California's Flood Future *Highlights*

Recommendations for Managing the State's Flood Risk

DRAFT November 2012

The California Department of Water Resources and the U.S. Army Corps of Engineers collaborated to produce ***California's Flood Future*** to guide local, State, and Federal decisions about policies and financial investments to improve public safety, environmental stewardship, and economic stability.

FloodSAFE CALIFORNIA

PUBLIC SAFETY ENVIRONMENTAL STEWARDSHIP ECONOMIC STABILITY

US Army Corps of Engineers ®

US Army Corps of Engineers ®

Even with a history of continuing investment and action by local, State, and Federal flood management agencies, every California county has major residual flood risks. Currently, funding sources typically drive flood management projects, rather than flood management priorities driving funding.

Without changes to the way flood protection is managed and funded, a catastrophic flood event in California is only a matter of time. California's exposure to flood risk presents an unacceptable threat to public safety, to the State and national economies, and to vital environmental resources.

The California Department of Water Resources and U.S. Army Corps of Engineers developed ***California's Flood Future*** based on these guiding principles:

- Floods cannot be entirely prevented. Flood management seeks to reduce the risk of flooding to improve public safety, provide for economic stability, and support environmental stewardship.
- Multiple-benefit flood management solutions provide the most responsible use of public resources.
- Flood management opportunities and potential impacts are most effectively evaluated from a watershed, or systemwide, perspective.
- Effective flood management is enhanced by collaboration and partnerships among public agencies at all levels (local, State, Federal) and across geographic boundaries.
- Public agencies must achieve sustainable solutions for flood management that will be durable across a spectrum of variables, including climate change.

California's Flood Future presents a call to action and recommendations for the path forward.

Table of Contents

Introduction..... 3

Understanding the Situation..... 7

The Problem..... 13

The Solution..... 20

Recommendations..... 21

The Path Forward 29

The complete ***California's Flood Future*** report, including technical attachments and other research findings, is available at: http://www.water.ca.gov/SFMP

California is at risk for catastrophic flooding.

More than 7 million people and $580 billion in assets (crops, buildings, and public infrastructure) are exposed to the hazards of flooding in California.

All 58 California counties have experienced at least one major flood event in the last 20 years, resulting in loss of life, and billions of dollars in damages.

Even with a history of continuing investment and action by local, State, and Federal flood management agencies, residual flood risks* exist in every California county. Here are the facts:

- One in five Californians lives in an area exposed to flood risk.
- Flooding in California has resulted in the loss of hundreds of lives and billions of dollars in damages.
- Flooding occurs in almost all parts of California.
- California's diverse geography contributes to the state's significant flood risk. In many California regions, peak flows – the largest volume of water flowing per second through a water system – occur in a very short timeframe, which spells disaster.
- The number of flood insurance policyholders in California has almost tripled since 1982, in part because of the increase in the number of structures located in floodplains and other factors. (Federal Emergency Management Agency, National Flood Insurance Program, BureauNET, 2012).

* Residual risk is the likelihood of damage or other adverse consequences remaining after flood management actions are taken. No one is 100 percent protected from flooding.

The impacts of a major flood would be devastating to California and to the nation.

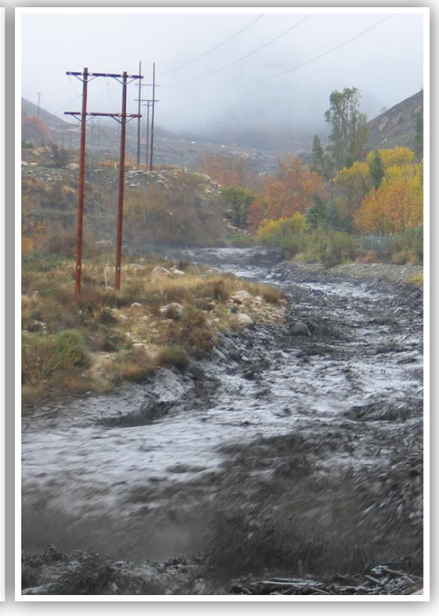
In addition to tragic loss of life, flooding in California can have a serious impact on the State's economy and environmental resources.

As one of the world's largest economies, a major flood in California will have an unprecedented impact on the national economy as well.

When California floods:

- **Critical infrastructure is damaged and could be out of service for long periods.**
  - » At risk are interstate highways, airports, ports, and transit facilities; gas and electric utilities; and military installations.
- **Vital services become isolated or are closed.**
  - » Communities suffer and public funds are depleted when necessary facilities, such as hospitals, police and fire stations, schools and public infrastructure, are flooded.
- **Vast areas of agricultural lands become unproductive, possibly for long periods.**
  - » Flooded farmland could have major impacts on local business, national food supplies, and the state's economy.
- **Water supplies and water quality are affected.**
  - » Flood events damage critical regional water supply and wastewater treatment facilities.
  - » A catastrophic levee failure in the Sacramento-San Joaquin Delta would endanger a major source of water supply for 60 percent of California residents and for a portion of the State's vital agricultural industry.

All Californians, regardless of whether they live in a floodplain, would be impacted by catastrophic flooding.



We must take action. Now.

We must invest now to help prevent flood disasters and to reduce the impacts of flooding, or we will spend billions more – and face the consequences of loss of life, livelihoods, and ecosystems – to recover from inevitable flooding.

Major flood events in the country's recent history provide important lessons for elected and appointed public officials.

The financial investment in flood management is a small percentage of the economic impact of a major flood, and an equally small percentage of the money spent recovering from a major flood.

Research for ***California's Flood Future*** identified the immediate need for more than $50 billion to complete flood management improvements and projects. These flood management projects include maintenance projects and other identified actions.

The research also indicated the need for substantial additional funding to complete flood risk assessments throughout the state, and to conduct flood management improvements based on the assessments.

What would it cost to recover from a major flood event in one of California's urban regions?

With many more people and structures per square mile in California's urban areas, California would likely see much higher recovery costs from a major flood than the $110 billion* that has been spent on recovery from Hurricanes Katrina and Rita.

**Congressional Budget Office, 2007*

Short-term and long-term solutions are necessary.

Although it will take many years to reduce flood risk to acceptable levels, elected and appointed officials at all levels must take steps now to reduce risks, and to lay the groundwork for long-term solutions.

Some short-term actions do not require substantial additional financial resources:

- Land use planning and decisionmaking must consider flood management. This includes limiting development in floodplains.
- Federal and State agencies must improve planning and permitting processes to allow critical flood management planning, implementation, operations, and maintenance actions to proceed.
- Flood management projects must be broadened to deliver multiple benefits.
- Ongoing public agency outreach programs must inform policymakers at all levels of government about the risks and consequences of flooding.

Long-term solutions require immediate attention:

- Sufficient and stable funding mechanisms must be developed to invest in public safety.
- Public funding for flood management requires alignment among public agencies to deliver the most efficient and economical multiple-benefit projects.

The current economic and ecosystem conditions make it more important than ever for all public agencies to use an IWM approach to short-term and long-term planning.

Flood management using an Integrated Water Management approach

Integrated Water Management (IWM) is a strategic approach that combines specific flood management, water supply, and ecosystem actions to deliver multiple benefits.

An IWM approach promotes system flexibility and resiliency to accommodate changing conditions such as regional preferences, ecosystem needs, climate change, flood or drought events, and financing capabilities.

Using an IWM approach is not a one-time activity. Long-term commitments and alignment among the responsible public agencies is necessary to create sustainable, affordable water resources systems.

Achieving agency alignment and regional collaboration can be a challenge, as an IWM approach requires striking a balance between sometimes competing objectives. However, using an IWM approach can provide broader stakeholder support, faster project completion, and access to additional funding sources.

Seven recommendations were developed to achieve this vision for flood management. The recommendations can be found on page 21.

Information for the *California's Flood Future* was provided by 142 local agencies located in all 58 counties, as well as by State and Federal agencies.

California's 10 hydrologic regions are identified in **bold text**.

UNDERSTANDING THE SITUATION

Local agencies speak out

The California Department of Water Resources and the U.S. Army Corps of Engineers collaborated to publish *California's Flood Future: Recommendations for Managing the State's Flood Risk*. *California's Flood Future* contains the first comprehensive look at flooding throughout the state and presents recommendations to improve flood management in California.

Research used to develop this document included soliciting information from local, State, and Federal agencies throughout California. More than 140 public agencies responsible for flood management provided information used to describe the problem and develop recommended solutions.

The research findings are alarming.

- **Different methodologies and inadequate data** make risk assessment complex and costly to complete.
- **Public understanding of flood risk is inadequate.** If residents are even aware that they live or work in a flood-prone area, they usually do not understand that flood management facilities do not provide 100 percent protection for public safety.
- **Emergency preparedness and response does not always receive necessary funding in all regions in the state.** Residents depend on first responders to have the personnel, expertise, and equipment necessary to do their jobs, especially during community-wide disasters.
- **Land use decisions may not adequately prioritize public safety.** Uninformed residents and policymakers can make decisions that put people and property at increased risk.
- **Flood management projects are not prioritized from a systemwide or multiple-benefit perspective.** State and Federal flood management funding has traditionally been provided to narrow benefit, local projects.
- **Flood management responsibility is fragmented**. Responsibilities for planning, administering, financing, and maintaining flood management facilities and emergency response programs are usually spread among several agencies.
- **Delayed permit approvals and complex permit requirements are obstacles to flood risk reduction.** Many agencies wait years for permits, resulting in poorly maintained projects and missed funding opportunities for new projects.
- **Lack of reliable, sustained funding puts California at significant risk.** Inadequate funding for flood management maintenance, operations, and improvements makes flood risk reduction difficult or impossible for many local agencies.

Flooding in California

Flooding occurs in all regions of the state.

Flooding varies according to the complexities and diversity of the physical features of the landscape, weather, climate, and human manipulations of the land (e.g., regional demographic differences, in part due to historical settlement patterns, land use regulations, and economic drivers). In addition, flood warning times vary across the state, with longer lead times for slow-rise flooding and often little to no lead time for flash flooding.

Flooding can affect California at different times of the year and in different forms—from stormwater flooding in urban areas to alluvial fan flooding at the base of hillsides. Rivers and streams flood in different ways—from fast-moving flash floods in Southern California to slow-rise deep flooding in the Central Valley.

The different types of flooding are shown on pages 11 and 12.

Flood management financing

Aside from the original planning for the Sacramento and San Joaquin river systems, flood risk management in California has primarily focused on individual projects; often without full consideration of life-cycle operations and maintenance costs, environmental impacts, and increased hazard exposure. Most major flood management projects have been a partnership among the California Department of Water Resources, U.S. Army Corps of Engineers (USACE), and one or more local agencies, although many significant California water projects have not relied on Federal funds.

Flood agencies throughout the state have cumulatively invested $11 billion in flood management in the last decade, with temporary financing from California's Proposition 1E and 84 bond funds accounting for most of this money.

Research conducted for ***California's Flood Future*** identified flood management needs of more than $50 billion. However, many regions must still conduct basic flood hazard analyses to identify potential flood projects. In addition to identifying future projects, significant annual costs are associated with the operations and maintenance of existing projects.

Flood management in California is complex.
A number of ongoing technical and planning efforts will impact flood and water management in California. The efforts listed here are led or funded by the State of California unless otherwise noted by parenthesis.

- California Water Plan
- Integrated Regional Water Management Plans
- Bay-Delta Conservation Plan
- Delta Islands & Levees Feasibility Study (USACE)
- Delta Stewardship Council Delta Plan
- Central Valley Flood Protection Plan
- Central Valley Integrated Flood Management Study (USACE)
- Climate Change Initiative
- National Flood Insurance Program Remapping Effort (Federal Emergency Management Agency)
- California Coastal Sediment Master Plan (USACE)

Flood Basics

Managing flood risk includes managing floodwater (keeping floodwater away from people), managing floodplain resources (keeping people and assets out of the path of floodwater), and protecting and restoring natural ecosystems.

Several factors influence flood risk, including storm frequency, development in floodplains, and operations and maintenance of flood facilities. A smaller flood that causes less damage generally occurs more frequently than a very severe flood with much greater consequences.

Engineers, scientists, and floodplain managers typically define flood risk using these factors:

Hazard identifies the cause (flood) and frequency of the problem (how often).

Performance calculates how well existing systems function (e.g., flood management system inadequacy or failure).

Exposure identifies who and what is impacted by flooding.

Vulnerability identifies level of exposure expected (i.e., how flooding adversely affects people and property).

Consequence calculates impact of flooding in terms of lives lost and cost (i.e., what is the loss or damage incurred from flooding).

Any storm can cause flood damage. Large storms, although infrequent, can have disastrous consequences to entire regions.

While the **500-year and 100-year flood** events are a simple description of the frequency of flooding, a complete flood risk analysis must consider all of the above factors.

It is important to understand these factors because they help calculate the impact and cost of potential floods. Once computed, "flood risk" is used to plan budgets for operations and maintenance, and to set project priorities.

Two flood event levels* are commonly used for insurance and planning purposes.

500-Year Flood is a shorthand expression for a flood that has a 1 in 500 probability of occurring in any given year. This may also be expressed as the 0.2 percent annual chance flood.

100-Year Flood has a 1 in100 (or 1 percent) probability of occurring in any given year.

These levels indicate a percentage of probability and severity. It does not mean a flood only happens every 100 or 500 years.

Slow rise flooding example

UNDERSTANDING THE SITUATION

California's variable flood conditions and risks require regional flood management approaches.

Tsunami Flooding

Duration of Flood: Minutes to hours

Time to Peak: Variable (hours to days)

Area Flooded: Coastal areas

Causes of Flood: Earthquake

Engineered Structure Failure Flooding

Duration of Flood: Variable

Time to Peak: Minutes to hours

Area Flooded: Areas downstream of engineered structure (i.e., levees, dams)

Causes of Flood: Failure of structures

Coastal Flooding

Duration of Flood: Seasonal

Time to Peak: Hours to days

Area Flooded: Coastal areas, bays, back bays, sounds, and inland tidal waterways

Causes of Flood: Winter and Spring coastal storms, high winds, storm surges and high tides

Debris Flow Flooding

Duration of Flood: Hours

Time to Peak: Hours

Area Flooded: Areas downstream of denuded hillsides

Causes of Flood: Heavy localized rainstorms on hillsides with charred or denuded ground

Tsunami Flooding

Slow Rise Flooding

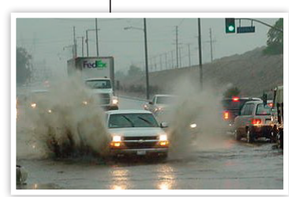
Engineered Structure Failure Flooding

Coastal Flooding

Debris Flow Flooding

Flash Flooding

Alluvial Fan Flooding



Stormwater Flooding

Potential Occurence by County

Absent | Present | Likely

Slow Rise Flooding

Duration of Flood: Weeks

Time to Peak: Days

Area Flooded: Deep floodplains and low-lying urban areas

Causes of Flood: Heavy precipitation especially with snowmelt

Flash Flooding

Duration of Flood: Hours

Time to Peak: Hours

Area Flooded: Steep slopes and impermeable surfaces, as well as adjacent to local streams and creeks

Causes of Flood: High-volume rainstorms, thunderstorms, or slow-moving storms

Alluvial Fan Flooding

Duration of Flood: Hours

Time to Peak: Hours

Area Flooded: Surface and toe of alluvial fans

Causes of Flood: High-volume rainstorms and thunderstorms; displaces high volume of sediment

Stormwater Flooding

Duration of Flood: Hours

Time to Peak: Hours

Area Flooded: Localized urban areas

Causes of Flood: Rainstorms along with blocked or overwhelmed storm drainage systems

One in five Californians live in a floodplain.

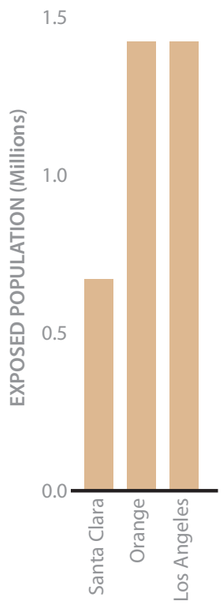
Four of the nation's 15 largest cities (Los Angeles, San Diego, San Jose, and San Francisco) are in California, and all of them are at risk for some type of flooding. Since 1950, there have been 50 State or Federally declared flood disasters in California.

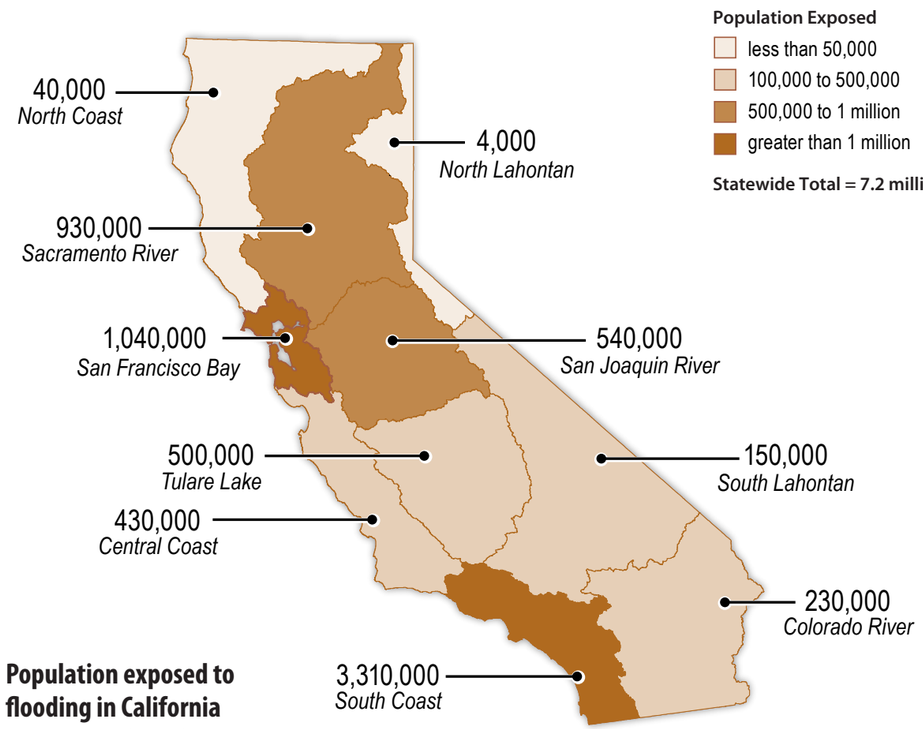
Exposure to flood hazard is distributed throughout the state, with all counties having some level of exposure to flooding. For example, in Yuba, Yolo, Merced, and Colusa counties more than 25 percent of the residents live in the 100-year floodplain.

The South Coast region has the greatest population exposed to the hazards of flooding, with more than 250,000 residents in the 100-year floodplain and more than 3 million people living in the 500-year floodplain.

The number of Californians exposed to flooding is likely to continue to increase because of increasing population and development in floodplains.

Counties with greatest population within 500-year floodplains





Population exposed to flooding in California by hydrologic region

$575 billion in structures are at risk.

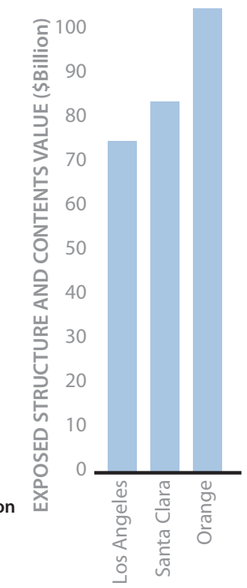
Property is exposed to flood hazards in all regions of California. Fourteen California counties have structures valued at more than $10 billion in 500-year floodplains. The largest numbers of facilities and structures exposed to flooding in California are in the South Coast, San Francisco Bay, and Sacramento River regions.

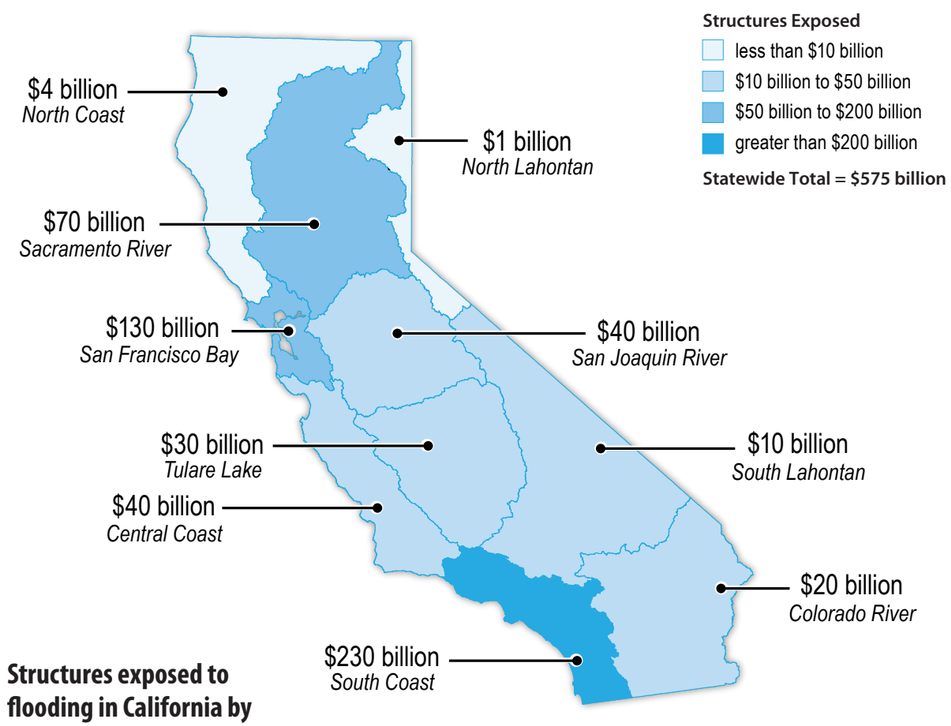
The $575 billion figure does not include the economic impact to families, communities, local businesses, and entire regions when worksites and critical public facilities are closed due to flood damage.

Serious flood damage in the state's urban areas would have significant economic impacts to the region, state, and nation. And it will not take a 500-year flood event to cause significant impacts. Even a few inches of flood water can have an expensive and disruptive impact on structures. When flooding occurs, businesses, homes, schools, and other important structures must be vacated for proper rehabilitation, causing significant economic impact on families and communities.

The number of structures and corresponding contents exposed to flooding will likely continue to increase because of population growth and development in floodplains.

Counties with the greatest number of structure values within 500-year floodplains





Structures exposed to flooding in California by hydrologic region

California's agricultural economy is at risk.

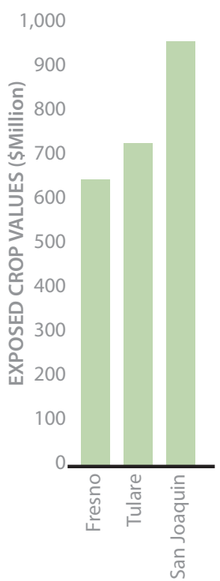
A major flood event in California has the potential to devastate regional agriculture-based economies and cause serious impacts on the state's economy.

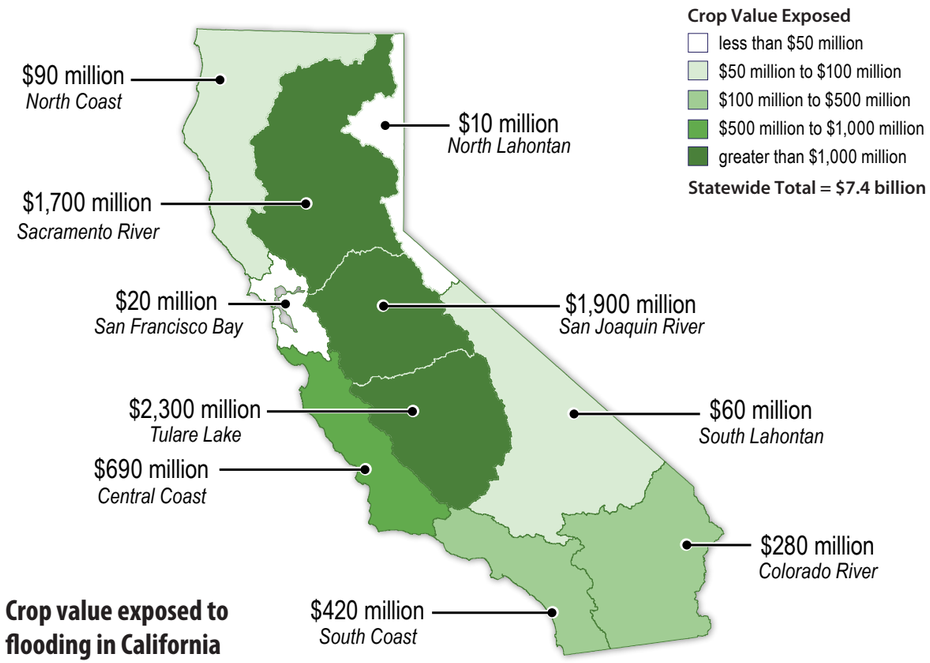
More than $7 billion in crop values are exposed to California's 500-year floodplains, and approximately 40 percent of agricultural land in the state is located in floodplains.

Three hydrologic regions (Sacramento River, San Joaquin River, and Tulare hydrologic regions) each have more than $1 billion in agricultural crops exposed in 500-year floodplains.

A major flood event could have an impact on national and international food supplies. California contributes 12 percent of the nation's total agricultural production and accounts for almost $15 billion in agricultural exports worldwide. In fact, California grows nearly half of the produce and nuts and 18 percent of the rice produced in the United States. (California Department of Food and Agriculture, California Agricultural Statistic Review 2011-12)

Counties with the largest value of agricultural crops within 500-year floodplains





Crop value exposed to flooding in California by hydrologic region

Environmental stewardship suffers from competing regulations and processes.

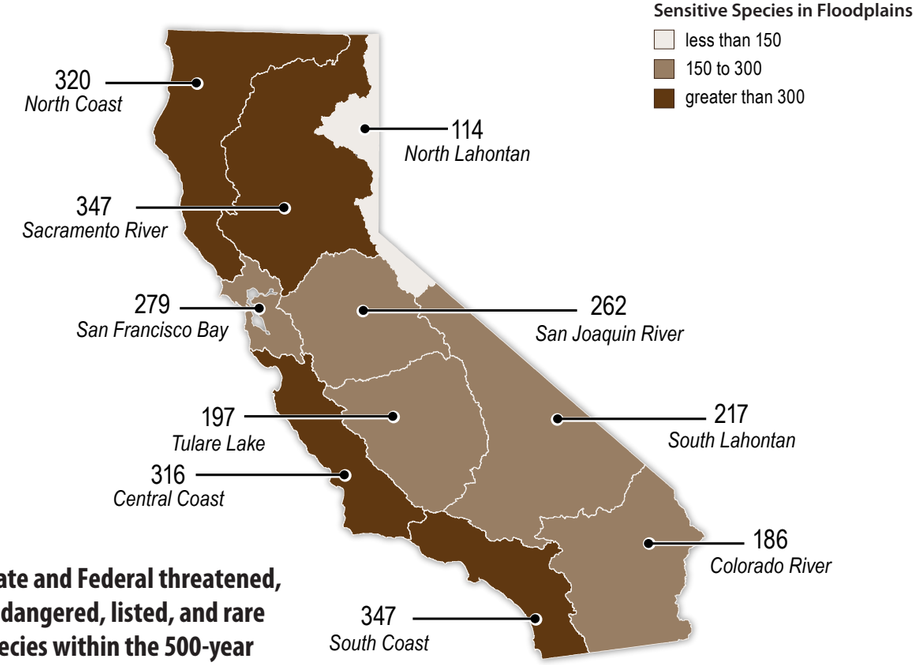
Effective floodplain management finds the appropriate balance between providing for public safety while protecting sensitive ecosystems.

Floodplains can provide a variety of regional benefits. However, competing regulations and processes present significant challenges to realizing the broad environmental and other benefits of effective floodplain management. Even projects that were developed to consider natural functions struggle to maintain floodplain capacity due to antiquated processes and conflicting resource agency standards.

Well-functioning floodplains provide habitat for a significant variety of plant and wildlife species and provides for natural reduction of flood flows. Flooding can recharge groundwater basins, improve water quality, and control erosion.

Development in floodplains can permanently alter natural floodplain functions, destroy habitat of sensitive species, and reduce the beneficial connections between different types of habitat and adjacent floodway corridors. Extreme flooding deposits debris, contaminants and decay.

Threatened, rare, listed, or endangered ("sensitive") plant and animal species are exposed to flood hazards throughout the state, with all regions having at least 100 sensitive species exposed to flooding.



State and Federal threatened, endangered, listed, and rare species within the 500-year floodplains by hydrologic region

Flood management responsibilities are complex and fragmented.

Flood management in California is affected by a complex framework of public agencies with overlapping and, in some cases, conflicting mandates.

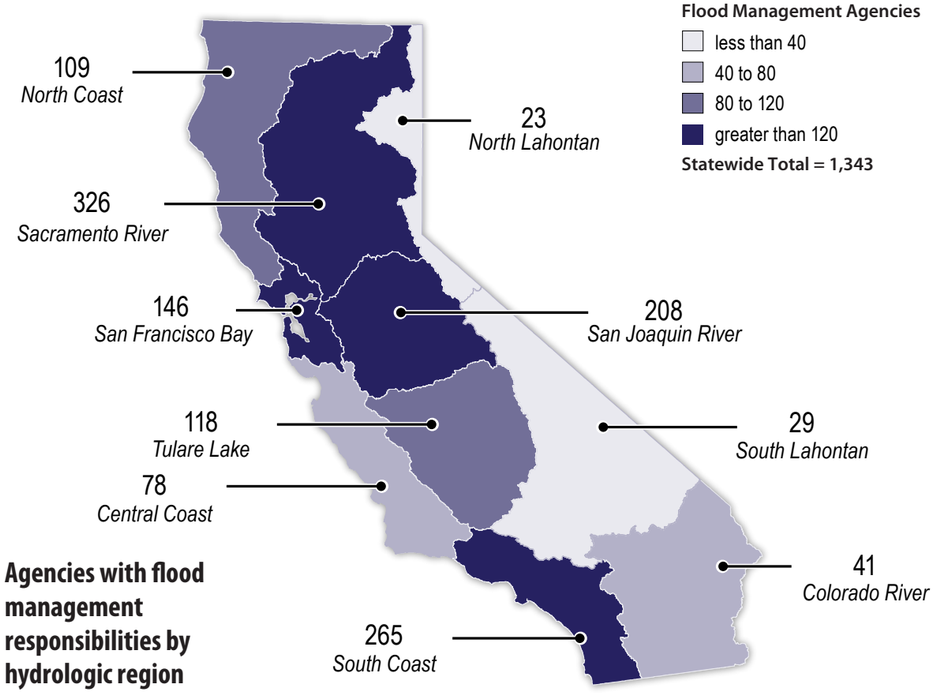
Agency roles and responsibilities are sometimes limited by an agency's enabling legislation, charter, ownership, or agreements with other agencies. Other challenges include:

- Overlapping – and sometimes conflicting – responsibilities and priorities among the many regulatory agencies complicate the task of protecting human life, property, economic interests, and the environment.
- Agencies must navigate through a maze of new or conflicting regulations as projects are planned, constructed, operated, and maintained.
- Traditional planning processes rely on project proponents that typically have a narrow mission and a specific geographic focus. Such projects miss the opportunity to provide a broader suite of benefits that consider systemwide and regional benefits.

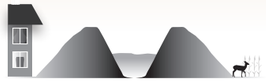
Although some public agencies are progressing toward an integrated planning approach, much more can be accomplished by linking State and Federal funding to the broader-based Integrated Water Management approach to flood management in California.

Flood management agencies are responsible for operation and maintenance of:

- More than 20,000 miles of levees
- More than 2,100 dams
- More than 1,000 debris basins
- More than 100 reservoirs
- Other facilities



Agencies with flood management responsibilities by hydrologic region



Flood infrastructure does not meet current and future needs.

California's flood management facilities have prevented billions of dollars of damage and saved many lives. However, resources for operations, maintenance, and much needed improvements have not kept up with demands, putting people and property at increased risk.

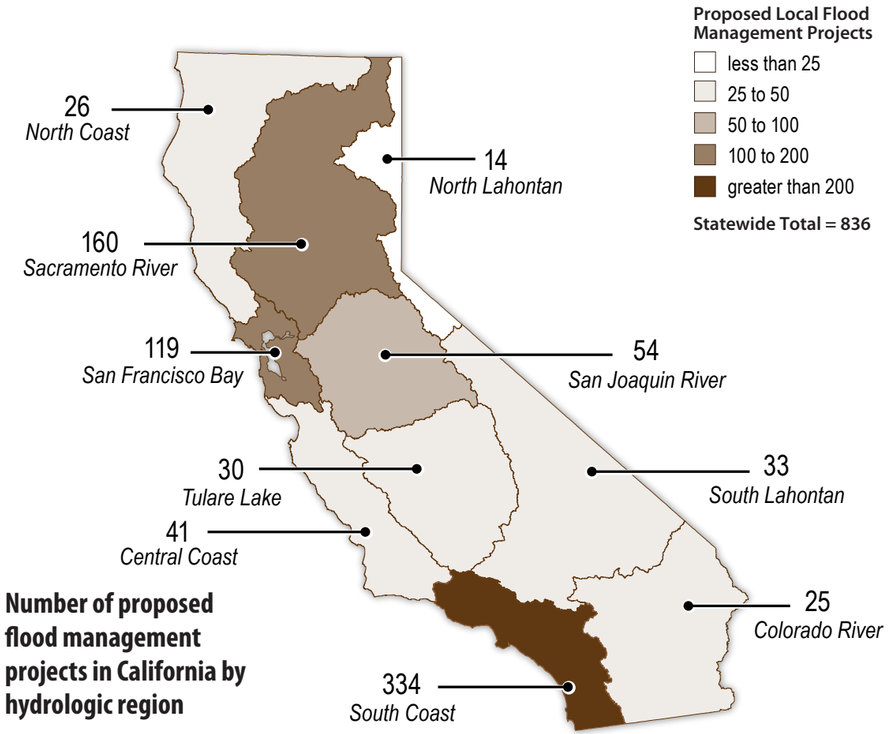
As part of the research effort for ***California's Flood Future***, local public agencies identified over 835 near-term and long-term flood management projects in different stages of planning and implementation.

Many are high priority – "crisis projects" – necessary to keep facilities functioning properly, while others are designed to increase protection for residents and structures located in areas where there is flood risk.

Even if all of these projects are completed, many regions in California will continue to be at high risk to flooding. Many regions must complete flood risk assessments to identify additional projects to improve public safety.

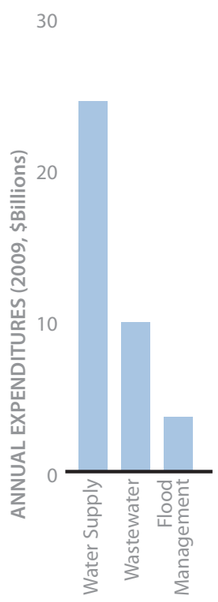
The projects included in this priority list are the projects that agencies perceive as feasible, but not necessarily all that is required to provide protection from an a 100-year flood.

More than $100 billion is needed in capital investment, including $50 billion for currently identified projects.



Number of proposed flood management projects in California by hydrologic region

Flood management agencies typically lack a direct funding source unlike water supply and wastewater agencies, which are rate payer funded.



(Water and the California Economy - Technical Appendix, Public Policy Institute of California, 2012)

Funding is limited and increasingly unreliable.

Funding sources typically drive flood management projects, rather than flood management priorities driving funding. Additional financing challenges include:

Inconsistent and Insufficient Funding

- Funding for flood management projects usually increases only following a flood disaster, and then gradually decreases.
- Flood management budgets are especially susceptible to reductions in dry-weather years and economic downturns.
- Flood management budgets generally do not adequately address full life-cycle operations and maintenance needs and environmental mitigation.
- The full costs associated with providing flood protection or flood response may not be considered by public agencies making land use decisions.
- Existing state bond funding for flood management will be depleted by 2017. This funding is being used primarily for critical repairs, early implementation projects, and other high-priority flood risk-reduction efforts in the Central Valley (as designated by the bond legislation).

Declining Local Resources

- Flood management agencies supported by local general funds must compete with other public demands for resources (i.e., water, sewer, transportation, parks, social services, education, health services).
- Agencies that are partially funded through development fees or special project assessments can be limited by assessment-zone boundaries.
- The ability of flood management agencies to fund projects, as well as operations and maintenance, has suffered from public opposition to additional property-based assessments.
- Small agencies in rural or agricultural communities are often responsible for large areas without the resources, tax base, or funding mechanisms to partner with Federal agencies or apply for State grant funding.
- The costs of ongoing operations and maintenance on existing facilities, along with rising permitting costs, consume a large portion of local agency budgets. In addition, local agency budgets are often unable to provide set aside replacement funds for deteriorating infrastructure.

Reduced Federal Cost Shares

- The U.S. Army Corps of Engineers (USACE) process for identifying Federal interest in flood risk-reduction projects has historically emphasized damage-reduction benefits, while placing less emphasis on other project outputs, such as ecosystem restoration, regional economic development, and other social benefits.
- Reductions in Federal spending signals that USACE may not continue to fund studies or ongoing projects at the same rate as it has in the past.
- Funding a large number of studies and projects over long periods of time is inefficient, too often resulting in delayed delivery and more costly products.

Flood management solutions must be developed using an Integrated Water Management approach.

The California Department of Water Resources and the U.S. Army Corps of Engineers are committed to an Integrated Water Management (IWM) approach and have started to structure flood management programs to support multiple-benefit projects.

The Integrated Water Management Approach

IWM is a strategic approach to planning and implementation that combines specific flood management, water supply, and ecosystem actions to deliver multiple benefits.

IWM relies on blending knowledge from a variety of disciplines, including engineering, economics, environmental sciences, public policy, and public information.

This approach also promotes system flexibility and resiliency to accommodate changing conditions such as regional preferences, ecosystem needs, climate change, flood or drought events, and financing capabilities.

High Value, Multiple Benefits

The value of using an IWM approach is in the results—improved public safety, enhanced environmental stewardship, and statewide economic stability.

Localized, narrowly focused projects are not the best use of public resources and might have negative unintended consequences in nearby regions. The IWM approach helps deliver more benefits at a faster pace, using fewer resources, than what is possible from single-benefit projects.

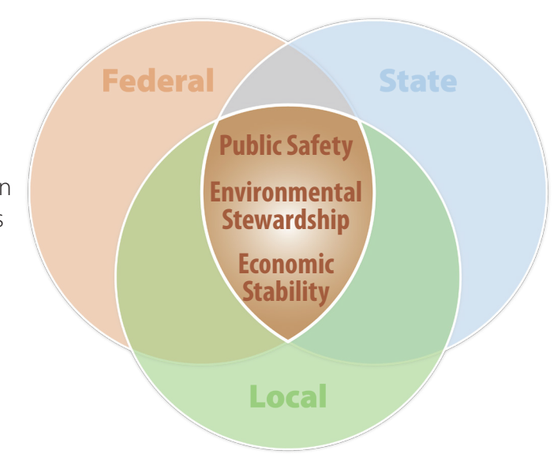
Regional Collaboration and Cooperation Are Necessary

Californians must think holistically to develop long-term, integrated approaches to flood management.

Using an IWM approach to meet flood management needs is not a one-time activity. Efforts to reduce flood risk will require unprecedented alignment and cooperation among public agencies, tribal entities, landowners, interest-based groups, and other stakeholders. Collaboration must address information gathering and other tools, policies, planning, regulations, and investments.

Broader Access to Funding Sources

One of the benefits of using an IWM approach is the potential to access funding sources that may not have been available to single-benefit projects. This is particularly important to achieving sufficient and stable funding for long-term flood management.



Recommendations for managing California's flood risk.

The recommendations in ***California's Flood Future*** are consistent with the overall Integrated Water Management (IWM) approach. The foundation of the IWM planning approach is improved agency alignment and interaction, which leads to agreement on tools, planning activities, policy and investment actions, and ultimately more beneficial results.

The recommendations in this document are directed to all local, State, and Federal agencies with responsibility for one or more of the following: land use planning, flood management, water resources, environmental habitat and ecosystem restoration, cultural and recreation resources, agriculture, and public safety. These recommendations are intended to guide discussions and encourage collaboration between public agencies, elected officials and key stakeholders to achieve necessary policy reforms and program results. The recommendations in this document are organized under the categories "Tools", "Plans", "Actions". They are outlined here, and are described in more detail on the following pages.

Tools

- **Risk Assessments:** Conduct regional flood risk assessments to understand statewide flood risk.
- **Flood Risk Awareness:** Increase public and policymaker awareness about flood risks to facilitate informed decisions.
- **Flood Readiness:** Increase support flood emergency preparedness, response, and recovery programs to reduce flood impacts.

Plans

- **Land Use Planning:** Encourage land use planning practices that reduce the consequences of flooding.
- **Regional, Systemwide, and Statewide Planning:** Implement flood management from regional, systemwide, and statewide perspectives to provide multiple resources.

Actions

- **Increase Agency Collaboration:** Increase collaboration among public agencies to improve flood management planning, policies, and investments. Actions also include the infrastructure improvements and other innovations conducted by flood and water management agencies.
- **Establish Sufficient and Stable Funding:** Establish sufficient and stable funding mechanisms to reduce flood risk.

Tools	Plans	Actions	Results
• Risk Assessments • Flood Risk Awareness • Flood Readiness	• Land Use Planning • Regional, Systemwide, and Statewide Planning	• Agency Collaboration • Sufficient and Stable Funding	✓ Public Safety ✓ Environmental Stewardship ✓ Economic Stability

Tools

1 Conduct regional flood risk assessments to better understand statewide flood risk.

Identifying flood risks is an important first step toward reducing risk and prioritizing flood management infrastructure needs in California; however, few detailed risk assessments have been completed. This often causes agencies to default to overly simplistic methods or leave their flood risk undetermined. Several complex methods are currently used to assess flood risk, which results in confusion and inconsistent assessment of risk. A consistent method of assessing risk would be more cost effective and result in better understanding of risk.

Goal: Consistent and locally appropriate assessments of flood risk to help local governments make informed decisions about priorities for land use, emergency response, ecosystem functions, and flood management projects throughout the state.

Strategies:

- **Identify regional methods and evaluate flood risk to prioritize areas where flood risk exists.**
  Standard methods to evaluate flood risk in California must be identified for each region of the state. Technical support for risk evaluations and data collection are needed to support the efforts of local agencies.
- **Assist in identifying regional flood risk reduction goals and corresponding acceptable levels of residual risk throughout the state.**
  Goals can be based on the number of lives and amount of property at risk, degree of urbanization, critical facilities, flood types, and level of acceptable risk for the region.
- **Identify opportunities to restore or maintain natural systems.**
  Flood risk evaluations should explore opportunities to restore or maintain the function of existing natural systems.
- **Assist agencies in assessing the impacts of climate change and sea level rise.**
  Climate change and sea level rise information must be developed for all areas of the state and made uniformly available to public agencies.

Tools

2 Increase public and policymaker awareness about flood risks to facilitate informed decisions.

Policymakers and the public have varying levels of understanding about the risks and consequences of flooding. Historically, they have made decisions that lead to putting people and property at increased risk.

Goals: Local, State, and Federal officials support policies, programs, and financing strategies to reduce flood risk in California. California voters support funding mechanisms to reduce flood risk. California residents in flood-prone regions support local flood preparedness efforts and develop personal preparedness plans.

Strategies:

- **Develop consistent messaging of local, State, and Federal initiatives for public awareness of flood risks.**
  Public agencies using common language and outreach tools will help avoid public confusion and will maximize limited financial resources.
- **Provide State and Federal outreach program tools, templates, and other resource materials to local agencies.**
  Sharing resources saves time and money, and will facilitate public awareness efforts in many regions. Sharing resources will foster consistency among outreach programs.
- **Catalog, provide, and promote online information resources about flood risk programs, grants, and other related topics.**
  A lot of information is available online about flood management, including data, case studies, budget information, and planning tools. Making agencies aware and providing easy access to this information will improve flood management at all levels of government.
- **Share research data and other information between public agencies in a timely fashion.**
  Sharing information fosters collaboration and cooperation between agencies, which helps save time and money as regional plans and projects are developed.

Tools

3 Increase support for flood emergency preparedness, response, and recovery programs to reduce flood impacts.

Flood emergency management is a cost-effective, non-structural tool to reduce flood risk. Flood emergency preparedness, response, and recovery are often fragmented between local agencies within a region and even within different departments of a single agency. Funds for emergency planning are often reduced during difficult or contracting budget cycles.

Goal: Effective and comprehensive flood emergency preparedness, response, and recovery at all levels of government.

Strategies:

- **Provide funding specifically for increased coordination among responders, facility managers, planners, and representatives of State and Federal resource agencies to improve readiness.**
  Pre-event coordination improves emergency preparedness by identifying and reinforcing areas of expertise, available resources, and planning agreement.
- **Develop or improve Flood Emergency Management Plans.**
  Consistent emergency plans based on the State Emergency Management System will help local responders work together to solicit and accept State and Federal assistance during emergencies.
- **Conduct flood emergency preparedness and response exercises statewide and increase participation among public agencies at all levels in flood-fight training.**
  Regular training, tabletop drills, and functional exercises are necessary parts of disaster preparedness.
- **Identify data and forecasting needs for emergency response and water management.**
  Accurate and timely forecasts for flood events can increase warning time, save lives, and reduce property damage. Additional data will help improve the readiness and response to floods.

Plans

4 Encourage land use planning practices that reduce the consequences of flooding.

Development in California has increased in areas that are at risk for flooding. Some local land use agencies experience pressure to foster economic growth by approving development in areas with high exposure to floods.

Goal: Reduced risk to people, property, and economies in floodplains.

Strategies:

- **Work with organizations that represent flood management and land use professionals to develop planning principles that will help decision makers determine if property is at risk for flooding.**
  Promote these principles as "best management practices" to increase wise land use planning.
- **Facilitate regular coordination at all levels among land use planners, resource managers, floodplain managers, and emergency response managers.**
  Coordination among planners, flood managers, resource managers, and emergency response managers can help to reduce impacts of flooding and improve public safety.
- **Link funding for flood management improvements to implementation of best management practices for floodplain management.**
  Fiscal incentives can help improve land use planning to reduce risks to people and property, as well as to maintain and restore natural functions of floodplains.

Plans

5 Implement flood management from regional, systemwide, and statewide perspectives to provide multiple benefits.

Historically, flood management projects have primarily been developed on a site-by-site basis. This approach does not consider California's complex regulatory, permitting, and water management environment. It is important for flood management agencies and water agencies to work together to develop regional solutions that produce integrated benefits.

Goal: Agencies at all levels of government use an integrated water management (IWM) approach for flood management.

Strategies:

- **Identify regional flood planning areas.**
  Establish specific regions for flood management planning throughout the state. Boundaries could be watershed based, systemwide, and consistent with existing State and Federal agency boundaries, including existing Integrated Regional Water Management (IRWM) Plan funding areas. IRWM is the application of IWM principles on a regional basis in California.
- **Prioritize flood management projects in each region.**
  Regional priorities for flood management actions can foster IWM actions and make the best use of funding.
- **Expand State and Federal processes for developing, funding, and implementing flood management projects with an integrated approach in each region.**
  Encourage and incorporate project components to achieve a broad range of objectives. Develop common terminology for State and Federal programs to help grantors and grantees understand IWM projects.
- **Improve coordination between programs and entities for water management and flood management planning.**
  State and Federal funding requirements must include coordination between flood management and water management programs.
- **Link funding to an IWM approach.**
  Incentivizing an IWM approach with State and/or Federal funds will encourage local agencies to consider systemwide, multiple-benefit projects when developing options for flood management.

Actions

6 Increase collaboration among public agencies to improve flood management planning, policies, and investments.

California has more than 1,300 agencies with direct responsibility for flood management. This complex governance situation makes agency coordination fragmented and difficult. California's flood and water management agencies oversee operation, maintenance, and improvement of vital infrastructure facilities within agency boundaries. This traditional "silo" approach is inefficient and expensive. Improved agency collaboration and alignment will provide a variety of benefits, including: fostering innovative solutions to problems; improving planning and permitting processes; developing high-value multiple benefit projects; and prioritizing investment needs.

Goal: Improved coordination and alignment between local, State, and Federal public agencies, providing increased effectiveness and efficiency in all aspects of flood management.

Strategies:

- **Establish regional working groups to foster efficient permitting, planning, and implementation of flood management projects.**
  Local, State, and Federal agencies must work together to develop solutions and work through regional issues. Agencies can work together to incentivize participation of resource agencies in regional working groups that focus on planning and implementing flood management projects. These working groups would provide a forum to prioritize projects, facilitate discussions about permitting, and address regional issues.
- **Provide funding and in-kind credit programs for regional planning.**
  State and Federal agencies can set financing program guidelines to encourage local agencies to collaborate on multiple-benefit projects. Programs such as the subventions funding by the California Department of Water Resources and grant funding by the Federal Emergency Management Agency could be realigned to direct more funding toward multiple-benefit or watershed-based projects.
- **Develop a methodology to prioritize and implement flood management investments.**
  Current funding criteria and processes are complex and hamper the development and implementation of priority projects. A new methodology should be developed and used by local, State, and Federal agencies to establish investment priorities across the state. Alignment among current and future local, State, and Federal resources is needed to implement priority flood projects and programs.

Actions

7 Establish sufficient and stable funding mechanisms to reduce flood risk.

The backlog of identified flood management projects is primarily due to lack of funding, which puts the State's economy, environmental resources, and millions of people at risk. Prioritizing and communicating flood management investment needs will help generate support for increased funding. Sustained investment in California's flood management systems can help avoid much larger future costs for flood recovery.

Goal: Funding to implement planned and future flood management programs and projects in California.

Strategies:

- **Assess the applicability of all potential sources and propose new options to provide sufficient and stable funding for flood management.**
  Local and State flood management partners can work together to propose changes or alterations to local funding methods. For example, changes to current law (e.g., Proposition 218 - 1996 Right to Vote on Taxes Act) could include reclassification of flood management agencies as exempted public safety utilities. Regional assessment districts can be established where needed to support flood management.
- **Improve and facilitate access to State and Federal funding sources.**
  Develop a central online resource catalog that describes the different funding programs and provides guidance to local agencies on how to apply for funding.
- **Increase State and Federal funding for flood management projects.**
  Local and State agencies must work together to advocate for sufficient and stable funding for regionally based integrated water management projects.

Results

A foundation of alignment among public agencies charts the path to success.

Flood management is at a crossroads. Either we continue down the path of fragmented planning, unreliable funding, and narrowly focused projects, or we use an integrated water management (IWM) approach to flood management that provides more benefits, sufficient and stable funding, broad support, and improved public safety.

Inaction could result in flood consequences of catastrophic proportions, risking lives and jeopardizing property and environmental resources. Maintaining the status quo will needlessly expose local and State economies to financial ruin.

As described in the recommendations, the path forward to effective results is charted using tools, plans, and actions.

Tools

Improved information and understanding leads to enhanced public safety and other IWM benefits. The tools described in the recommendations, such as flood risk assessments, should be implemented in the short term while longer-term actions are pursued.

Plans

Flood management solutions must be developed using an IWM approach. Regional planning must be part of statewide planning for policy and investment priorities. Regional flood management planning areas and forums must be established to:

- Overcome perceived or real institutional barriers
- Reduce the regulatory and administrative burden to operate, maintain, and improve flood infrastructure
- Develop multiple-benefit solutions

Actions

Agencies throughout the state should strive for alignment on governance and policies for flood management. Agency alignment will make the best use of limited time, money, and staff resources.

Financial investment priorities and sustained funding must be established. Public agencies at every level must work together to develop and pursue both short-term and long-term sustainable financing to support flood management that uses an IWM approach.

Results

Results

The recommendations outlined in ***California's Flood Future*** are designed to deliver measureable results to achieve public safety, environmental stewardship, and economic stability. These include:

- Reduced risk and consequences of flooding.
- Informed decisions for flood risk made by policy leaders and the public.
- Protected ecosystems and preserved floodplain functions.
- Multiple benefits delivered for projects funded by State and Federal agencies.
- Improved flood management governance and policies.
- Identification of statewide investment priorities.
- Sufficient and stable funding for flood management.

California's future depends on elected officials, stakeholders, and agencies at every level of government working together to improve public safety, enhance environmental stewardship, and achieve economic stability.

Produced by

US Army Corps of Engineers ®

The complete report, *California's Flood Future: Recommendations for Managing the State's Flood Risk*, including technical attachments and other supporting information is available for review at:

http://www.water.ca.gov/SFMP