoration after flooding, and emergency assistance, provided that the reclamation district is accepted into the USACE's program and passes a rigorous initial inspection and periodic follow-up inspections. Eligibility for PL 84-99 was formerly based primarily on levee geometry with minimum freeboard and maximum steepness of slopes. USACE's periodic

Levee Guidance

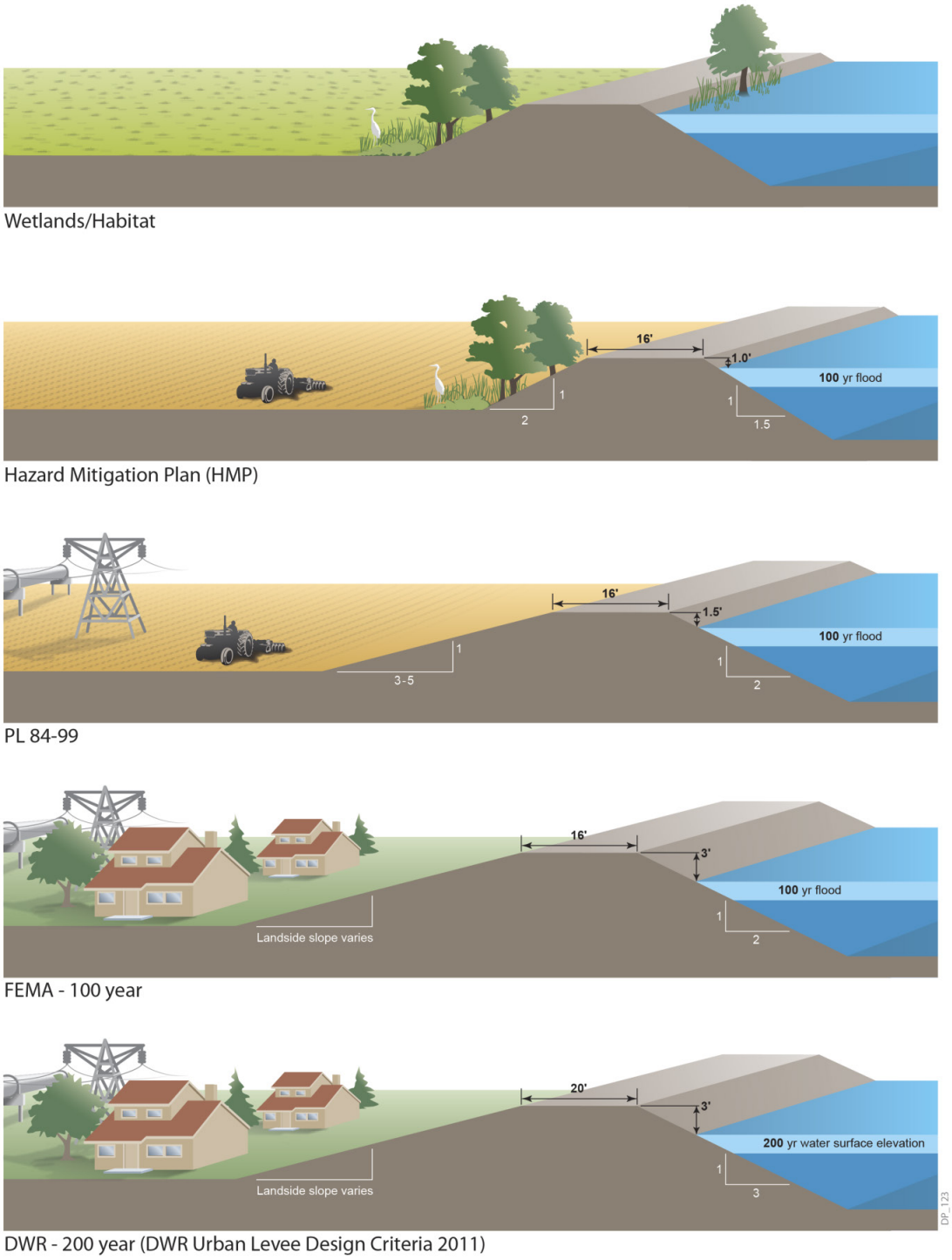


Figure 7-4 *Source: Adapted from Delta Vision Blue Ribbon Task Force 2008 and DWR 2011b*

inspection program incorporates other elements into eligibility, including presence of structure encroachments, vegetation, rodent control programs, and more. The standard for levee geometry implies a minimum levee height and a slope stability factor of safety, but is not associated with a level of protection (such as a 100-year flood) and does not address seismic stability. In 1987, USACE developed a Delta-specific standard based on the Delta's particular organic soils and levee foundation conditions. The CALFED Record of Decision set a goal of improving Delta levees to the PL 84-99 standard, as does the DPC Economic Sustainability Plan, but funding has been inadequate to attain this objective.

- **FEMA Hazard Mitigation Plan (HMP) Guidance:** FEMA, DWR, the California Office of Emergency Services (now the California Emergency Management Agency [Cal EMA]), and the Delta levee-maintaining agencies negotiated the HMP guidance to reduce the likelihood of repetitive flood damage to Delta levees and islands, so that FEMA disaster assistance would not be requested repetitively for the same islands after minor floods. Fifty-three of the Delta's reclamation districts, protecting over 47 percent of the legal Delta's acreage, fall below this standard, which 139 miles of Delta levees do not meet (DWR 2012). Local communities that do not meet the HMP guidance are not eligible for FEMA disaster reimbursement for flood fights or assistance if levees fail or islands flood. If even a portion of the levee around an island or tract does not meet the HMP guidance, assistance from FEMA to recover from levee damage is unavailable. Fifteen districts comply with this guidance, but are below the PL 84-99 standard. FEMA and Cal EMA have a memorandum of understanding, updated in 2010, that sets forth the requirements for FEMA public assistance funding for emergency flood fighting, emergency repair, permanent restoration, and/or replacement of eligible damaged nonproject levees within Delta reclamation districts (Cal EMA and FEMA 2010). The guidance is based on geometric criteria for the levees. The HMP guidance, negotiated between 1983 and 1987, was intended as an interim guidance, but has not been adjusted using subsequent or projected flood elevations.

No State standards currently address design criteria for flood protection of the state highways and interstate highways that traverse the Delta. Federal standards require that interstate highways must be protected from 50-year flood events to qualify for Federal Highway Administration funds (23 Code of Federal Regulations 650.115). Because most roads in the Delta were constructed before these standards were developed, they do not meet the standards. For example, sections of State Route 12 are 10 feet or more below sea level. A flood on the islands this highway traverses could interrupt transportation and trade, and put motorists at risk.

Levees and Ecosystem Function

Historically, most discussion of levees has emphasized reducing flood risks to life and property. However, habitat and ecosystem values and functions can provide multiple benefits, and must be considered in flood management planning and actions. For example, the CVFPP includes a conservation framework and strategy that outline how environmental elements can be integrated into flood management activities and provide an environmental guide for flood project planning. Setting levees back from the riverbank can expand flood conveyance capacity and reduce flood risk while providing ecosystem restoration and recreational opportunities (USACE 2002). Setback levees also allow opportunities for construction of an improved levee foundation and section using modern design and construction practices, thereby reducing risk of failure.

Much discussion has occurred on how to more effectively accommodate ecosystem function with the current levee system, highlighting the following issues (Healey and Mount 2007):

- Current levees tend to be narrow, with steep waterside slopes that provide little upland habitat value.

- Setback levees may provide habitat value and increased levee integrity.
- Levees can be used to promote specific habitat types (such as waterfowl habitat) by ensuring that some areas of freshwater marsh are sustained.
- Where lands are not heavily subsided, levees can allow for multiple land uses including habitat management and wildlife-friendly agriculture.
- Allowing levees to fail on deeply subsided islands would not generate any obvious ecological benefits.
- Subsidence reversal on deeply subsided islands would rely on levees to appropriately manage water levels during tule growth.

As management efforts in the Delta proceed, it will be important to consider ecosystem functions and their interactions with the levee system, as discussed in Chapter 4. An example where these interactions are already being debated is the USACE's current policy requiring removal of vegetation from levees. Scientific support for and against this policy is mixed. Concerns with maintaining woody vegetation on levees include difficulties with inspection and flood fighting, potential for root holes, and trees toppling from erosion. Other evidence, however, suggests that woody shrubs and small trees on levees enhance levee structural integrity while providing environmental benefits. A study on a channel levee along the Sacramento River concluded that roots reinforced the levee soil and increased shear resistance by providing increased stability against slope failures (Shields and Gray 1992). In either case, the widespread removal of vegetation from Delta levees could have significant adverse environmental impacts that are not well understood.

Floodplains and Channels

Floodplains and channels that provide the capacity to carry and store flood flows are critical for managing flood risks, and for overall Delta water management and ecosystem integrity. The CVFPB and FEMA both play roles in designating floodways and floodplains to accommodate flood flows.

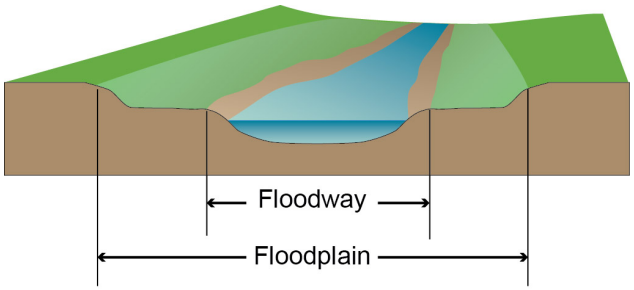
The CVFPB regulates encroachment in floodplains by designating floodways in the Sacramento River and San Joaquin River drainages, including the Delta (Water Code section 8609). A "designated floodway" is the channel of the stream and that portion of the adjoining floodplain, as shown on Figure 7-5, reasonably required to provide for the passage of a specified flood. It may also be the floodway between existing levees as determined by the CVFPB.

The CVFPB regulates encroachments within designated floodways and regulated streams through its permitting authority. The encroachment permit process applies to all projects, existing and proposed (including habitat restoration projects), within State/federal flood control project levees, designated floodways, bypasses, and regulated streams (CCR, Title 23, Division 1). The CVFPB should be consulted prior to the consideration of any projects that may be in a designated floodway in the Delta. Appendix L includes a map of the CVFPB's jurisdictional areas in the Delta.

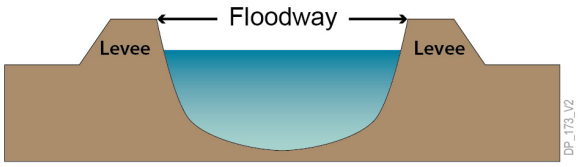
Additionally, under the National Flood Insurance Program, FEMA maps floodplains that have a 1 percent chance of flooding in any year (a 100-year flood). FEMA works with participating communities to regulate development within these floodplains according to federal regulations. No new construction, substantial improvements, or other development (including fill) may be permitted within specified flood zones on the community's Flood Insurance Rate Map unless it is demonstrated that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the water surface elevation of the base flood more than 1 foot at any point within the community.

In some flood channels and bypasses, dredging may have benefits because it increases channel capacity and also provides material that can be used for levee maintenance and other flood risk management activities. Because some

Conceptual Diagrams of Floodways



Conceptual Diagram of a Floodway within a Floodplain



Conceptual Diagram of Floodway within a Leveed Channel

Figure 7-5 The floodway is the channel of the stream and that portion of the adjoining floodplain reasonably required to provide for the passage of a specified flood; it is also the floodway between existing levees as determined by the CVFPB or the Legislature.

Source: FEMA 2006

portions of the Delta are within a tidal pool and other areas are riverine, the efficacy of dredging must be addressed on a site-specific basis and cannot simply be considered useful on a Delta-wide basis.

The benefits and impacts of dredging Delta channels are being investigated by a consortium of federal and State agencies, including U.S. Environmental Protection Agency, USACE, DWR, and the Regional Water Quality Control Boards, under the Delta Dredged Sediment Long-Term Management Strategy (LTMS) Program. The LTMS is designed to improve operational efficiency and coordination of the collective and individual agency decision-making responsibilities resulting in approved dredging and dredged material management actions in the Delta. Approved dredging and dredged material management actions will take place in a manner that protects and enhances Delta water quality, identifies appropriate opportunities for the beneficial reuse of Delta sediments for levee rehabilitation and ecosystem restoration, and establishes safe disposal for materials that cannot be reused (USACE 2007).

Investment in Reducing Risk

Because the Delta's levees protect residents; agricultural land; water supplies; and energy, communications, and transportation facilities, the State has invested considerable funding in Delta levees over several decades through various legislative actions. Legislation sponsored by Senator Howard Way in 1973 established the Delta Levees Maintenance Subventions Program, SB 34 (1988) established the Delta Levees Special Flood Control Projects Program, and Assembly Bill 360 (1996) extended these two programs and initiated a requirement for net habitat enhancement. Bond measures passed since the late 1990s have provided sizeable but one-time funding for levee maintenance, repair, and improvements. Propositions 84 and 1E provided substantial public financing toward most of the recent Delta levee projects. An estimated $700 million of State taxpayer money has been spent by DWR on Delta levee maintenance and improvements since the Delta levee funding programs began in the 1970s. This includes $274 million of bond funds that are encumbered for future Delta levee projects. Funding to improve levees that protect urban and urbanizing areas within the Delta is currently provided by the State via the Early Implementation Program managed by DWR.

The Delta's project levees are authorized as part of the federal flood control project and so are eligible for federal funding (as well as the maintenance subventions mentioned below). The CVFPB serves as the nonfederal partner to USACE for the Delta's project levees.

State investments for nonproject levees in the legal Delta are distributed according to guidelines and criteria of the Delta Levees Maintenance Subventions Program or Delta Levees Special Flood Control Projects Program. These two programs provide State matching funds for maintaining and improving Delta levees. Local agencies in the legal Delta receive partial reimbursement for levee maintenance and

rehabilitation from the State when funding is available. Currently, the State contributes up to 75 percent of qualifying costs for maintenance of many Delta levees. Local levee-maintaining agencies provide local cost-share matches, and both local and State efforts contribute to Delta flood risk reduction by maintaining continuous efforts to preserve Delta levees. It is often difficult for local agencies to raise funds for the local cost share of State and federal assistance programs. Funding assistance provided by the Delta Levees Maintenance Subventions Program is governed by guidelines developed by DWR and adopted by the CVFPB. State funds are not available for levee maintenance or improvement in most of Suisun Marsh.

Although the State has contributed the majority of costs for maintaining and improving Delta nonproject levees for many years, the concept of shared responsibility with local landowners is key to the long-term success of the Delta levee system. Neither the State nor the federal government is legally obligated to pay the full cost of Delta flood protection projects. The continued participation and financial support of local reclamation districts is essential. As noted in the Delta Reform Act's Section 85003(b), "Delta property ownership developed pursuant to the federal Swamp Land Act of 1850, and state legislation enacted in 1861, and as a result of the construction of levees to keep previously seasonal wetlands dry throughout the year. That property ownership, and the exercise of associated rights, continue to depend on the landowners' maintenance of those nonproject levees and do not include any right to state funding of levee maintenance or repair."

Prioritizing State Investment in Levees

The Delta Reform Act requires that State investments in Delta levees be prioritized to reduce risks to people, property, and State interests in the Delta (Water Code sections 85305(a) and 85306). Prioritizing investment is necessary to ensure that limited public funds are expended responsibly for improvements critical to State interests, rather than simply applying one objective to all Delta levees regardless of priority. These priorities, in combination with the Delta Reform Act directive that State agencies act consistently with the Delta Plan, will ensure that State spending on Delta levees reflects these priorities in the future. The Delta Reform Act provides that activities of the Council in determining priorities for State levee investments in Delta levees do not increase the State's liability for flood protection in the Delta or its watershed (Water Code section 85032(j)).

This Delta Plan outlines a process to prioritize State investments in levee operation, maintenance, and improvements in the Delta. It is also important to prioritize interim actions while longer-term guidelines are being established. Interim actions taken should consider and, where feasible, incorporate habitat and ecosystem values and enhancement in their development and implementation. This will allow for a more coordinated, effective approach to reducing Delta flood risk and prioritizing both immediate and long-term State investments. This approach will also take into account future actions that may be proposed through other planning efforts such as the CVFPP and Bay Delta Conservation Plan.

To effectively prioritize State investments in levees, a framework is needed to adequately assess Delta flood risk. This framework should include the following steps:

- Assess existing Delta levee conditions. Initially, a sufficient understanding of the current status of Delta levees is needed to establish baseline conditions against which future risk reduction efforts can be gauged. Because Delta levee conditions change, it is critical to conduct periodic assessments so that maintenance and improvement actions can be directed rationally. Assessment methods should be used that provide sufficient information to portray a reasonable snapshot of conditions.
- Develop an economics-based risk analysis for each Delta tract and island. This analysis must address several critical parameters, including life safety, private property, impacts on State water supply, critical infrastructure,

Delta water quality, ecosystem values, and systemwide integrity. Accepted risk analysis methods should be used, such as those developed by USACE (1996, 2006). This analysis could include "expected annual damage" assessments as a metric for analyzing flood risk. This approach, which integrates the likelihood and consequences of flooding, provides values that are useful for comparing flood risk at various locations and for ranking alternative levee projects.

- Conduct ongoing Delta flood risk analyses in an open manner for the public. Baseline and subsequent analytical efforts should always be conducted in manner open to scrutiny, with results being readily available for decision makers, interested parties, and the general public. Flood risk analyses will need to take into account future actions that may be proposed through other planning efforts such as the CVFPP and Bay Delta Conservation Plan.
- Develop an updated understanding of Delta hydrology. An updated understanding of water surface elevations in the Delta is critical for levee design purposes and should be addressed.

The approach must be based on sound scientific and engineering principles, and incorporate appropriate economic and hydrologic data.

As these long-term priorities for State investments in levee operation, maintenance, and improvements are developed, State funds for Delta levee projects should focus on the interim priorities set forth in RR P1, including the following actions:

- Provide a 200-year level of flood protection for existing urban and adjacent urbanizing areas (Water Code section 9600 et seq.).
- Improve the levees that protect aqueducts crossing the Delta and the freshwater pathway to Clifton Court Forebay, as depicted on Figure 7-6, to improve the reliability of these water supplies.
- Improve other Delta levees not specifically planned for ecosystem restoration to the FEMA HMP guidance level to ensure that the Delta's reclamation districts are eligible for public funding for emergency flood fighting, emergency repair, permanent restoration, and/or replacement of eligible damaged nonproject levees.
- Continue to fund and implement the Delta Levees Maintenance Subventions Program to maintain Delta levees.

In addition, the Delta Plan proposes creating a regional agency to assist with the planning, implementation, and financing of Delta flood risk reduction activities (see RR R2). Local levee-maintaining agencies have managed the financing and ongoing maintenance, rehabilitation, and repair of Delta levees, and have improved the levels of levee integrity, reducing overall Delta flood risk. Although the State has provided financial assistance over several decades, these programs have been funded primarily through State general obligation bonds, which face an uncertain future. The unencumbered bond funds that remain available for Delta levee projects total only $123 million.

An alternative funding mechanism could provide a more stable, long-term approach to funding in which local participation by all beneficiaries of flood risk management is more broadly incorporated. A regional flood risk management district with fee assessment authority could address a variety of Delta flood risk-related activities, including levee maintenance and improvements; regional flood management planning; flood facilities inspections; data collection; risk notification; and emergency preparedness planning, response, and mitigation. A regional flood risk management district could complement reclamation district activities. Because two ballot measures, Propositions 218 (1996) and 26 (2010) (discussed in Chapter 8), have raised the approval thresholds for new fees and taxes, the proposed regional assessment district will need to be broadly supported.

Delta Flood Management Facilities

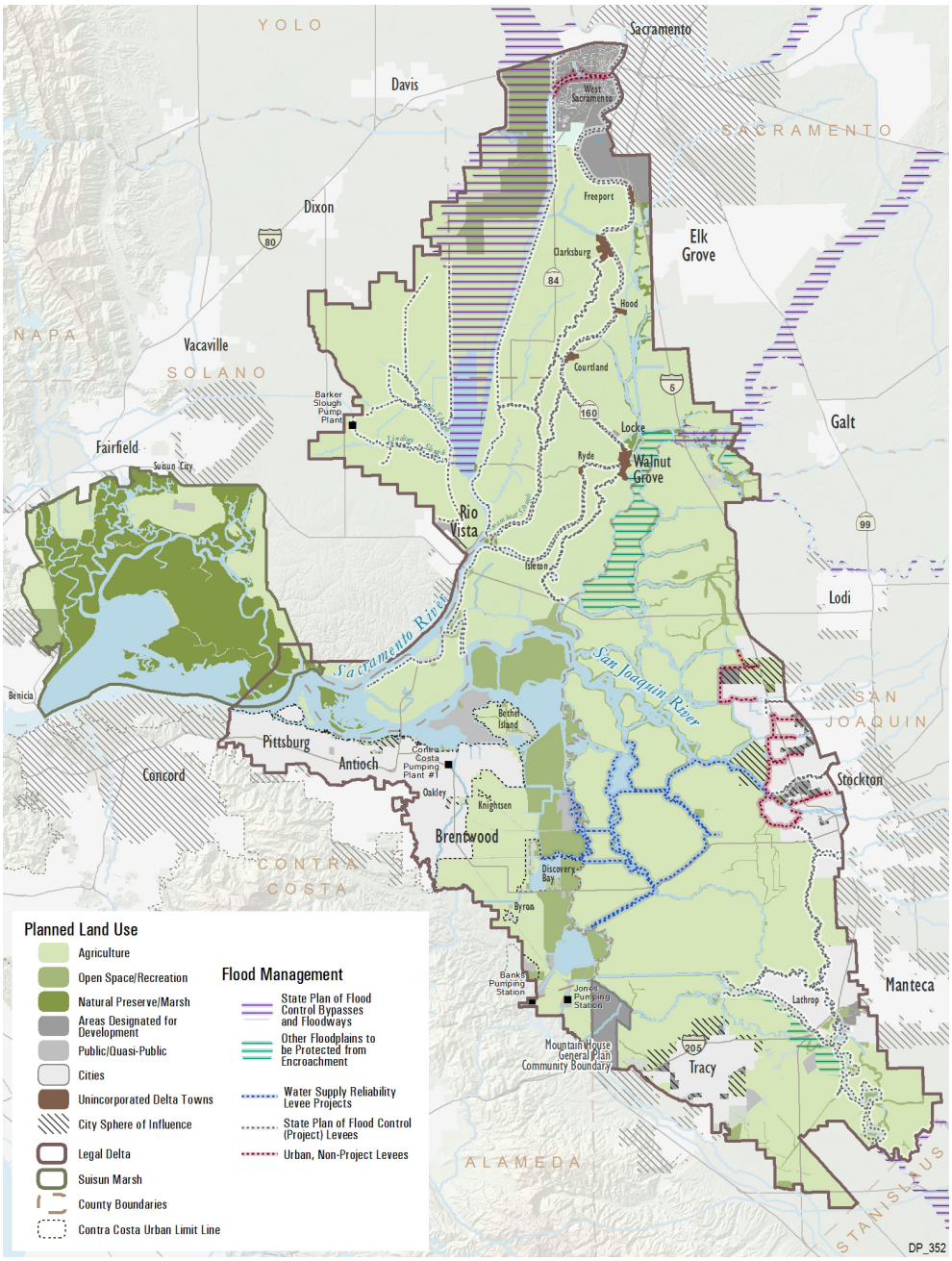


Figure 7-6 The map shows land uses designated by city and county general plans. Within cities' spheres of influences, the map shows land use designations proposed in city general plans, where available. In cases where cities have not proposed land uses within their spheres of influence, the map shows land uses designated by county general plans.

Sources: City of Benicia 2003, Contra Costa County 2008, Contra Costa County 2010, DWR 2011b, DWR 2011c, DWR 2011d, City of Fairfield 2008, Jones & Stokes 2007, City of Lathrop 2012, City of Manteca 2012, Mountain House Community Services District 2008, City of Rio Vista 2001, SACOG 2009, City of Sacramento 2008, Sacramento County 2011, Sacramento County 2012, Sacramento County 2013, San Joaquin County 2008a, San Joaquin County 2008b, Solano County 2008a, Solano County 2008b, South Delta Levee Protection and Channel Maintenance Authority 2011, City of Stockton 2011a, City of Stockton 2011b, City of Suisun City 2011, City of Tracy 2011a, City of Tracy 2011b, City of West Sacramento 2010, Yolo County 2010a, Yolo County 2010b.

Planning for Floodplain Land Use

The most important step in reducing risk to people in the Delta is to stop putting more people at risk behind levees that do not meet minimum modern standards for flood protection. Actions that increase the demand for higher public spending on flood risk reduction and exacerbate flood risk (for example, urbanizing floodprone areas) should be discouraged.

The DPC *Land Use and Resource Management Plan for the Primary Zone of the Delta* also includes important policies to limit development in floodprone areas of the Primary Zone:

> *Local governments shall carefully and prudently carry out their responsibilities to regulate new construction within flood hazard areas to protect public health, safety, and welfare. These responsibilities shall be carried out consistent with applicable regulations concerning the Delta, as well as the statutory language contained in the Delta Protection Act of 1992. Increased flood protection shall not result in residential designations or densities beyond those allowed under zoning and general plan designations in place on January 1, 1992, for lands in the Primary Zone. (DPC 2010)*

As noted in Chapter 5, the legacy community of Bethel Island warrants a special note because of its flood hazards. About 2,100 people reside on the island in about 1,300 residences concentrated on the south central shoreline and four mobile home parks. The island, which is below sea level, is surrounded by approximately 15 miles of levees, limiting the drainage of floodwaters in the event of a levee breach. A single road, Bethel Island Road, links the island to the mainland at the city of Oakley, complicating emergency response or evacuation in the event of flooding. Because developments on Bethel Island are proposed to be served by the Bethel Island Municipal Improvement District or other adjacent public services, the entire island is within the urban limit line adopted by Contra Costa voters in 2006. The high flood risks on the island and the restricted evacuation opportunities, however, indicate the island has greater hazards to lives and property than the Delta's other areas designated for development. For this reason, it is not excluded from the Delta Plan policy prohibiting new subdivisions unless adequate flood protection is provided. This is consistent with provisions of the Contra Costa County General Plan, which require that development other than a single home on existing parcels await resolution of several issues, including improvement of the community's public services, levees, and emergency evacuation routes.

As described in Chapter 5, urban residential, commercial, and industrial uses should be located in cities, other urban areas, and their spheres of influence, where strong levees can be provided, rather than in rural lands protected only by nonproject levees. Outside of these urban and urbanizing areas and the legacy communities, the Delta Plan prohibits major subdivisions of five or more parcels where 200-year flood protection is not available. Recognizing legacy community needs for incidental growth to maintain their unique cultural values, development within community boundaries should continue consistent with existing general plans, and federal and local flood protection laws. Appendix B provides maps of Delta community boundaries. Maintaining most of the Delta in rural, agricultural land use, as described in Chapter 5, complements policies that reduce the number of properties and the population exposed to high flood risks.

Finally, the participation of Delta counties and cities in the National Flood Insurance Program brings with it a requirement that all residential, commercial, agricultural, and industrial buildings comply with FEMA floodproofing standards, including elevating structure ground floors above the 100-year flood elevation. Examples of floodproofing are shown on Figure 7-7.

Examples of Floodproofing

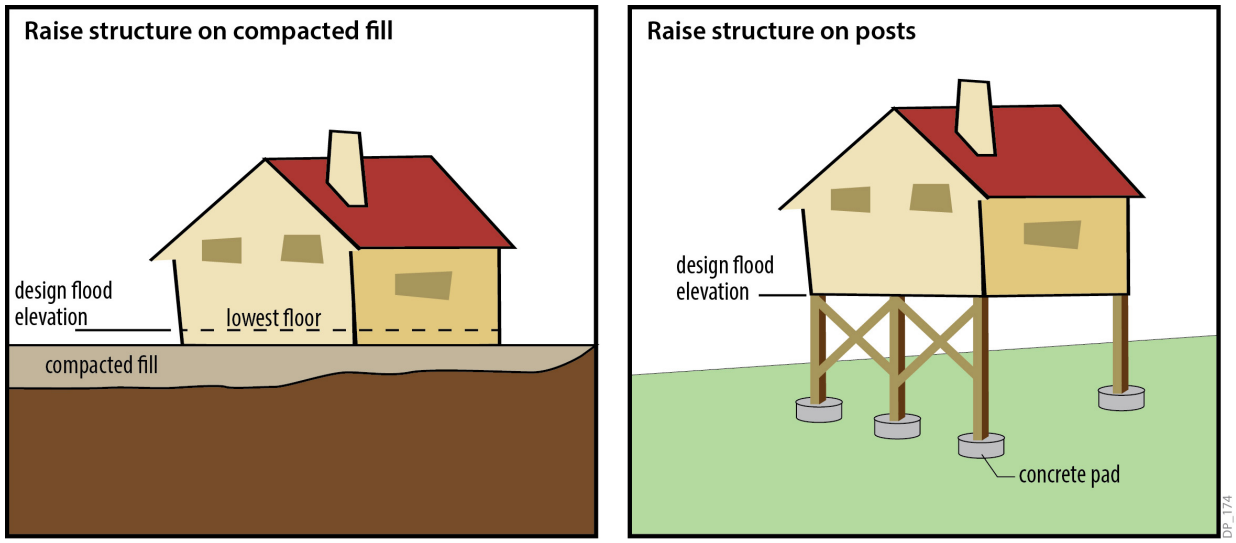


Figure 7-7 Floodproofing in accordance with the National Flood Insurance Program can be achieved through several methods. The illustration on the left shows an example of floodproofing by constructing the lowest floor within a structure above the design flood elevation. The illustration on the right shows floodproofing by raising the bottom of the structure above the design flood elevation.

Source: FEMA 1994; FEMA 2001

Emergency Preparedness and Response

Even with the best-engineered levees, channels, and floodways, a residual risk from flooding will always remain; flood risk can never be eliminated. Although investment in flood protection infrastructure can considerably reduce the likelihood of a catastrophic levee failure, failures are inevitable and will require well-coordinated and carefully developed emergency response efforts. To reduce response time and optimize effectiveness of response efforts, such plans need to leverage the unique capabilities of each agency with a mission in the Delta. This section provides an overview of the agencies and planning involved in emergency preparedness and response in the Delta.

Responsibilities for preparing for, declaring, and responding to flood emergencies are distributed among local, State, and federal agencies. Federal agencies with authority include USACE and FEMA. In California, State and local responsibilities fall to county offices of emergency services, local reclamation districts, Cal EMA, and DWR. In a Delta flood emergency, the response efforts by local and State emergency management professionals are guided by California's Standardized Emergency Management System (SEMS). SEMS was established by Government Code section 8607(a), and provides for effective management of multiagency and multijurisdictional emergencies in California, including flood emergencies. This system consists of five organizational levels, which are activated as necessary: (1) field response, (2) local government, (3) operational area, (4) regional, and (5) State. These levels are activated stepwise as the events warrant additional response and resources, meaning that each level of emergency responder contacts the next level above them should they deem the emergency beyond their capabilities to control. Federal resources are called upon if State resources are exhausted or additional assistance is needed. SEMS incorporates the functions and principles of the Incident Command System, the Master Mutual Aid Agreement, existing mutual aid systems, the

operational area concept, and multiagency or interagency coordination. A detailed discussion of SEMS can be found in Cal EMA SEMS Guidelines (Cal EMA 2009). Local governments must use SEMS to be eligible for funding of their response-related personnel costs under State disaster assistance programs.

At the State level, Cal EMA's *California Emergency Plan* is the current guiding plan for all State emergencies. The California Emergency Plan incorporates and complies with the principles and requirements found in federal and State laws, regulations, and guidelines. Cal EMA typically defers to DWR for emergency management during floods. DWR emergency flood management actions are guided by its 2007 *Interim Flood Emergency Operations Plan*. DWR is in the process of developing its Delta Flood Emergency Preparedness Response and Recovery Program (EPRRP), which will be the overall guiding flood emergency management program for DWR activities for project and nonproject levees in the Delta. The Delta Flood EPRRP consists of three components: (1) the plan for flood emergency preparedness, response, and recovery actions in the Delta; (2) multiagency plan coordination, which coordinates DWR's plan with the plans of other Delta flood response agencies; and (3) response facilities implementation, which includes the development of flood emergency response facilities in the Delta.

At the federal level, USACE has a standing All-Hazards Emergency Response Plan and standing contracts for emergency response work in the Delta region, and is ready to assist the State, as requested through PL 84-99. These existing plans and procedures are considered in DWR's flood emergency operations plans and are a critical part of the Delta Flood EPRRP Plan. FEMA is responsible for coordinating the response of several federal agencies to a large natural disaster that overwhelms the resources of State and local authorities. The primary duty of FEMA is to ensure services to disaster victims through operational planning and integrated preparedness measures.

Following a flood disaster, various federal programs can provide disaster assistance. USACE has specific criteria concerning eligibility for assistance under PL 84-99. FEMA's HMP criteria must be met to be eligible for its assistance (Delta Stewardship Council Staff 2010b).

To further address emergency preparedness and response issues in the Delta, the Legislature passed SB 27 (Water Code section 12994.5) to develop and implement multi-hazard preparedness and response strategies for the Delta. This legislation required the Office of Emergency Services (now Cal EMA) to establish the Sacramento-San Joaquin Delta Multi-Hazard Coordination Task Force. Led by Cal EMA, the task force consisted of representatives from the DPC, DWR, and representatives of the five Delta counties. The task force was directed to do the following:

- Make recommendations to the Secretary of Cal EMA relating to the creation of an interagency unified command system organizational framework, in accordance with the guidelines of the National Incident Management System and SEMS.
- Coordinate the development of a draft emergency preparedness and response strategy for the Delta region for submission to the Secretary of Cal EMA. Where possible, the strategy shall use existing interagency plans and planning processes of the involved jurisdictions and agencies that are members of the DPC.
- Develop and conduct all-hazard emergency response exercises and training in the Delta that are designed to test or facilitate implementation of regional coordination protocols.

The recommendations being prepared by the task force will likely play an important role in planning efforts for the Delta, and will be considered in the Delta Plan. When this Delta Plan was written, the task force recommendations had been approved by the Secretary of Cal EMA and forwarded to the Governor.

San Joaquin County has developed flood contingency maps and urban evacuation maps as part of its coordinated flood

emergency planning efforts. These maps and plans could be used as an example by other Delta counties, and State and federal agencies to prepare a Delta-wide emergency response plan.

Liability Concerns

USACE and other federal agencies are generally afforded some immunity from liability for damages from flood events under the concept of sovereign immunity and provisions of the Flood Control Act of 1928 (33 United States Code section 702c). Congress provided immunity to federal agencies for some but not all tort damages. However, this immunity does not apply to nonfederal agencies.

As the risks of levee failure and corresponding damage increase, California's courts have generally exposed public agencies, and the State specifically, to significant financial liability for flood damages (DWR 2005). The most notable recent court decision on flood liability was the California Court of Appeal decision in *Paterno v. State of California* (2003) (113 Cal. App. 4th 998). The court found the State was liable for damages caused by the failure of a project levee on the Yuba River that the State did not design, build, or even directly maintain. This decision makes it possible that the State will ultimately be held responsible for the structural integrity of much of the federal flood control system in the Delta and Central Valley. The *Paterno v. State of California* decision will ultimately cost State taxpayers approximately $464 million in awarded damages.

In *Arreola v. County of Monterey* (2002) (99 Cal. App. 4th 722), the court held local agencies and the California Department of Transportation (Caltrans) liable for 1995 flood damages to property owners that resulted from a failure to properly maintain levees of the Pajaro River project.

The California *Draft FloodSAFE Strategic Plan* states, "Local communities are responsible for land use decisions, but generally have not been found liable for failure of the flood protection system. Continued local actions to approve development within floodplains may increase flood risk, even if levees and other flood protection improvements are made. This creates liability issues which the State is concerned about. Legislation passed in 2007 addresses the need to connect land use planning with diligent and factual consideration of flood risks for areas of proposed development" (DWR 2008a).

In 2007, the Legislature amended the Water Code to address local community liability for approving development in floodprone areas. It provides that "a city or county may be required to contribute its fair and reasonable share of the property damage caused by a flood to the extent that the city or county has increased the state's exposure to liability for property damage by unreasonably approving new development in a previously undeveloped area that is protected by a state flood control project" (Water Code sections 8307(a) and (b)).

Ultimately, however, it is important to note that the State does not own, operate, control, or maintain nonproject levees, and does not have authority to do so. The Delta levee subventions program grants financial assistance to local reclamation districts for their levees. The State conducts evaluations to make sure subventions program funds have been spent appropriately, but not to ensure the quality of the work or the stability or structural integrity of nonproject levees. Rather, the nonproject levees are the sole responsibility of the reclamation districts, and the State is not liable for damages caused by their failure.

POLICIES AND RECOMMENDATIONS

These policies and recommendations are based on the Council's core strategies for reducing flood risks in the Delta, which are:

- Improve emergency preparedness and response
- Finance and implement flood management activities
- Prioritize flood management investment
- Improve residential flood protection
- Protect and expand floodways, floodplains, and bypasses
- Integrate Delta levees and ecosystem function
- Limit liability

Reducing flood risks also relies on locating urban development in the Delta's cities where levees are stronger, as discussed in Chapter 5, and retaining rural lands for agriculture, so that development in the most floodprone areas is minimized.

Improve Emergency Preparedness and Response

To effectively and reliably reduce risks to people, property, and State interests in the Delta, a multifaceted strategy of coordinated emergency preparedness, appropriate land use planning, and prioritized investment in flood protection infrastructure is necessary (Water Code sections 85305(a) and 85306). Federal, State, and local governments—and Californians—must be prepared for a variety of emergency situations.

The recommendations prepared by the Sacramento-San Joaquin Delta Multi-Hazard Coordination Task Force will likely play an important role in planning efforts for the Delta, and will be considered by the Council for incorporation in future updates of the Delta Plan.

Problem Statement

Levee failures and flooding can and will place human life and property in danger, and can have potentially significant implications for the State's water supply and infrastructure, and the health of the Delta ecosystem. Appropriate emergency preparedness and response planning and implementation activities need to be initiated.

Policies

No policies with regulatory effect are included in this section.

Recommendations

RR R1. Implement Emergency Preparedness and Response

The following actions should be taken by January 1, 2014, to promote effective emergency preparedness and response in the Delta:

- *Responsible local, State, and federal agencies with emergency response authority should consider and implement the recommendations of the Sacramento-San Joaquin Delta Multi-Hazard Coordination Task Force (Water Code section 12994.5). Such actions should support the development of a regional response system for the Delta.*
- *In consultation with local agencies, the California Department of Water Resources should expand its emergency stockpiles to make them regional in nature and usable by a larger number of agencies in accordance with California Department of Water Resources' plans and procedures. The California Department of Water Resources, as a part of this plan, should evaluate the potential of creating stored material sites by "over-reinforcing" west Delta levees.*
- *Local levee-maintaining agencies should consider developing their own emergency action plans, and stockpiling rock and flood-fighting materials.*
- *State and local agencies, and regulated utilities that own and/or operate infrastructure in the Delta should prepare coordinated emergency response plans to protect the infrastructure from long-term outages resulting from failures of the Delta levees. The emergency procedures should consider methods that also would protect Delta land use and ecosystem.*

Finance and Implement Local Flood Management Activities

The responsibility for securing funding for Delta levee maintenance, repairs, and improvements lies with the numerous local levee-maintaining agencies (primarily reclamation districts). Funding is generated through property assessments of local landowners and

also is provided by the State under programs administered by DWR (the Delta Levees Special Flood Control Projects and Delta Levees Maintenance Subventions programs). These programs provide State matching funds for addressing Delta flood risk; however, many other entities that benefit from flood risk management are not assessed, nor do they contribute to maintenance and upkeep of Delta levees, including owners of regional infrastructure that crosses the Delta. The duty of providing for Delta flood risk management should be borne by all entities benefitting from these actions, and an equitable methodology of defining and apportioning assessments should be developed and implemented.

Local levee-maintaining agencies have managed the financing and ongoing maintenance, rehabilitation, and repair of Delta levees, and have improved the levels of levee integrity, reducing overall Delta flood risk. Although financial assistance has been provided by the State over several decades, these programs have most recently been funded exclusively through State general obligation bond financing, which faces an uncertain future. The development of an alternative funding mechanism and authority would provide for a more stable, long-term funding approach in which local participation by all beneficiaries of flood risk management is more broadly incorporated. Propositions 218 (1996) and 26 (2010) raised the approval thresholds for new fees and taxes; these thresholds may make it more difficult for a proposed regional assessment district to gain revenue authority.

The establishment of a regional flood risk management district with fee assessment authority could address a variety of Delta flood risk-related activities, including levee maintenance and improvements; regional flood management planning; flood facilities inspections; data collection; risk notification; and emergency preparedness planning, response, and mitigation. Establishing a more centralized and responsive entity could provide a mechanism for addressing issues at the individual district level and for the Delta region overall for the long term.

Problem Statement

No mechanism exists for ensuring that costs of levee maintenance are borne by all beneficiaries. Current financing of levee operations and maintenance is not well coordinated, and future funding sources are uncertain. Financing of local levee operations, maintenance, emergency preparedness and response, and related data collection and reporting efforts would benefit from greater coordination and integration.

Policies

No policies with regulatory effect are included in this section.

Recommendations

RR R2. Finance Local Flood Management Activities

The Legislature should create a Delta Flood Risk Management Assessment District with fee assessment authority (including over State infrastructure) to provide adequate flood control protection and emergency response for the regional benefit of all beneficiaries, including landowners, infrastructure owners, and other entities that benefit from the maintenance and improvement of Delta levees, such as water users who rely on the levees to protect water quality.

This district should be authorized to:

- *Identify and assess all beneficiaries of Delta flood protection facilities.*
- *Develop, fund, and implement a regional plan of flood management for both project and nonproject levees of the Delta, including the maintenance and improvement of levees, in cooperation with the existing reclamation districts, cities, counties, and owners of infrastructure and other interests protected by the levees.*
- *Require local levee-maintaining agencies to conduct annual levee inspections per the California Department of Water Resources subventions program guidelines, and update levee improvement plans every 5 years.*
- *Participate in the collection of data and information necessary for the prioritization of State investments in Delta levees consistent with RR P1.*
- *Notify residents and landowners of flood risk, personal safety information, and available systems for obtaining emergency information before and during a disaster on an annual basis.*
- *Potentially implement the recommendations of the Sacramento-San Joaquin Delta Multi-Hazard Coordination Task Force (Water Code section 12994.5) in conjunction with local, State, and federal agencies, and maintain the resulting regional response system and components and procedures on behalf of SEMS jurisdictions (reclamation district, city, county, and State) that would jointly implement the regional system in response to a disaster event.*
- *Identify and assess critical water supply corridor levee operations, maintenance, and improvements.*

RR R3. Fund Actions to Protect Infrastructure from Flooding and Other Natural Disasters

- *The California Public Utilities Commission should immediately commence formal hearings to impose a reasonable fee for flood and disaster prevention on regulated privately owned utilities with facilities located in the Delta. Publicly owned utilities should also be encouraged to develop similar fees. The California Public Utilities Commission, in consultation with the Delta Stewardship Council, the California Department of Water Resources, and the Delta Protection Commission, should allocate these funds among State and local emergency response and flood protection entities in the Delta. If a new regional flood management agency is established by law, a portion of the local share would be allocated to that agency.*
- *The California Public Utilities Commission should direct all regulated public utilities in their jurisdiction to immediately take steps to protect their facilities in the Delta from the consequences of a catastrophic failure of levees in the Delta, to minimize the impact on the State's economy.*
- *The Governor, by Executive Order, should direct State agencies with projects or infrastructure in the Delta to set aside a reasonable amount of funding to pay for flood protection and disaster prevention. The local share of these funds should be allocated as described above.*

Prioritize Flood Management Investment

A method is needed for prioritizing State funds for use in operating, maintaining, and improving Delta levees with a systemwide approach. Although the State has expended millions of dollars since the early 1970s on Delta levees, almost half of the Delta's acreage is not protected by levees that meet the HMP guidance today. Efforts by landowners, reclamation districts, and other parties using local resources to perform levee upgrades, beyond the standards that may be funded by the State, are encouraged and would be consistent with the goal of reducing Delta flood risk. The Delta Reform Act provides that activities of the Council in determining priorities for State investments in Delta levees do not increase the State's liability for flood protection in the Delta or its watershed.

Problem Statement

The Delta Reform Act (Water Code section 85306) requires the Delta Plan to recommend priorities for State investments in Delta levees, including project and nonproject levees. Currently, no comprehensive method exists to prioritize State investments in Delta levee operations, maintenance, and improvement projects. Without a prioritization methodology, the apportionment of public resources into levees may not occur in a manner that reflects a broader, long-term approach.

Policies

RR P1. Prioritization of State Investments in Delta Levees and Risk Reduction

(a) Prior to the completion and adoption of the updated priorities developed pursuant to Water Code section 85306, the interim priorities listed below shall, where applicable and to the extent permitted by law, guide discretionary State investments in Delta flood risk management. Key priorities for interim funding include emergency preparedness, response, and recovery as described in paragraph (1), as well as Delta levees funding as described in paragraph (2).

(1) Delta Emergency Preparedness, Response, and Recovery: Develop and implement appropriate emergency preparedness, response, and recovery strategies, including those developed by the Delta Multi-Hazard Task Force pursuant to Water Code section 12994.5.

(2) Delta Levees Funding: The priorities shown in the following table are meant to guide budget and funding allocation strategies for levee improvements. The goals for funding priorities are all important, and it is expected that over time, the California Department of Water Resources must balance achievement of those goals. Except on islands planned for ecosystem restoration, improvement of nonproject Delta levees to the Hazard Mitigation Plan (HMP) standard may be funded without justification of the benefits. Improvements to a standard above HMP, such as that set by the U.S. Army Corps of Engineers under Public Law 84-99, may be funded as befits the benefits to be provided, consistent with the California Department of Water Resources' current practices and any future adopted investment strategy.

Priorities for State Investment in Delta Integrated Flood Management Categories of Benefit Analysis

Goals	Localized Flood Protection	Levee Network	Ecosystem Conservation
1	Protect existing urban and adjacent urbanizing areas by providing 200-year flood protection.	Protect water quality and water supply conveyance in the Delta, especially levees that protect freshwater aqueducts and the primary channels that carry fresh water through the Delta.	Protect existing and provide for a net increase in channel-margin habitat.
2	Protect small communities and critical infrastructure of statewide importance (located outside of urban areas).	Protect floodwater conveyance in and through the Delta to a level consistent with the State Plan of Flood Control for project levees.	Protect existing and provide for net enhancement of floodplain habitat.
3	Protect agriculture and local working landscapes.	Protect cultural, historic, aesthetic, and recreational resources (Delta as Place).	Protect existing and provide for net enhancement of wetlands.

(b) For purposes of Water Code section 85057.5(a)(3) and section 5001(j)(1)(E) of this Chapter, this policy covers a proposed action that involves discretionary State investments in Delta flood risk management, including levee operations, maintenance, and improvements. Nothing in this policy establishes or otherwise changes existing levee standards.

23 CCR Section 5012
NOTE: Authority cited: Section 85210(i), Water Code.
Reference: Sections 85020, 85300, 85305, and 85306, Water Code.

Recommendations

RR R4. Actions for the Prioritization of State Investments in Delta Levees

The Delta Stewardship Council, in consultation with the California Department of Water Resources, the Central Valley Flood Protection Board, the Delta Protection Commission, local agencies, and the California Water Commission, should develop funding priorities for State investments in Delta levees by January 1, 2015. These priorities shall be consistent with the provisions of the Delta Reform Act in promoting effective, prioritized strategic State investments in levee operations, maintenance, and improvements in the Delta for both levees that are a part of the State Plan of Flood Control and nonproject levees. Upon completion, these priorities shall be considered for incorporation into the Delta Plan.

The priorities should identify guiding principles, constraints, recommended cost share allocations, and strategic considerations to guide Delta flood risk reduction investments, supported by, at a minimum, the following actions to be conducted by the California Department of Water Resources, consistent with available funding:

- *An assessment of existing Delta levee conditions. This should include the development of a Delta levee conditions map based on sound data inputs, including, but not limited to:*
  - *Geometric levee assessment*
  - *Flow and updated stage-frequency analysis*
- *An island-by-island economics-based risk analysis. This analysis should consider, but not be limited to, values related to protecting:*
  - *Island residents/life safety*
  - *Property*
  - *Value of Delta islands' economic output, including agriculture*
  - *State water supply*
  - *Critical local, State, federal, and private infrastructure, including aqueducts, state highways, electricity transmission lines, gas/petroleum pipelines, gas fields, railroads, and deep water shipping channels*
  - *Delta water quality*
  - *Existing ecosystem values and ecosystem restoration opportunities*
  - *Recreation*
  - *Systemwide integrity*
- *An ongoing assessment of Delta levee conditions. This should include a process for updating Delta levee assessment information on a routine basis.*

This methodology should provide the basis for the prioritization of State investments in Delta levees. It should include, but not be limited to, the public reporting of the following items:

- *Tiered ranking of Delta islands, based on economics-based risk analysis values*
- *Delta levee conditions status report, including a levee conditions map*
- *Inventory of Delta infrastructure assets*

Improve Residential Flood Protection

To reduce the risk to lives, property, and State interests in the Delta, additional standards are needed to address new residential development. Sea level rise, subsidence, and new residential development combine to potentially put many more lives at risk. The policies in this section are designed to reduce risk while preserving the Delta's unique character and agricultural way of life. These policies should be construed as those required to provide the minimum level of flood protection, and should not be viewed as encouraging development in floodprone Delta areas. Flood insurance, and awareness of local emergency preparedness and response policies is strongly encouraged for all who live in floodprone areas of the Delta.

Consistent with existing law, urban development in the Primary Zone should remain prohibited. Urban development in the Secondary Zone should be confined to existing urban spheres of influence where the 200-year design standard will be fully implemented by 2025. The 2007 flood risk management legislation (SB 5) contained provisions affecting city and county responsibilities relating to local planning requirements, such as general plans, development agreements, zoning ordinances, tentative maps, and other actions (Government Code sections 65865.5, 65962, and 66474.5). Future land use decisions should not permit or encourage construction of significant numbers of new residences in the nonurban Delta. For the legacy communities in the Delta, structures developed in these areas are required to meet the legal standard of a 100-year minimum level of flood protection. However, developing and maintaining adequate flood protection remains difficult.

Problem Statement

Continued residential development without adequate flood protection increases risk to lives, property, and State interests in the Delta. Flood risks are expected to grow in light of anticipated climate change effects related to peak flows and sea level rise.

Policies

The appendices referred to in the policy language below are included in Appendix B of the Delta Plan.

RR P2. Require Flood Protection for Residential Development in Rural Areas

(a) New residential development of five or more parcels shall be protected through floodproofing to a level 12 inches above the 100-year base flood elevation, plus sufficient additional elevation to protect against a 55-inch rise in sea level at the Golden Gate, unless the development is located within:

(1) Areas that city or county general plans, as of May 16, 2013, designate for development in cities or their spheres of influence;

(2) Areas within Contra Costa County's 2006 voter-approved urban limit line, except Bethel Island;

(3) Areas within the Mountain House General Plan Community Boundary in San Joaquin County; or

(4) The unincorporated Delta towns of Clarksburg, Courtland, Hood, Locke, Ryde, and Walnut Grove, as shown in Appendix 7.

(b) For purposes of Water Code section 85057.5(a)(3) and section 5001(j)(1)(E) of this Chapter, this policy covers a proposed action that involves new residential development of five or more parcels that is not located within the areas described in subsection (a).

23 CCR Section 5013
NOTE: Authority cited: Section 85210(i), Water Code.
Reference: Sections 85020, 85300, 85305, and 85306, Water Code.

Protect and Expand Floodways, Floodplains, and Bypasses

Local land use policies guiding development in floodways are not consistent across Delta counties. Floodways have not been established for many of the channels in the Delta by FEMA or by the CVFPB. In light of these inconsistencies, the Delta Plan addresses these issues and highlights the need for the protection of floodplains and floodways consistent with improved flood protection. Over the next 100 years, Delta floodways may expand and deepen because of sea level rise and changing precipitation patterns. Development in existing or potential future designated floodplain or bypass locations in the Delta or upstream of the Delta can permanently eliminate the availability of these areas for future floodplain usage. It is important to identify floodplain areas now for immediate protection and eventual integration into the flood protection system.

Problem Statement

The carrying capacity of the existing flood control system is diminished by encroachments into floodways, critical floodplains, and existing floodplain or bypass locations in the Delta. Local land use policies guiding development in floodways are not consistent across Delta counties. The existing system is already at suboptimal capacity. Expected changes in sea level rise and runoff patterns due to climate change are expected to exacerbate the problem.

Policies

RR P3. Protect Floodways

(a) No encroachment shall be allowed or constructed in a floodway, unless it can be demonstrated by appropriate analysis that the encroachment will not unduly impede the free flow of water in the floodway or jeopardize public safety.

(b) For purposes of Water Code section 85057.5(a)(3) and section 5001(j)(1)(E) of this Chapter, this policy covers a proposed action that would encroach in a floodway that is not either a designated floodway or regulated stream.

23 CCR Section 5014
NOTE: Authority cited: Section 85210(i), Water Code.
Reference: Sections 85020, 85300, 85302, and 85305, Water Code.

RR P4. Floodplain Protection

(a) No encroachment shall be allowed or constructed in any of the following floodplains unless it can be demonstrated by appropriate analysis that the encroachment will not have a significant adverse impact on floodplain values and functions:

(1) The Yolo Bypass within the Delta;

(2) The Cosumnes River-Mokelumne River Confluence, as defined by the North Delta Flood Control and Ecosystem Restoration Project (McCormack-Williamson), or as modified in the future by the California Department of Water Resources or the U.S. Army Corps of Engineers (California Department of Water Resources 2010); and

(3) The Lower San Joaquin River Floodplain Bypass area, located on the Lower San Joaquin River upstream of Stockton immediately southwest of Paradise Cut on lands both upstream and downstream of the Interstate 5 crossing. This area is described in the Lower San Joaquin River Floodplain Bypass Proposal, submitted to the California Department of Water Resources by the partnership of the South Delta Water Agency, the River Islands Development Company, Reclamation District 2062, San Joaquin Resource Conservation District, American Rivers, the American Lands Conservancy, and the Natural Resources Defense Council, March 2011. This area may be modified in the future through the completion of this project.

(b) For purposes of Water Code section 85057.5(a)(3) and section 5001(j)(1)(E) of this Chapter, this policy covers a proposed action that would encroach in any of the floodplain areas described in subsection (a).

(c) This policy is not intended to exempt any activities in any of the areas described in subsection (a) from applicable regulations and requirements of the Central Valley Flood Protection Board.

23 CCR Section 5015
NOTE: Authority cited: Section 85210(i), Water Code.
Reference: Sections 85020, 85300, 85302, and 85305, Water Code.

Recommendations

RR R5. Fund and Implement San Joaquin River Flood Bypass

The Legislature should fund the California Department of Water Resources and the Central Valley Flood Protection Board to evaluate and implement a bypass and floodway on the San Joaquin River near Paradise Cut that would reduce flood stage on the mainstem San Joaquin River adjacent to the urban and urbanizing communities of Stockton, Lathrop, and Manteca in accordance with Water Code section 9613(c).

RR R6. Continue Delta Dredging Studies

The current efforts to maintain navigable waters in the Sacramento River Deep Water Ship Channel and Stockton Deep Water Ship Channel, led by the U.S. Army Corps of Engineers and described in the Delta Dredged Sediment Long-Term Management Strategy (USACE 2007, Appendix K), should be continued in a manner that supports the Delta Plan and the coequal goals. Appropriate dredging throughout other areas in the Delta for maintenance purposes, or that would increase flood conveyance and provide potential material for levee maintenance or subsidence reversal should be implemented in a manner that supports the Delta Plan and coequal goals. Coordinated use of dredged material in levee improvement, subsidence reversal, or wetland restoration is encouraged.

RR R7. Designate Additional Floodways

The Central Valley Flood Protection Board should evaluate whether additional areas both within and upstream of the Delta should be designated as floodways. These efforts should consider the anticipated effects of climate change in its evaluation of these areas.

Integrate Delta Levees and Ecosystem Function

Setback levees can provide additional levee system stability, more complex land-water interface structure, and shaded riverine aquatic habitat that benefit ecosystem function in appropriate settings. They can also provide flood control benefits in those areas of the Delta not subject to strong tidal influences where channel capacity improvements can actually increase flood-carrying capacity. Not all locations are amenable or useful for setback levee placement. Each site should be investigated for its potential to provide ecological benefits consistent with levee integrity.

Problem Statement

Criteria for the development and implementation of setback levees in the Delta have not yet been developed by relevant agencies. These criteria are needed to provide appropriate guidance when considering setback levee siting and design. Currently, agencies have no consistent method for determining the appropriateness of setback levee incorporation as they relate to habitat enhancement and flood control benefit.

Policies

No policies with regulatory effect are included in this section.

Recommendations

RR R8. Develop Setback Levee Criteria

The California Department of Water Resources, in conjunction with the Central Valley Flood Protection Board, the California Department of Fish and Game, and the Delta Conservancy, should develop criteria to define locations for future setback levees in the Delta and Delta watershed.

Limit State Liability

The Delta Reform Act requires that the Delta Plan attempt to reduce risks to people, property, and State interests in the Delta by, among other things, recommending priorities for State investments in levee operation, maintenance, and improvements in the Delta, including project and nonproject levees (Water Code sections 85305, 85306, and 85307). The law expressly states that these provisions do not affect the liability of the State for flood protection in the Delta or its watershed (Water Code section 85032(j)). Consequently, no action taken by a State agency as required or recommended by, or otherwise in furtherance of, this Delta Plan shall affect State flood protection liability in the Delta or its watershed. Therefore, the Legislature should consider requiring an adequate level of flood insurance for residences, businesses, and industries in floodprone areas.

Problem Statement

As the risks of levee failure and corresponding damage increase, California courts have generally exposed public agencies and the State, specifically, to significant financial liability for flood damages. DWR's 2005 white paper recommends one way that the State should reduce its liability is to require houses and businesses to have flood insurance (DWR 2005).

Policies

No policies with regulatory effect are included in this section.

Recommendations

RR R9. Require Flood Insurance

The Legislature should require an adequate level of flood insurance for residences, businesses, and industries in floodprone areas.

RR R10. Limit State Liability

The Legislature should consider statutory and/or constitutional changes that would address the State's potential flood liability, including giving State agencies the same level of immunity with regard to flood liability as federal agencies have under federal law.

Timeline for Implementing Policies and Recommendations

Figure 7-8 lays out a timeline for implementing the policies and recommendations described in the previous section. The timeline emphasizes near-term and intermediate-term actions.

Timeline for Implementing Policies and Recommendations

TIMELINE | **CHAPTER 7: Risk Reduction**

	ACTION (REFERENCE #)	LEAD AGENCY(IES)	NEAR TERM 2012–2017	INTERMEDIATE TERM 2017–2025
POLICIES	Prioritization of State investments in Delta levees and risk reduction (RR P1)	Council, DWR, CVFPB	●	
	Require flood protection for residential development in rural areas (RR P2)	Local agencies	●	●
	Protect floodways (RR P3)	CVFPB	●	●
	Floodplain protection (RR P4)	CVFPB	●	●
RECOMMENDATIONS	Implement emergency preparedness and response (RR R1)	Local, State, and federal agencies	●	
	Finance local flood management activities (RR R2)	Legislature, DPC	●	
	Fund actions to protect infrastructure from flooding and other natural disasters (RR R3)	PUC	●	
	Actions for the prioritization of State investments in Delta levees (RR R4)	Council, DWR, CVFPB	●	
	Fund and implement San Joaquin River Flood Bypass (RR R5)	Legislature, DWR, CVFPB	●	
	Continue Delta dredging studies (RR R6)	USACE	●	●
	Designate additional floodways (RR R7)	CVFPB	●	
	Develop setback levee criteria (RR R8)	DWR	●	
	Require flood insurance (RR R9)	Legislature	●	
	Limit State liability (RR R10)	Legislature	●	

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Agency Key:

Council: Delta Stewardship Council
CVFPB: Central Valley Flood Protection Board
DPC: Delta Protection Commission
DWR: California Department of Water Resources
PUC: California Public Utilities Commission
USACE: U.S. Army Corps of Engineers

Figure 7-8

Issues for Future Evaluation and Coordination

The following list of issues should be considered in future updates of the Delta Plan. These and other issues will need to be considered as additional information and materials become available. The various activities called for in this Delta Plan, as well as issues that arise from other planning efforts, such as the Central Valley Flood Protection Plan, will be considered. Additional areas of interest and concern related to flood risk in the Delta may deserve consideration in the development of future Delta Plan updates, including:

- **Reoperation of Upstream Reservoirs and Peak Flow Attenuation:** Reservoir operations upstream of the Delta can have substantial impacts on flood flows through the Delta; therefore, operation procedures among government agencies should be well coordinated and, where possible, focused more on flexibility to prevent flooding in the Delta. Water Code section 85309 directs DWR to develop a proposal to coordinate flood and water supply operations with appropriate State and federal agencies, and this shall be considered by the Council for future inclusion in the Delta Plan.
- **Utility Corridor Consolidation:** An attempt to consolidate infrastructure into "utility corridors" as facilities are added and upgraded over time should be further investigated to determine whether this can allow for better management of flood risk consequences to these critical assets.
- **State Highways and Sea Level Rise:** The Council will consult with Caltrans regarding the potential effects of climate change and sea level rise on the three state highways that cross the Delta (Water Code section 85307 (c)).

Science and Information Needs

The Delta system and its influencing factors are not static; therefore, research is needed to better understand dynamic issues such as climate change, seismicity, sea level rise, subsidence, and other areas. Continuing investigations into the science, engineering, and economic aspects of the Delta are critical to adaptively managing for expected and unexpected changes, and can provide decision makers and stakeholders with key information for future planning and decision making. Specifically, additional information will be needed in the following areas:

- The interaction between Delta levees and ecosystem function
- Sea level rise: impacts on, and incorporation into, flood risk reduction standards
- Climate change: effects of altered hydrology on levee system integrity
- Effects of seismicity on levee integrity
- Updated flood stage-probability functions
- Potential for subsidence reversal and carbon sequestration from growing native marsh plants
- Understanding the impacts on Delta flood management from upstream flood management infrastructure operations, including reservoir operations
- Technologies for assessing levee integrity

Efforts to address these needs and others that arise during Delta Plan implementation should be undertaken in a systematic fashion so that information developed and lessons learned can be incorporated into future Delta Plan updates.

Performance Measures

Development of informative and meaningful performance measures is a challenging task that will continue after the adoption of the Delta Plan. Performance measures need to be designed to capture important trends and to address whether specific actions are producing expected results. Efforts to develop and track performance measures in complex and large-scale systems like the Delta are commonly multiyear endeavors. The recommended output and outcome performance measures listed below are provided as examples and subject to refinement as time and resources allow. Final administrative performance measures are listed in Appendix E and will be tracked as soon as the Delta Plan is completed.

Output Performance Measures

- New residential development takes into account sea level rise in flood protection planning and development. (RR P2)
- Delta land acreage and the number of reclamation districts with levees below HMP are reduced. (RR P1)
- Freshwater aqueducts passing through the Delta and the primary freshwater channel pathways through the Delta are protected by levees that provide adequate protection against floods and other risks of failure. (RR P1)
- Responsible local, State, and federal agencies with emergency response authority implement the recommendations of the Sacramento-San Joaquin Delta Multi-Hazard Coordination Task Force (Water Code section 12994.5). (RR R1)
- DWR and the CVFPB construct a bypass and floodway on the San Joaquin River near Paradise Cut. (RR R5)

Outcome Performance Measures

- No lives are lost in the Delta as a result of flood emergencies, and economic damages associated with Delta flood emergencies decrease. (RR R1)
- Emergency response and recovery costs are eligible for FEMA reimbursement. (RR P1)
- Water deliveries to East Bay Municipal Utilities District, Contra Costa Water District, the CVP, and the SWP are not interrupted by floods or earthquakes. (RR P1)

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