State of California
Multi-Hazard Mitigation Plan
2007

Prepared by:

The Governor's Office of Emergency Services
3650 Schriever Avenue
Mather, CA 95655
www.oes.ca.gov

With support from:

City and Regional Planning Department
Community Safety & Sustainability Group
Faculty Advisors and Consultants
California Polytechnic State University
San Luis Obispo, CA 93407-0283

Public Comment Draft

Table of Contents

Chapter 1 - The Planning Process 1
1.0 Chapter Summary 1
1.1 The Purpose of the Plan 2
1.2 Plan Overview 4
1.3 Planning Process Components 5
1.3.1 Plan Update Procedure 5
1.3.2 Coordination of Agencies and Departments 7
1.3.3 Integration with Other Planning Efforts 10
1.4 Public Involvement 14
1.5 Adoption by the State 16
Chapter 2 – Legal, Institutional, and Policy Framework 21
2.0 Chapter Summary 21
2.1 Institutional and Legal Context 23
2.2 Federal Laws, Institutions, and Policies 23
2.2.1 Flood Insurance Act 23
2.2.2 Stafford Act 24
2.2.3 Disaster Mitigation Act of 2000 24
2.2.4 Other Federal Disaster Laws 26
2.2.5 Federal Emergency Management Directives 27
2.3 California Laws, Institutions, and Policies 28
2.3.1 California Emergency Services Act 28
2.3.2 Relationship of SHMP to Emergency Management 32
2.3.3 State Agency Responsibilities 34
2.3.4 State Emergency Management and Mitigation Laws 39
2.4 Local Government Laws, Institutions, and Policies 40
2.4.1 Local Emergency Management Responsibilities 40
2.4.2 Local Hazard Mitigation Responsibilities 41
2.4.3 Relationships of Local Planning Processes to LHMPs 44
2.5 Private Sector Emergency Management and Mitigation 45
2.5.1 Utilities 45
2.5.2 Business, Industry, and Community-Based Organizations 46
Chapter 3 - State Mitigation Strategy 47
3.0 Chapter Summary 47
3.1 Hazard Mitigation Goals and Objectives 48
3.1.1 Reducing Life Loss and Injuries 49
3.1.2 Minimizing Damage and Disruption 50
3.1.3 Environmental Protection 51
3.1.4 Integrated Mitigation Policy 52
3.2 State Priorities 54
3.2.1 Priority Determination 54
3.2.2 Federal Hazard Mitigation Funding Priorities 55
3.2.3 Types of State Mitigation Strategies 56
3.3 State Capability Assessment 59
3.3.1 Legal Foundations of State Capability 60
3.3.2 Levels of State Capability 60

3.4 Local Government Capability Assessment 61
3.4.1 Legal Foundations of Local Government Capability 61
3.4.2 State Actions Supporting Local Capability 63
3.4.3 Fostering Local Government Capability 63
3.4.4 Role of California Planning and Building Codes 64
3.4.5 Enhanced State and Local Capabilities 65
Chapter 4 - Profile of State Assets 71
4.0 Chapter Summary 71
4.1 Scale and Diversity of Assets Needing Protection 72
4.2 Population 73
4.3 Economy 74
4.4 Geography 80
4.5 Climate 81
4.6 Rivers and Watersheds 81
4.7 Geology 82
4.8 Forest Resources 82
Chapter 5 - Hazard, Vulnerability, and Risk Assessment 85
5.0 Chapter Summary 85
5.1 State and Federal Disaster History 89
5.1.1 Statewide Disaster Loss Findings 89
5.1.2 Primary Sources of Disaster Losses 92
5.1.3 Criteria for Hazards and Vulnerability Assessment 92
5.2 Terminology 93
5.2.1 Hazard 94
5.2.2 Vulnerability 94
5.2.3 Risk 95
5.2.4 Disaster 95
5.2.5 Natural and Human-Caused Disasters 96
5.2.6 Mitigation 96
5.2.7 Preparedness 97
5.2.8 Response 97
5.2.9 Recovery 97
5.3 Climate Change – An Emerging Issue 98
5.3.1 International Panel on Climate Change 98
5.3.2 California Initiatives 99
5.3.4 Implications for Hazard, Vulnerability, and Risk Assessment 101
5.4 Statewide Multi-Hazard Risk Assessment 103
5.4.1 GIS Risk Exposure Analyses 103
5.4.2 Planning, Policy, and Action Implications 114
5.5 Earthquake Hazards, Vulnerability, and Risk 115
5.5.1 Identifying Earthquake Hazards 115
5.5.2 Profiling Earthquake Hazards 123
5.5.3 Assessment of State Vulnerability and Potential Losses 125
5.5.4 Assessment of Local Vulnerability and Potential Losses 131
5.5.4.1Vulnerability and Mitigation of Buildings 132
5.5.4.2 Vulnerability and Mitigation of Utilities and Transportation 150

5.5.5 Current Earthquake Hazard Mitigation Efforts 160
5.5.6 Opportunities for Enhanced Earthquake Hazard Mitigation 161
5.6 Flood Hazards, Vulnerability and Risk Assessment 168
5.6.4 Assessment of Local Vulnerability and Potential Loss to Flood Hazards 178
5.6.5 Current Flood Hazard Mitigation Efforts 180
5.7 Wildfire Hazards 189
5.7.1 Identifying Fire Hazards 189
5.7.2 Profiling Fire Hazard Events 190
5.7.3 Assessment of State Vulnerability and Potential Losses 195
5.7.4 Assessment of Local Vulnerability and Potential Losses 199
5.7.5 Current Wildfire Hazard Mitigation Efforts 201
5.7.6 Opportunities for Enhanced Wildfire Hazard Mitigation 207
5.8.1 Levee Failure 210
5.8.2 Landslides and Other Earth Movements 216
5.8.3 Tsunami Hazards 225
5.9 Climate-related Hazards 231
5.9.1 Avalanches 231
5.9.2 Coastal Flooding, Erosion, Sea Level Rise 232
5.9.3 Drought 236
5.9.4 Extreme Heat 241
5.9.5 Freeze 244
5.9.6 Severe Weather and Storms 247
5.10 Other Hazards 250
5.10.1 Dam Failure 250
5.10.2 Energy Shortage 251
5.10.3 Epidemic/Pandemic 256
5.10.4 Hazardous Materials Release 258
5.10.5 Insect Pests 262
5.10.6 Marine Invasive Species 264
5.10.7 Radiological Accidents 265
5.10.8 Terrorism 269
5.10.9 Volcanoes 276
5.11Additional Hazards Summarized in the 2007 SHMP Appendix 277
Chapter 6 - Local Hazard Mitigation Planning 279
6.0 Chapter Summary 279
6.1 Overview and Status of Local Mitigation Planning 280
6.1.1 California LHMP Program 281
6.1.2 Goal and Objectives of the LHMP Program 281
6.2 Analysis of Local Mitigation Planning 283
6.2.1 Assessment of Trends 283
6.2.2 LHMP Content Review and Survey Methods 284
6.2.3 Preparation Trends 284
6.2.4 Hazard and Risk Assessment Trends 285
6.2.5 Planning and Mitigation Trends 290
6.3 Local Mitigation Planning Assistance 293
6.3.1 Planning and Technical Assistance 293

6.3.2 Funding Assistance 293
6.4 Integration of Local and State Mitigation Efforts 293
Chapter 7 - Funding Sources and Capability 295
7.0 Chapter Summary 295
7.1 Federal Funding Sources 295
7.2 State Funding 301
7.2.1 Earthquake Hazard Mitigation Funding 301
7.2.2 Flood Hazard Mitigation Funding 302
7.2.3 Wildfire Hazard Mitigation Funding 306
7.2.4 Other State Hazard Mitigation Funding 307
7.3 Local Funding Sources 308
7.4 Alternative Funding Sources 309
Chapter 8 - Enhanced Plan Criteria Achievements Program 311
8.0 Chapter Summary 311
8.1 Integration with Other Planning Initiatives 313
8.2 Project Implementation Capability 316
8.2.1 Hazard Mitigation Grant Program (HMGP) 316
8.2.2 Pre-Disaster Mitigation Grants (PDM) 320
8.2.3 Flood Mitigation Assistance Grants (FMA) 320
8.2.4 Determining Cost Effectiveness 320
8.3 Program Management Capability 321
8.4 Assessment of Mitigation Actions 325
8.5 Effective Use of Available Mitigation Funding 328
8.6 Commitment to a Comprehensive Mitigation Program 330
8.7 Monitoring, Evaluating, and Updating the Plan 331
2007 SHMP Appendix 335
Document 1.3.2A SHMT Meeting Minutes 337
Table 2.3.3B State Agency Functions – Agency Responsibility Matrix 369
Table 2.3.4B Earthquake Hazard Mitigation Legislation, 1933 to 2006 395
Table 2.3.4C Flood Hazard Mitigation Legislation, 1933 to 2006 407
Table 2.3.4D Wildfire Hazard Mitigation Legislation, 1933-2006 410
Document 2.3.4A Earthquake Hazard Mitigation Legislative History – Historical Development 414
Table 5.1.1C California Disaster History: State Proclamations, Federal Declarations, and Selected Events (1950 – May 2007) 418
Document 5.4.1A GIS Risk Exposure Analysis Methodology 439
Map 5.5.4.1B State Owned and Leased Structures, Northern California – Earthquake Faults 453
Map 5.5.4.1C State Owned & Leased Structures, Central California – Earthquake Faults 454
Map 5.5.4.1D State Owned & Leased Structures Southern California – Earthquake Faults 455
Table 5.5.4.1G-1 Draft Overall Progress Toward Earthquake Mitigation of Key Building Inventories in California 456
Table 5.5.4.1G-2 Draft Overall Progress Toward Earthquake Mitigation of Key Building Inventories in California 458

Chart 5.7.1B Dollar Damage on State Responsibility Area (SRA) Since 2000 460
Chart 5.7.1C Structures Burned in State Responsibility Area Since 2000 460
Map 5.6.3B State Owned & Leased Structures, Northern California – 100 Year Flood Plain 461
Map 5.6.3C State Owned & Leased Structures, Central California – 100 Year Flood Plain 462
Map 5.6.3D State Owned & Leased Structures, Southern California – 100 Year Flood Plain 463
Table 5.7.2B Structures and Life Loss by Wildfire Event, 2004-2007 464
Map 5.8.2B General Areas Susceptible to Landslides..... 474
Map 5.8.2C Landslide Declared Disasters..... 475
Document 5.11A. Additional Hazards..... 476
Table 7.1K FEMA Mitigation Funding and Technical Assistance Sources..... 479
Map 8.3A Hazard Mitigation Grant Projects by County DR-845 through 1585 (1989-Present) 482
Map 8.3B Hazard Mitigation Grant Projects Percent Geocoded by County DR-845 through 1585 (1989-Present) 483

Executive Summary

This plan tells the story of how California has successfully organized to implement hundreds of hazard mitigation programs strengthening the state's resilience in the face of future disasters. An overall purpose of this plan is to facilitate mitigation planning and actions by state agencies, local governments, business and industry, and citizens.

The State Hazard Mitigation Plan (SHMP) is the official statement of California's statewide hazard mitigation goals, strategies, and priorities. Hazard mitigation deals with reshaping and strengthening the built environment to significantly reduce disaster losses created by natural and human-caused hazards and risks.

Hazard mitigation planning is a dynamic process built on realistic assessments of hazards, coupled with effective strategies for investing in preventive measures. It involves multiple stakeholders from throughout the state and community, blending public and private sector objectives, goals and actions.

The goals of this plan are to significantly reduce life loss and injuries and minimize damage to structures and property from disasters, protect the environment, and promote hazard mitigation as an integrated public policy, i.e., create safer communities and state.

This plan is required under federal law and must be updated every three years. The revised plan addresses a range of new conditions, laws, and programs that have emerged since the current plan was approved by FEMA in October 2004.

The current plan was approved by FEMA as a "standard" plan. However, the California Office of Emergency Services (OES) intends to submit an "enhanced" plan to FEMA to qualify California for additional federal hazard mitigation grant funds after future disasters.

To achieve this California must show how it integrates the SHMP with other state and regional planning, demonstrates strong project implementation and management capability, systematically assesses mitigation actions, effectively uses available mitigation funding, and is committed to a comprehensive mitigation program.

An enhanced plan would make the state eligible for up to a 20% increase in total post-disaster hazard mitigation assistance after each federally declared disaster, compared with substantially lesser amounts with the current "standard" plan.

The updated plan consists of nine chapters and carries forward elements from the current SHMP. It also places added emphasis on hazards such as climate change, levee failure, and tsunamis as well as addressing flood, seismic, wildfire, and other hazards.

Chapter 1, Planning Process, summarizes the plan, describes the planning process, and demonstrates the importance of stakeholder engagement in mitigation planning and action.

Chapter 2, Legal, Institutional and Policy Framework, reviews federal and state hazard mitigation laws, tracks legislative and policy progress, profiles the mitigation responsibilities of 40+ agencies, and provides examples of local hazard mitigation best practices.

Chapter 3, State Mitigation Strategy, presents a new mission, vision, goals and objectives for hazard mitigation, assesses state and local capability to conduct effective mitigation, and notes that the state's mitigation priorities reflect the state's historical experience with disasters.

Chapter 4, Profile of State Assets, describes the resources that California seeks to protect and provides context regarding the hazards, risks, and vulnerabilities that are analyzed in more detail in Chapter 5.

Chapter 5, Assessing Hazards, Vulnerability and Risk, links hazards to state goals, objectives and priorities, and classifies hazards into a hierarchy of primary impacts (flood, earthquake, fire), secondary impacts (vulnerable levees, landslides, tsunamis), climate-related hazards (drought, heat, severe storms), and other (terrorism, hazardous materials release, dam failure). It chronicles California's disaster history since 1950 and looks forward with a discussion of the risks of climate change. Also included is a multi-hazard risk assessment for flood, fire, and earthquake in each of California's 58 counties using geographic information system (GIS) modeling, taking into account social vulnerability as well as physical hazards.

Chapter 6, Local Hazard Mitigation Planning, discusses the status of local hazard mitigation planning efforts, using information and analysis gained from a review of 400 LHMPs and a detailed survey of cities, counties, and special districts. The analysis identifies areas of deficiency, discusses how LHMPs can be more effective, and recommends ways to better link the local LHMPs with state efforts.

Chapter 7, Funding Sources and Financial Considerations, discusses federal, state, and local mitigation funding sources, addressing both public and private sector sources.

Chapter 8, Enhanced Plan Criteria, Achievements, Program, describes mitigation program management capabilities, and discusses how mitigation efforts can be better integrated via legislative, policy, institutional, substantive, functional and financial perspectives. Included is an analysis of mitigation actions and effective use of funds. Included as well is a system and strategy for monitoring the effectiveness of mitigation efforts and updating the SHMP in the future. It also addresses FEMA criteria for qualifying the 2007 plan as an enhanced plan.

As the state grows, it faces the dual challenges of addressing vulnerabilities in the built environment and accommodating growth and change in ways that avoid or mitigate future vulnerabilities.

Comment On: Chapter 1

Chapter 1 - The Planning Process

Chapter Organization

1.0 Chapter Summary
1.1 The Purpose of the Plan
1.2 Plan Overview
1.3 Planning Process Components
  1.3.1 Plan Update Procedure
  1.3.2 Coordination of Agencies and Departments
  1.3.3 Integration with Other Planning Efforts
1.4 Public Involvement
1.5 Adoption by the State

Comment On: Chapter 1 Section 0

1.0 Chapter Summary

Since 1950 California has experienced nearly 300 state or federally declared disasters. Of those, roughly half were caused by wildfires, floods, or earthquakes. Together these three hazards account for the largest losses of life among all disasters and over $55 billion in disaster costs. As a consequence of its experience with disasters, California has initiated a variety of ongoing hazard mitigation efforts.

Previously the state has undertaken particularly significant mitigation planning efforts for California's three primary impact disaster sources: earthquakes, floods, and wildfires. Three separate mitigation plans for these hazards include information on state and local risk that helped to form the foundation for the risk assessment in this Plan. The 2007 SHMP provides an opportunity to knit these previous mitigation plans together with consideration of other hazards.

The purpose of the State Hazard Mitigation Plan (SHMP) is to significantly reduce deaths, injuries, and other disaster losses caused by natural and human-caused hazards in California. The SHMP describes past and current hazard mitigation activities and outlines future disaster loss reduction goals, strategies, and actions. It provides guidance for hazard mitigation activities in a formal written document highlighting partnerships among local, state, tribal, and federal organizations as well as the private sector. It is intended to be a "living document" that will be modified regularly to reflect future changes in hazards and societal conditions.

A "hazard" is any event or condition with the potential to cause fatalities, injuries, property damage, infrastructure damage, agricultural loss, environmental damage, business interruption, or other loss. "Mitigation" means sustained, long-term action to reduce or eliminate the risk to life and property from natural, human-caused, and technological hazards. Usually hazard mitigation involves making changes in the physical environment to permanently reduce risk of losses, whereas emergency preparedness concentrates on activities improving readiness to respond to a disaster with emergency equipment, food, shelter, and medicine.

The 2007 SHMP includes new content on emerging subjects brought to public attention by recent events. In the revised 2007 SHMP, OES is addressing a variety of new conditions, laws, and programs which have emerged since the current plan was published in 2004. These include: climate change, tsunami mitigation and preparedness, San Francisco Bay-San Joaquin Delta regional levee failure, and deadly landslides such as that which occurred in La Conchita in 2005.

La Conchita Landslide, 2005

Source: California Geological Survey

Preparation of the 2007 SHMP has relied heavily on the State Hazard Mitigation Team (SHMT) to provide information regarding new laws, hazard conditions, and mitigation actions taken since 2004. Comprised of over 40 state agencies and related organizations having responsibility for specific state-mandated hazard mitigation activities, the SHMT has been instrumental in the development of the 2007 SHMP.

OES has recently augmented its web site with the addition of a new State Hazard Mitigation Web Portal. This serves as a one-stop location for matters dealing with hazard mitigation and represents an easy way for the public to participate in the 2007 SHMP revision. The Mitigation Web Portal includes a comment/request form allowing individuals to communicate directly with OES staff to give specific comments on the 2007 SHMP. The Portal is available on the OES web home page at the following url: http//hazardmitigation.oes.ca.gov

Comment On: Chapter 1 Section 1

1.1 The Purpose of the Plan

The State of California is required to have a FEMA-approved multi-hazard mitigation plan to be eligible for disaster recovery assistance and mitigation funding. This document known as the California State Multi-Hazard Mitigation Plan (SHMP or Plan) fulfills

FEMA requirements and provides direction and guidance on implementing hazard mitigation by state agencies, local governments, tribal governments, and the private sector.

The SHMP reflects California's cultural, societal, economic, and environmental values and acknowledges numerous regulatory and compliance issues facing the state. It is intended to set the tone for the implementation of hazard mitigation practices that will build a safe and resilient California and perform the following functions:

1. Document statewide hazard mitigation systems implemented in California;
2. Describe strategies and priorities for future mitigation activities;
3. Facilitate integration of local, state, tribal, and business hazard mitigation activities into a comprehensive statewide effort; and
4. Meet state and federal statutory and regulatory requirements for an Enhanced Plan.

2007 SHMP Update

The purpose of the SHMP is to significantly reduce deaths, injuries, and other disaster losses caused by natural and human-caused hazards in California. It describes past and current hazard mitigation activities and outlines future disaster loss reduction goals, strategies, and actions. The SHMP provides guidance for hazard mitigation activities while cementing partnerships among local, state, and federal agencies in a formal written document. It is intended to be a "living document" that will be periodically modified to reflect future changes in hazards and societal conditions.

Meeting Federal Requirements

The previous SHMP was approved by FEMA in November 2004. This updated 2007 SHMP meets the requirements for an Enhanced Plan under Interim Final Rule 44 Code of Federal Regulations (CFR) 201.4 published by FEMA on February 28, 2002. Adoption of the SHMP by the state and approval by FEMA qualifies California to obtain federal assistance for hazard mitigation and for the repair and replacement of infrastructure damaged in natural disasters.

What is Hazard Mitigation?

According to Interim Final Rule 44 CFR Section 206.401 hazard mitigation is defined as, "any action taken to reduce or eliminate the long-term risk to human life and property from natural hazards." For the purposes of this plan, hazards are both natural and human-caused. A "hazard" is any event or condition with the potential to cause fatalities, injuries, property damage, infrastructure damage, agricultural loss, environmental damage, business interruption, or other loss.

"Mitigation" means sustained, long-term action to reduce or eliminate the risk to life and property from natural, human-caused, and technological hazards. Usually this involves making changes in the physical environment to permanently reduce risk of losses.

Hazard mitigation is different from emergency preparedness planning. The latter concentrates on activities which make a person, place, or organization ready to respond to a disaster with emergency equipment, food, emergency shelter, and medicine.

Hazard mitigation and emergency preparedness planning go hand-in-hand. To the degree that time or financial resources preclude the long-term mitigation of many hazards in the natural and social environment, it is important to undertake plans and actions to prepare for emergencies. Emergency preparedness planning makes it easier to respond to and recover from an emergency.

By investing in hazard mitigation measures which make the built environment safer hazards and resultant losses of life and property can be significantly reduced, making it easier and less expensive to respond to and recover from disasters.

Plan Development Process

While the Governor's Office of Emergency Services (OES) has lead responsibility for the development and maintenance of the SHMP, the document has been produced in collaboration with multiple state agencies. A State Hazard Mitigation Team (SHMT) representing over 40 state agencies met regularly starting in October 2006 to help revise the statewide goals, strategies, and priorities reflected in the Plan. The SHMT is an "owner" of the Plan on behalf of the people of California, and OES is its steward.

Comment On: Chapter 1 Section 2

1.2 Plan Overview

The SHMP is designed for reference by a variety of users having specific interests in one or another detailed aspect of its contents. For those interested in understanding the Plan as a whole but not necessarily interested in the details of subjects covered, an executive summary with a series of chapter summaries will be available.

What's New in the Updated Plan?

The 2007 SHMP reflects a reorganization and expansion of material in the 2004 plan and includes new content on emerging subjects such as climate change, tsunamis, and levee failure brought to public attention by recent events. New materials found in each chapter include the following.

Chapter 1, The Planning Process – identifies over 40 state agencies and related organizations brought together to update the Plan, as well as an expanded outreach process used to solicit public input to improve the utility of the Plan.

Chapter 2, Legal, Institutional and Policy Framework – this is entirely new. It reviews federal, state, and local government laws, as well as institutions and practices together forming a comprehensive framework for hazard mitigation action which improves the safety of citizens through strengthening the built environment.

Chapter 3, State Hazard Mitigation Goals, Objectives, and Strategies – presents new state mitigation goals, objectives, and strategies constituting the core of the Plan and assesses state and local capabilities to conduct effective mitigation.

Chapter 4, Profile of State Assets – provides a thumbnail profile of California's size, dynamic growth, and diverse assets, including its people, geography, businesses, and natural resources, providing a background for discussion in Chapter 5 of hazards, risk, and vulnerability.

Chapter 5, Assessing Hazards, Vulnerability, and Risk – consolidates separate chapters in the 2004 SHMP into a comprehensive assessment of multiple hazards, adds new definitions of key terms along with a multi-hazard assessment and comparison of vulnerability to earthquake, flood, and wildfire threats among the 58 counties of California, and contains new sections on climate change, levee fragility, landslides, and tsunamis.

Chapter 6, Local Hazard Mitigation Planning – this is also entirely new. It provides an overview of over 500 local hazard mitigation plans (LHMPs) prepared in California and approved by FEMA under the provisions of the Disaster Mitigation Act of 2000. It identifies linkages between LHMPs and other local mitigation planning and projects.

Chapter 7, Funding Sources and Financial Considerations – adds information about federal, state, and local mitigation funding sources, and identifies non-governmental mitigation funding from a variety of sources including the private sector.

Chapter 8, Enhanced Plan Criteria, Achievements, Program – this is also completely new. It addresses FEMA criteria for qualifying the 2007 Plan as an Enhanced Plan. These criteria deal with integration of the SHMP with other planning initiatives, program management and project implementation, effectiveness of mitigation actions, and use of available mitigation funding. It links these to California's comprehensive mitigation program, also describing an ongoing strategy for monitoring, evaluating, and updating the Plan.

Comment On: Chapter 1 Section 3

1.3 Planning Process Components

Hazard mitigation planning is a dynamic process built on realistic assessments of hazards, coupled with effective strategies for investing in preventive measures. It involves multiple stakeholders from throughout the state and within communities, blending public and private sector objectives, goals and actions.

Comment On: Chapter 1 Section 3.1

1.3.1 Plan Update Procedure

Revision of the SHMP has been undertaken by OES with the support of the California Polytechnic State University-San Luis Obispo, with work undertaken by City and Regional Planning Department faculty and research assistants along with advisory faculty from other departments.

An overall goal of the plan revision is to facilitate mitigation planning and action across the boundaries of state agencies, local governments, tribal organizations, business and industry, and community organizations.

Benefits of an Enhanced Plan

The 2007 SHMP is structured to meet a variety of objectives, but above all to qualify for FEMA approval as an Enhanced Plan. According to the FEMA guidance criteria:

> An Enhanced State Mitigation Plan documents the State's demonstrable and sustained commitment to the objectives of hazard mitigation. This designation recognizes the State as a proactive leader in implementing a comprehensive statewide program. The enhanced status acknowledges the extra effort a State has made to reduce losses, protect its resources, and create safer communities.

Stakes are high for achieving Enhanced Plan status. Under the Stafford Act, as amended, an Enhanced Plan would qualify California for Hazard Mitigation Grant Program (HMGP) funding following future disasters up to 20% of a federally declared disaster authorization. With the current Standard Plan, California would only qualify for receipt of hazard mitigation funds according to the following formula:

- 15% for amounts not more than $2 billion;
- 10% for amounts more than $2 billion and not more than $10 billion;
- 7½% for amounts more than $10 billion and not more than $35 billion.

Although most disasters cost well under the $2 billion threshold, a few in California since 1950 have exceeded $10 billion. In short, the principal value of having a FEMA-approved Enhanced Plan lies with California's potential for catastrophic events. In light of increasingly high probabilities estimated for catastrophic earthquakes to occur on the San Andreas and Hayward Faults, approval of an Enhanced Plan is in everyone's interest in California.

To be approved by FEMA as an Enhanced Plan, the 2007 SHMP must describe the state's system and strategy for tracking mitigation projects, demonstrate that the state is capably managing these in relation to SHMP goals, and show that California is a "proactive leader in implementing a comprehensive statewide program."

New Laws and Conditions

In the revised 2007 SHMP, OES is addressing a variety of new conditions, laws, and programs which have emerged since the current plan was published in 2004. These include: climate change, tsunami mitigation and preparedness, and San Francisco Bay Delta regional levee failure potential. OES has used GIS modeling to prepare a systematic statewide analysis of vulnerability of the 58 counties to primary impact hazards (earthquakes, wildfires, and floods) showing the distribution within the state of these hazards and their interrelationships.

Plan Update Work Program

Eight major tasks were undertaken in revising this Plan. They include the following:

Task 1, conduct liaison with state and federal agencies – multiple meetings were conducted between OES, state agencies, and FEMA to assure full communication regarding work objectives, criteria, and product content.

Task 2, assess 2004 SHMP content – the 2004 Plan was completely reviewed as to how well it met FEMA Enhanced Plan guidelines, and to Plan upgrade content to comply.

Task 3, evaluate local hazard mitigation plans – over 500 local hazard mitigation plans prepared by cities, counties, and special districts, as well as tribal organizations, were reviewed to determine relationships with the SHMP and other local mitigation planning.

Task 4, conduct outreach to local government and professional associations – an outreach effort was conducted to contact regional councils of governments, special districts, utilities, counties and cities, and professional associations to solicit ideas on the linkage between the Plan and local best practices.

Task 5, conduct outreach to business and industry groups – an outreach effort was simultaneously conducted to contact industry groups to solicit ideas on how to make the Plan useful to business.

Task 6, formulate a mitigation-preparedness model – this task involved a systematic evaluation of how to strengthen linkages between the 2007 SHMP and preparedness planning.

Task 7, prepare the draft 2007 SHMP – a draft 2007 SHMP has been prepared for public release during the summer of 2007. Following public input, a final draft will be submitted for official FEMA approval.

Task 8, prepare summary materials for general public information – the 2007 Plan has been prepared to meet various levels of interest: an executive summary providing a quick overview along with a series of chapter summaries will be available for general reading purposes. The summary materials will be published along with the 2007 SHMP in October 2007.

Comment On: Chapter 1 Section 3.2

1.3.2 Coordination of Agencies and Departments

While OES coordinates statewide hazard mitigation activities in California, many specific mitigation efforts are part of programs administered by other state agencies and departments such as the California Seismic Safety Commission, CAL FIRE, Department of Water Resources, Governor's Office of Planning and Research, California Geological Survey, and Department of Housing and Community Development.

The foundation for state agency coordination in the field of hazard mitigation is the Governor's Executive Order W-9-91, issued in 1991, which authorized the Director of OES to assign specific emergency functions to state agencies through standing administrative orders which are operational until superseded. A letter to agency secretaries on September 12, 2000, by then Governor Davis initiated the updating of all

standing orders related to emergency management and included hazard mitigation for the first time. Standard hazard mitigation provisions in the standing administrative order included the following:

- Identify, document, and when practical, implement those activities that potentially could reduce or lessen the impact of an emergency;
- Establish hazard mitigation as an integral element in operations and program delivery as appropriate;
- During a Presidential declaration of a major disaster, participate in the hazard mitigation planning process.

Various local, state, and federal agencies, tribal governments, businesses, non-profit organizations, and others are involved in hazard mitigation planning efforts in California. Many mitigation planning efforts and groups in the state are collaborative and coordinated by multiple agencies.

Implementation Role of OES

The primary responsibilities of OES in preparing and implementing this Plan are to:

1. Ensure that it meets FEMA requirements and is approved by FEMA;
2. Coordinate the continued development of the Plan, including coordination of the State Hazard Mitigation Team and local and federal agencies;
3. Administer FEMA hazard mitigation grant programs, including the Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation Program (PDM), Flood Mitigation Assistance Program (FMA), and Fire Mitigation Assistance Grants (FMAG);
4. Provide ample opportunity for public involvement in the development of the Plan.

The 2007 SHMP outlines California state government's assessment of hazards the state faces together with goals, strategies, and activities to address and minimize them. Although the 2004 SHMP which this replaces was the state's first formal multi-hazard mitigation plan, California had been successfully implementing hazard mitigation over several decades, expending hundreds of million of dollars to reduce or eliminate long-term risks to life and property caused by hazards.

OES implements the state multi-hazard mitigation planning process put forward in the 2007 SHMP and its predecessor by:

- Inviting state agencies with key hazard mitigation roles to join the SHMT and become active participants in the development of this Plan;
- Providing outreach, technical assistance, and education at the local and tribal government levels regarding the Plan and implementation of local and tribal plans;
- Providing the public with the opportunity to review and comment on the Plan.

State Hazard Mitigation Team (SHMT)

Preparation of the 2007 SHMP has relied heavily on the State Hazard Mitigation Team (SHMT) to provide information regarding new laws, hazard conditions, and mitigation

actions taken since 2004. Comprised of over 40 state agencies and related organizations having responsibility for specific state-mandated hazard mitigation activities, the SHMT has been instrumental in the development of the 2007 SHMP which contains substantial new information about individual agency mitigation program responsibilities. The SHMT has more than doubled in size since the 2004 Plan was prepared.

State Hazard Mitigation Team Meeting May 2007

Meeting initially in October 2006, then in January, February, May, and June 2007, the SHMT has carried out the following goals and functions related to the 2007 SHMP:

- Coordinated review of all state agencies' hazard mitigation roles;
- Identified new legislative initiatives;
- Actively worked to develop a sustainable statewide hazard mitigation program;
- Reported on changes in hazards, along with agency progress toward achieving mitigation goals, ongoing projects, and new opportunities arising through advancements in technology, knowledge, or completed work;
- Addressed most recent mitigation achievements to keep current on significant changes, new technologies, and advances in knowledge; and
- Reviewed the draft 2007 Plan and recommended refinements.

Table 1.3.2A at the end of this chapter lists state agencies and related organizations with hazard mitigation responsibilities. Information on specific mitigation responsibilities is provided in Chapter 2, Table 2.3.3A, and Appendix Table 2.3.3B. Appendix Document 1.3.2A provides minutes of five State Hazard Mitigation Team meetings from October 2006 through June 2007.

Comment On: Chapter 1 Section 3.3

1.3.3 Integration with Other Planning Efforts

This Plan integrates and enhances all state planning efforts within a statewide comprehensive mitigation planning framework. Various state agencies have been delegated planning responsibilities through state law or by executive order.

State Emergency Plan

Executive Order W-9-91 requires the Director of OES to prepare the State of California's Emergency Plan and to coordinate activities of all State agencies during the preparedness and response phases of emergencies. By subsequent standing administrative orders, it requires hazard mitigation as part of emergency planning activities.

The SHMP is a supporting document to the California State Emergency Plan, which defines the emergency management system used for all emergencies in California. It describes the California Emergency Organization which provides the governor access to public and private resources within the state in times of emergency. By requiring that the SHMP include a "Hazard, Vulnerability and Risk Assessment" the State Emergency Plan serves to identify hazards that impact the communities of California and acknowledges the associated risk.

The 2007 SHMP provides a common database and assessment concerning hazards, vulnerabilities, and risk from natural and human-caused hazards for the State Emergency Plan and a variety of related operational emergency plans. The following is a list of OES plans and guidance documents referencing mitigation.

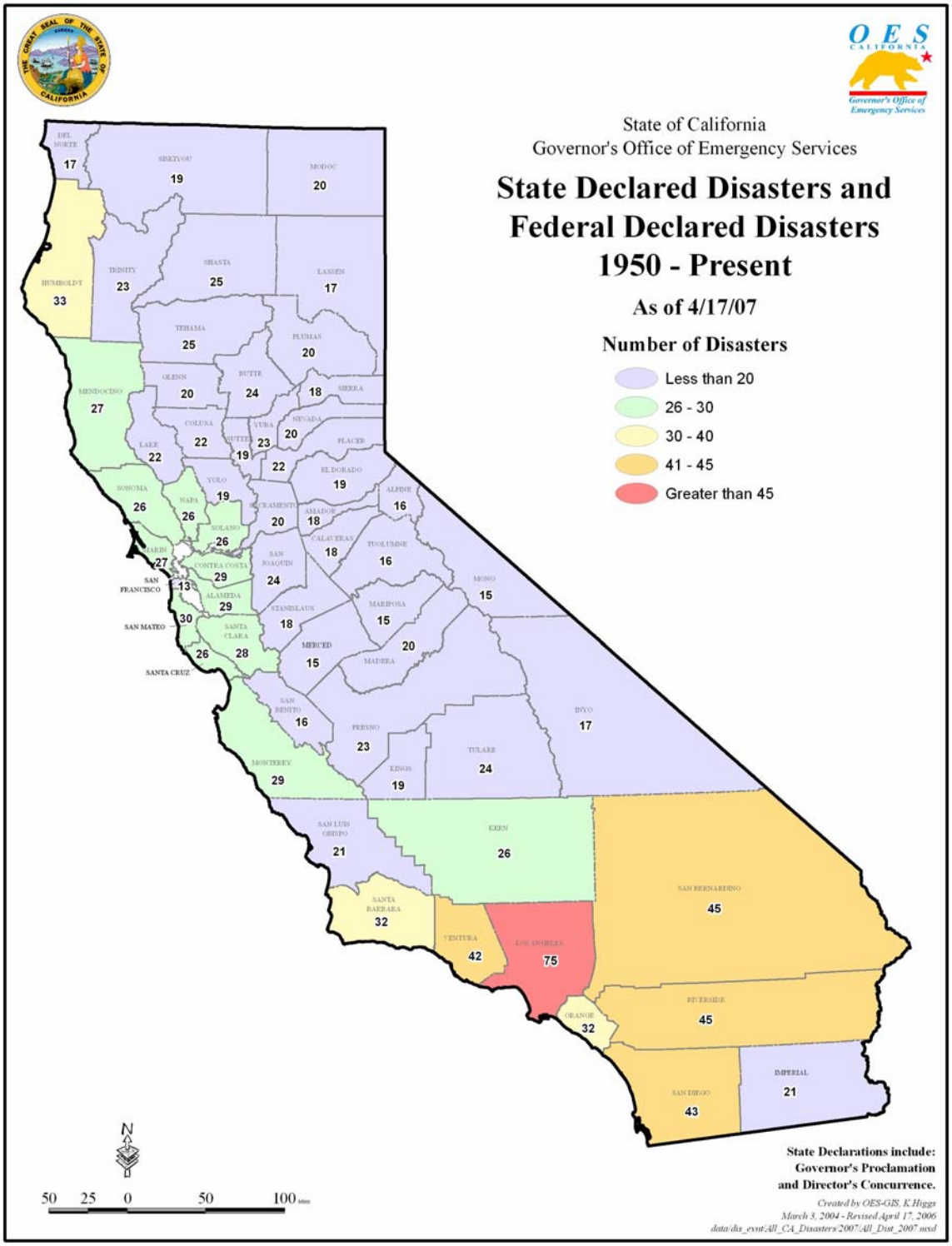
- California Emergency Plan
- Disaster Recovery and Mitigation Handbook
- Electric Power Disruption
- Emergency Planning Guidance for Local Government (revised 2007)
- Emergency Management in California (2003)
- Emergency Planning Guidance for Public and Private Water Utilities
- Recovery Manual
- Risk Communication Guide for State and Local Agencies
- Statewide Emergency Management Strategic Plan (2005-2010).

The comprehensive hazard mitigation planning process captured in the 2007 SHMP provides an opportunity to integrate hazard mitigation into these other ongoing OES and statewide planning documents. Where specific hazards are not dealt with in other state plans, this Plan presents original research and analysis suggesting methods for achieving mitigation as well as preparedness. For further information on relationships between the 2007 SHMP, the State Emergency Plan, and other plans, see Chapters 2 and 8.

California Disaster History

Since 1950, California has experienced 272 disasters. Map 1.3.3A on the following page shows the numbers of disasters in each of the 58 counties in California. Many of these are concentrated in Southern California and along the Pacific Coast.

Map 1.3.3A California Disasters Since 1950



Map 1.3.3A shows large numbers of disasters have been concentrated in and around Los Angeles County, in Southern California, and secondarily along the Pacific Coast.

Multi-Hazard Mitigation Planning History

As a consequence of its experience with disasters, California has initiated a variety of ongoing hazard mitigation efforts for many years. Due to the frequency, intensity, and variety of natural disasters and the corresponding statutory responses, mitigation efforts have tended to focus in a piecemeal fashion on mitigation of specific hazards. For example, after the 1971 Sylmar Earthquake, a wide variety of legislation was passed focusing on earthquake hazard mitigation.

Primary Impact Hazard Mitigation Plans

The state has undertaken particularly significant mitigation planning efforts for California's three primary impact disaster sources: earthquakes, floods, and wildfires. As an outcome, California has a number of hazard-specific mitigation plans in place that have been approved by FEMA, including the:

- California Earthquake Loss Reduction Plan;
- California Fire Plan; and
- State Flood Hazard Mitigation Plan.

California Earthquake Loss Reduction Plan

The California Seismic Safety Commission (CSSC) prepared the California Earthquake Loss Reduction Plan to fulfill the requirements of the California Earthquake Hazards Reduction Act of 1986 (Government Code §8870, et seq.). Numerous organizations and individuals participated in the development of the plan which reflects the state of the art in seismic hazard mitigation techniques and is used as a tool to evaluate potential initiatives to reduce the impact of future earthquakes. The California Earthquake Loss Reduction Plan is periodically updated on a separate cycle. For more information on the California Earthquake Loss Reduction Plan, see Chapter 5, Part 2.

California Fire Plan

The California Fire Plan describes the state's priorities for wildfire hazard mitigation. Required by state law, the plan defines a framework for the systematic assessment of existing wildland fire protection services, identifies high-risk and high-value areas that are potential locations for costly and disastrous wildfires, ranks these areas by relative risk for wildfires, and describes available mechanisms to reduce future costs and losses from fire events. The California Board of Forestry and Fire Protection and CAL FIRE developed the plan jointly with significant input from all levels of government, the business community, non-profit organizations, and the public. Elements of the plan are being updated during 2007. For more information on the California Fire Plan, see Chapter 5, Part 2.

State Flood Hazard Mitigation Plan

The State Flood Hazard Mitigation Plan was developed through a multi-agency collaborative effort that involved all levels of government, the private sector, and other stakeholders. The plan identifies high flood hazard areas and outlines mitigation strategies to address the flood risk. FEMA initially approved the plan in 1996 on the condition that the state complete community profiles and state agency capability

assessments. These two additional sections were approved by FEMA in 1997. Elements of the plan are presently being updated through the FloodSAFE California initiative and other recently initiated Delta area levee retrofit programs. For more information on the California Flood Hazard Mitigation Plan, see Chapter 5, Part 2.

The three plans include information on state and local risk that helped to form the foundation for the risk assessment in this Plan. To the extent they are coordinated over time with each other and various other state and local plans dealing with hazard mitigation, they form an excellent foundation for comprehensive mitigation planning. The following cooperative efforts served as models for the development of this Plan.

Related Planning Efforts

OES and the SHMT reviewed and incorporated elements from numerous plans and documents in the development of this Plan, including:

- California Fire Alliance
- OPR General Plan Guidelines
- OPR technical advice publications
- Sacramento-San Joaquin River Basins Comprehensive Study
- California Floodplain Management Task Force
- Hazardous materials plans
- Integrated Watershed Planning Principles
- Drought Task Force Report
- State of California Homeland Security Strategy

OES Local Hazard Mitigation Planning Program

Through OES, the state has started a program to promote and support local hazard mitigation planning and local participation in the state hazard mitigation planning process. Principal among its own local hazard mitigation responsibilities is OES coordination of the planning requirements of the HMGP, FMA, and PDM programs to promote multi-hazard mitigation planning by local governments. Project grants funded through these programs will be based upon priorities identified in this Plan, as interpreted through Notices of Interest distributed to local jurisdictions after disasters.

OES is also working with OPR to incorporate information on hazard mitigation planning into the General Plan Guidelines which provides guidance to California cities and counties in the preparation of their general plans.

Assembly Bill 2140, adopted by the California legislature in the fall of 2006, provides financial incentives for local jurisdictions adopting their Local Hazard Mitigation Plan as part of their general plan. For further information on AB 2140 see Chapters 2 and 6.

Additionally, OPR, OES, CAL FIRE, and the Regional Council of Rural Counties have developed a guidance document for incorporating wildland fire hazard mitigation language into general plans. OPR, CAL FIRE, and OES are providing outreach to local jurisdictions on wildfire mitigation planning through the Firewise Communities

workshops and the California Fire Safe Communities programs. The Fire Hazard Planning document is part of OPR's General Plan Technical Advice Series and can be downloaded from the following url:
www.opr.ca.gov/publications/PDFs/Fire_Hazards_Planning-Final_Report.pdf

Comment On: Chapter 1 Section 4

1.4 Public Involvement

Preparation of this Plan has involved public participation at various times, venues, and levels of focus. These include public participation involved with: 1) statewide single-hazard plans and 2) the revised 2007 SHMP.

Prior Public Participation

The three hazard-specific plans mentioned previously—California Earthquake Loss Reduction Plan; California Fire Plan; and the State Flood Hazard Mitigation Plan—were developed through collaborative processes that involved multiple stakeholders, including local, state, and federal agencies, non-profit organizations, and the public. They continue to be revised with separate update and public participation cycles.

Public Participation in Local Hazard Mitigation Planning

Through the preparation and adoption in the past several years of over 500 FEMA-approved Local Hazard Mitigation Plans, local governments have encouraged local grassroots organizations, public and private agencies, and the general public to directly participate in planning for increased safety and sustainability of their own communities. For an analysis of Local Hazard Mitigation Plan public participation, see Chapter 6.

2007 SHMP Public Outreach

The 2007 SHMP is being publicized by OES with the support of the following outreach and public participation tools.

1. Posting the draft 2007 Plan on the OES Hazard Mitigation Web Portal – OES is posting the draft Plan on its website and inviting comments. Reviewers are able to submit comments directly on-line through electronic forms and/or make requests for a CD or a hard copy of the Plan.

2. Outreach to local government and professional associations – OES is contacting counties, cities, special districts, regional councils of governments, utilities, and professional associations to encourage feedback on the 2007 SHMP, solicit ideas on how to make the Plan most useful, and incorporate best practices and success stories in the Plan.. Local governments are being asked their opinions on the 2007 SHMP through an additional survey as well as direct commentary through the OES Hazard Mitigation Web Portal.

3. Outreach to business and industry associations – OES is also reaching out to contact business and industry groups through a survey as well as direct commentary through the OES Hazard Mitigation Web Portal to solicit ideas on how to make the Plan useful to business, and to incorporate best practices and success stories in the Plan.

4. Public notices – OES is publishing notices in newspapers serving most medium to large cities to announce the availability of the draft Plan on the Web Portal.

5. Press releases and postcard announcements – OES is publicizing the draft 2007 Plan through press releases and distribution of over 7,000 postcards announcing its availability on the Web Portal to cities, counties, special districts, state and federal agencies, and interested groups.

Hazard Mitigation Web Portal

The OES web site has recently been augmented with the addition of a new State Hazard Mitigation Web Portal available on the OES web home page at the following url: http://hazardmitigation.oes.ca.gov

The State Hazard Mitigation Web Portal serves as a one-stop location for matters dealing with hazard mitigation, representing an easy way for the public to participate in the 2007 SHMP revision process.

The portal includes a comment/request form allowing individuals to communicate directly with OES staff on a wide range of mitigation topics and to give specific comments on the 2007 SHMP. Such comments are being assembled by OES for consideration as revisions to the draft 2007 SHMP.

2007 SHMP Public Participation Outreach Schedule

Table 1.4A below shows the 2007 SHMP public participation outreach schedule. Beginning in February 2007 with initial contacts to local government and professional associations, it continues through the summer of 2007 with formal release of a public review draft in early July and a public comment period ending on August 31.

OES is conducting outreach for the SHMP Plan revision through state and local agencies as well as business and professional organizations with questionnaires and workshops. Outreach has targeted government, non-profit, and business/trade associations who represent a broad spectrum of the community of interest. These associations in turn are reaching their individual members directly and delivering information provided by OES on the project. Some organizations have been targeted to receive additional direct contact and comment opportunities based on their level of expertise and ongoing involvement and interest in the project.

Table 1.4A Public Participation Schedule

2007 Activity	Date
Local government, professional, business outreach	February – September, 2007
State Clearinghouse state agency review	July – August, 2007
Public review	July – August, 2007
Review and revise 2007 Plan	July – August, 2007
Formal FEMA Review	August – September, 2007

The objective of this outreach is to provide organizations and professionals, especially those with particular interest in the area of hazard mitigation, the opportunity to maximize feedback. A questionnaire will facilitate more extensive interaction opportunities for those who request it. Public feedback from this outreach effort will be taken directly into account during final revision of the SHMP.

A public release draft 2007 SHMP was posted on the website in July 2007. In addition to other measures, public involvement in 2007 SHMP preparation includes comments directly submitted to the State Hazard Mitigation Web Portal during July and August 2007. Comments and suggestions submitted will be taken into account in preparation of the final 2007 SHMP.

1.5 Adoption by the State

Although this Plan is coordinated and maintained by OES, it is actually the culmination of recommendations from numerous stakeholders from local, state, and federal government agencies, and private business organizations as well as individual citizens. Adoption of the 2007 SHMP is implemented by OES Director Henry Renteria on behalf of the State government as an annex to the State Emergency Plan. The 2007 SHMP represents a thorough description of the State's commitment to significantly reduce or eliminate impacts of natural and human-caused disasters through preparing and implementing comprehensive hazard mitigation plans and actions.

Table 1.3.2A. State Hazard Mitigation Team Agencies
SHMP Revision Meetings

October 2006 – June 2007

State Agencies, Departments, and Other Units (** = participating member)

Business, Transportation & Housing Agency
- California Highway Patrol**
- Department of Housing & Community Development*
- Department of Transportation**

California Earthquake Authority**

California Environmental Protection Agency**
- Air Resources Board**
- Department of Pesticide Regulation
- Department of Toxic Substances Control
- Integrated Waste Management Board
- Office of Environmental Health Hazard Assessment
- State Water Resources Control Board

California Health & Human Services Agency
- Department of Health Services
- Office of Statewide Health Planning and Development**

California Public Utilities Commission
California State Archives**
California State Military Reserve
California State University System**
California Volunteers
Department of Corrections & Rehabilitation
Department of Education
Department of Food & Agriculture**
Department of Insurance**
Department of Social Services
  -- Disaster and Client Services Bureau
Governor's Office of Emergency Services**
Governor's Office of Homeland Security**
Governor's Office of Planning & Research**
State Office of Historic Preservation**

Resources Agency
- CAL FIRE
  -- Department of Forestry & Fire Protection**
  -- Office of State Fire Marshal
- California Coastal Commission**
- California Conservation Corps**
- California Energy Commission**
- California State Lands Commission**
- Delta Protection Commission**
- Department of Boating and Waterways

- Department of Conservation**
  -- California Geological Survey**
- Department of Fish & Game**
  -- Office of Spill Prevention & Response
- Department of Parks and Recreation**
- Department of Water Resources**
- CA Resources Agency (Dept. of Resources)

State & Consumer Services Agency

- Office of the Insurance Advisor
- Building Standards Commission**
- California Seismic Safety Commission**
- Department of General Services
  -- Division of the State Architect**
  -- Office of Public School Construction
- Department of Technology Services**

The Reclamation Board**
University of California
  -- Office of the Secretary of the Regents**

Non-State Agency Invitees

American Red Cross
California Special Districts Association
California State Association of Counties**
California Utilities Emergency Association (CUEA) **
League of California Cities**
Native American Heritage Commission
Volunteers for OES Safety Assessment Program (American Society of Civil Engineers, Earthquake Engineering Research Institute)**
FEMA Region IX**

Sources: Table 2.3.3A; OES

[SEPARATE PAGE ON OES LETTERHEAD]

October 8, 2007

STATEMENT OF PLAN ADOPTION

The State of California Multi-Hazard Mitigation Plan (Plan) has been updated in 2007. The Plan is a comprehensive description of the State's commitment to reduce or eliminate the impacts of disasters caused by natural and human caused hazards. This Plan is coordinated and maintained by the Governor's Office of Emergency Services but is the culmination of input and recommendations from numerous stakeholders from local, state and federal government agencies, private business and organizations.

In adopting this Plan, the State of California agrees to comply with all applicable state and federal statutes and regulations, as stipulated in previously documented assurances, and will update the plan at least every three years. The Plan has been amended to reflect emerging hazard conditions and risks as well as new or revised state and federal statutes and regulations. Future amendments will also reflect changes to State organization or policy as appropriate.

The Director of the Governor's Office of Emergency Services by virtue of the Emergency Services Act, Executive Order W-9-91, and the Administrative Orders is an appropriate body. State agencies are committed through Executive Order W-9-91 and the Administrative Orders to adhere to the plan.

As Director of the Governor's Office of Emergency Services and the Governor's Authorized Representative, I the undersigned do hereby formally adopt this California State Multi-Hazard Mitigation Plan.

_____
Henry Renteria, Director
Governor's Office of Emergency Services

(This Page Intentionally Left Blank)

Comment On: Chapter 2

Chapter 2 – Legal, Institutional, and Policy Framework

Chapter Organization

2.0 Chapter Summary
2.1 Institutional and legal context
2.2 Federal laws, institutions and policies
  2.2.1 Flood Insurance Act
  2.2.2 Stafford Act
  2.2.3 Disaster Mitigation Act of 2000
  2.2.4 Other federal disaster laws
  2.2.5 Federal emergency management directives
2.3 California Laws, Institutions, and Policies
  2.3.1 California Emergency Services Act
  2.3.2 State emergency management and mitigation laws
  2.3.3 State agency responsibilities
2.4 Local Government Laws, Institutions, and Policies
  2.4.1 Local emergency management responsibilities
  2.4.2 Local hazard mitigation responsibilities
  2.4.3 Relationships of local planning processes to LHMPs
2.5 Private sector emergency management and mitigation
  2.5.1 Utilities
  2.5.2 Business, industry, and community-based organizations

Comment On: Chapter 2 Section 0

2.0 Chapter Summary

Mitigation planning is conducted within a complex, fragmented, and overlapping context of federal, state, and local laws, institutions, and policies. To understand state and local hazard mitigation, it is useful to examine primary laws and policies at each level of the federal system.

Principal U.S. federal statutes guiding disaster mitigation, preparedness, response, and recovery at the state and local levels are the National Flood Insurance Act of 1968, the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) of 1988, and the Disaster Mitigation Act of 2000. These laws comprise the primary foundation of federally guided hazard mitigation throughout the United States, influencing state and local actions in complex ways. Together, they represent a trend in the past decade toward more systematic and comprehensive mitigation planning and implementation efforts at the federal, state, and local levels, and interact with a wide variety of other federal, state, and local disaster management laws.

The National Flood Insurance Act established the National Flood Insurance Program (NFIP), which provides for federal government backing of flood insurance sold by private companies. The NFIP encourages local governments to avoid or mitigate flood risks through local regulation and financial incentives.

The Stafford Act is the basic disaster relief law of the country. It authorizes three post-disaster programs, implemented by the Federal Emergency Management Agency (FEMA), now part of the Department of Homeland Security (DHS), including Individual and Household Assistance, Public Assistance Program, and Hazard Mitigation Grant Program (HMGP).

The Disaster Mitigation Act of 2000 (DMA 2000) amended the Stafford Act and the Public Works Act to require preparation of hazard mitigation plans by local governments as a precondition for receipt of Hazard Mitigation Grant Program (HGMP) project funds. The general purpose of DMA 2000 was to reduce preventable, repetitive disaster losses by encouraging states and local jurisdictions to plan more wisely through mitigation of natural hazards, vulnerability, and risk.

The State of California has adopted a variety of laws, institutions, and policies dealing with emergency management and hazard mitigation which represents a powerful resource for reducing losses of lives and property to disasters over the long term in the face of substantial natural and human-cased hazards, vulnerabilities, and risks.

The California Emergency Services Act provides the legal authority for emergency management and the foundation for coordination of state and local emergency response, recovery, preparedness, and mitigation activities throughout California. The State Emergency Plan describes the California Emergency Organization that provides the state and local agencies access to public and private resources during emergencies. The Standardized Emergency Management System (SEMS) is the system required by Government Code Section 8607(a) for managing response to multi-agency and multi-jurisdiction emergencies in California.

Cities and counties typically adopt ordinances establishing their local emergency organization, and most local jurisdictions have adopted the master mutual aid agreement to share critical skilled personnel and equipment. Local hazard mitigation is implemented by cities, counties, and special districts in California. In California, building and fire codes adopted under the state's various safety planning laws have helped to create a solid foundation for mitigating impacts of floods, fire, earthquakes, and other natural hazards in new development. Planning and Zoning Law requires all cities and counties to adopt a comprehensive general plan which includes a safety element. The safety element must identify hazard abatement provisions to guide local decisions related to zoning, subdivisions, and entitlement permits. Many jurisdictions have written hazard mitigation provisions into local zoning, development subdivision, and environmental assessment ordinances and codes for reference in routine project review.

FEMA is promoting integration of hazard mitigation planning with comprehensive planning, i.e., local general plans, Regional Blueprint Plans, and Regional Transportation Plans. Some benefits include reduction of vulnerability to disasters, stimulation of pre- and post-disaster decision making, formation of partnerships, expansion of external funding, and facilitation of post-disaster recovery.

A wide variety of private organizations including utility companies, business, and industry are also important. Utility organizations are continuously involved in ongoing investments increasing service capacities and replacing obsolete equipment and facilities. Community-based volunteer agencies represent the most extensive source of response resources in an emergency. They can provide caring and knowledgeable assistance in support of emergency response and recovery operations. The California Service Corps provides a central agency to connect volunteers with hundreds of community-based organizations.

Comment On: Chapter 2 Section 1

2.1 Institutional and Legal Context

To understand state and local hazard mitigation, it is useful to examine primary laws and policies at each level of the federal system. Mitigation planning is conducted within a complex, fragmented, and overlapping context of federal, state, and local laws, institutions, and policies. These are intermingled with a variety of private sector risk reduction and mitigation practices. Development of disaster management systems in the U.S. has been piecemeal and fragmented, rather than systematic and comprehensive.

For the most part, disaster management laws have been designed to deal very specifically with particular issues as they arise. They have been used mostly in the context of dealing with largely localized emergency events because very few catastrophic events, such as Hurricane Katrina, have occurred within the 50-year period during which most were adopted. Administrative actions taken to enforce these laws are ultimately evaluated by the courts should questions arise as to how reasonable, equitable, or just an enforcement action might be within the framework of the U.S. Constitution.

Comment On: Chapter 2 Section 2

2.2 Federal Laws, Institutions, and Policies

Among the principal federal statutes guiding disaster mitigation, preparedness, response, and recovery at the state and local levels are the Flood Insurance Act of 1968, the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) of 1988, and the Disaster Mitigation Act of 2000. These laws comprise the primary foundation of federally guided hazard mitigation throughout the United States, influencing state and local actions in complex ways. Together, they represent a trend in the past decade toward more systematic and comprehensive mitigation planning and implementation efforts at the federal, state, and local levels, and interact with a wide variety of other federal, state, and local disaster management laws.

Comment On: Chapter 2 Section 2.1

2.2.1 Flood Insurance Act

Public Law 90-448 of 1968, known as the National Flood Insurance Act, established the National Flood Insurance Program (NFIP) which provides for federal government backing of flood insurance sold by private companies. Supported by a national mapping system showing boundaries for 100 and 500 year flood plains, NFIP encourages local governments to direct development away from flood plain areas or elevate construction to mitigate flood risks through local regulation. Through the Community Rating Service (CRS), the NFIP provides for financial incentives in the form of lower insurance rates for local communities encouraging mitigation of flood hazards in a manner parallel to rate incentives related to private fire insurance and enforced by the mortgage industry.

Additionally, the National Flood Insurance Act was modified in 1994 by Public Law 103-325, the National Flood Insurance Reform Act, to provide for flood hazard mitigation planning and project grants.

Flood Mitigation Assistance

The Flood Mitigation Assistance (FMA) program assists states and local communities in implementing flood hazard mitigation measures before a major disaster occurs. The program targets NFIP communities with numerous repetitive losses. The program offers two types of grants to local communities: planning and project grants. A community must have a FEMA-approved Floodplain Management Plan (FMP) to be eligible for FMA grant funding. Under the FMA program, a community has two years from the time it is awarded a planning grant to develop an FMP. When awarded a project grant the community has three years to complete the project with FMA grant funds. States also receive technical assistance with grants to administer the FMA program.

Comment On: Chapter 2 Section 2.2

2.2.2 Stafford Act

Public Law 93-288 of 1988, titled the Robert T. Stafford Disaster Relief and Emergency Assistance Act—more commonly known as the Stafford Act—is the basic disaster relief law of the country. It authorizes three post-disaster programs, implemented by the Federal Emergency Management Agency (FEMA), now part of the Department of Homeland Security (DHS), including:

1. Individual and Household Assistance which provides limited post-disaster grants to assist displaced homeowners with mortgage payments and minor repairs;

2. Public Assistance Program which provides grants to local governments and non-profit groups for post-disaster repair of infrastructure and facilities; and

3. Hazard Mitigation Grant Program (HMGP) which provides post-disaster grants to state and local governments to mitigate future damage.

It should be noted that in addition to these three programs the Stafford Act includes preparedness and response authorities. Examples include the Fire Mitigation Assistance Grant (FMAG) program, Part 204 of 44 CFR under the Stafford Act, along with other miscellaneous programs. Subpart F has unemployment assistance, legal aid, relocation, and crisis counseling. Subpart K has community disaster loans.

Comment On: Chapter 2 Section 2.3

2.2.3 Disaster Mitigation Act of 2000

The most important federal hazard mitigation law is the Disaster Mitigation Act of 2000 (DMA 2000). It amended the Stafford Act and the Public Works Act to require preparation of hazard mitigation plans by local governments as a precondition for receipt of Hazard Mitigation Grant Program project funds. State governments were already required by the Stafford Act to prepare such plans. An initial deadline of November 2003 was extended to November 2004 and then to May 2005.

The general purpose of DMA 2000 was to reduce preventable, repetitive disaster losses by encouraging states and local jurisdictions to plan more wisely through mitigation of natural hazards, vulnerability, and risk. The basic reason for its passage was the growing volume and severity of preventable, repetitive losses from natural disasters aggravated by the widespread problem of poorly planned local development. Major disasters during the 1990s, including the 1993 mid-western floods along the Missouri and Mississippi Rivers, and the Northridge Earthquake of 1994 together with an increase in wildland-urban interface fires, convinced Congress that more should be done locally to reduce the growing number of disaster losses.

Northridge Earthquake 1994

Source: OES
Major damage from disasters like the Northridge Earthquake compelled Congress to pass DMA 2000.

Local Multi-Hazard Mitigation Plans

Preparation of an LHMP is a pre-condition for a local jurisdiction to receive HMGP project funds. Local jurisdictions include cities, counties, special districts, and Native-American organizations. DMA 2000 requires all locally applicable hazards to be addressed in LHMPs, which can be prepared by a single jurisdiction or on a multi-agency regional basis. Whether singly or jointly conducted, FEMA requires direct participation, selection of mitigation strategies, and formal adoption by each jurisdiction. FEMA also has promoted open public involvement in the process, documented participation of stakeholders, and opportunity for public comment on the mitigation plan. Other key aspects of LHMP preparation encouraged by DMA 2000 include: 1) pre-disaster planning, 2) integrated state and local planning, 3) use of all-hazards approaches, 4) risk assessment and risk reduction measures, and 4) community-based processes, including public/private partnerships.

A detailed discussion of FEMA-approved LHMPs in California is provided in Chapter 6.

Hazard Mitigation Grant Program

The HMGP program represents a disaster-based approach to allocating federal funds for use in mitigating hazards which might cause future disasters. HMGP funds are administered by states as sub-grants to local governments which have FEMA-approved LHMPs. Generally, HMGP allocations have represented from 7½-15% of post-disaster Stafford Act funding authorizations by Congress. Under H. R. 5441, the 2007 Department of Homeland Security Appropriations Act passed by Congress in October 2006, states with standard multi-hazard mitigation plans receive HMGP project funding based on varying proportions of a federally declared post-disaster Stafford Act funding authorization:

- 15% for amounts not more than $2 billion;
- 10% for amounts more than $2 billion and not more than $10 billion;
- 7½% for amounts more than $10 billion and not more than $35 billion.

A more extensive discussion of the HMGP program is provided in Chapter 7, Funding Sources/Financial Considerations.

Pre-Disaster Mitigation

DMA 2000 also provides for Pre-Disaster Mitigation (PDM) grants for hazard mitigation planning. PDM is administered in California by OES. It was created under DMA 2000 to provide a funding mechanism that was not dependent on a presidential disaster declaration. Of the $25 million appropriated in fiscal year 2002 nationwide, California received approximately $1 million or 4%. The majority of these funds were spent on the development of the 2004 SHMP. Starting in fiscal year 2003, the PDM program was split into two different grants: planning and competitive.

A more detailed discussion of the PDM program is provided in Chapter 7, Funding Sources/Financial Considerations.

2.2.4 Other Federal Disaster Laws

Other federal laws authorize post-disaster funding to support restoration of highways, housing, and business. These include the Housing and Community Development Act, Federal-Aid Highways Act, Public Works Act and Small Business Administration Act, which generally provide grants and loans for post-disaster recovery and reconstruction.

The Federal-Aid Highways Act, for example, authorizes emergency grants for freeways and highways on the federal network. The Housing and Community Development Act provides for several types of post-disaster assistance, including:

1. Section 235 rental assistance;
2. Section 8 rental vouchers;

3. Community Development Block Grants (CDBG) for housing repair and commercial loans which are also used locally to help finance local hazard mitigation projects associated with rebuilding.

The Small Business Administration Act authorizes emergency provision of business resumption loans for small businesses and loans to homeowners for damage restoration. Finally, the Public Works Act authorizes assistance to small businesses as well as assistance to local governments for economic development.

Comment On: Chapter 2 Section 2.5

2.2.5 Federal Emergency Management Directives

In addition to federal disaster management laws are a series of administrative directives regarding federal emergency management systems. These have been put in place over the past two decades by FEMA and, more recently, by the Department of Homeland Security, of which FEMA is now a part, in order to standardize disaster preparedness, response, and recovery practices nationwide.

The theory underlying the federal emergency management systems is a "bottom-up" concept which places priority in an emergency on local use of all locally available resources, including those supplied by mutual aid partners, before assistance is requested from the state government. In turn, it also emphasizes state use of all available state resources before assistance is requested of the federal government.

Thus, where local resources are overwhelmed in an emergency, assistance is requested from the state government. The Governor can declare a state of emergency and, if the emergency is so great as to overwhelm state resources, can request assistance from the federal government. Federal emergency response is provided after the President receives a request from a state and declares a federal emergency. An exception is when an emergency is seen as an "incident of national significance." In such cases, the federal government can take action without a state request.

In return for federal emergency resources and post-disaster financial assistance, state and local governments are expected to follow specific federal regulations and guidelines associated with federal mitigation, preparedness, response, and recovery programs. This expectation forms the basis for the institutional arrangements and operations created at the state and local levels under federal administrative direction. Principal among these federal systems are the National Incident Management System (NIMS) and the National Response Plan (NRP).

National Incident Management System (NIMS)

NIMS is a standardized incident command system (ICS) providing standardized terminology and procedures for common use in an emergency in any jurisdiction. NIMS uses standard incident command functions for managing an emergency, i.e., command, operations, planning and intelligence, logistics, and finance. NIMS is similar in many respects to a previously adopted system in California known as the Standardized Emergency Management System (SEMS), described below.

NIMS is a major source of guidance for all state and local emergency management agencies in developing their own ICS protocols. Beginning in 2005, state and local governments wishing to receive federal financial assistance have been required by DHS to prepare emergency management plans which comply with NIMS. This is known as "NIMS compliance."

National Response Plan (NRP)

The National Response Plan (NRP), released by DHS in 2004, is a plan to coordinate emergency management responsibilities of several dozen federal departments. It updated and revised a similar plan adopted originally in 1992. Within NRP, 15 Emergency Support Functions (ESF) include a variety of functional categories, as follows:

ESF #1-Transportation
ESF #2-Communications
ESF #3-Public Works and Engineering
ESF #4-Firefighting
ESF #5-Emergency Management
ESF #6-Mass Care, Housing, and Human Services
ESF #7-Resource Support
ESF #8-Health and Medical Services
ESF #9-Urban Search and Rescue
ESF #10-Oil and Hazardous Materials
ESF #11-Agriculture and Natural Resources
ESF #12-Energy
ESF #13-Public Safety and Security
ESF #14-Long-Term Community Recovery and Mitigation
ESF #15-External Affairs

Inclusion of long-term community recovery and mitigation as ESF #14 was one of several new subjects added.

Comment On: Chapter 2 Section 3

2.3 California Laws, Institutions, and Policies

The State of California has adopted a variety of laws, institutions, and policies dealing with emergency management and hazard mitigation, within the basic framework set out by the State Constitution and various state codes. Examples include the Government Code, Health and Safety Code, and Public Resources Code. This complex mass of rules, policy, and programs represents a powerful resource for reducing losses of lives and property to disasters over the long term in the face of the substantial natural and human-cased hazards, vulnerabilities, and risks identified in Chapter 5.

Comment On: Chapter 2 Section 3.1

2.3.1 California Emergency Services Act

Among the more important laws, regulations, and administrative orders governing disaster management are the California Emergency Services Act, Natural Disaster Assistance Act, and Title 19 of the California Code of Regulations. The California Emergency Services Act provides the legal authority for emergency management and the

foundation for coordination of state and local emergency response, recovery, preparedness, and mitigation activities throughout California.

State Emergency Plan

The Governor's Executive Order W-9-91 requires the Director of OES to prepare the State of California's Emergency Plan and coordinate activities of all State agencies during the preparedness and response phases of emergencies. This Executive Order also directs State government organizations to submit agency emergency plans and procedures to the Director of OES for review and approval, provide personnel emergency training, define lines of succession, and ensure effective use of resources during response and recovery.

The State Emergency Plan describes the California Emergency Organization that provides the state and local agencies access to public and private resources during emergencies. The State Emergency Plan is revised periodically. Draft versions of revisions of the State Emergency Plan are posted on the OES Website for review and comment by other governmental entities and the public.

Standardized Emergency Management System (SEMS)

The Standardized Emergency Management System (SEMS) is the system required by Government Code Section 8607(a) for managing response to multi-agency and multi-jurisdiction emergencies in California. SEMS consists of five organizational levels which are activated as necessary: field response, local government, operational area, region, and State.

There are five SEMS organization levels which, together with the private sector, comprise the California Emergency Organization. This organization potentially represents all resources available within the State which may be applied in disaster response and recovery phases. The five levels include:

State - Statewide resource coordination integrated with federal agencies;

Regional - Management and coordination of information and resources among operational areas;

Operational Area - Management and/or coordination of information, resources, and priorities among all local governments within the boundary of a county;

Local - County, city or special districts; and

Field - On-scene responders.

SEMS operates from established Emergency Operations Centers (EOCs) at all five levels, as well as in many businesses and industries. SEMS incorporates the use of the Incident Command System (ICS), the Master Mutual Aid Agreement, existing mutual aid systems, the operational area concept, and multi-agency or inter-agency coordination. A prime

objective in emergency operations is to provide local jurisdictions with the resources to meet their disaster needs and maintain continuity of government. All public employees are Disaster Service Workers (DSW) and may be given emergency assignments.

Role of OES and SEMS

OES is part of the Governor's Office and performs executive functions assigned by the Governor. The Director coordinates the State's disaster preparedness and response activities, assisted by representatives of State agencies. SEMS helps unify all elements of California's emergency management organization into a single integrated system. Its use is required for State response agencies and local government agencies seeking eligibility for State funding of response-related personnel costs.

Local Government Coordination

An important point of vertical and horizontal integration of emergency preparedness and response at the local level is the county operational area EOC. This EOC manages and/or coordinates information, resources, and priorities among all local governments within the boundary of a county. There are 58 operational areas within California, consistent with the number of counties. While each city within a county may have its own EOC, the county EOC has a special responsibility under SEMS to be the clearinghouse for all other EOCs in that particular county. These fall within one or another of three OES administrative regions.

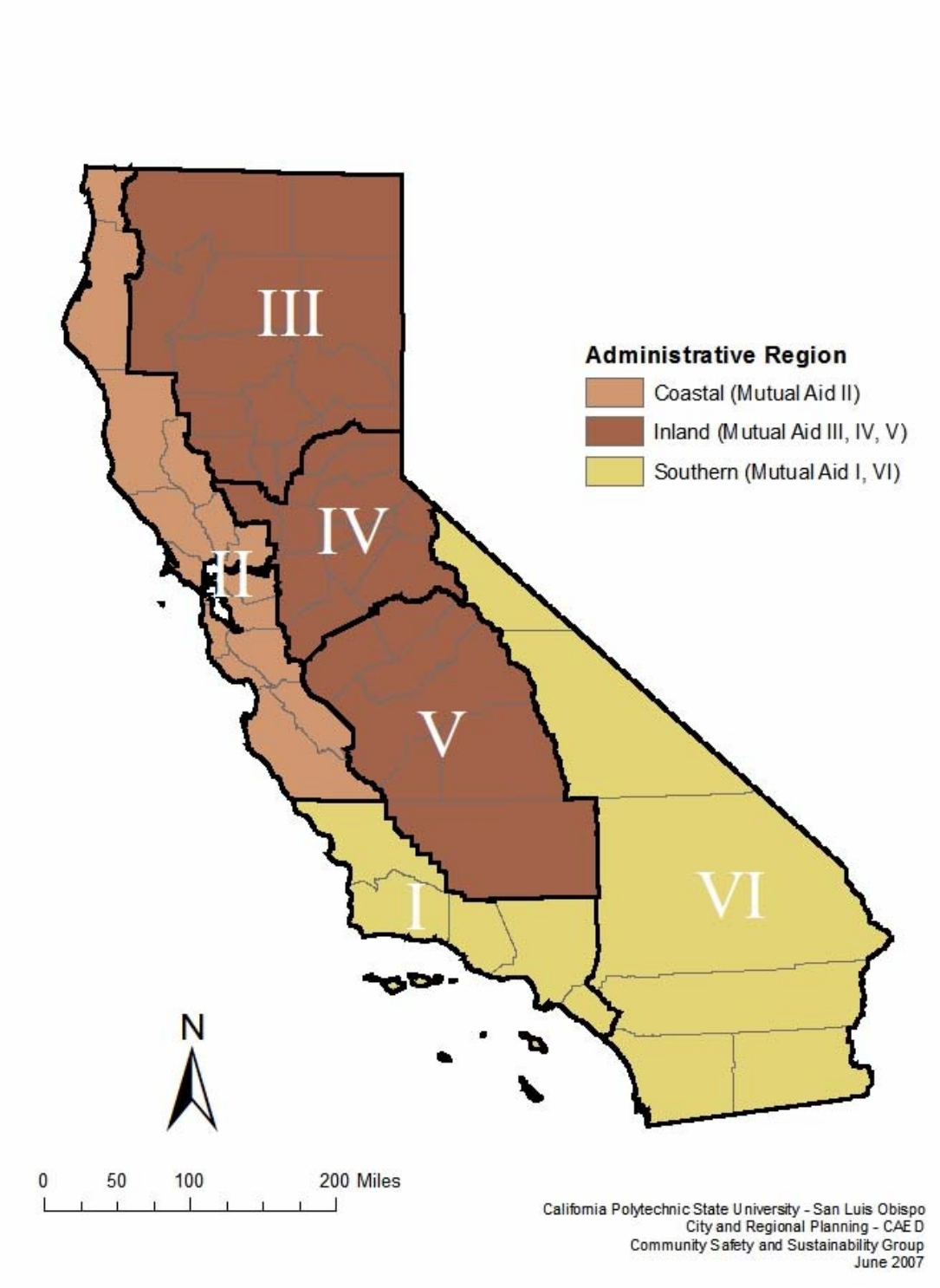
OES Administrative Regions

There are three OES Administrative Regions (Inland, Coastal, and Southern) in California. Within these are six Mutual Aid Regions for fire and general mutual aid coordination. Law Enforcement and Coroners have seven Mutual Aid Regions.

The OES Administrative Regions manage and coordinate information and resources among operational areas within mutual aid regions and between operational areas and state agencies for support during emergency mitigation, preparedness, response, and recovery activities.

Map 2.3.1A below identifies the 58 county operational areas within three OES administrative regions, and six fire and general coordination mutual aid regions. The Coastal OES region extends from Monterey County on the south to Del Norte County on the north and is a single mutual aid region. The Inland OES region extends from Kern County on the south to Siskiyou and Modoc Counties on the north and contains three mutual aid regions. The Southern OES region extends from San Diego County on the south to San Luis Obispo County on the north along the Pacific Coast and Mono County on the north along the California-Nevada border and contains two mutual aid regions.

Map 2.3.1A OES Administrative Regions



Comment On: Chapter 2 Section 3.2

2.3.2 Relationship of SHMP to Emergency Management

As discussed initially in Chapter 1 as well as later in this Plan, the SHMP is a supporting document to the California State Emergency Plan. By requiring that the SHMP include a "Hazard, Vulnerability, and Risk Assessment" the State Emergency Plan serves to identify hazards that impact the communities of California and acknowledges the associated risk (see Chart 2.3.2A Hierarchy of Hazard Mitigation Programs).

The State Emergency Plan establishes the policies, concepts, and general protocols for the implementation of SEMS. The use of SEMS is required by law during multi-agency or multi-jurisdictional emergency response by state agencies. Local government must also use SEMS to be eligible for reimbursement of certain response-related personnel costs.

Special Note on Relationship of Mitigation and Emergency Plans

The Disaster Mitigation Act of 2000 (DMA 2000) brought hazard mitigation to the forefront by requiring FEMA-approved state and local hazard mitigation plans in order for state agencies and local governments to remain eligible for reimbursement for permanent work under the federal Public Assistance Program and for all federal hazard mitigation grant funding.

In addition, since 2005 state and local emergency management plans must be consistent with the National Incident Management System (NIMS) in order to be eligible to qualify for federal preparedness funds. NIMS added Prevention and Protection to the Emergency Management Cycle. In this way, the Department of Homeland Security merged under one roof the capability to anticipate, preempt and deter threats to the homeland whenever possible and the ability to respond quickly when such threats do materialize.

The overall strategy of the revised emergency management cycle can be expressed very simply—what you cannot mitigate or prevent you must be prepared to respond to and recover from**.** (see Chart 2.3.2B. Emergency Management Cycle after DMA 2000.)

Other OES plans and guidance documents referencing mitigation include: the California Emergency Plan; Disaster Recovery and Mitigation Handbook; Electric Power Disruption; Emergency Planning Guidance for Local Government (revised 2007); Emergency Management in California (2003); Emergency Planning Guidance for Public and Private Water Utilities; Recovery Manual; Risk Communication Guide for State and Local Agencies; Statewide Emergency Management Strategic Plan (2005-2010).

Chart 2.3.2A Hierarchy of Hazard Mitigation Programs

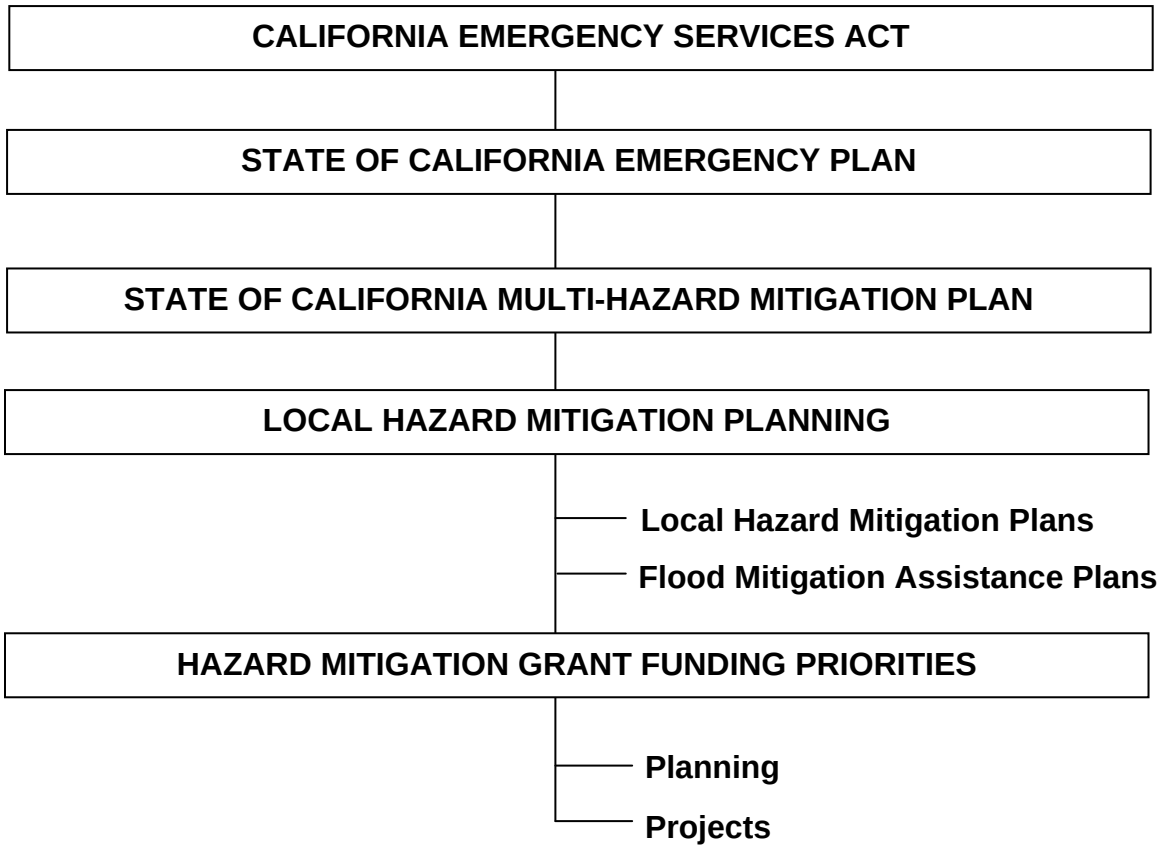
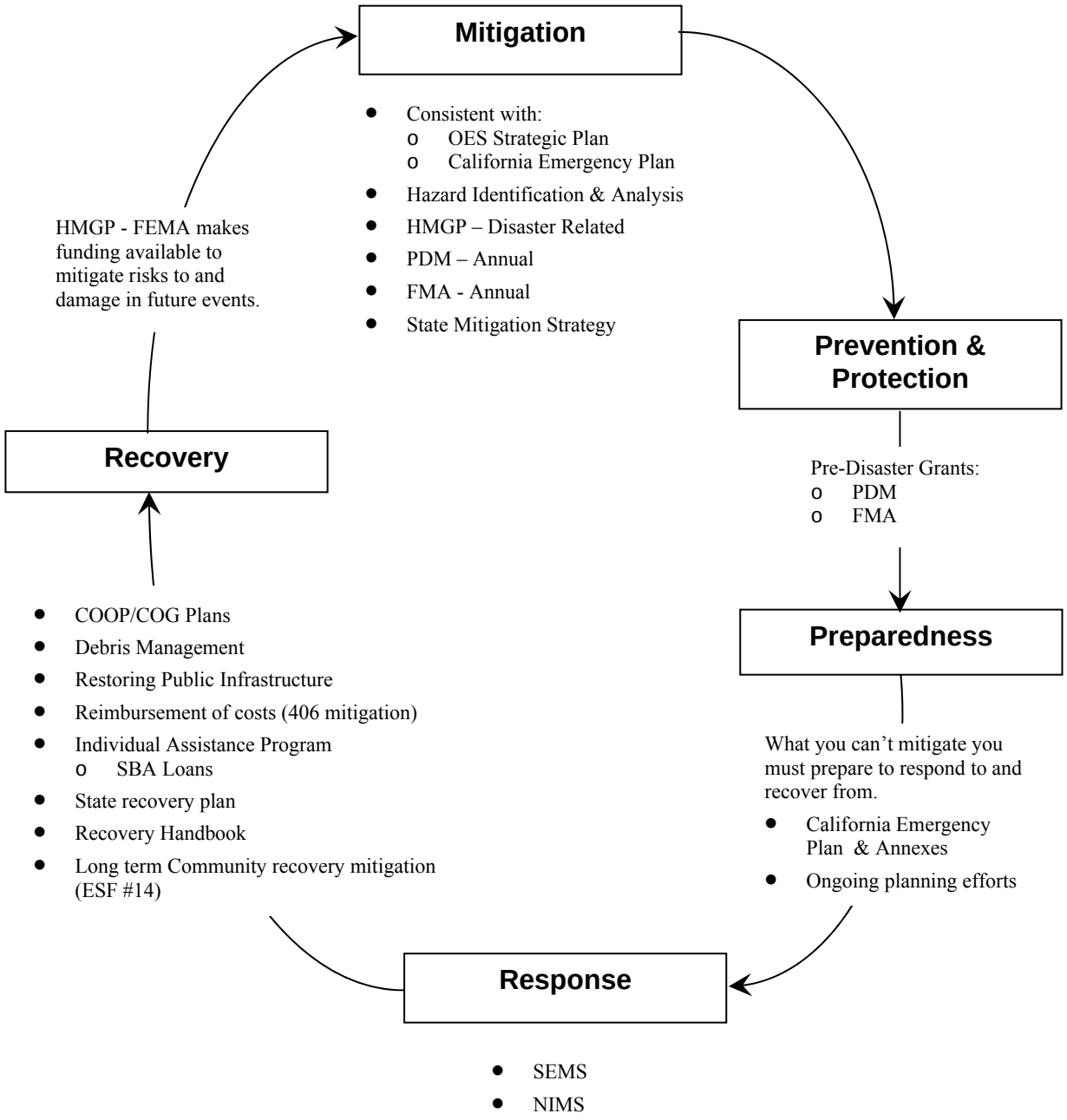


Chart 2.3.2B Emergency Management Cycle after DMA 2000



Comment On: Chapter 2 Section 3.3

2.3.3 State Agency Responsibilities

The preceding laws are administered by more than 40 state agencies, departments, and divisions responsible for their implementation, many of which have been active in the State Hazard Mitigation Team (SHMT). Many of these agencies have key

responsibilities for emergency management and hazard mitigation activities assigned by statute. Provided in Table 2.3.3A below is a list of state agencies involved in various disaster mitigation functions:

Table 2.3.3A California State Agency Emergency Management and Mitigation Responsibilities

Agency	Emergency Management and Mitigation Role
Business, Transportation & Housing Agency	
- California Highway Patrol	Protects state employees and property; supports evacuations, public safety in emergencies
- Department of Housing & Community Development	Expands and preserves safe and affordable housing options; enforces seismic codes and standards for mobile homes, manufactured homes; special housing programs for vulnerable populations.
- Department of Transportation	Assures safety standards of California highway infrastructure; implements seismic strengthening of highway bridges and overpasses
California Earthquake Authority	Provides residential earthquake insurance; conducts mitigation pilot projects
California Environmental Protection Agency	
- Air Resources Board	Regulates toxic air contaminants; oversees Climate Action Team; manages programs which reduce air pollution
- Department of Pesticide Regulation	Regulates sale and use of pesticides; develops pest management systems.
- Department of Toxic Substances Control	Regulates transport, treatment, storage and disposal of hazardous waste; monitors and cleans up waste sites.
- Integrated Waste Management Board	Manages generated waste, promotes reduction of waste; implements Disaster Debris Management Plan.
- Office of Environmental Health Hazard Assessment	Assesses exposure and risks to public health from toxic substances; supports green chemistry.

Agency	Emergency Management and Mitigation Role
- State Water Resources Control Board	Administers NPDES program and cleanup of underground storage tanks
California Health & Human Services Agency	
- Department of Health Services	Monitors West Nile Virus, prepares for pandemic flu and bioterrorism incidents; monitors drinking water quality
- Office of Statewide Health Planning & Development	Regulates the safety of acute care hospital design, construction, and retrofits
California Public Utilities Commission	Participates in Energy Action Plan, reducing greenhouse gas emissions and encourages solar energy infrastructure in existing homes and businesses
California State Archives	Preserves historic records of state government
California State Military Reserve	Responds to natural and man-made threats to California
California State University System	Regulates the safety of CSU campus facility design, construction, and retrofits
California Volunteers	Provides volunteers for disaster relief
Department of Corrections & Rehabilitation	Provides labor for vegetation management and wildland firefighting
Department of Education	Identifies nonstructural earthquake hazards in public schools, assists with California Schools Integrated Pest Management Program; oversees school preparedness programs
Department of Food & Agriculture	Food safety oversight and inspection, responds to invasive animal and plant disease, oversees integrated pest control
Department of Insurance	Enforces compliance with residential earthquake insurance policy
Department of Social Services (Disaster and Client Services Bureau)	Provides post-disaster support to OES to disaster victims seeking recovery assistance
Governor's Office of Emergency Services	Protects the public and the state from natural and man-made disasters through comprehensive emergency management programs; provides mitigation planning and technical assistance; administers hazard mitigation grant programs.

Agency	Emergency Management and Mitigation Role
Governor's Office of Homeland Security	Gathers and disseminates information critical to protection of the state; oversees Critical Infrastructure Protection Plan.
Governor's Office of Planning & Research	Provides technical advice, related to land use and environmental issues, including advice on developing the Safety Element for local General Plans.
Office of Historic Preservation	Oversees seismic upgrading issues in historical buildings
Resources Agency	
- CAL FIRE -- Department of Forestry & Fire Protection	Protects and manages forest and vegetation resources, protects people and property from fires, responds to emergencies; develops fire hazard maps; develops firesafe standards; monitors forest pest infestations; conducts public education programs.
-- Office of State Fire Marshal	Protects life and property from fires through education, enforcement and fire prevention engineering.
- California Coastal Commission	Administers California Coastal Act, manages conservation and development of coastal resources
- California Conservation Corps	Provides critical front-line and logistical support for natural and manmade hazards; assists with pre and post disaster mitigation
- California Energy Commission	Statewide energy policy and planning; implements Energy Emergency Response Plan and supports Green Building Initiatives.
- California State Lands Commission	Manages and protects important natural and cultural resources on public lands within state
-- Marine Invasive Species Program	Manages and protects important natural and cultural resources on public lands within the state.
-- Oil Spill Prevention Program	Responsible for the prevention of oil spills at marine terminals. Prevents or minimizes the introduction of NIS from commercial vessels.
- Delta Protection Commission	Implements the Land Use and Resource Management Plan for the Delta
- Department of Boating and Waterways	Controls invasive species in Sacramento-San Joaquin Delta
- Department of Conservation	Disseminates seismological and geological information regarding earthquakes, landslides and other geological hazards

Agency	Emergency Management and Mitigation Role
-- California Geological Survey	Provides expert technical services and advice on seismic hazards and earthquake engineering; implements Seismic Hazard Mapping Program, and Strong Motion Instrumentation Program.
- Department of Fish & Game	Maintains native fish, wildlife, plant species and natural communities for their ecological value; monitors invasive species and implements CERCLA
-- Office of Spill Prevention & Response	Spill prevention and response responsibilities
- Department of Parks and Recreation	CDPR has property jurisdiction for approximately 1.5 million acres, including over 300 hundred miles of ocean coastline. CDPR serves approximately 80 million or more visitors to state park facilities each year. Mission is to protect natural/cultural resources, the state's biodiversity, and provide quality recreational experiences.
- Department of Water Resources	Provides dam safety and flood control services, water quality monitoring; monitors drought conditions; administers CALFED program; participates in Delta Levee risk reduction; operates and maintains the State Water Project; administers the drought water bank.
State & Consumer Services Agency	
- California Building Standards Commission	Reviews, approves and publishes building codes for new construction and alterations (including retrofits) proposed by state agencies
- California Seismic Safety Commission	Provides decision-makers and the general public with cost-effective recommendations that reduce earthquake losses and expedite recovery.
- Department of General Services	Manages state-owned or state-leased properties statewide
-- Division of the State Architect	Regulates the safety of design, construction, and retrofits for state owned facilities, K-14 public schools, and essential services facilities
-- Office of Public School Construction	Adopts sound repair standards for state's public schools

Agency	Emergency Management and Mitigation Role
- Department of Technology Services	Recovers critical computer applications in event of disaster
The Reclamation Board	Designates floodways in Central Valley
University of California	Regulates the safety of UC campus facility design, construction, and retrofits

Table 2.3.3B, a detailed chart showing state agency contact information, general functions, mitigation responsibilities, and corresponding enabling legislation, is provided in the 2007 SHMP Appendix.

Comment On: Chapter 2 Section 3.4

2.3.4 State Emergency Management and Mitigation Laws

During its history as a state, the California legislature has adopted dozens of laws dealing with emergency management and hazard mitigation. The following is a representative list of such laws.

Table 2.3.4A Representative Emergency Management and Mitigation Laws

1. Air Pollution, Health and Safety Code §42320
2. Air Toxics Hot Spots, Health and Safety Code §44300
3. Alquist-Priolo Earthquake Fault Zoning Act, Public Resources Code 2621
4. California Building Code, CCR, Title 24
5. California Environmental Quality Act (CEQA), Public Resources Code, §21000
6. California Fire Code, CCR, Title 24, Part 9
7. Dam Safety Act, Water Code §6000-6501
8. Disaster Project Law, Health and Safety Code §34000
9. Disaster Recovery Reconstruction Act, Government Code §8877.1
10. Earthquake Hazards Reduction Act, Government Code §8871
11. Earthquake Fault Zoning Mapping Act, Public Resource Code §2621
12. Economic Disaster Act, Government Code §8695
13. Employees Safety Act, Labor Code §2801
14. Emergency Response Team for State Operations, Government Code §8549.10
15. Emergency Services Act, Government Code §8550
16. Essential Services Buildings Seismic Safety Act, Health and Safety Code §16000
17. Field Act for K-14 public school design and construction safety, Education Code §17280, §81130, §17365
18. FIRESCOPE Act, Health and Safety §13070
19. Flood Control Law, Water Code §8000
20. Flood Control Law of 1946, Water Code §12800
21. Flood Plain Management, Water Code §8400
22. Hazardous Substances Highway Spill Containment and Abatement Act, Vehicle Code §2450

23. Hazardous Materials Release Response Plans and Inventory, Health and Safety Code § 25500
24. Alfred E. Alquist Hospital Facilities Seismic Safety Act, Health and Safety Code §129675
25. Integrated Waste Management Act, Resources Code, §40050
26. Katz Act, Education Code §35295 - 35297
    (Requires schools to plan for earthquakes and other emergencies)
27. Natural Disaster Assistance Act, Government Code §8680
28. Natural Hazards Disclosure Act, Civil Code §1102
29. Oil Refinery and Chemical Plant Safety Preparedness Act, Government Code §51020
30. Oil Spill Prevention and Response Act, Government Code 8674.1
31. Planning and Zoning Law, Government Code 65000
32. Radiation Protection Act, Health and Safety Code §114650
33. Riley Act, Health and Safety Code §19100
34. Sabotage Prevention Act, Military and Veterans Code §1630
35. Seismic Hazards Mapping Act, Public Resources Act §2690
36. Alfred E. Alquist Seismic Safety Commission Act, Government Code §8870
37. Subdivision Map Act, Government Code §66410
38. Water Shortage Emergency Act, Water Code §350

For a more complete list and detailed descriptions of the content of such laws by hazard type, see Tables 2.3.4B-D in the Appendix.

Comment On: Chapter 2 Section 4

2.4 Local Government Laws, Institutions, and Policies

Adding to this complex of federal and state government laws, institutions, and policies are those of over 5,000 local governments in California. In late 2005, there were 6,481 local jurisdictions in California, including 58 counties, 478 cities, 4,783 special districts, and 1,053 school districts. Also in California, there are 109 Native-American tribal governments. Although FEMA works directly with tribal governments on review of hazard mitigation plans, California law requires direct ongoing consultation between the state and tribes on projects affecting tribal areas.

Under the California constitution and state codes, a variety of state functions are delegated to local governments, including elections, environmental health, fire prevention and protection, law enforcement, property tax assessment and collection, paramedic and public services, welfare services, and a variety of other local services.

Cities and counties generally are most directly responsible for response to emergencies as well as for hazard mitigation through local general plans and zoning. Additionally, a wide array of special districts and school districts are instrumental in the provision of infrastructure and related services.

Comment On: Chapter 2 Section 4.1

2.4.1 Local Emergency Management Responsibilities

Cities and counties typically adopt ordinances establishing their local emergency organization, authorizing establishment of a local disaster council and adoption of an

emergency plan, designating responsibilities for emergency management operations, and specifying officials authorized to declare a local emergency.

Most local jurisdictions have adopted the master mutual aid agreement to share critical skilled personnel and equipment, and have conducted training for emergency response and taken advantage of training made available by a wide variety of agencies. During an immediate threat or in actual disaster conditions, local authorities immediately put emergency response plans into operation and take actions required to cope with disaster situations. As conditions require, all immediately available local, state, and federal resources are committed to protect lives, property, and the environment.

Traditionally, special districts also play an important role in emergency preparedness and response. Special districts are active participants in the operational area which is a focal point for all local emergency management information and the provision of mutual aid.

Comment On: Chapter 2 Section 4.2

2.4.2 Local Hazard Mitigation Responsibilities

Local hazard mitigation is implemented by cities, counties, and special districts in California under certain of the laws listed previously. Each agency is responsible for mitigating hazards within their jurisdictions, as well as for assuring health and safety conditions related to development constructed by the private sector and local government.

Building and Fire Codes

In California, state laws and state-mandated professional building and fire codes adopted under the state's various safety planning laws have helped to create a solid foundation for mitigating impacts of floods, fire, earthquakes, and other natural hazards in new development. Such safety planning laws and codes have created a supportive policy framework for passage of laws dealing with retrofitting of existing potentially hazardous structures. A well-recognized example of such retrofit programs is Los Angeles City's unreinforced masonry (URM) seismic retrofit program under way since the 1980s. According to the City of Los Angeles, 9,211 of its URMs had been retrofitted or demolished by 2006 under this program (CSSC 2006-04).

Planning and Zoning

Beyond facility safety are the mitigation practices improving safety from natural hazards having to do with the location and form of new development. These include local development planning and development oversight responsibilities delegated to cities and counties. Principal among these are compliance with the Planning and Zoning Law (Government Code 63200), the Subdivision Map Act (Government Code Section 66410), and the California Environmental Quality Act (CEQA), (Public Resources Code, Section 21000).

The Planning and Zoning Law requires all cities and counties to adopt a comprehensive general plan including land use, circulation, housing, safety, open space, conservation, and noise. It also mandates consistency between all general plan elements as well as consistency between the general plan and implementation measures such as zoning and subdivision review.

General Plan Safety Element

California is one of approximately 10 states mandating that natural hazards should be addressed as a required element of the local general plan. The General Plan safety element establishes policies and programs to protect the community from risks associated with earthquakes, floods, wildfire and other natural and human-caused hazards.

According to the general plan safety element guidelines of the Governor's Office of Planning and Research:

> The aim of the safety element is to reduce the potential risk of death, injuries, property damage, and economic and social dislocation resulting from fires, floods, earthquakes, landslides, and other hazards. Other locally relevant safety issues, such as airport land use, emergency response, hazardous materials spills, and crime reduction, may also be included. Some local jurisdictions have even chosen to incorporate their hazardous waste management plans into their safety elements.
>
> The safety element overlaps topics also mandated in the land use, conservation, and open-space elements. When preparing a new general plan or undertaking a comprehensive revision of an existing general plan, OPR suggests addressing these common topics in a single place rather than scattering them among four separate elements. The key concern should be to integrate effectively these common issues into the decision-making process.
>
> The safety element must identify hazards and hazard abatement provisions to guide local decisions related to zoning, subdivisions, and entitlement permits. The element should contain general hazard and risk reduction strategies and policies supporting hazard mitigation measures. Policies should address the identification of hazards and emergency response, as well as mitigation through avoidance of hazards by new projects and reduction of risk in developed areas.

As a required element of the general plan, the safety element provides the foundational information and policy direction regarding hazards, vulnerability, and risk upon which proactive mitigation strategies and actions can be based over time. All other general plan elements must be consistent with the safety element, and vice versa. Likewise, all zoning, subdivisions, and capital improvements must be consistent with the safety element.

Subdivision Review

The Subdivision Map Act is clear regarding the requirement for consistency of subdivisions with the general plan. No tentative map can be approved unless the city or county finds that the subdivision, including its design and improvements, is consistent with the general plan. This requirement for direct implementation of the general plan through the specific implementation tool of subdivision review appears to be unusual when comparing California planning laws to those of other states.

Environmental Review

CEQA is also an important California law reinforcing hazard mitigation. CEQA provides for an environmental assessment for any "discretionary" project such as a general plan amendment, zone change, specific plan, subdivision, or development plan review. If significant impacts are found, an environmental impact report (EIR) might be required.

Seismic Zonation

Complementing these laws are seismic zonation requirements of the Alquist-Priolo Earthquake Fault Zoning Act (Public Resources Code, Section 2621) which prohibits buildings designed for continuing human occupancy from being constructed across an active fault and the Seismic Hazards Mapping Act (Public Resources Code Section 2690) which directs the California Geological Survey to provide maps showing areas susceptible to ground shaking, landslides, or liquefaction. Local governments must take such maps into account in their planning and development review.

State Responsibility Areas

Under the California Fire Plan, areas designated by CAL FIRE as State Responsibility Areas (SRA) require local governments to consult with the California Department of Forestry and Fire Protection on development review to assure safe development conditions.

Hazard Mitigation Through Local Land Use Planning

To maximize the value of effective pre-disaster mitigation, many jurisdictions have written hazard mitigation provisions into local zoning, development subdivision, and environmental assessment ordinances and codes for reference in routine project review. Such ordinances are designed to reflect hazards addressed in federal and state hazards mapping, such as FIRM mapping for 100 year flood plains, as well as any identified in the general plan or a Local Hazard Mitigation Plan prepared by the locality under the Disaster Mitigation Act of 2000.

Ordinance language provides direction for further investigation where scientific evidence regarding hazard presence, return periods, or potential magnitude of impact is not clear. Such ordinances also identify standard hazard mitigation measures which can be attached to the project or subdivision as conditions to be met prior to subsequent stages of development.

Examples of commonly applied zoning and subdivision regulatory approaches to new developments in naturally hazardous areas include:

- Transfer of allowable density or intensity from hazardous parts of a site to safer areas during development plan review;
- Restriction of allowable residential densities, thereby reducing the potential number of structures at risk;
- Enforcement of suitable building setbacks from flood, landslide, and fault zones;
- Adoption of slope-density formulas to limit the number of dwellings on hillsides;

- Modification of proposed parcel boundaries and street locations to avoid hazardous areas;
- Requirement of multiple ingress and egress points for emergency access and evacuation;
- Provision of adequate street widths for two-directional movement in an emergency;
- Assurance of sufficient water storage and pressure for adequate fire flows.

Also commonly in use is an array of complementary techniques for avoiding private property development in hazard-prone areas. Examples include:

- Application of agricultural and conservation easements by private land trusts;
- Establishment of open space easements or donation of property for tax relief purposes;
- Acquisition of land or development rights using developer fees or public park bonds;
- Limiting infrastructure provision and extensions.

Together these regulations and practices represent a powerful combination of tools to strengthen natural hazard mitigation in the course of day-to-day development planning review.

Of these, the two most critical points at which communities make important risk reduction decisions related to new development in hazard-prone areas consist of: 1) general plan and zoning decisions, and 2) subdivision map approvals. General plan, zoning and subdivision decisions all have far-reaching consequences in areas where natural hazards can create the potential for damage to development. If flooding, geological, and other hazards are not sufficiently recognized at these key decision points, a "multiplier" effect can be created in which the existing hazards are distributed among many new land parcels authorized under the decision.

Comment On: Chapter 2 Section 4.3

2.4.3 Relationships of Local Planning Processes to LHMPs

An important interest of FEMA in promoting compliance with the LHMP process as part of planning for hazard mitigation grants of various kinds is creation of an interface of mitigation planning with comprehensive planning, i.e., the local general plans, Regional Blueprint Plans, and Regional Transportation Plans.

Within this regional and local planning framework, key considerations identified by FEMA in evaluating mitigation planning strategies include considerations such as the:

- compatibility with community goals;
- legal authority;
- ability to implement and enforce mitigation actions;
- technical feasibility;
- financial capability;
- cost/benefit ratio of a proposed solution;
- priority level of the proposal project among the hazards addressed, and

- completeness of the solution.

Some benefits of integrating mitigation planning with comprehensive planning include reduction of vulnerability to disasters, stimulation of pre- and post-disaster decision making, formation of partnerships between planners and emergency managers, expansion of external funding opportunities, and facilitation of the post-disaster return of the community to normalcy, as well as resolution of locally sensitive issues with community-based rather than externally-based solutions.

A recent California legislative action reinforcing these principles is Assembly Bill 2140, signed into law by the Governor in October 2006. This bill provides the following incentives for LHMP preparation: 1) authorizes cities and counties to adopt a Local Hazard Mitigation Plan prepared under the terms of DMA 2000 as part of its mandated general plan safety element; 2) requires OES to give preference for assistance in developing and adopting such a plan to local jurisdictions that have not adopted an LHMP ; and most importantly, 3) authorizes the Legislature to provide to such cities or counties a state share of local costs exceeding 75% of total state-eligible post-disaster costs under the Stafford Act.

Comment On: Chapter 2 Section 5

2.5 Private Sector Emergency Management and Mitigation

Also important within this complex framework of California laws, institutions, and policies dealing with emergency management and mitigation are the activities of a wide variety of private organizations including utility companies, business, and industry.

Comment On: Chapter 2 Section 5.1

2.5.1 Utilities

The California Utilities Emergency Association (CUEA) cooperates with OES to coordinate public and private utility emergency-related issues in California. Largely supported by memberships from public and private utilities with jurisdiction or service territory in California, the CUEA operates and manages the Utilities Branch at OES. Utilities membership in the CUEA includes gas, electric, telecommunications (including wireless), water, waste water, and petroleum pipeline industries. During emergencies, the Utilities Operations Center (UOC) is activated to enhance the utilities capability to respond to and recover from emergencies by providing a structure for cooperation and communication among utilities and government agencies.

Beyond involvement in emergency management, private utilities are continuously involved in ongoing investments increasing service capacities and replacing obsolete equipment and facilities. Many of these investments represent incremental improvements in the resilience against natural and human-caused hazards within their plants and facilities.

Additional discussion on private utility mitigation investment in hazard mitigation is provided within Chapter 7, Funding Sources/Financial Considerations.

Comment On: Chapter 2 Section 5.2

2.5.2 Business, Industry, and Community-Based Organizations

Many business and industry organizations are recognizing that preparedness and mitigation can make a difference between company survival from a disaster or going out of business. Risk managers and chief executive officers assess threats posed by disasters and, where risks are high, implement mitigation and preparedness measures. Employee injury and illness prevention programs and business resumption plans are helping to influence many businesses to develop or expand their emergency plans and move forward on hazard mitigation investments.

The American Red Cross (ARC) provides disaster relief to individuals and families and emergency mass care in coordination with government and private agencies. It receives its authority from a congressional charter that cannot be changed by State or local emergency plans and procedures. In providing their services, the ARC will not duplicate the programs of other public or private welfare agencies, nor will it assume financial responsibility for their actions.

Community-based volunteer agencies represent the most extensive source of response resources in an emergency. A multitude of volunteer organizations are able to provide caring and knowledgeable assistance in support of emergency response and recovery operations. Government recognizes the value and importance of community-based organizations which perform services and have resources which can augment the ARC and other traditional response and relief agencies.

Recognizing the critical need for coordination with the private sector, Governor Schwarzenegger signed Senate Bill 546 in September 2005 to help expand public/private partnerships and allow greater participation by the private sector in governmental emergency management efforts. SB 546 authorizes an OES budget account supporting partnership activities funded by the private sector.

California also has an extensive system of FireSafe Councils which are 501(c)3 non-profit organizations involving thousands of citizens as well as over 50 corporate partners. Activities include community outreach and education, hazardous fuel assessment, community wildfire protection planning, and community chipping projects. Everyone is a volunteer.

The California Volunteers provide a central agency to connect volunteers with hundreds of community-based organizations. Following a disaster, volunteer agencies continue to provide services for their constituents as well as for the governmental agencies which might have need of their unique services.

Many of these organizations have already been identified through statewide information and referral networks and are trained in SEMS to maximize their efficiency and ability to become better integrated into response and relief efforts. Many groups providing voluntary disaster services can be contacted through the national Voluntary Organizations Active in Disasters (VOAD)

Comment On: Chapter 3

Chapter 3 - State Mitigation Strategy

Chapter Organization

3.0 Chapter Summary
3.1 Hazard Mitigation Goals and Objectives
- 3.1.1 Reducing Life Loss and Injuries
- 3.1.2 Minimizing Damage and Disruption
- 3.1.3 Environmental Protection
- 3.1.4 Integrated Mitigation Policy

3.2 State Priorities
- 3.2.1 Priority Determination
- 3.2.2 Federal Hazard Mitigation Funding Priorities
- 3.2.3 Types of State Mitigation Strategies

3.3 State Capability Assessment
- 3.3.1 Legal Foundations of State Capability
- 3.3.2 Levels of State Capability

3.4 Local Capability Assessment
- 3.4.1 Legal Foundations of Local Government Capability
- 3.4.2 State Actions Supporting Local Capacity
- 3.4.3 Fostering Local Government Capability
- 3.4.4 Role of California Planning and Building Codes
- 3.4.5 Enhanced State and Local Capabilities

Comment On: Chapter 3 Section 0

3.0 Chapter Summary

The vision for this Plan is a safe and resilient California through hazard mitigation. Its mission is to integrate current laws and programs into a mitigation system that will guide the state in significantly reducing potential casualties and damage as well as physical, social, economic, and environmental disruption from disasters.

Priorities for mitigation action are related to the Plan goals, state legislation, and executive orders. State legislation and Governor's executive orders constitute the highest priorities. Resource allocations through the annual budget and long-term capital budgets are ultimately the process for setting priorities. State priorities are affected by Congressional legislation and presidential executive orders affecting the entire federal system. Federal priorities include the following.

1. Ensure communities are eligible for federal programs by supporting local multi-hazard mitigation planning.
2. Protect lives and property at risk from imminent hazards created or exacerbated by disasters.
3. Protect vulnerable critical facilities and infrastructure in high hazard areas of the state.
4. Reduce repetitive losses.
5. Ensure that all communities are covered by an adopted local hazard mitigation plan.

6. Improve understanding of natural hazards and the performance of hazard mitigation practices.

Strategies for mitigation action can be classified as mandatory and discretionary. Mandatory mitigation strategies include statutes and ordinances stimulating uniform mitigation action. Discretionary mitigation actions are voluntary measures taken by individuals, businesses, and local government organizations with the motivation of reducing potential future disaster losses to homes and facilities. Ultimately, a combination of mandatory and discretionary mitigation strategies is needed to bring about substantial changes in physical environments to reduce future disaster losses.

California has a history of successfully implementing hazard mitigation through a process of legislation, program development, and project implementation. This history demonstrates the state's enhanced capability to implement state-level hazard mitigation programs that are effective and, in many ways, state-of-the-art hazard mitigation programs.

The state has expended billions of dollars on seismic, fire, and flood hazard mitigation. Efforts to implement hazard mitigation at the local level are complicated. The state supports the development of effective hazard mitigation policies at the local level through model ordinances. The state works with local governments to enhance local hazard mitigation efforts. Planning and building codes and standards are usually enforced by local building inspectors or in extreme cases by law enforcement.

A challenge during implementation of this Plan will be to devise a system for monitoring progress while setting more definitive future mitigation targets on a systematic basis. A system is needed for establishing targets for risk reduction from primary hazards such as earthquakes, floods, and wildfires. This should become the focus of the next three-year planning cycle.

Comment On: Chapter 3 Section 1

3.1 Hazard Mitigation Goals and Objectives

Strategic Framework

The content of this Plan is governed by rules drawn from the Disaster Mitigation Act of 2000 (DMA 2000). While it is not a strategic plan as such, the 2007 SHMP includes some elements similar to those of a strategic plan, such as vision, mission, goals and objectives statements. These represent a strategic direction-setting framework with some consideration of short-term outcomes.

In preparing the draft 2007 SHMP, a sustained effort has been made to examine and clarify the Plan vision, mission, goals, objectives, priorities, and action programs. The challenge during implementation of this Plan will be to devise a system for setting future mitigation targets on a statewide basis. This should become the focus of the 2010 SHMP.

Vision and Mission Statements

The vision for this Plan is a safe and resilient California through hazard mitigation. The Plan's mission is to integrate current laws and programs into a mitigation system that will guide the state in significantly reducing potential casualties and damage as well as physical, social, economic, and environmental disruption from disasters.

Goals

Within this vision and mission are the following goals reflecting California's organized response to the state's assets mitigation challenges reflected in other chapters.

1. Significantly reduce life loss and injuries.
2. Minimize damage to structures and property, as well as disruption of essential services and human activities.
3. Protect the environment.
4. Promote hazard mitigation as an integrated public policy.

The sections below identify four hazard mitigation goals with related groups of objectives and briefly describe modifications since the preceding 2004 SHMP.

Comment On: Chapter 3 Section 1.1

3.1.1 Reducing Life Loss and Injuries

California is the most populous state in the country with over 37 million residents, and the third largest land area. The sheer number and broad distribution of people can make hazard mitigation and emergency management activities a challenge. California's population is concentrated in areas where hazard risk exposure tends to be high. For example, large earthquakes have struck the San Francisco Bay Area and Southern California; flooding has historically been heavy in portions of Southern California where urbanization contributes to high volumes of local storm water runoff; and devastating wildfires have been experienced in wildland urban interface areas in the mountainous regions of many California counties. Chapter 4 identifies patterns of growth which are encroaching on such areas, and Chapter 5 shows variations in exposure to such risks for all 58 California counties.

Goal 1: Significantly reduce life loss and injuries.

This goal, which in the 2004 Plan read "save lives and reduce injuries," was revised to clarify the theme of reducing potential casualties from disasters through long term physical changes which make places and buildings safer through mitigation investments and actions, as distinguished from "life saving" which accompanies disaster response. Corresponding objectives under Goal 1 are shown below. Objectives 1-5 have been reworded with minor changes for breadth or clarity.

Objective 1: Improve understanding of the locations, potential impacts, and linkages between hazards, vulnerability, and measures needed to protect life safety and health.

Objective 2: Provide updated information about hazards, vulnerabilities, and mitigation processes to state and local agencies.

Objective 3: Ensure that enforcement of relevant state regulations and local ordinances significantly reduce life loss and injuries.

Objective 4: Ensure that structures are modified, as necessary, over time to meet life safety standards.

Objective 5: Ensure that mitigation measures are incorporated into repairs, major alterations, new development, and redevelopment practices, especially in areas subject to substantial risk from hazards.

Objective 6: Identify and mitigate all imminent threats to life safety.

Comment On: Chapter 3 Section 1.2

3.1.2 Minimizing Damage and Disruption

Strengthening of laws, regulations, and ordinances for new and existing facilities is not only critical to the protection of property and life but also to reduction of massive physical, social, and economic disruption which accompanies disasters. Regulations and ordinances help communities design and construct new facilities or alter existing facilities in a manner that resists the forces of nature and ensures safety. The state's land use laws support this effort by keeping buildings and development out of the most hazardous areas through local land use planning. It is essential that mitigation planning be incorporated into all land use planning activities at the local and state levels.

Earthquakes, floods, and other natural hazards can disrupt critical infrastructure of the state. Transportation routes, utilities, government facilities, hospitals, etc., are essential to the state's ability to provide assistance to the people of California. In addition, retrofitting facilities by priority based on overall risk will protect important buildings, occupants, and informational records. This includes integrating mitigation efforts into all city, county, and special district infrastructure development and retrofit plans.

Protection of property includes preservation of vital records, valuable operational data, historical information, and other non-structural assets. Plan stakeholders have encouraged the incorporation of mitigation activities into Continuity of Business and Continuity of Government Operations plans.

Goal 2: Minimize damage to structures and property, as well as disruption of essential services and human activities.

In the 2004 Plan this goal simply read "avoid damage to property." It was reworded to include structures as an important aspect of both life safety and property damage and to reflect the desired outcome of minimizing disruption of essential services (police, fire, and medical response) as well as normal human activities after a disaster. Corresponding objectives under Goal 2 are shown below. Objectives 1- 5 have been reworded with minor changes for breadth or clarity. Objective 6 has been added.

Objective 1: Encourage new development to occur in locations avoiding or minimizing exposure to hazards or enhance design requirements to improve resiliency in future disasters.

Objective 2: Encourage life and property protection measures for all communities and structures located in hazard areas.

Objective 3: Reduce repetitive property losses due to flood, fire, and earthquake through revised land use, design, and construction policies.

Objective 4: Research, develop, and promote adoption of cost-effective building and development laws, regulations, and ordinances exceeding the minimum levels needed for life safety.

Objective 5: Establish partnerships and maintain between all levels of government, the private sector, community groups, and institutions of higher learning that improve and implement methods to protect life and property.

Objective 6: Ensure the protection of vital records to minimize post-disaster disruption and facilitate short-term and long-term recovery.

Comment On: Chapter 3 Section 1.3

3.1.3 Environmental Protection

Californians place a strong emphasis on the quality of the physical environment. It is a primary reason why people live in California and why all levels of government and many organizations strive to conserve it. Natural disasters not only destroy the man-made environment, but they can also adversely affect the physical environment.

Dead and diseased trees create unhealthy forests and provide fuel for wildland fires that damage or eliminate habitat necessary to the survival of plants and wildlife. Flooding can adversely affect water quality in the rivers and streams that support fisheries and can also damage critical spawning habitat. Geologic hazards can result in landslides that can block streams and prevent fish migration. Debris from natural disasters can pollute the water, foul the land, and diminish air quality if not disposed of properly.

Goal 3: Protect the environment.

This goal was not revised. However, objectives 1, 2, and 3 have been reworded with minor changes for breadth or clarity.

Objective 1: Review all hazard mitigation projects for compliance with all applicable environmental laws.

Objective 2: Encourage hazard mitigation measures that result in the least adverse effect on the natural environment and that use natural processes.

Objective 3: Ensure that all state and local hazard mitigation planning reflects the goal of protecting the environment.

Objective 4: Implement wildfire mitigation and watershed protection strategies that reduce losses of wildlife, habitat, and water.

Objective 5: Promote the use of sustainable hazard mitigation measures.

Comment On: Chapter 3 Section 1.4

3.1.4 Integrated Mitigation Policy

Historically, the state and its communities have tended to implement hazard mitigation polices and measures in an ad hoc fashion. New mitigation policies, programs, and projects are often developed in response to the latest disaster. As the population of the state continues to grow in areas most susceptible to natural and man-caused hazards, comprehensive hazard mitigation is becoming more imperative. Planning, compliance, and education are the best steps toward increased awareness and integration.

State and local hazard mitigation planning efforts are significant steps in broadening the understanding of the importance of mitigation. The law requiring local general plans that guide land use has proven to be useful in reducing the number and the severity of disasters. It will take time to see if the new hazard mitigation planning processes are as accepted and successful.

The state has already had success with education and awareness through programs addressing the three major natural hazards—fire, flood, and earthquakes. At three separate times of the year, OES, the California Seismic Safety Commission, the Department of Conservation, CAL FIRE, the Department of Water Resources, and the Department of Education support special programs in schools and in communities to raise hazard awareness.

Goal 4 – Promote hazard mitigation as an integrated public policy.

This goal was revised to include the word “public” to give meaning to the word “policy.” It suggests not only governmental but societal attention to the need for mitigation. Corresponding objectives under Goal 4 are shown below. Objectives 1- 5 have been reworded with minor changes for breadth or clarity. Objectives 6-10 have been added.

Objective 1: Encourage all cities, counties, special districts and tribal organizations to develop, adopt, and implement a Local Hazard Mitigation Plan.

Objective 2: Encourage all cities and counties to adopt their Local Hazard Mitigation Plans as part of an updated General Plan Safety Element.

Objective 3: Monitor government- and privately-funded mitigation progress, develop new data on hazards, vulnerability and risk, and revise the State Hazard Mitigation Plan every three years to integrate new progress and data.

Objective 4: Promote general public understanding of the benefits of hazard mitigation in reducing casualty and property losses and ensuring continuity of business, institutional, and government functions.

Objective 5: Continually build operational linkages between hazard mitigation, disaster preparedness, and recovery programs within the public and private sectors.

Objective 6: Utilize mandatory local general plan, zoning, and subdivision requirements to create disaster-resistant sustainable communities.

Objective 7: Promote continuous regional hazard mitigation coordination between state agencies, cities, counties, special districts, and tribal organizations.

Objective 8: Utilize the Regional Blueprint Plan program to promote hazard mitigation and to help create disaster-resistant sustainable communities within a regional context. For a description of the Regional Blueprint Plan, see Section 3.4.6.

Objective 9: Institutionalize hazard identification, risk assessment, and hazard mitigation planning to reduce vulnerability and provide parameters for preparedness planning.

Objective 10: Create financial and regulatory incentives to motivate stakeholders to mitigate hazards and risk.

Objective 11: Enhance and integrate public education efforts by state and local agencies that have mitigation-directed programs.

Progress in Meeting Mitigation Objectives

Throughout this Plan are numerous examples of progress toward meeting mitigation goals and objectives. The following are a few examples.

- Goal 1, Objective 5—progress has been made in implementing Unreinforced Masonry Building (URM) Retrofit programs as documented in Chapter 5.
- Goal 2, Objective 2—the work of the California Fire Safe Councils throughout the state continues to help reduce local risks of wildland fire damage by involving community members and private land owners in lowering fuel levels.
- Goal 2, Objective 5—Governor Schwarzenegger through Executive Order S-04-06 has focused on public-private partnerships as a central tool for bringing more stakeholders into the mitigation and disaster preparedness planning process; results of this effort can be seen in the work of the California Utility Emergency Association's work, mentioned in Chapter 2.
- Goal 3, Objective 2—integrated planning efforts like the statewide Blueprint Planning efforts and the Partnership for Integrated Planning (PIP) of the California Department of Transportation (Caltrans) show a promise of integrating mitigation as part of environmental mitigation and stakeholder consultation in various regions of the state.

Comment On: Chapter 3 Section 2

3.2 State Priorities

Most mitigation actions in the state are a result of priorities determined by federal and state mandates, plans, and special reports. As noted in Chapter 2, there are a number of state laws and programs that require, guide, or oversee mitigation done by local agencies, businesses, and private citizens. There are also mandates that direct state agencies to protect state owned or controlled property. The state protects critical facilities such as the State Water Project, the state university systems, the state park systems, state owned and maintained highways and bridges, and the facilities owned or operated by the Department of General Services. A list of these facilities is contained in the Inventory of State Facilities, 2007 SHMP Appendix.

Comment On: Chapter 3 Section 2.1

3.2.1 Priority Determination

Because of the probability and severity of the multiple risks that are faced by the state, California is forced to continuously and simultaneously address a number of hazards, vulnerabilities, and risks described in depth in Chapter 5. The multiplicity, diversity, and geographic variation and differences in levels of risks and vulnerability make it difficult to give priority to one type of hazard over another on a statewide basis. However, California's disaster history since 1950, indicates that earthquakes, floods, and wild fires require priority attention because they account for the largest losses.

For a description of these hazard priorities, see Chapter 5, Parts 1 and 2.

Mitigation Goals

Priorities for mitigation action related to the goals and objectives of this Plan, state legislation, and executive orders require ongoing assessment. Certain fundamental priorities are inherent in the goals of this Plan: significantly reduce life loss and injuries; minimize damage to structures and property, as well as disruption of essential services and human activities; and protect the environment. The fourth goal, to promote hazard mitigation as an integrated public policy, defines the underlying strategy for all actions based on this Plan.

State Legislation and Executive Orders

Emerging priorities for action are reflected in new laws passed, specific examples of which are identified in the strategies to address hazards and risks assessed in Chapter 5. After large disasters, post-disaster assessments often result in new recommendations for legislative and administrative action. These legislative and administrative assessments result in important new lines of mitigation policy for hazards such as earthquakes, floods, wildfires, and other disasters. Actions that are a result of state legislation or Governor's executive orders constitute the highest priorities. Actions recommended or identified in agency strategic plans or in reports demand a lesser priority than those prescribed by legislative or gubernatorial policies. See the 2007 SHMP Appendix for an index of legislation and copies of executive orders influencing mitigation priorities.

Budget Adoption

The allocation of state resources to actions is also the responsibility of the Governor and legislature through the state budget process. This process of resource allocation is ultimately the process for setting priorities.

Federal Mandates

Federal mandates constitute an important source of prioritization. Congressional legislation and presidential executive orders affect the entire federal system. For example, the allocation for the distribution of federal funding is based on federal requirements and any state priorities must be addressed within those requirements.

Comment On: Chapter 3 Section 2.2

3.2.2 Federal Hazard Mitigation Funding Priorities

OES is responsible for distributing federal mitigation funds from FEMA. The priorities for distributing the funds are generally as follows.

1. **Ensuring communities are eligible for federal programs by supporting local multi-hazard mitigation planning (to the extent allowed by the federal program)**. FEMA provides states with hazard mitigation grant funding from three programs: the Hazard Mitigation Grant Program and Public assistance Program described under the Robert T. Stafford Act, the Pre-Disaster Mitigation Program described in the Disaster Mitigation Act of 2000, and the Flood Mitigation Assistance Program described in the National Flood Insurance Act of 1968. Each of these programs requires approved projects to be consistent with locally developed plans and be cost effective long-term mitigation. Also, each program allows some funding to be available for developing local hazard mitigation plans.

2. **Protect lives and property at risk from imminent hazards created or exacerbated by disasters.** After disasters, affected communities can be threatened by imminent hazards related to the initial disaster event. The experience from the October 2003 fires in Southern California is a clear example. The fires destroyed vegetation and changed the absorption characteristics of the soils on the slopes above many communities. Subsequent winter storms caused floods, mudflows, and landslides that added to the destruction from the fire. Aftershocks, landslides, and fires can follow from earthquakes, while the aftermath of a major flood might include landslides and increased vulnerability to future flooding.

   Recovery efforts after a disaster have several sources of funding. Some of those sources can help in abating or mitigating hazards. The process for making HMGP funds available usually takes 90 to 180 days. That time is used to identify sources of funding and the projects for which the funding can be used. This assures that funding will be used in a complementary fashion without duplicating use.

   Funding projects that will mitigate imminent hazards is highly cost effective and assists in critical efforts to help communities recover from disasters. It is anticipated that not all such projects will be identified in local hazard mitigation plans. Establishing this priority provides guidance for locals to build in the flexibility to

identify critical mitigation needs that may arise from a disaster when there is no time to update a local plan.

3. **Protect vulnerable critical facilities and infrastructure in high hazard areas of the state.** The next most important priority for federal funding is to help with protecting critical facilities and infrastructure. Though the state and many communities have ongoing capital improvement programs, there is still an almost overwhelming need to retrofit, replace, protect, or relocate facilities and infrastructure important to the state's communities that are at risk from hazards. It is anticipated that the local hazard mitigation plans will provide a list of projects falling in this category. Those projects located in the high hazard zones will generally be more cost effective than those that are not. Examples of needed mitigation include facilities located in floodplains, within 2400 meters of an extreme threat of fire, on or near active faults, in liquefaction zones, and on or near landslides and unstable soil areas.

4. **Reduce repetitive losses**. Areas of repetitive loss are high priorities for hazard mitigation funding. Repetitive losses are a drain on community, state, and national disaster management resources and are very cost effective to mitigate. The current national priority is the reduction of repetitive flood losses because these translate into a loss to the National Flood Insurance Program (NFIP). California has numerous areas of repetitive flood loss. Additionally, many areas of the state experience repetitive losses from wildfire. Although less frequent, due to recurrence intervals and location, earthquakes can also result in repetitive losses to buildings and infrastructure.

5. **Ensure that all communities are covered by an adopted local hazard mitigation plan**. Because of the history of disasters throughout California, encouraging communities to adopt a local hazard mitigation plan is a priority. Such plans are necessary to receive federal financial assistance for hazard mitigation.

6. **Improve understanding of natural hazards and the performance of hazard mitigation practices**. State agencies and many of the state's universities are researching the behavior of natural events and developing improved methods for research. There is also considerable research devoted to improving disaster-resistant building materials and practices. This research is critical to improving building standards and practices.

3.2.3 Types of State Mitigation Strategies

Direct and Indirect Strategies

Strategies pursued to mitigate hazards can be viewed from two perspectives. One is to classify mitigation strategies as either direct or indirect. Direct actions are those which directly protect life, property, and the environment. These include physical measures to improve survivability of occupants and their structures. Examples include designing structures to resist destructive forces during initial development or through a retrofit process, as in bolting walls to their foundations for better performance during an

earthquake, elevating houses to prevent flooding, and using asphalt and clay tile roofing to reduce wildfire spread. Indirect mitigation strategies are those which do not make physical changes but facilitate direct mitigation actions by others. They include education, public information, community outreach, and safety campaigns which motivate self-help action.

Mandatory and Discretionary Strategies

A more straightforward perspective is represented by classification of mitigation strategies as either mandatory or discretionary. Mandatory mitigation strategies include statutes and ordinances stimulating uniform mitigation action. Examples of mandatory strategies include the following.

- State mandates;
- Local regulations and ordinances;
- Restrictions on property use—these limit or avoid development on hazardous land, such as not building on or near known active faults or in floodways;
- Building protective measures—these are usually tax supported and keep destructive forces away from communities or structures, for example, levees, drainage channels and firebreaks.

The essential outcome of a mandatory mitigation strategy is general compliance with building codes for new facilities or alterations to existing facilities. Property owners, builders, investors, and other stakeholders cannot choose whether or not to comply with this mitigation strategy.

Mandatory strategies bear two types of cost. One is the direct cost of implementation which must be exceeded by the potential loss reduction benefit to be reasonably justified as a mandatory measure. Another cost is that of public enforcement to ensure uniform compliance, requiring staffing and budgets.

Additionally, since code requirements change over time, many older facilities constructed to meet regulations in effect during a previous period may no longer be considered to provide reliable levels of safety.

Discretionary Strategies

Discretionary mitigation actions are voluntary measures taken by individuals, businesses, and local government organizations with the motivation of reducing potential future disaster losses to homes and facilities. Examples of discretionary mitigation actions might include voluntarily retrofitting existing business facilities or investment in enhanced building designs exceeding minimum requirements for new facilities.

Strategies which encourage individuals, businesses, and local governments to take discretionary mitigation actions might include the following:

- Publications of advisory plans and technical manuals—an example might be the "How To" Guides published by FEMA to assist local governments in LHMP preparation;
- Education and awareness programs—these are programs that are intended to persuade people to voluntarily behave in a manner that reduces chances of loss. These programs can either have targeted or general audiences;
- Research and development—these are efforts supported by either public or private funding that improve understanding of hazards, vulnerabilities, and mitigation.

Outcomes of discretionary mitigation strategies are more uncertain. Cost can be a deterrent when revenue sources are insufficient or the potential loss reduction benefit cannot be seen by a stakeholder making a mitigation decision.

Frequency of disaster losses are very often a motivating factor for discretionary mitigation. Intermittent flooding may more readily motivate private investment in mitigation for home or business owners because they are affected more frequently. Whereas infrequent but more damaging disasters such as earthquakes provide a less imminent reminder of the value of mitigation, leading owners to postpone mitigation investments in hopes that such disasters will not happen during their lifetime or ownership tenure.

Evaluation of mandatory and discretionary strategies is needed to determine their relative effectiveness over time. The California Seismic Safety Commission has reviewed local unreinforced masonry retrofit programs and found that mandatory programs are more effective than discretionary. The table below summarizes their findings.

Table 3.2.3A Unreinforced Masonry Retrofit Program Findings

Program Type	Summary
Mandatory Strengthening	These programs require owners to strengthen or otherwise reduce risks in their buildings within times prescribed by each local government. Time schedules vary and generally depend on the number of occupants. Programs are based on the City of Los Angeles' Division 88 ordinance (LA, 1981) which is also the historic basis for the Uniform Code For Building Conservation Appendix Chapter 1 (ICBO, 2001) and the Seismic Safety Commission's Recommended Model Ordinance (CSSC, 1995). Triggers for the Model Ordinance were developed in 1991 in cooperation with the California Building Officials. This is the most effective program type.
Voluntary Strengthening	These programs establish seismic retrofit standards and require owners to evaluate the seismic risks in their buildings. Owners then write publicly available letters to their local governments indicating when they intend to retrofit (CSSC, 1990). This type of program is somewhat more effective than "Notification Only" (see next program type).

Table 3.2.3A Unreinforced Masonry Retrofit Program Findings Continued

Program Type	Summary
Notification Only	Local governments write letters to owners stating that their building type has been known to perform poorly in earthquakes. This is typically the least effective type of program. Most jurisdictions have adopted more comprehensive measures than this.
Other	Variations of the above with unique requirements and effectiveness. Some cities, for example, require owners to post placards on URM buildings that warn occupants and passersby of earthquake risks. In general, placarding has not proven to be an effective motivation for owners to retrofit.

Source (for Table 3.2.3A on previous page): CSSC 2006 Report," Status of the Unreinforced Masonry Building Law"

Need for Combined Approach

Ultimately, a combination of mandatory and discretionary mitigation strategies is needed to bring about substantial changes in physical environments to reduce future disaster losses. This theme is demonstrated throughout the rest of this Plan in relation to the legal, policy, and institutional framework identified in Chapter 2, the funding sources identified in Chapter 7, and the Enhanced Plan criteria emphasized in Chapter 8.

Need for Formal Strategic Planning Process

Although the 2007 SHMP is not a strategic plan, it has strategic planning elements including the preceding mitigation goals and objectives. Needed in the long run is a formal strategic planning process which encourages statewide development of near- and long-term mitigation targets. The need for formalization of a strategic planning process, together with examples of strategic targets already included within California's laws and Governor's executive orders, is discussed at greater length in Section 3.4.6.

3.3 State Capability Assessment

The State of California has a history of successfully implementing hazard mitigation through a process of legislation, program development, and program and project implementation. This history demonstrates the state's enhanced capability to implement state-level hazard mitigation programs that are effective and, in many ways, state-of-the-art hazard mitigation programs such as CAL FIRE's Fire Planning Framework, which has become a national template for fire planning.

Examples of the state's capability are the Bridge Seismic Retrofit program that has been highly successful. Over four billion dollars were spent retrofitting bridges throughout the state. The Vegetation Management Program, which funds local fuel load reduction efforts by local governments, treats about 40,000 acres each year. The Flood Protection Corridor Program (FPCP) provided $70 million dollars for primarily non-structural flood management projects that include wildlife habitat enhancement and/or agricultural land preservation.

Comment On: Chapter 3 Section 3.1

3.3.1 Legal Foundations of State Capability

To understand the state's capability in implementing hazard mitigation, it is important to understand the political framework of the California state government as presented in Chapter 2, Legal, Institutional, and Policy Framework. Numerous California laws, regulations, and other policy documents described in Chapter 2 provide a framework for the state's policies related to hazard mitigation and disaster management.

Together these form the core of the state's overall hazard management capabilities. Many of these laws and programs are described in greater detail in Chapters 5 and 7 of this Plan.

Comment On: Chapter 3 Section 3.2

3.3.2 Levels of State Capability

The state's efforts at implementing hazard management can be viewed as being effective at three levels: state legislation; state level implementation; local level implementation of state priorities.

State Legislation

Legislation related to hazard mitigation has been, for the most part, hazard specific and effective. Most legislation is the result of disaster events in which specific vulnerabilities were highlighted. Examples of these laws include:

1. Dam Safety Act
2. Field Act
3. Alquist-Priolo Act
4. Unreinforced Masonry Building Law
5. Essential Services Building Seismic Safety Act
6. Seismic Hazards Mapping Act

Many of the state's legislative efforts have come as recommendations from special commissions that were formed following a disaster. The most recent examples of these commissions are the Flood Emergency Action Team from the 1990s and the recent Governor's Blue Ribbon Fire Commission. The legislative aspect of California's approach to hazard mitigation is responsive, focused, and effective.

Extensive descriptions of legislation strengthening state mitigation capability are provided in Chapter 2 and the draft 2007 SHMP Appendix. For a list of over 30 laws which provide a foundation for emergency management and hazard mitigation institutions and policies in California, see Section 2.3.2 State Emergency Management and Mitigation Laws. In addition to the basic laws documented in Chapter 2 are a variety of additional laws and programs responding to mitigation needs for specific hazards.

Figures 3.3.1A through Figure 3.3.1D in the 2007 SHMP Appendix identify state laws, policies and programs. Figure 3.3.1A shows laws, policies, and programs for general hazard management. Figures 3.3.1B through 3.3.1D show laws, policies, and programs for the primary hazards—earthquakes, floods, and wildfire—for which statewide mitigation plans have been prepared.

State Level Implementation

Implementing state level hazard mitigation has also been an effective part of the state's approach to hazard mitigation. The state has expended billions of dollars on seismic, fire, and flood hazard mitigation. Some of these efforts are the State Water Project, the Bridge Retrofit Program, and several fire hazard management programs.

Local Level Implementation

The state's efforts at implementing hazard mitigation at the local level are the most complicated. State laws that strengthen building codes and standards have been effective and explain why California has experienced far less damage (especially in earthquakes) than might have otherwise been the case had such regulations not been adopted. Local governments have the authority to adopt amendments that enhance minimum requirements of the California Building Standards Code. A May 2007 recommendation by the California Building Officials encourages local governments to adopt a model ordinance for the repair and reconstruction of damaged buildings would require mitigation during repairs of structures that experience substantial damage. It is available at http://www.calbo.org/documents/Repair%20%20Reconstruction%20Ordinance%205-07.pdf

Encouraging local governments to initiate hazard mitigation efforts on their own is difficult. California has periodically experienced severe budget challenges. Funding is often scarce for activities that don't appear to have an immediate need. But a major area of opportunity for California to realize the benefits of hazard mitigation is in local government initiated and implemented hazard mitigation. This is why one of the state's hazard mitigation priorities is to "ensure that all communities are covered by an adopted local hazard mitigation plan."

Comment On: Chapter 3 Section 4

3.4 Local Government Capability Assessment

The Disaster Mitigation Act of 2000, through 44 CFR Parts 201 and 206, requires that the state mitigation strategy include a general description and analysis of the effectiveness of local mitigation policies, programs, and capabilities.

While California cities and counties are separate autonomous subdivisions of state government, state law, policies, and programs have a large influence on local land use and hazard mitigation activities. While the California Government Code (Sections 65000 et seq.) contains many of the laws regulating land use planning including the general plan, specific plans, subdivisions, and zoning, the state is seldom directly involved in local land use and development decisions. These have been delegated to the city councils and county boards of supervisors. Local decision makers adopt their own land use policies based upon the state laws and approve individual land development projects based on these policies.

Comment On: Chapter 3 Section 4.1

3.4.1 Legal Foundations of Local Government Capability

State law is the foundation for local planning in California. There are approximately 536 incorporated cities and counties in California. State law requires each of these jurisdictions adopt "a comprehensive, long-term general plan for [its] physical development." Through the general plans, local jurisdictions document official decisions

and future strategies regarding the location of housing, business, industry, roads, parks, and other land uses, protection of the public from environmental hazards, and conservation of natural resources. Within the general plan there are many opportunities for local agencies to identify, plan for, and mitigate local hazardous conditions such as flood, fire, and geologic events. The legislative body of each city (the city council) and county (the board of supervisors) adopts zoning, subdivision, and other ordinances to regulate land use and to implement the policies of its general plan.

Cities and Counties

Cities and counties are distinct and independent political entities. Each city and county formally adopts its own general plan and develops regulations for implementing its policies. There is no requirement that adjoining cities or counties have identical, or even similar, plans and ordinances.

Special Districts

Special districts with taxing authority can also be formed to address hazard issues such as fire protection, geologic hazard abatement, and flood control. According to the California Special Districts Association "Special districts are a form of local government created by a local community to meet a specific need. Inadequate tax bases and competing demands for existing taxes make it hard for cities and counties to provide all the services their citizen's desire. When residents or landowners want new services or higher levels of existing services, they can form a district to pay for and administer them." (See url: http://www.csda.net/speldist.htm) The ability of local communities to create special districts provides local communities a significant capability to address hazard concerns.

Joint Powers Authorities

Cities and counties can also form special districts and Joint Power Authorities to address specific and multiple issues. Examples of these special districts and Joint Power Authorities are the Sacramento Area Flood Control Agency (SAFCA). (See url: http://www.safca.org) and the Association of Bay Area Governments (ABAG) – a joint powers authority (see url: http://www.abag.ca.gov).

Land Conservation Organizations

Another local quasi-public mechanism for hazard mitigation is the emergence of land conservancies. These conservation organizations can become landholders with the goal of preserving the natural environment, which may also have hazard mitigation benefits. For example, land with flood or geologic hazard issues may be kept out of development through the purchase of the land for open space or through the purchase of the land's development rights. Since its founding in 1958, the Nature Conservancy has worked on more than 100 projects and preserves in California. Many mature projects and preserves, however, are now managed by other organizations – for example, local conservation organizations or appropriate public agencies. (The Nature Conservancy website, url: http://nature.org/wherewework/northamerica/states/california/preserves/)

Comment On: Chapter 3 Section 4.2

3.4.2 State Actions Supporting Local Capability

OES, through its Local Hazard Mitigation Planning (LHMP) Program, assists local governments in identifying those measures most effective for hazard mitigation. The LHMP Program has held workshops and assists local communities in developing their hazard mitigation plans.

The state supports the development of effective hazard mitigation policies at the local level through model ordinances such as the Model Floodplain Management Ordinance, available at www.fpm.water.ca.gov. The state requires local governments to adopt certain building standards, as does the Alquist-Priolo Earthquake Fault Zoning Act. The natural Hazard Disclosure Act also supports hazard mitigation in local communities.

The state, through its various agencies, also works with local governments to enhance local hazard mitigation efforts. CAL FIRE works closely with local governments in the development of mitigation policies that impact state responsibility areas for fire protection. DWR works with FEMA and local governments in administration of the NFIP. OES works closely with local governments in developing emergency plans.

Comment On: Chapter 3 Section 4.3

3.4.3 Fostering Local Government Capability

At the time of the writing of the 2004 SHMP, few local hazard mitigation plans had been forwarded to the state for review to identify specific local government hazard mitigation policies. However, in the past several years, FEMA has approved LHMPs for 424 cities, counties, and special districts. A detailed comparative assessment of FEMA approved LHMPs in California is provided in Chapter 6.

In the current budgetary environment most local governments are faced with serious financial constraints, but it is clear that communities that make a commitment to community safety are able to propose, develop, and implement hazard mitigation strategies. Many California communities have participated in the federal hazard mitigation grant program and the flood mitigation assistance program. These communities understand the value of hazard mitigation. It is expected that as the state's Local Hazard Mitigation Planning program matures, more communities will participate. This will increase the capability of local communities to plan, develop, and implement effective hazard mitigation strategies.

The new Local Hazard Mitigation Planning Program creates an opportunity for further analysis. Review of local hazard mitigation plans in the future will be integral to a more complete analysis of the effectiveness of local hazard mitigation strategies. Where communities have not developed a Local Hazard Mitigation Plan (LHMP) it is more difficult to assess the effectiveness of mitigation efforts. Where communities have developed LHMPs, however, effectiveness can more readily be assessed.

During the 2007 revision to this Plan, an assessment of LHMPs has been developed. Preliminary recommendations for improving the quality of local hazard mitigation planning are found in Chapter 6, Local Hazard Mitigation Plans.

Comment On: Chapter 3 Section 4.4

3.4.4 Role of California Planning and Building Codes

As discussed at greater length in Chapter 2, Legal, Institutional, and Policy Framework, planning, building, fire and other codes have been adopted by all local governments in California.

Planning Requirements

California's planning codes and standards include the following requirements and declarations:

1. Every city and county in the state must adopt a general plan for the physical development of the county or city and any land outside its boundaries that bears relation to its planning. The general plan must cover a local jurisdiction's entire planning area and address the broad range of issues associated with the city's or county's development.

2. The state legislature has declared that "decisions involving the future growth of the state, most of which are made and will continue to be made at the local level, should be guided by an effective planning process, including the local general plan."

3. The legislature has further declared that the state's land is an exhaustible resource, not just a commodity, and is essential to the economy, environment, and general well-being of the people of California.

The role of a local government's general plan is to act as a "constitution" for future development. The general plan bridges the gap between a community's values, vision, and goals, and physical development actions, such as the subdivision of land and public works projects. Information found in the general plan underlies most local land use decisions.

As discussed in Chapter 2, Legal, Institutional, and Policy Framework, counties and general law cities are required to have zoning and specific plans consistent with the general plan. Moreover, the Subdivision Map Act requires general plan consistency. By extension, LHMPs must also conform to the general plan.

The 2003 *General Plan Guidelines*, prepared by the California Governor's Office of Planning and Research (OPR), emphasize consideration of each local general plan in its regional context. OPR encourages local governments to approach planning issues, including issues that affect mitigation planning, from beyond the artificial boundaries of a city or county whenever the affects of those issues transcend those boundaries. Wildfire, flooding, and air pollution are examples of hazards that could extend across jurisdictional boundaries.

The role of OPR is not to regulate local government planning, but to provide cities and counties with planning assistance and resources. OPR prepares numerous publications on a variety of planning topics and provides advice and assistance to local planners by phone

and e-mail. Additionally, OPR maintains a database on the status of city and county general plans and posts the information (see: www.calpin.ca.gov).

Other OPR roles potentially supporting mitigation include providing research support to the Governor on planning issues, providing comprehensive planning information statewide, facilitating state level interagency coordination, coordinating state and local agency review of environmental documents prepared under requirements of the California Environmental Quality Act (CEQA).

Building and Fire Codes

Building and fire codes are usually enforced by cities and counties staff, including building inspectors, fire department personnel, and sometimes by law enforcement. Cities and counties review detailed plans for new construction for conformance with state building, fire, mechanical, and plumbing codes. Local code enforcement agencies arbitrate disputes concerning portions of facilities involved in repairs or upgrades and are tasked with making final decisions on such matters.

According to California Health and Safety Code §16006, the "enforcement agency means the agency of a city, city and county, or county responsible for building safety within its jurisdiction. The office of the State Architect is the enforcement agency for state-owned facilities…" The Division of the State Architect (DSA), within the Department of General Services, is also the review agency for the design and construction of school facilities in California.

Local fire safety requirements are governed under state laws established through the legislature, and administered through the State Fire Marshall and the California Department of Forestry and Fire Protection, depending upon location. Fire safety enforcement is an important part of local hazard mitigation. In May 2007, the California Building Officials issued a recommendation for local governments to adopt its Repair and Reconstruction Model Ordinance that triggers mitigation during repairs of buildings with substantial structural damage (www.calbo.org/build_dept/emergency/Emergency.aspx).

After a disaster, inspections are often necessary to determine if buildings are still safe to occupy. In California, the responsible enforcement agency sends out inspectors to review damaged buildings. These buildings are tagged with a colored placard posted on the building exterior and visible from the street. The color coding is as follows:

1. Green—safe to occupy,
2. Yellow—safe only for limited use by occupants,
3. Red—the building is unsafe and entry is not permitted.

Comment On: Chapter 3 Section 4.5

3.4.5 Enhanced State and Local Capabilities

The California vision for statewide hazard mitigation includes the implementation of a multi-faceted, integrated, statewide and local hazard mitigation planning program. California has developed a number of comprehensive and effective state and local pre-

and post-disaster mitigation laws, policies, programs, codes, and standards to enhance mitigation capabilities at both levels, as noted in Chapters 2, 5 and 8.

Formalizing an Ongoing Strategic Planning Process

During the upcoming implementation cycle for the 2007 SHMP and in the course of preparation of the 2010 SHMP, a formalized, integrated strategic planning process is needed to enhance state and local mitigation capabilities. Proposed in Chapter 8 is an extension of the SHMT to serve both as a monitoring mechanism for implementation outcomes and as a strategic planning forum for more definitive mitigation target setting during the next cycle of state hazard mitigation planning leading to the 2010 SHMP. In this process, the SHMT will meet as the SEMS Mitigation Advisory Committee on a quarterly basis to monitor success of 2007 SHMP implementation and to identify, integrate, and prioritize definitive near- and long-term mitigation targets in relation to primary hazards.

Within this strategic planning context, local government associations such as the League of California Cities, California State Association of Counties, and the Special Districts Association would continue to be represented on the SEMS Mitigation Advisory Committee to implement recommendations for improved integration between local and state mitigation planning set forth in Chapter 6.

Toward a Formal Strategic Planning Process

At the outset of this chapter it was emphasized that, while the 2007 SHMP is not a strategic plan, it has elements similar to those of a strategic plan, i.e., vision, mission, and goals and objectives statements to identify a strategic direction-setting framework. It also includes discussions of general mitigation priorities and strategies and their outcomes as well as state and local capabilities for achieving such outcomes.

Many of the changes and refinements to mitigation goals and objectives stated early in this chapter were identified by members of the State Hazard Mitigation Team (SHMT), who represented over 40+ state agencies involved in revision of the 2004 Plan. Further refinement to the Draft 2007 SHMP is expected to result from the outreach to business, professional, and local government organizations as well as to the general public to be undertaken during the July-August 2007 public comment period.

During this outreach process, efforts are being made to identify outstanding best mitigation practices practiced in California by local government, business, and community organizations, as well as to identify modifications to this Plan which will improve its usefulness to a variety of stakeholders.

Near- and Long-term Target Setting

Needed for development in the long run within this overall strategic planning process is additional attention to setting of systematic near- and long-term mitigation targets. Examples of strategic target setting are already included within California's laws and Governor's executive orders, expressed as time targets or numerical targets or a

combination. Established mitigation targets include quantified objectives expressing the numbers of buildings to be retrofitted by type of structure by given time periods.

The following are examples of retrofit targets established by Health and Safety Code Section 130050 et seq., expressed in terms of time:

> By 2013, replace or retrofit all acute care hospitals posing a significant risk to life in the event of earthquakes.
>
> By 2030, replace or retrofit all acute care hospitals that will not be immediately occupiable and reasonably capable of providing emergency services after earthquakes.

Another example is Executive Order S-03-05, signed by Governor Schwarzenegger on June 1, 2005, which established climate change emission reduction targets for the State for the purpose of mitigating global warming. The Executive Order established Greenhouse Gas (GHG) targets as follows:

- By 2010, reduce to 2000 emission levels
- By 2020, reduce to 1990 emission levels
- By 2050, reduce to 80 percent below 1990 levels.

Further discussions of mitigation targets as well as natural hazards posed by global warming and climate change are found in Chapter 5.

Data Systems, Modeling, and Mitigation Registry

Needed as part of the 2010 planning cycle as a foundation for this enhanced strategic planning process is a substantially upgraded investment in database development, disaster loss data monitoring, and a geographic information system (GIS) modeling process to help identify linkages between population, housing, and economic growth, projected losses, and specific mitigation needs by geographic sub-regions.

Additionally, there is a need for registering mitigation projects of all kinds in a statewide database accessible to the public to demonstrate varying local experiences with mitigation. For example, the California Seismic Safety Commission has invested in a registry of Unreinforced Masonry (URM) retrofit progress using data provided by local governments for its URM update reports and has produced a progress map by operational area (see Chapter 5). Also, information on 6,000 other mitigation projects has been documented and submitted to the California Geological Survey. These databases represent valuable information resources on mitigation which could be systematically organized into a registry to be publicized on the OES Mitigation Web Portal to enhance mandatory and discretionary strategies undertaken by state and local governments, businesses, and community organizations.

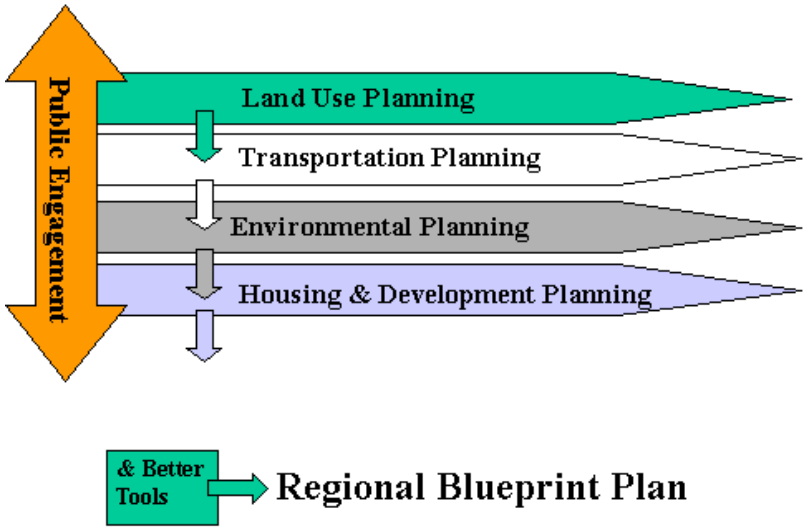
The California Regional Blueprint Process

Also needed during the 2007 SHMP implementation process will be integration of state and local hazard mitigation planning with the Regional Blueprint Process recently undertaken by Caltrans under the California Transportation Plan (CTP). Regional Blueprint Planning Program grants support efforts of the California Metropolitan Planning Organizations (MPO) and Councils of Government (COG) to conduct comprehensive scenario planning that results in consensus by regional leaders, local governments and stakeholders on a preferred growth scenario – or "blueprint" - for a twenty-year planning horizon.

Ongoing integrated planning efforts such as these which include broad-based stakeholder involvement lend themselves directly to the integration of natural hazard mitigation considerations as part of the comprehensive scenario planning processes. Under the California general plan law, mitigation planning through the general plan safety element and new Local Hazard Mitigation Plans should be a direct consideration in the formation of growth scenarios. For example, if local general plan safety elements and LHMPs call for constrained growth or mitigation in the FEMA 100-year flood plain, then such considerations should be reflected in the 20 or 50 year growth scenario for transportation planning purposes.

Shown in Chart 3.4.5A below is a schematic diagram of the Regional Blueprint Process.

Chart 3.4.5A California Regional Blueprint Process



According to Caltrans, the statewide Blueprint Planning Process has shown a strong promise to address environmental mitigation and consultation in a number of regions statewide. Environmental planning is being conducted in close conjunction with land use planning and transportation planning, leading to proactive environmental stewardship, as opposed to reaction to projects that have progressed beyond the early stages. Partnerships with resource management areas are being created with knowledge and participation of

the responsible agencies for land use. The role of the state is to provide encouragement, information about best practices, and in some cases, grant funding to continue to promote these integrated planning approaches. These efforts will be further examined with the next full update of the CTP in 2008

(This Page Intentionally Left Blank)

Comment On: Chapter 4

Chapter 4 - Profile of State Assets

Chapter Organization

4.0 Chapter Summary
4.1 Scale and Diversity of Assets Needing Protection
4.2 Population
4.3 Economy
4.4 Geography
4.5 Climate
4.6 Rivers and Watersheds
4.7 Geology
4.8 Forest Resources

Comment On: Chapter 4 Section 0

4.0 Chapter Summary

California has extensive human, economic, and natural assets worthy of protection from natural and human-caused disasters. These include its immense and diverse population, dynamic economy, geography, climate, rivers and watersheds, geology, and forest resources. Given the size and complexity of these assets, no single formulaic mitigation approach can ensure full protection of people, property, and resources.

California is the most populous state in the US, with a population in 2007 of over 37 million, expected to grow to 55 million by 2050. With a land area of nearly 160,000 square miles, it is the third largest state. Its size and diversity are reflected in its population, economy, landscape, and culture. California contains a wealth of natural resources. According to the California Department of Finance, if California were an independent nation it would have the seventh largest economy in the world

California's population is also the most ethnically diverse state in the nation, having no single ethnic group representing a majority. California has the largest labor market in the US, with 15.4 million jobs. The labor force is highly skilled—over 40 percent of the working population has a postsecondary degree, and three-quarters of these are BA or higher.

California has 58 counties varying widely in land area, total population, population growth, and residential construction. In 2006 nearly three quarters of the state's population lived in the 10 most populous counties.

Climates in California vary widely depending on latitude, elevation, and proximity to the coast. Most of the state has rainy winters and dry summers. The Sacramento and San Joaquin rivers and their tributaries, which drain the Central Valley, form California's principal river systems and. unite to form a large inland delta that drains into Suisun Bay, the eastern arm of San Francisco Bay. Numerous mountain streams descend from the Sierra Nevada to join the two rivers.

Golden Gate Bridge and San Francisco

Source: National Parks Service

The rivers of California's Coast Ranges are relatively short except for the 250-mile Klamath River which rises in Oregon and flows through the northwestern portion of the state. The Salinas River takes form in the Coast Ranges and flows northwest through a broad fertile valley to Monterey Bay. The Colorado River is the major river in southern California, following the Arizona-California state line before flowing into the Gulf of California in Mexico.

California sits on two major tectonic plates, the North America Plate and the Pacific Plate. The Pacific Plate is currently moving north, scraping along the edge of the North American Plate. The periodically violent interactions of these two plates are responsible for most of California's rugged geologic features. Earthquakes have claimed the lives of more than 3,000 Californians in the past two centuries.

Forests cover 40 percent of California's land area. California usually ranks third in the nation in terms of timber and lumber output. Lumbering is the chief economic activity in the Sierra Nevada and in northwestern California. About two-fifths of the forestland in the state is classified as commercial forest. The United States Forest Service manages more than half of these commercial forests.

Comment On: Chapter 4 Section 1

4.1 Scale and Diversity of Assets Needing Protection

California's extensive assets are worthy of protection from natural and human-caused hazards. Given their size, diversity, and complexity, no single formulaic approach to mitigation is adequate to ensure full protection of people, property, and resources. As the most populous state with the third largest land area in the nation and the seventh largest economy in the world, California contains a wealth of human and natural resources. The state leads the nation in volume of annual construction and manufacturing as well as

value of annual farm output. Given the scale and diversity of these resources, there exists an urgent need for expanding California's comprehensive mitigation strategies documented in other chapters. Mitigation investments made now will result in long-term protection of these assets.

Comment On: Chapter 4 Section 2

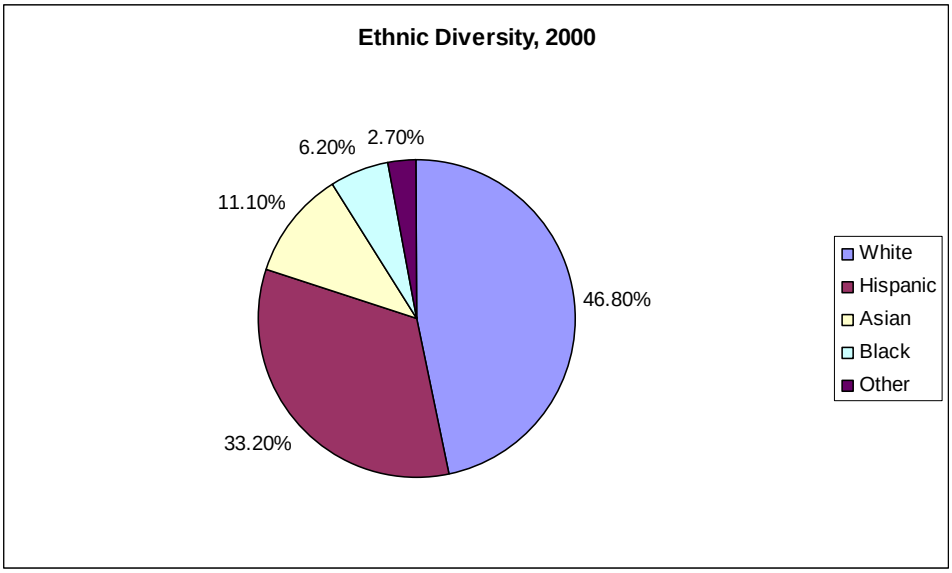
4.2 Population

California's population on January 1, 2007, was 37.7 million residents, according to the California Employment Development Department, compared with 33.9 million reported by the Census in 2000. From 2000 to 2006, California's population grew by nearly 3.5 million—equivalent to nearly four cities with populations the size of San Francisco. Combined single family and multi-family housing starts in California totaled 1,082,672. Future population is expected to grow to 44 million by 2020 and 55 million by 2050.

Ethnic Diversity

California is not only the most populous state but also the most ethnically diverse. No single ethnic group represents a majority of the population. According to the 2000 Census, California had the following ethnic composition:

Chart 4.2A Ethnic Diversity, 2000



In addition to being diverse, California's population is dynamic. Statistics from the California Department of Real Estate indicate that the average homeowner in California relocates every seven years. Renters move much more frequently. The mobility of the population poses a challenge to educating residents about the hazards and risks associated with their communities.

California's population is slightly younger than the national population. California faces an aging workforce, like the rest of the nation, together with loss of skilled workers due to retirement. However, from 2000 to 2006, numerical growth of population under age 18 totaled 551,208, contrasted with 315,983 additional residents over age 65.

California is home to more Native Americans than any other state in the country. Of the 561 federal recognized tribal governments in the United States, 109 are in California. The state has 109 reservations and rancherias in 32 counties.

Comment On: Chapter 4 Section 3

4.3 Economy

According to the California Department of Finance, if California were an independent nation it would have the seventh largest economy in the world. California's economy is the largest of any state by far, representing 13 percent of U.S. gross domestic product. It is a highly diversified economy, with jobs and businesses in many different industries. The service, finance, insurance, and real estate industries account for about half of the state's total gross product.

Labor Market and Force

The Employment Development Department reports that in 2006 California had the largest labor market in the US, with 15 million non-farm jobs, and 375,200 jobs in the farm sector, for a total of 15.4 million jobs in 2006. California's largest industries are trade, transportation, and utilities (2.8 million jobs); government (2.4 million jobs); professional and business services (2.2 million jobs); and natural resources and mining (24,300 jobs).

The labor force is highly skilled—over 40 percent of the working population has a postsecondary degree, and three-quarters of these are BA or higher. However, 16 percent of the workers aged 25-50 years have not received a high school diploma or GED and 4,706,130 people were under the poverty line in 2000, growing to 4,813,304 in 2004. This represented an increase of 107,174 and a slight decrease as a percent of the total state population from 13.9% to 13.2%.

Economic Activity

The state is the nation's top agricultural producer and leads the nation in the production of fruits and vegetables, including carrots, lettuce, onions, broccoli, tomatoes, strawberries, and almonds. The state's most valuable crops are grapes, cotton, flowers, and oranges. California also leads the nation in dairy products, which account for the largest share of farm income in the state. The state also contributes a major share of the nation's domestic wine production. If the Central Valley were a separate state, it would rank first in agricultural production in the nation. The unique combination of climate, soils, and water in the Central Valley is a major factor in its agricultural productivity. Because the Valley's climate is mild most of the year, the growing seasons are longer. This condition allows farmers to produce more crops than in other states. California exports agricultural products worth more than $6.5 billion each year.

Since World War II, manufacturing of electronic equipment, computers and related chips and software, machinery, transportation equipment, and metal products has increased enormously in California. Many high-tech companies and small low-tech companies thrive in Southern California in what is said to be the largest manufacturing belt in the country. The Silicon Valley, an area near San Jose, is the leading producer of semiconductors and software development.

California continues to be a major center for motion picture, television, film, and related entertainment industries. Tourism is another important source of income.

County Land, Population, and Growth Comparisons

California has 58 counties which vary widely in land area, total population, population growth, and residential construction. Map 4.3A on the following page identifies the counties. An analysis of land area, population, and residential growth reveal the following findings.

1. Most counties in California range in size between 1,000 and 5,000 square miles. As shown in Table 4.3A, the 10 largest counties vary widely in size, from over 20,000 in San Bernardino County to just over 4,000 in Imperial County. The five largest are San Bernardino, Inyo, Kern, Riverside, and Siskiyou, all with over 6,000 square miles.

Table 4.3A Top 10 Counties Comparison Land Area

County	Land Area (mi^2)	Rank
San Bernardino	20,052.50	1
Inyo	10,203.10	2
Kern	8,140.96	3
Riverside	7,207.37	4
Siskiyou	6,286.78	5
Fresno	5,962.73	6
Tulare	4,823.97	7
Lassen	4,557.27	8
San Diego	4,199.89	9
Imperial	4,174.73	10

Source: California Department of Finance

Map 4.3A California Counties

2. As shown in Table 4.3B below, the 10 most populous counties in 2006 had a combined population of 26.4 million residents, or 71% of California's total population of 37.4 million. The 10 counties with the largest populations vary widely, from Los Angeles County with nearly 10 million residents, to Fresno County with about 892,000.

Table 4.3B Top 10 Counties in Total Population, 2006

County	Total Population (2006)	Rank
Los Angeles	9,948,081	1
Orange	3,002,048	2
San Diego	2,941,454	3
Riverside	2,026,803	4
San Bernardino	1,999,332	5
Santa Clara	1,731,281	6
Alameda	1,457,426	7
Sacramento	1,374,724	8
Contra Costa	1,024,319	9
Fresno	891,756	10
Total Top 10	26.397,224	

Source: California Department of Finance

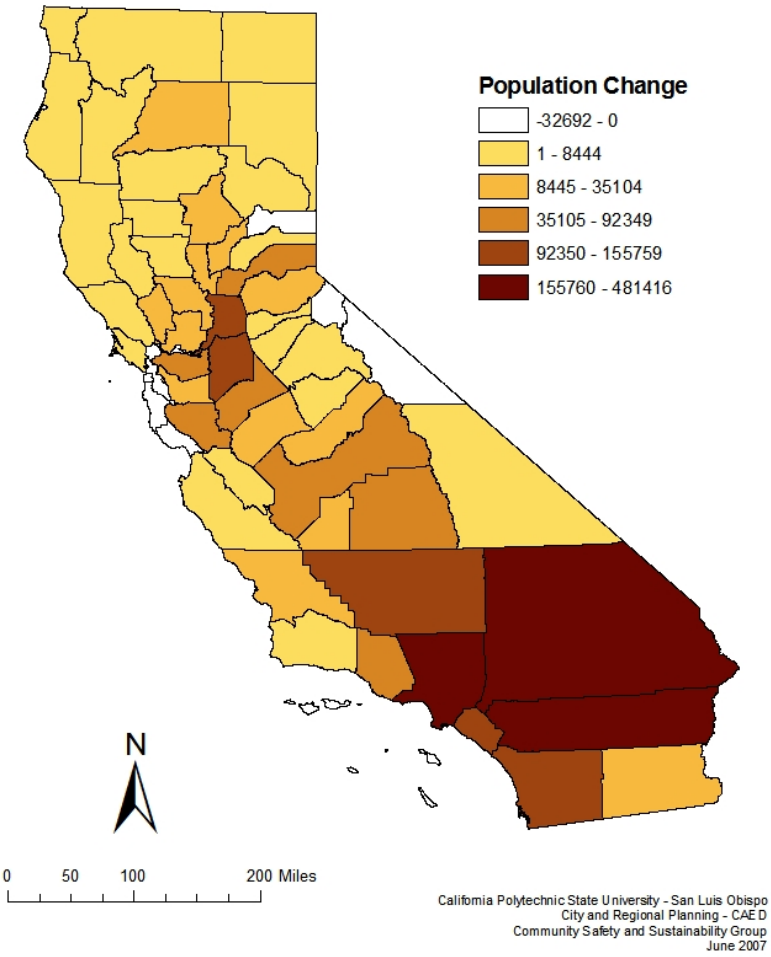
3. As shown in Table 4.3C, the top counties in numerical growth accounted for over 2 million additional people between 2000 and 2006, or nearly 57% of California's total population growth of 3.5 million. This ranged from over 400,000 new residents in Riverside and Los Angeles County to somewhat under 100,000 new residents in Fresno and Placer Counties.

Table 4.3C Top 10 Counties Population Growth 2000 to 2006

County	Population Change 2000-2006	Rank
Riverside	481,416	1
Los Angeles	428,743	2
San Bernardino	289,898	3
Orange	155,759	4
Sacramento	151,225	5
San Diego	127,621	6
Kern	118,472	7
San Joaquin	109,572	8
Fresno	92,349	9
Placer	77,843	10
Total Top 10	3,544,335	

Source: California Department of Finance

Map 4.3B Population Change by County, 2000-2006



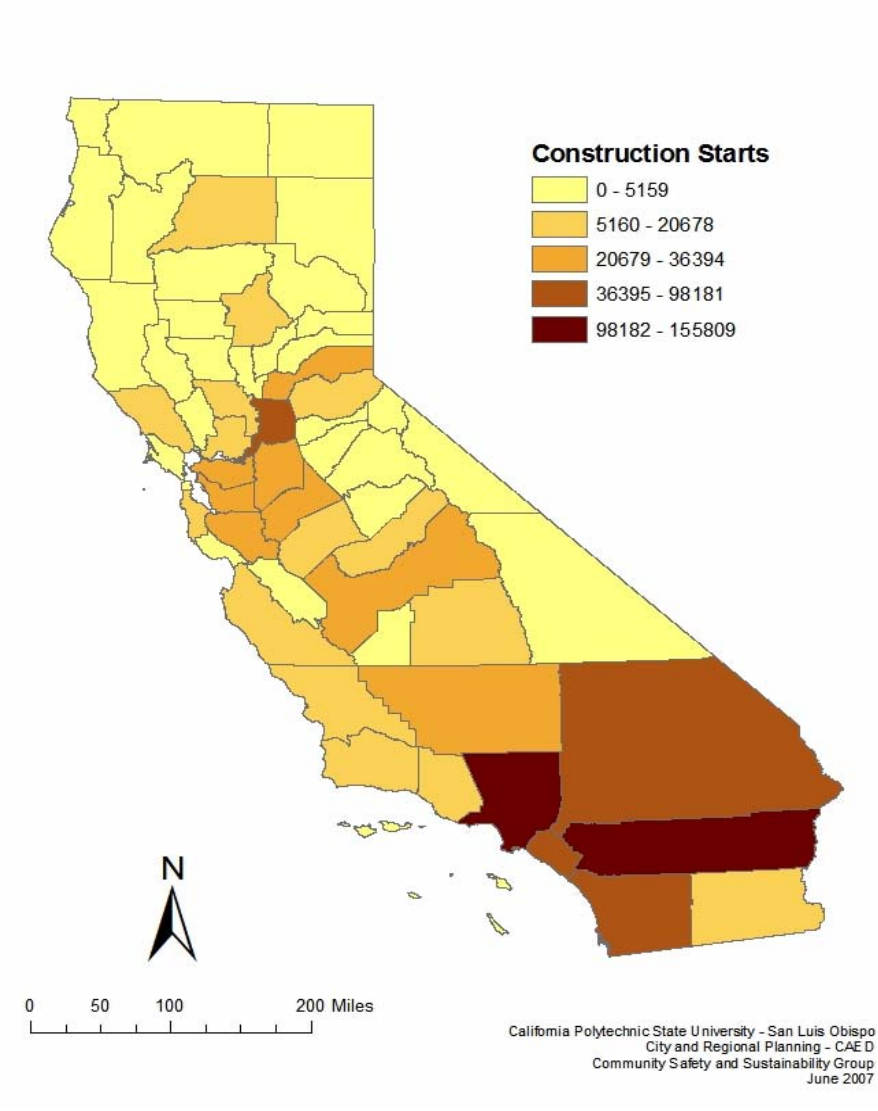
4. Table 4.3D on the following page shows data for the top 10 counties in total residential construction starts, including single family and multi-family, from 2000 to 2006. Highest growth took place in the southern counties of Riverside, Los Angeles, San Diego, San Bernardino, and Orange, as well as in the S.F. Bay Area and Central Valley counties of Sacramento, Santa Clara, San Joaquin, and Contra Costa.

Table 4.3D Top 10 Counties Residential Construction Starts 2000 to 2006

County	2000	2001	2002	2003	2004	2005	Total
Riverside	15,410	19,014	22,664	30,361	34,226	34,134	155,809
Los Angeles	17,071	18,253	19,364	21,313	26,935	25,647	128,583
San Diego	15,927	15,638	15,738	18,314	17,306	15,258	98,181
San Bernardino	6,580	8,527	10,616	12,640	18,470	16,684	73,517
Sacramento	7,750	9,434	12,854	13,833	12,962	9,749	66,582
Orange	12,367	8,646	12,020	9,311	9,322	7,206	58,872
Santa Clara	7,054	5,960	4,513	7,490	5,505	5,872	36,394
San Joaquin	5,323	4,399	6,280	6,952	6,886	6,272	36,112
Contra Costa	5,639	5,136	5,805	6,895	5,483	6,312	35,270

Source: California Department of Finance

Map 4.3C Construction Starts by County, 2000-2006

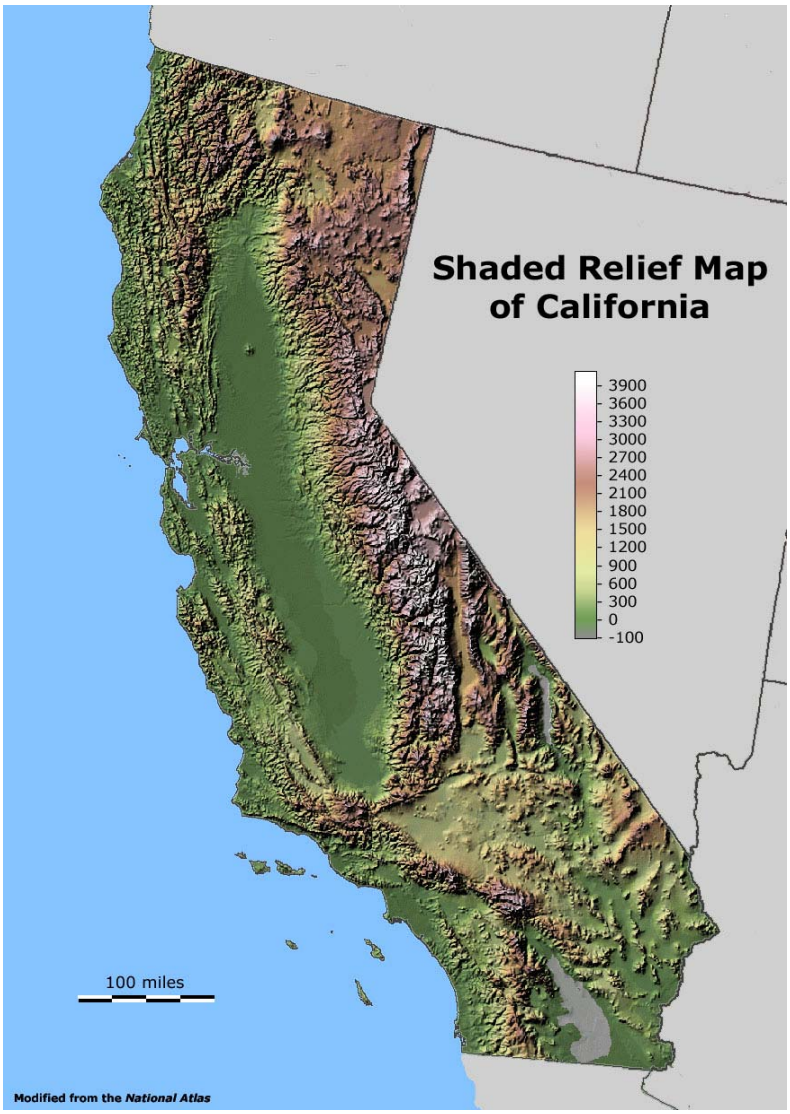


Comment On: Chapter 4 Section 4

4.4 Geography

With an area of 158,869 square miles, California is the third largest state in the country. It is a land of great geographic diversity, with many striking natural features. The state's 1,100 miles of coastline is home to several major cities, including San Francisco, Los Angeles, and San Diego. Down its center lies the Central Valley, a huge, fertile valley bound by the coastal mountain ranges in the west, the Sierra Nevada to the east, the Cascade Range in the north, and the Tehachapi Mountains in the south. Mountain-fed rivers naturally irrigate the Central Valley. With dredging, a number of these rivers have become sufficiently large and deep so that several inland cities, most notably Stockton, are harbor communities.

Map 4.4A. California Relief Map



Source: USGS

Map 4.4A depict the general topographic features comprising the physical regions of California. Colors depict elevations in relation to sea level. Prominent features include the Pacific Coast, Sierra Nevada range, between which lies the Central Valley.

The Sierra Nevada range runs much of the length of California's eastern border. Located in the Sierras are Mount Whitney, the highest peak in the continental U.S. at 14,495 feet, Yosemite National Park, and Lake Tahoe. To the east of the Sierras are the Owens Valley and Mono Lake, which are environmentally significant as habitat essential to birds.

The south portion of the State has the Transverse Ranges, one of the few east-west trending ranges in the country, the Mojave Desert, and Death Valley, which at 282 feet below sea level contains the lowest point in North America and at 134 degrees has the hottest recorded temperature in the U.S.

Comment On: Chapter 4 Section 5

4.5 Climate

Climates in California vary depending on latitude, elevation, and proximity to the coast. Most of the state has rainy winters and dry summers. The influence of the ocean generally creates cooler summers and warmer winters along the coast, along with summer fog. Further to the east, communities experience hotter summers and colder winters. Winds from the ocean carry moisture to the northern parts of the state, which generally receive more rainfall than the south. California's mountain ranges influence the climate as well. Moisture-laden air from the west cools as it ascends the mountains, dropping moisture. Some of the rainiest parts of the state are west-facing mountain slopes.

High desert climates are found east of the Sierra Nevada and the Transverse and Peninsular ranges of southern California. The low deserts east of the southern California mountains, including the Imperial and Coachella valleys and the lower Colorado River basin, are part of the Sonora Desert, with hot summers and mild winters. The higher elevation deserts of eastern California, including the Mojave Desert, the Owens Valley, and the Modoc Plateau, are part of the Great Basin region and experience hot summers and cold winters.

Comment On: Chapter 4 Section 6

4.6 Rivers and Watersheds

The Sacramento and San Joaquin rivers and their tributaries, which drain the Central Valley, form California's principal river systems. The Sacramento, the longest river in the state, flows south for 377 miles from its source at the base of Mount Shasta in the southern Cascade Mountains to its junction with the San Joaquin. The Pit River is the longest tributary of the Sacramento, although shorter tributaries, such as the Feather and American rivers, carry larger volumes of water. The San Joaquin River forms in the Sierra Nevada near Yosemite National Park and flows north for 350 miles before joining the Sacramento River. The Sacramento and San Joaquin rivers unite to form a large inland delta that drains into Suisun Bay, the eastern arm of San Francisco Bay. Numerous mountain streams descend from the Sierra Nevada to join the two rivers.

The rivers of California's Coast Ranges are relatively short except for the 250-mile Klamath River which rises in Oregon and flows through the northwestern portion of the state. The Salinas River takes form in the Coast Ranges and flows northwest through a broad fertile valley to Monterey Bay. The Colorado River is the major river in southern California, following the Arizona-California state line before flowing into the Gulf of California, in Mexico.

California has several thousand lakes, most of which are small. The largest is the Salton Sea, a salty lake in the southeast corner of the state that lies 233 feet below sea level and covers 364 square miles. Lake Tahoe, high in the Sierra Nevada on the California-Nevada state line, is one of the deepest lakes in the United States and covers 191 square miles.

The damming of rivers has created numerous other lakes. These include Folsom Reservoir on the American River, Lake Oroville on the Feather River, and Pine Flat Reservoir on the Kings River, all in the Sierra Nevada, as well as Clair Engle Lake on the Trinity River in the Klamath Mountains. Shasta Lake, behind Shasta Dam on the upper Sacramento River, is the largest reservoir in the state and, along with Clair Engle and Whiskeytown Lakes, forms one of the largest national recreation areas in the nation.

Comment On: Chapter 4 Section 7

4.7 Geology

California sits on two major tectonic plates, the North America Plate and the Pacific Plate. The Pacific Plate is currently moving north, scraping along the edge of the North American Plate. The frequently violent interactions of these two plates are responsible for most of California's rugged geologic features. As magma seeped up from the subduction zone between the two plates, a massive pool of granite was created that slowly cooled, forming batholiths. These batholiths have been rising, pushing upwards along faults that run along the edge of the Sierra Nevada. This violent upward movement was demonstrated in 1872 when a massive earthquake near Lone Pine caused upward thrusts of 20 feet or more.

The infamous San Andreas Fault is a lateral strike-slip fault that begins along the north coast of California, passes adjacent to San Francisco, runs east of Los Angeles, and branches into Mexico. As the two plates slide past one another, tension builds and potential energy is stored until something gives, releasing massive amounts of energy in the form of an earthquake. Earthquakes have claimed the lives of more than 3,000 Californians in the past two centuries. The San Andreas is not the only active fault in California. The state is laced with numerous faults that can cause earthquakes.

Comment On: Chapter 4 Section 8

4.8 Forest Resources

Forests cover 40 percent of California's land area. California usually ranks third in the nation in terms of timber and lumber output. Lumbering is the chief economic activity in the Sierra Nevada and in northwestern California. About two-fifths of the forestland in the state is classified as commercial forest. The United States Forest Service manages more than half of these commercial forests

The most densely forested areas are the Klamath Mountains, the Coast Ranges north of San Francisco, and the Sierra Nevada. Tree growth is heaviest on the wet, westward-facing slopes. The coast redwood grows in dense forests on the lower mountain slopes along the coast between the Santa Lucia Range south of Monterey Bay and the Oregon state line. Redwoods in California grow in pure stands and also with Douglas fir, canoe cedar, and Port Oxford cedar. Douglas fir is predominant on slopes immediately above the redwood areas. Further inland the Douglas fir forests give way to a more open forest of deciduous trees, such as tan oak, madrone, Oregon maple, California bay tree, and several species of oak. In the Klamath Mountains and Coast Ranges above 5,000 feet, ponderosa pine predominates.

Map 4.8A California Parks and Public Lands

Source: USGS

The giant Sequoia grows in groves at somewhat higher elevations along the western slopes of the Sierra Nevada in what is known as the yellow pine belt. The yellow, or ponderosa, pine is the most valuable commercial conifer logged in the Sierra, and thrives at elevations between 3,000 to 8,000 feet. Above the pine forests are stands of red fir and Jeffrey pine. They give way above 9,000 feet to Lodgepole pine, Engelmann spruce, and other firs.

South of San Francisco and on the low mountain slopes of the Central Valley, grasslands, mixed evergreens and broadleaf species and areas of shrub growth predominate. The golden poppy, the state flower, grows abundantly in the Central Valley. Grasses and sedges also form meadows above 11,500 feet, the timberline, in the Sierra Nevada. The mixed evergreen and broadleaved woodlands occupy the low western slopes of the Sierra Nevada and extensive areas in the Coast Ranges inland from the coast. These relatively open woodlands include oak, pine, and juniper. Large areas of the uplands along the southern coast are covered with chaparral, a low, and in places almost impenetrable, shrub growth of manzanita, mountain mahogany, California scrub oak, chamise, buckbrush, and other evergreen species. The lower western slopes of the Sierra Nevada are covered partly with chaparral.

The 18 national forests in California cover about 20.6 million acres. Within the national forests are a number of wilderness areas and wildlife refuges. Los Padres National Forest, the largest national forest wholly within the state, covers 1,700,000 acres in western California. Most of the other larger national forests in California lie in the northern and northeastern parts of the state. Shasta-Trinity national forest, in northern California, lies in a volcanic area and includes Mount Shasta. The Six Rivers National Forest, noted for its groves of redwoods, can be found in the northern coastal uplands. Along California's eastern border are the Plumas, Tahoe, El Dorado, Stanislaus, and Inyo national forests. Sierra National Forest, in the Sierra Nevada region, preserves stands of giant Sequoias.

Comment On: Chapter 5

Chapter 5 - Hazard, Vulnerability, and Risk Assessment

Part 1 – Risk Assessment Overview

Part 1 Organization

5.0 Chapter Summary
5.1 State and Federal Disaster History
- 5.1.1 Statewide Disaster Loss Findings
- 5.1.2 Primary Sources of Disaster Losses
- 5.1.3 Criteria for Hazards and Vulnerability Assessment

5.2 Terminology
- 5.2.1 Hazard
- 5.2.2 Vulnerability
- 5.2.3 Risk
- 5.2.4 Disaster
- 5.2.5 Natural and Human-Caused Disasters
- 5.2.6 Mitigation
- 5.2.7 Preparedness
- 5.2.8 Response
- 5.2.9 Recovery

5.3 Climate Change an Emerging Issue
- 5.3.1 International Panel on Climate Change
- 5.3.2 California Initiatives
- 5.3.3 Implications for Hazard, Vulnerability, and Risk Assessment

Comment On: Chapter 5 Section 0

5.0 Chapter Summary

Disasters have increased rapidly in California since 1950. Losses peaked in the 1990s with the 1994 Northridge Earthquake, but disaster events continue to rise. Statistical analysis of disasters sources confirms that earthquakes, floods, and wildfire hazards are pervasive and primary determinants of disaster losses.

Among the three primary hazards earthquakes represent the least frequent source but account for the greatest combined losses (deaths, injuries, and damage costs) in state and federally declared disasters. Floods are the second most frequent disaster source, accounting for the second highest combined losses. Wildfires are the most frequent source of declared disasters, but account for the third highest combined losses. Of the three primary hazards, earthquakes are by far the deadliest disaster source.

A GIS-based hazard risk exposure analysis undertaken to compare hazards, vulnerability, and risk in various California counties reveals the following findings.

- Earthquake shaking hazards represent a threat to heavily populated counties in southern California, the San Francisco Bay area, Delta region, Central Valley, and along the Pacific Coast.
- Flood risks affect threaten populations in the Central Valley, especially in the Delta region, and well as in southern California and the San Francisco Bay area.
- Wildfire hazard risk exposure is generally pervasive in mountainous regions, with high concentrations in southern California.
- Population growth between 2000 and 2006 occurred largely within counties having substantial concentrations of vulnerable populations exposed to high and medium risk from multiple hazards.

Seismic shaking during earthquakes has long been recognized as the main threat to structures and people. Strong earthquakes of Magnitude 6 to 6.9 strike on an average of once every two to three years. An earthquake of this size, such as the 1994 Northridge Earthquake (M6.7) is capable of causing major damage if the epicenter is near a densely populated area. For example, the Northridge Earthquake caused over $40 billion of direct and indirect disaster losses, 57 deaths, and 11,846 injuries. Major earthquakes (M7 to 7.9) occur in California about once every ten years. If they strike populated areas they can cause great damage and harm.

Building codes have been the main mitigation tool for mitigating the effects of seismic shaking for most buildings. Earthquake hazard mitigation efforts in California have been focused on certain key categories of structures and impacts.

- Unreinforced masonry (URM) buildings – risk to life from URM building collapse can be significantly reduced by seismic retrofits. Since 1986, when California passed a law requiring local governments in high seismic regions nearest active faults to inventory their URM buildings. As of 2007, 93% of local jurisdictions have complied with the law's provisions, and 70% of all URM buildings have been mitigated.
- Public school buildings – since 1933, public schools have been constructed in accordance with the Field Act, which requires thorough reviews of construction plans, strict inspections, and quality control. Nearly all public schools built before the Field Act were retrofitted or were no longer being used for instructional purposes as of the late 1970s.
- Steel frame and high rise buildings – after the Northridge Earthquake, the City of Los Angeles enacted an ordinance that required the repair of existing damaged steel frame buildings. Although there are no statewide requirements for retrofitting or post-disaster repair of such buildings, the state has since strengthened provisions of its building code for new steel frame buildings. The economic stakes are high for mitigation of such buildings because much of California's corporate, finance, legal and insurance commerce takes place within them.
- Mobile homes – performance of pre-1994 mobilehomes in California earthquakes is significantly worse during an earthquake than for conventional wood-frame dwellings. Mobile homes on inadequate foundations can shift and fall several feet in earthquakes, severing gas lines. Doors can become stuck, trapping occupants and

creating serious threats to life in events with fires. Since 1994, the state has required new or relocated mobile homes to be braced to resist earthquakes.

- Hospitals – since 1973, hospitals have been required to be built to higher standards than other buildings so that they can be reoccupied after major earthquakes. However, most hospitals built before 1973 still remain in service, some of which pose risks to life or are not expected to be available for occupation after future earthquakes, when especially needed.
- Utilities and transportation – although there is no statewide inventory of earthquake resistance of utilities, various utility groups have collected data on the performance of utilities and transportation systems after earthquakes in California and new standards and guidelines have been developed for power plants, electrical transmission and distribution systems, natural gas pipelines, water supply lines (including canals and aqueducts), and seismic retrofit projects. Caltrans and local governments have been retrofitting bridges using new design techniques and new standards and guidelines.
- Earthquake mitigation investments – estimated expenditures on earthquake hazard mitigation to date total over $18.9 billion. Selected future state seismic hazard mitigation commitments amount to over $35 billion.

Floods are next in overall magnitude of disaster losses. Since 1950, the state has had 32 state declared flood disasters and 18 federally declared flood disasters. Since 1992, every county in California has been declared a federal disaster area at least once for a flooding event. The standard references for establishing the location of flood hazards are the FEMA Flood Insurance Rate Map (FIRM) designated floodplain maps under the National Flood Insurance Program (NFIP). In 2000, over 5 million people lived in a FIRM-designated floodplain (15% of total population) and nearly 2 million lived in the 100-yr floodplain (5.8% of total population). The repetitive nature of flood damage causes the greatest concern. FEMA has identified California's top Repetitive Loss (RL) communities, which together account for 84 percent of the state's total NFIP losses, many of which are outside FIRM-designated floodplains. Under the Flood Insurance Act, the Flood Mitigation Assistance (FMA) program assists states and local communities in implementing flood hazard mitigation measures before a major flood disaster occurs. The state seeks to reduce repetitive flood losses by encouraging communities to participate in the FMA planning process to bring about the greatest reduction of losses in the most vulnerable areas.

A third primary hazard is wildfire. Wildfires are costly, putting lives and property at risk and compromising watersheds, open space, forests, recreation, wildlife, historic and cultural assets, and local economies. Wildfire risk is predominantly associated with Wildland-Urban Interface (WUI) areas. WUI is a general term that applies to development interspersed or adjacent to landscapes that support wildland fire. Development in California has led to high-risk WUI communities amid the state's fire dependant landscapes.

Despite increased fire agency staffing, equipment, and training, 7 of the 10 most destructive wildfires in California history have occurred in the last 15 years, resulting in the loss of 53 lives and almost 12,000 homes. The 2003 southern California fires alone

burned approximately 750,000 acres, killed 22 people, consumed over 4,800 homes, and cost $1.3 billion to suppress. As a result of the 2003 southern California fires state law was changed to increase mandatory vegetation clearance around homes from a previous standard of 30 feet to a current standard of 100 feet in all designated areas where the State has primary suppression responsibilities. These new standards have the potential to significantly reduce the losses caused by wildfire.

From this risk assessment the need for accelerating pre-disaster mitigation of earthquakes, floods, and wildfires is clear. However, the need also exists to address other related risks from secondary hazards—levee failure, tsunamis, and landslides—all of which can result from earthquakes.

Most levees in California are in the San Francisco Bay Delta region and for the most part protect land that is at or below sea level. Built since the late 1800s to protect or reclaim floodplains for agricultural purposes, the levees were not engineered until about the 1940's-1950's. After that, the Army Corp of Engineers (USACE) endeavored to reengineer older levees and build new levees to increasing design standards. Levees are susceptible to failure during earthquakes through liquefaction of levees founded on granular or sandy soils. Non-seismic concerns include sufficient levee height to withstand peak flows, armoring against toe or face erosion, preventing detrimental seepage through and beneath levees, and mitigation against degradation. A vote of the people in November 2006 resulted in an initial commitment of $3.275 billion in the Central Valley and the Delta for conducting urgent repairs and improvements on state-federal flood project facilities. However, levee hazard mitigation must be conducted on a system-wide basis. Like a chain, a levee system is only as strong as its weakest "link." More investment in levee strengthening will be needed over time to substantially mitigate threat of failure.

Landslides represent another serious secondary hazard in California. A landslide is the breaking away and gravity-driven downward movement of hill slope materials, which can travel at speeds ranging from fractions of an inch per year to tens of miles per hour depending on the slope steepness and water content of the rock/soil mass. Landslides range from the size of an automobile to a mile or more in length and width and due to their shear weight and speed can cause serious damage and loss of life. Landslides are pervasive in California's mountainous terrain, and occur far more often than earthquakes. Average annual landslide losses in California are estimated at about $100 million.

Tsunamis are another category of secondary hazards. A tsunami is a large ocean wave triggered by any form of mass movement below the ocean surface, either from submarine landslides or earthquake fault rupture that results in seafloor movement. A report issued by the California Seismic Safety Commission in 2005 states that tsunamis pose a significant threat to life and property in California and points out that losses from tsunamis can be reduced by creating more damage-resistant buildings and port structures, public education on what to do, warning systems to alert a population a tsunami is coming from a distant source, and effective evacuation planning.

A new category of hazards addressed in this Plan are those which are climate-related. In 2006 the California legislature passed and the Governor signed Assembly Bill 32, known as the California Global Warming Solutions Act of 2006, calling for development of regulations and market mechanisms reducing California's greenhouse gas emissions by 25 percent by 2020. In coming decades natural disasters will intensify due to climate change. Disasters expected to be more widely experienced in the future include: avalanches, coastal erosion, flooding, and sea level rise; extreme heat and prolonged drought; mudslides and landslides; severe weather and storms; and wildland fires.

Finally, a variety of additional hazards threaten life and property in California: dam failure, energy shortage, epidemics, hazardous materials releases, insect pests, marine invasive species, radiological accidents, terrorism, and volcanoes. Each of these hazards has applicable mitigation measures either planned or being implemented.

Comment On: Chapter 5 Section 1

5.1 State and Federal Disaster History

Federal regulations require that each state undertake a risk assessment of the hazards and vulnerabilities that affect it to provide a factual basis for developing a hazard mitigation strategy. The risk assessment helps to prioritize risks, jurisdictions, and geographic areas to receive funding and technical assistance for conducting more detailed local risk and vulnerability assessments and mitigation planning.

The risk assessment in this Plan consolidates, updates, and streamlines content from the 2004 SHMP. Content has been restructured to cover a wide range of emerging hazard, vulnerability, and risk issues. The 2007 SHMP risk assessment integrates these materials within a new framework structured in four parts.

Comment On: Chapter 5 Section 1.1

5.1.1 Statewide Disaster Loss Findings

Over the past five decades, disasters and corresponding losses have grown rapidly, as has California's post-World War II population. Table 5.1.1A below shows overall increases in state emergency proclamations and federal disaster declarations from 1950 to the present. These figures show disaster losses, including casualties and OES-administered disaster costs increasing each decade and peaking in the 1990s, reflecting the impacts of the 1994 Northridge Earthquake. Although it is too soon to draw conclusions for the present decade, disaster events have continued to increase since 2000. Table 5.1.1B on the following page identifies disaster incidents, casualties, and OES costs by type. OES has revised the database from which the following summary tables were drawn during the revision of this Plan in an effort to continuously improve disaster history data.

Table 5.1.1A Trends in Disaster Incidents and Losses by Decade, 1950-2007

Year	State Proclamations	Federal Declarations	Deaths	Injuries	OES-Administered Costs[1]
1950 – 1959	8	3	100	25	$332,283,000
1960 – 1969	32	12	99	1,224	806,931,196
1970 – 1979	63	18	246	2,226	4,207,670,330
1980 – 1989	61	23	210	5,245	3,690,093,888
1990 – 1999	50	19	224	15,592	9,277,209,362
2000 - 2007	43	74*	7*	0*	1,019,812,085
Total	257	149	886	24,312	$19,333,999,860 [2]

Source: OES database
**Figures to be checked by OES.*

[1] The figures in this column show only OES-administered certain disaster costs, such as Individual and Household (IA), Public Assistance (PA), Fire Management Assistance Grants (FMAG), and Community Disaster Assistance Act costs, together with certain Small Business Act and Individual Assistance (IA) costs. These reflect only a portion of total disaster costs when taking into account other government-funded housing, transportation, and economic development costs, plus insurance and business interruption costs.
[2] Disaster costs reflect actual estimates at the time of incidents and have not been adjusted for inflation through normal means such as applying the Consumer Price Index get equivalent values.

Table 5.1.1B Disaster Emergencies, Casualties and Costs by Type, 1950-2007

Disaster Type	Emergencies	State Procl'ns	Federal Decl'ns.	Deaths	Injuries	OES-Administered Costs [3]
Wildfire	128	61	83	74	1,258	$2,092,991,622
Flood	120	111	45	292	759	4,813,564,327
Earthquake	21	19	12	191	18,962	8,059,421,902
Agricultural	18	17	0	0	0	389,895,974
Freeze	9	8	4	0	0	1,025,734,520
Landslide	8	7	1	0*	0*	51,967,236
Economic	7	6	2	0	0	33,587,001
Civil Unrest	6	6	1	85	3,331	167,722,732
Drought	5	5	0	0	0	2,686,858,480
Hazardous Materials	5	3	0*	0*	0*	0*
Wind	3	3	0	0	0	82,100
Air Disaster	2	2	0	232	2	0
Facility	2	2	0	0	0	654,897
Road Damage	2	2	0	0	0	396,521
Tsunami	2	2	1	12	0	10,000,000
Invasive Species	1	1	0	0	0	0
Snow	1	1	0	0	0	1,122,549
Tornado	1	1	0	0	0	0
Total	341	257	149	886	24,312	$19,333,999,860

Source: OES database
**Figures to be checked by OES.*

For a detailed account of the data in the preceding tables, see Table 5.1.1C in the 2007 SHMP Appendix.

[3] As noted for Table 5.1.1B, figures in this column show only certain post-disaster recovery costs such as IA, PA, and FMAG grants, which together reflect only a portion of total disaster costs. For example, direct and indirect costs of the Northridge Earthquake have been estimated at $48 billion (Petak, W. and Elahi, S. "The Northridge Earthquake, USA and Its Economic and Social Impacts." *Conference Paper*. EuroConference on Global Change and Catastrophe Risk Management: Earthquake Risks in Europe, IIASA, Luxemburg, Austria, July 6-9, 2000).

Comment On: Chapter 5 Section 1.2

5.1.2 Primary Sources of Disaster Losses

From Table 5.1.1B, the following findings on relative frequency and severity of disasters by hazard type are evident which shows disaster emergencies and losses by types since 1950.

1. Earthquakes occur less frequently than the other primary hazards, but account for greatest combined losses (deaths, injuries, and damage costs).

2. Floods are the second most frequent disaster source, and account for the second highest combined losses.

3. Wildfires are the most frequent source of declared disasters, and account for the third highest combined losses.

4. Earthquake costs exceeded wildfire costs by four times, using limited measures identified in these tables.

5. Earthquakes represent the highest number of casualties of the three primary hazards. Although cumulatively floods have resulted in a greater number of total deaths, earthquakes can result in a greater number of deaths and injuries per event.

From the preceding analysis it is clear that these three hazards were predominant among the sources of disaster declarations since 1950: earthquakes, fires, and floods. These are referred to in this risk assessment as "primary hazards." These findings explain the basis for past preparation of hazard-specific statewide mitigation plans for each of these primary hazards, and focus attention to the analysis in Part 2 – Primary Impact Hazards.

Catastrophic Earthquake Potential

Earthquake hazard mitigation is particularly relevant to Plan Goal 1, reduction of deaths and injuries, and Plan Goal 2, avoiding structural and property damage, and minimizing disruption of essential services and human activities, as set forth in Chapter 3. In light of both the social and economic disruption caused by moderate-sized earthquakes, together with the significant potential for catastrophic disasters posed by earthquakes far greater in magnitude than those experienced since 1950, heightened attention is needed to mitigation strategies relating to this particular hazard.

Comment On: Chapter 5 Section 1.3

5.1.3 Criteria for Hazards and Vulnerability Assessment

Why Hazards Were Included in This Risk Assessment

This risk assessment encompasses a wide variety of hazards which can cause disasters. It has been reorganized on the basis of a series of hazard impact criteria:

- Levels of loss (life, structures and property, environment),
- Geographic extent,
- Frequency and return periods,
- Mitigation potential.

From this review this chapter has been structured to reflect three classes of hazards:

- Primary hazards, including earthquakes, floods, and wildfires;
- Secondary hazards, including levee failure, landslides, and tsunamis;
- Additional hazards, including the potential effects of climate change, an emerging hazard condition with far reaching implications.

Primary hazards were so identified for several key reasons:

- They have historically caused significant human and/or monetary losses;
- Past events have led to the development of hazard mitigation recommendations;
- They have the potential to cause significant human, property, and/or monetary losses in the future.

Standard Risk Assessment Text Template Categories

Throughout Chapter 5, an effort is made to utilize standard FEMA hazard and risk assessment criteria:

- Identifying the hazard – i.e., what are its main characteristics?
- Profiling the hazard – i.e., where is it found, with what effects?
- Assessment of state vulnerability and potential loss to the hazard – i.e., what kinds of populations and facilities are at risk?
- Assessing vulnerability by jurisdiction – in this update, a GIS multi-hazard risk assessment by counties is included in Chapter 5, Part 2;
- Assessment of local vulnerability and potential loss to the hazard – in this update, a preliminary set of findings regarding local vulnerability and potential loss are included from Local Hazard Mitigation Plans;
- Current hazard mitigation efforts – FEMA's criterion;
- Opportunities for enhanced hazard mitigation – an added category looking to the future.

5.2 Terminology

One of the difficulties in mitigation planning is confusion over the meaning of the terms. During the 2004 SHMP update process, special attention has been given to terminology used in the Plan for the purpose of standardization. The following discussion identifies key terms, their working definitions, and their expanded meanings found in references consulted during exploration of this issue.

The following working definitions are described briefly, and accompanied by alternative definitions lending additional meaning from the law and natural hazards literature. One important source for these working definitions is a training handbook prepared by FEMA and the American Planning Association (APA).[4]

[4] "Planning for a Disaster-Resistant Community" AICP Professional Development Workshop Handbook, APA 2007 National Conference in Philadelphia, Pennsylvania, April 2007.

Comment On: Chapter 5 Section 2.1

5.2.1 Hazard

For purposes of this Plan, the term "hazard" means an event or physical condition that has the potential to cause fatalities, injuries, property damage, infrastructure damage, agricultural losses, damage to the environment, interruption of business, or other types of harm or loss.

Comment On: Chapter 5 Section 2.2

5.2.2 Vulnerability

For purposes of this Plan, the term "vulnerability" broadly means the level of exposure of human life and property to damage from natural and manmade hazards.

Cutter, Boruff, and Shirley expand broader definition with a discussion of social vulnerability which they describe as partially the product of social inequalities—those social factors that influence or shape the susceptibility of various groups to harm and that also govern their ability to respond, as well as the product of place inequalities—those characteristics of communities and the built environment, such as the level of urbanization, growth rates, and economic vitality, that contribute to the social vulnerability of places.[5]

Tierney expands on this vulnerability perspective noting that disasters result not only from physical agents, but from a combination of three factors:

(1) Disaster agent – whether a hurricane, earthquake, tornado, or some technological or human-induced event;
(2) Physical setting affected by the disaster, including
    (a) characteristics of the built environment (e.g., structures not built to survive the physical impact of the disaster agent) and
    (b) environmental features that serve to either mitigate the effects of disasters or make them more severe (e.g., diminished wetlands that could have cushioned the impacts of Katrina); and
(3) Population vulnerability, a complex construct that includes such factors as:
    (a) proximity to physical disaster impacts;
    (b) material resources (e.g., income and wealth);
    (c) race, ethnicity, gender, age;
    (d) knowledge concerning recommended safety measures; and
    (e) factors associated with social and cultural capital, such as routine involvement in social networks that can serve as conduits for information and mutual aid, as well as knowledge that enables community residents to interact successfully with mainstream societal institutions.

[5] Cutter, S.; B. Boruff and W. L. Shirley. 2003. "Social Vulnerability to Environmental Hazards," *Social Science Quarterly* 84 (1):242-261.

Tierney further notes that human populations are also made vulnerable by steps their governments and institutions take (or fail to) to protect them before and after disasters strike.[6]

Comment On: Chapter 5 Section 2.3

5.2.3 Risk

For purposes of this Plan, the term "risk" means the potential losses associated with a hazard, defined in terms of expected probability and frequency, exposure, and consequences.[7]

The International Standards Organization defines the term "risk" as the combination of the probability of an event and its consequences, where:

- Probability is the extent to which an event is likely to occur;
- Event is the occurrence of a particular set of circumstances;
- Consequences are the outcome of an event. [8]

Comment On: Chapter 5 Section 2.4

5.2.4 Disaster

For purposes of this Plan, the term "disaster" means a major detrimental impact of a hazard upon the population and the economic, social, and built environment of an affected area. Note that a variety of other definitions of the term "disaster" are found in the natural hazards literature and the law, including the following:

> …an event concentrated in time and space, in which a society or one of its subdivisions undergoes physical harm and social disruption, such that all or some essential functions of the society or subdivision are impaired…[9]

> …the occurrence of a sudden or major misfortune which disrupts the basic fabric and normal functioning of a society (or community)… [10]

For declaring a disaster at the federal level, the Stafford Act provides the following definition of the term "major disaster":

> …any natural catastrophe (including any hurricane, tornado, storm, high water, wind-driven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm, or drought), or, regardless of

---

[6] Tierney, K. 2006. "Foreshadowing Katrina: Recent Sociological Contributions to Vulnerability Science". *Contemporary Sociology: A Journals of Reviews* 35 (3):207-212.

[7] Schwab, J., K. C. Topping, C. C. Eadie, R. E. Deyle and R. A. Smith. 1998. Planning for Post-Disaster Recovery and Reconstruction. American Planning Association, Planning Advisory Service. Report No. 483/484.

[8] International Organization for Standardization (ISO). 2002. *Risk Management – Vocabulary – Guidelines for Use in Standards*. ISO/IEC Guide 73ISO. Geneva, Switzerland: Central Secretariat.

[9] Fritz, Charles. "Disaster" pp. 651-694 in *Contemporary Social Problems*, R.K. Merton and R.A. Nisbet, eds. New York: Harcourt Press, 1961.

[10] Coburn, A. W., R. J. S. Spence, A. Pomonis. *Vulnerability and Risk Assessment*. 2nd edition. Cambridge Architectural Research Limited. United Nations Disaster Management Training Programme, 1994.

> cause, any fire, flood, or explosion, in any part of the United States, which in the determination of the President causes damage of sufficient severity and magnitude to warrant major disaster assistance under this Act to supplement the efforts and available resources of states, local governments, and disaster relief organizations in alleviating the damage, loss, hardship, or suffering caused thereby... [11]

Note that the term "catastrophe" in the Stafford Act definition implies an event of a magnitude exceeding available local and state response and recovery resources. In more recent history, the term "catastrophic" has been redefined by events such as the 9/11 World Trade Center disaster and Hurricane Katrina to mean disasters large enough to stretch national resources.

Comment On: Chapter 5 Section 2.5

5.2.5 Natural and Human-Caused Disasters

For purposes of this Plan, the term "natural disaster" refers to destructive events involving natural forces such as droughts, earthquakes, floods, hurricanes, landslides, mudslides, storms, tornados, tsunamis, high or wind-driven waters, wildfires, and volcanic eruptions.

By contrast "human-caused" disasters, such as acts war and acts of terrorism, are usually distinguished from natural disasters because of the underlying human motivation to destroy.

"Technological" disasters, such as airplane crashes, dam failures, hazardous materials spills, major truck transportation accidents, and rail oil spills, nuclear accidents, and radiological releases are also distinguished from natural disasters because of the technological agents involved.

However, distinctions between human-caused, technological and natural disasters are artificial when taking into account the human decisions underlying settlement patterns which conflict with natural hazards. For example, Hurricane Katrina on the Gulf Coast was both a natural and human-caused disaster involving the construction of urban areas over time in naturally hazardous areas below sea level, compensated only partially by construction of inadequate levees. To the extent that disaster losses could be made preventable through mitigation, natural disasters can also be considered human-caused.

Comment On: Chapter 5 Section 2.6

5.2.6 Mitigation

For purposes of this Plan, the term "mitigation" means sustained action taken to reduce or eliminate the long-term risk to human life and property from natural, human-caused, and technological hazards and their effects. Note that this emphasis on long-term risk distinguishes mitigation from actions geared primarily to emergency preparedness and short-term recovery.

[11] Public Law 93-288 of 1988, the Robert T. Stafford Disaster Relief and Emergency Assistance Act.

Mitigation is one of four basic phases of disaster management, the other three including preparedness, response, and recovery. Mitigation is predicated on the principles that many losses are preventable through better community design and that each event should teach us how to reduce losses in the next disaster.

Mitigation generally means reducing long-term risk from hazards to acceptable levels through predetermined measures accompanying physical development, for example: strengthening structures to withstand earthquakes; prohibiting or limiting development in flood-prone areas; designing streets with sufficient pavement width to provide for two-way movement for emergency access and evacuation; installing emergency water and power backup systems.

Mitigation is different from emergency preparedness. The latter concentrates on activities which make a person, place, or organization ready to respond to a disaster with emergency equipment, food, emergency shelter, and medicine.

Comment On: Chapter 5 Section 2.7

5.2.7 Preparedness

For purposes of this Plan, the term "preparedness" means making preparations before a disaster for what to do immediately after a disaster. Examples of preparedness include developing pre-disaster plans and information regarding who to contact and where to go after a disaster; what food, equipment, and other emergency supplies to have ready and stored to enable quick action; what emergency communications measures should be available; how and where to evacuate people, and how to provide food, shelter, medical assistance, and basic services to disaster victims. It can also mean preparing for recovery, educating the public on personal and household preparedness, and practicing disaster drills.

Preparedness is sometimes confused with mitigation. However it is distinguished from mitigation by its focus on immediate post-disaster action. Mitigation and preparedness go hand-in-hand. Where mitigation is insufficient to significantly reduce potential disaster losses, then preparedness becomes especially important. To the extent that time or financial resources preclude long-term mitigation of many hazards in the natural and social environment, then it becomes very important to undertake plans and actions to prepare for emergencies, making it easier to respond to and recover. This interdependency is fundamental to this Plan, as discussed elsewhere.

Comment On: Chapter 5 Section 2.8

5.2.8 Response

For purposes of this Plan, the term "response" means actions taken to respond to the disaster, such as rescuing survivors, mass evacuation, feeding and sheltering victims, and restoring communications.

Comment On: Chapter 5 Section 2.9

5.2.9 Recovery

For purposes of this Plan, the term "recovery" means restoring people's lives and creating new opportunities for the future. It includes such actions as: restoration of essential transportation, utilities, and other public services; repair of damaged facilities; provision

of both temporary and replacement housing; restoration and improvement of the economy; and long-term reconstruction which improves the community.

Comment On: Chapter 5 Section 3

5.3 Climate Change – An Emerging Issue

An emerging topic affecting disaster management is climate change caused by global warming. Scientific literature developing over the past several decades has confirmed that release of greenhouse gases—such as CO_2, methane, chlorofluorocarbons (CFCs) and nitrous oxide—is creating changes to the earth's climate leading to a variety of negative impacts. Impacts of these meteorological changes have been under observation by risk management and natural hazards researchers for several decades.

In *Understanding Globalization,* published in 2003, Robert Schaeffer summarized the recent history of global warming and climate change as both a scientific and public policy challenge. He pointed out that rising temperatures leading to polar ice melt contributing to sea level rise affecting low lying island countries. Noting that that most scientists agreed that global warming was real, Schaeffer attributed automobile dependence as an important cause of rising carbon dioxide (CO_2) levels contributing to climate change. He pointed out further that the U.S. was not one of the countries signing on to the Kyoto Protocol which set 2012 emissions reductions targets for developed countries, but that some American companies were already pursuing their own technological solutions to greenhouse gas reduction measures in order to lower costs and remain competitive.[12]

Comment On: Chapter 5 Section 3.1

5.3.1 International Panel on Climate Change

The most recent scientific literature has confirmed the likelihood that such changes in climate are anthropogenic (human-caused). At its Paris meeting of February 2007, the Working Group I on physical science of the Intergovernmental Panel on Climate Change (IPCC) observed that carbon dioxide and nitrous oxide emissions in the past century and a half have increased more rapidly than in preceding centuries, and that these emissions have resulted in global warming having long-term impacts on the world's climate and environment.

Key findings from the IPCC Working Group I report include the following:

> [1.] …Global atmospheric concentrations of carbon dioxide, methane and nitrous oxide have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values determined from ice cores spanning many thousands of years…
>
> [2.] …The global increases in carbon dioxide concentration are due primarily to fossil fuel use and land-use change, while those of methane and nitrous oxide are primarily due to agriculture...

[12] Schaeffer, Robert K. *Understanding Globalization: The Social Consequences of Political, Economic, and Environmental Change*. Rowman & Littlefield Publishers, Inc. Oxford: 2003.

> [3.] …Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level...
>
> [4] …Most of the observed increase in globally averaged temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations....
>
> [5] …Continued greenhouse gas emissions at or above current rates would cause further warming and induce many changes in the global climate system during the 21st century that would very likely be larger than those observed during the 20th century.[13]

A more recent report released by the IPCC Working Group II on April 6, 2007, predicts a wide range of negative impacts on the global environment, together with accumulating evidence that changes in many physical and biological systems are linked to anthropogenic warming. Projected impacts of climate change include more severe storms and flooding, food and water shortages, increases in the range of insect pests and diseases presently found in tropical areas, and desertification of presently temperate regions.[14]

The Working Group III report *Climate Change 2007: Mitigation of Climate Change* was published in May 2007. It outlines broad short-range, mid-range, and long-range mitigation efforts that will be needed to combat global warming and climate change through proactive countermeasures in the future.

Comment On: Chapter 5 Section 3.2

5.3.2 California Initiatives

In advance of these most recent international scientific findings, California state government has undertaken several initiatives to address climate change challenges. Governor Schwarzenegger in June 2005 signed Executive Order S-03-05 which established climate change emission reduction targets for the State for the purpose of mitigating global warming. The Executive Order established Greenhouse Gas (GHG) targets as follows:

- By 2010, reduce to 2000 emission levels
- By 2020, reduce to 1990 emission levels
- By 2050, reduce to 80 percent below 1990 levels.

Subsequent to this, the California legislature in 2006 passed and the Governor signed Assembly Bill 32, known as the California Global Warming Solutions Act of 2006. The

---

[13] Intergovernmental Panel on Climate Change, *Climate Change 2007: The Physical Science Basis – Summary for Policymakers*. Working Group I Report, February 2007.

[14] Intergovernmental Panel on Climate Change, *Climate Change 2007: Impacts of Climate Change – Impacts, adaptation and vulnerability – Summary for Policymakers*. Working Group II Report, April 2007.

law establishes a comprehensive program to achieve quantifiable, cost-effective reductions of greenhouse gases on a scheduled basis. It requires the California Air Resources Board (ARB) to develop regulations and market mechanisms that will ultimately reduce California's greenhouse gas emissions by 25 percent by 2020. Mandatory caps begin in 2012 for significant sources. Specifically, AB 32 requires the ARB, among other things, to:

- Establish a statewide greenhouse gas emissions cap for 2020, based on 1990 emissions by January 1, 2008;
- Adopt mandatory reporting rules for significant sources of greenhouse gases by January 1, 2009;
- Adopt a plan by January 1, 2009, indicating how emission reductions will be achieved from significant greenhouse gas sources via regulations, market mechanisms and other actions.
- Adopt regulations by January 1, 2011 to achieve the maximum technologically feasible and cost-effective reductions in greenhouse gas, including provisions for using both market mechanisms and alternative compliance mechanisms.

A report on early action to mitigate climate change in California was published by the California Air Resources Board in April 2007. The ARB received more than 70 suggestions from stakeholders for early action. These have been vetted by appropriate agencies and are initially discussed in this report[15]

Measures similar to AB 32 have been adopted by 11 states, with California leading the way. In response to an industry challenge to one of these state laws, the United States Supreme Court ruled in a recent decision that greenhouse gases should be considered pollutants. This decision emphasized the Court's view that the federal Environmental Protection Agency has a responsibility to pass nationwide regulations governing such emissions. A response from EPA is pending. Meanwhile, California is proceeding with implementation of AB 32.

Related Emissions Reduction Programs

Pursuant to Proposition 1B passed by the voters in November 2006, the state Business Transportation and Housing Agency (BTH) and Cal/EPA on January 11, 2007, jointly released the Goods Movement Action Plan (GMAP). The GMPA outlines a comprehensive strategy to address the environmental issues associated with moving goods via the state's highways, railways, and ports. It has been sent to the California Transportation Commission (CTC) and the ARB and the Maritime Transportation Security Council for their consideration as they deliberate allocation of the Proposition 1B funds. The GMAP identifies projects for consideration in the CTC's allocation of the $2 billion for infrastructure investment. The ARB will allocate the remaining $1 billion for emission reduction projects related to goods movement. A range of funding sources

[15] California Environmental Protection, Agency Air Resources Board. *Proposed Early Actions to Mitigate Climate Change in California*. April 20, 2007.

and mechanisms will be used to leverage Proposition 1B funds. See url: http://www.arb.ca.gov/gmp/docs/gmap-1-11-07.pdf

Comment On: Chapter 5 Section 3.4

5.3.4 Implications for Hazard, Vulnerability, and Risk Assessment

These events have a twofold implication for emergency management and hazard mitigation. Discussions of climate change and risk management have begun to appear in the professional literature focusing on systematic development of solutions capable of reducing risks to within critical impact thresholds.[16] It was not until Hurricane Katrina drew the attention of the news media to scientific evidence on intensification of storm events that climate change was recognized as an emergency management topic.

It is now clear that in coming decades natural disasters will intensify due to climate change. Emergency managers, planning agencies, private companies, and communities especially affected by climate change will be challenged to adapt their planning to take into account an increasing array of related natural hazards. Disasters expected to be more widely experienced in the future include: avalanches, coastal erosion, flooding, and sea level rise; extreme heat and prolonged drought; mudslides and landslides; severe weather and storms; and wildland fires.

In this risk assessment climate change is recognized somewhat as a place-holder, with more refined understanding of impacts to be forthcoming during the next three-year SHMP planning cycle. For now, climate change impacts are recognized as having an effect on primary hazards such as flooding and wildfires described in Chapter 5, Part 2, secondary hazards such as levee failure and landslides described in Chapter 5, Part 3, and other climate-related hazards described in Part 4, Section 5.9.

A second aspect of this emerging issue is the urgency of broadening effective means of minimizing release of greenhouse gases into the atmosphere. This involves not only technological but also life-style changes, including a variety of energy conservation, transportation, power production, and land use changes. Although CO_2 emissions can be reduced through automotive technology innovations, the need will intensify for planning innovations reducing greenhouse gas emissions, such as energy-conserving green building design, development of urban areas with greater residential densities, more mixed use, expanded mass transit options, and pedestrian-oriented development.

[16] Jones, Roger N. "An Environmental Risk Assessment/Management Framework for Climate Change Impact Assessments." *Natural Hazards.* 23: 197–230, 2001.

(This Page Intentionally Left Blank)

Chapter 5—Hazard, Vulnerability, and Risk Assessment

Part 2 – Primary Hazards

Part 2 Organization

5.4 Statewide Multi-Hazard Risk Assessment
- 5.4.1 GIS Risk Exposure Analysis
- 5.4.2 Planning, Policy, and Action implications

5.5 Earthquake Hazards, Vulnerability and Risk Assessment
- 5.5.1 Identifying Earthquake Hazards
- 5.5.2 Profiling Earthquake Hazards
- 5.5.3 Assessment of State Vulnerability and Potential Losses
- 5.5.4 Assessment of Local Vulnerability and Potential Losses
  - 5.5.4.1 Vulnerability and Mitigation of Buildings
  - 5.5.4.2 Vulnerability and Mitigation of Utilities and Transportation
- 5.5.5 Current Earthquake Hazard Mitigation Efforts
- 5.5.6 Opportunities for Enhanced Earthquake Hazard Mitigation

5.6 Flood Hazards, Vulnerability, and Risk Assessment
- 5.6.1 Identifying Flood Hazards
- 5.6.2 Profiling Flood Hazards
- 5.6.3 Assessment of State Vulnerability and Potential Losses
- 5.6.4 Assessment of Local Vulnerability and Potential Losses
- 5.6.5 Current Flood Hazard Mitigation Efforts
- 5.6.6 Opportunities for Enhanced Flood Hazard Mitigation

5.7 Wildfire Hazards, Vulnerability, and Risk Assessment
- 5.7.1 Identifying Wildfire Hazards
- 5.7.2 Profiling Wildfire Hazards
- 5.7.3 Assessment of State Vulnerability and Potential Losses
- 5.7.4 Assessment of Local Vulnerability and Potential Losses
- 5.7.5 Current Wildfire Hazard Mitigation Efforts
- 5.7.6 Opportunities for Enhanced Earthquake Hazard Mitigation

Comment On: Chapter 5 Section 4

5.4 Statewide Multi-Hazard Risk Assessment

During preparation of this Plan, each of the three primary hazards has been evaluated for its impact on California both on a comparative basis using geographic information systems (GIS) and separately for each hazard. The GIS hazard risk exposure analysis is a new feature using counties as a basic land classification unit. It enables comparison between counties of the relative exposures to hazards and sets the groundwork for further development of a sub-county level of analysis in the future.

Comment On: Chapter 5 Section 4.1

5.4.1 GIS Risk Exposure Analyses

The overall purpose of the GIS risk exposure analysis was to establish a basis for comparing relationships of the three primary hazards—earthquakes, floods, and fires—and population vulnerability within California. To provide comparability, data indicating

the relative presence of hazards, population, and vulnerable people have been identified on a range of high, medium, and low, and shown on statewide maps. A benefit has been the development of a policy framework for enhancing future mitigation strategies.

Within this overall approach, there were four specific objectives:

1. Assess relative single and multiple hazard risk exposure in relation to population;
2. Compare risk exposure for single and multiple hazards between different counties;
3. Enable comparison of specific local hazards with a consistent statewide framework;
4. Match accomplishments of other states, such as Oregon, in analyzing comparative hazard risk exposure.

The County as a Classification Unit

In this GIS analysis, counties have been used as the primary land classification unit. It is recognized that counties vary widely in size so a similar proportion of a county affected by the same hazard in two adjoining counties of differing sizes might reflect quite different amounts of land area. Also, any hazard represented may only exist in a portion of a county, and population may not necessarily be located in close proximity to that hazard. However, for the purpose of the 2007 Plan revision, the decision was made to utilize the county as the standard land classification unit for three important reasons.

1. Counties are a unit for which common, comparable data exist for all five factors;
2. Counties comprise jurisdictions having broad powers as extensions of the state;
3. Under the State Emergency Management System (SEMS), counties represent the Operational Area level and which local emergency response is coordinated;
4. Counties are a widely understood and recognizable unit of land classification.

As data become available for each of these five factors at a sub-county level in the future, OES will consider conducting similar risk exposure analyses for areas within counties, such as cities and unincorporated areas.

Summary of Methods

Two types of source maps were used either singly or in combination to identify the relative presence of each hazard: a) the proportion of each county subject to the potential level of hazard severity (ranked low, medium, and high); b) the combined number of Governor's emergency proclamations and federal disaster declarations for each county depicting the recurrence frequency of disasters generated by a hazard. Sources for the three hazards and disaster frequencies included:

- Earthquake shaking potential from California Geological Survey mapping;
- Fire threat from CAL FIRE mapping;
- 100-year flood zones from FEMA mapping;
- Wildfire and flooding disaster proclamations and declarations from OES mapping.

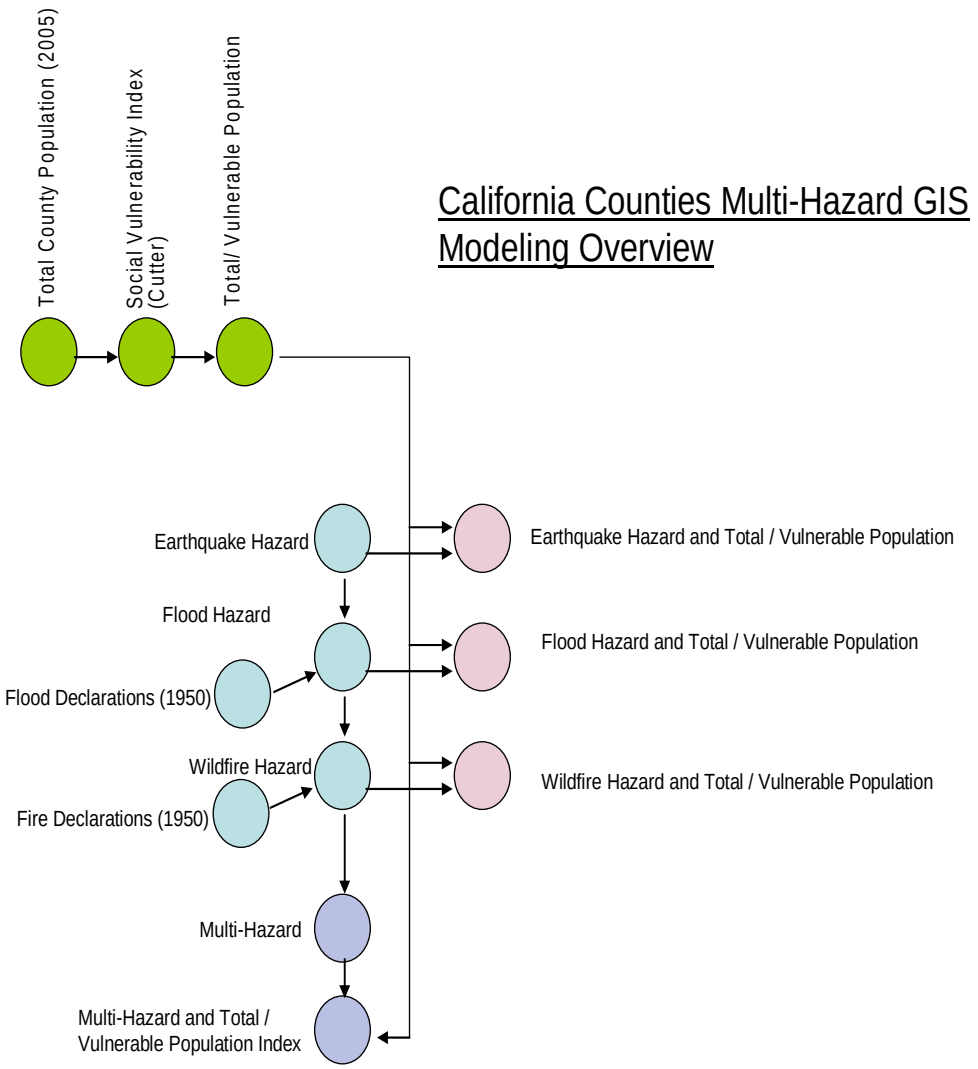
The GIS modeling procedure produced a series of maps allowing comparison between counties of the relative presence of each hazard and multiple hazards in relation to total

population and vulnerable population. Each of these five factors is compared between counties by the application of a simple ranking of low, medium, or high. Expert judgment of subject matter specialists was used in a consensus review to evaluate and adjust the procedure. A general methodology statement and further diagrams depicting the ranking and weighting methods are provided in 2007 SHMP Appendix (Document 5.4.1A)

Mapping Sequence

Chart 5.4.1B below provides an overview of the mapping sequence by which various source maps were combined to provide the comparative maps which follow.

Chart 5.4.1B. GIS Modeling



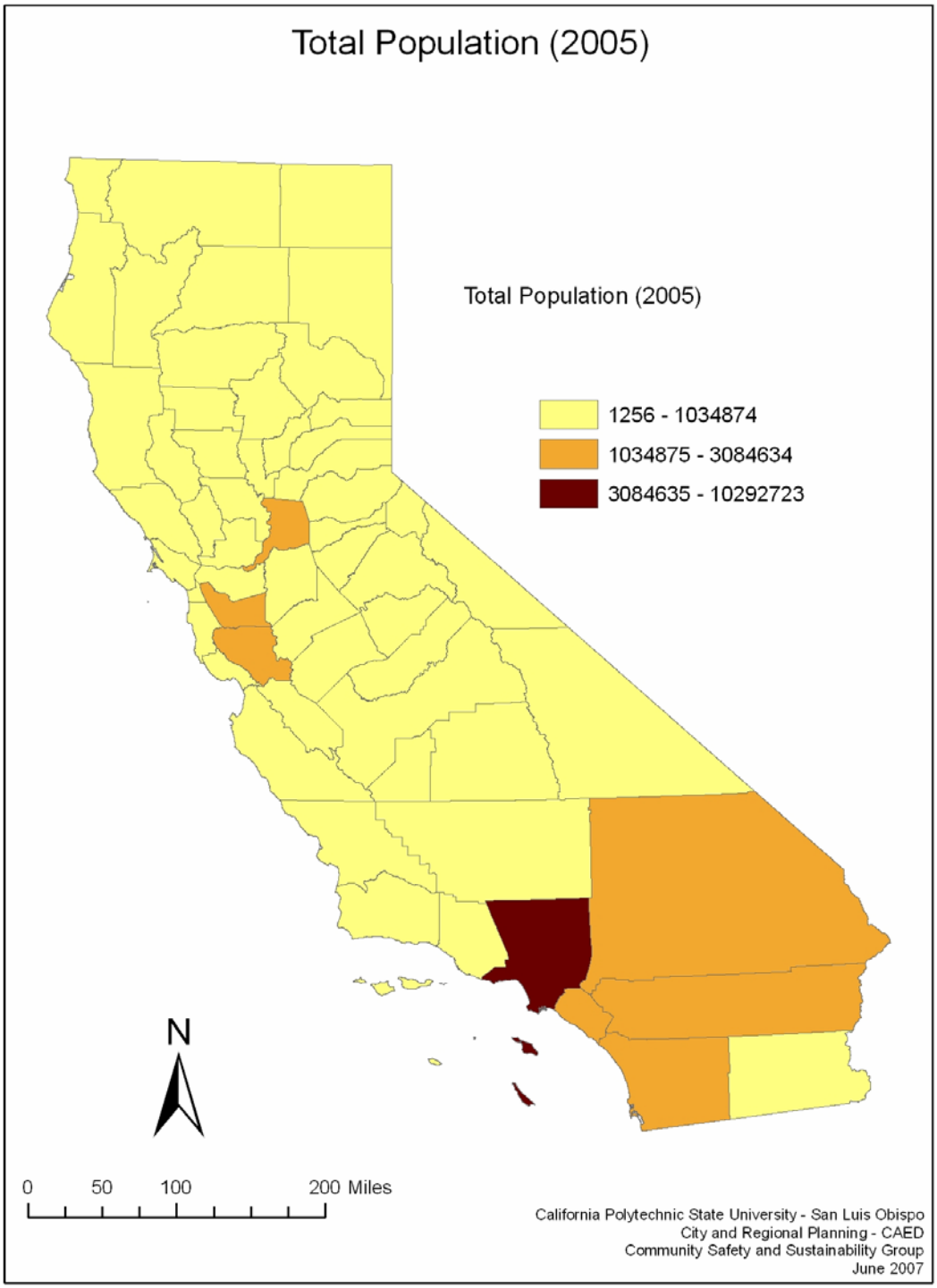
What is Social Vulnerability?

In this analysis, a measure of vulnerability devised by Dr. Susan L. Cutter for application throughout the U.S. was adapted for use with this risk assessment. In this measure, a combined index of vulnerable populations and ground conditions are identified in Dr. Cutter's Social Vulnerability Index (SoIV) by the presence of the following variables:

- Socioeconomic status (income, political power, prestige)
- Gender
- Race and ethnicity
- Age
- Commercial and industrial development
- Employment loss
- Rural/urban population ratio
- Residential property quality (e.g. mobile homes)
- Infrastructure and lifelines
- Renters
- Occupation
- Family structure
- Education
- Population growth
- Medical services
- Social dependence
- Special needs population.[17]

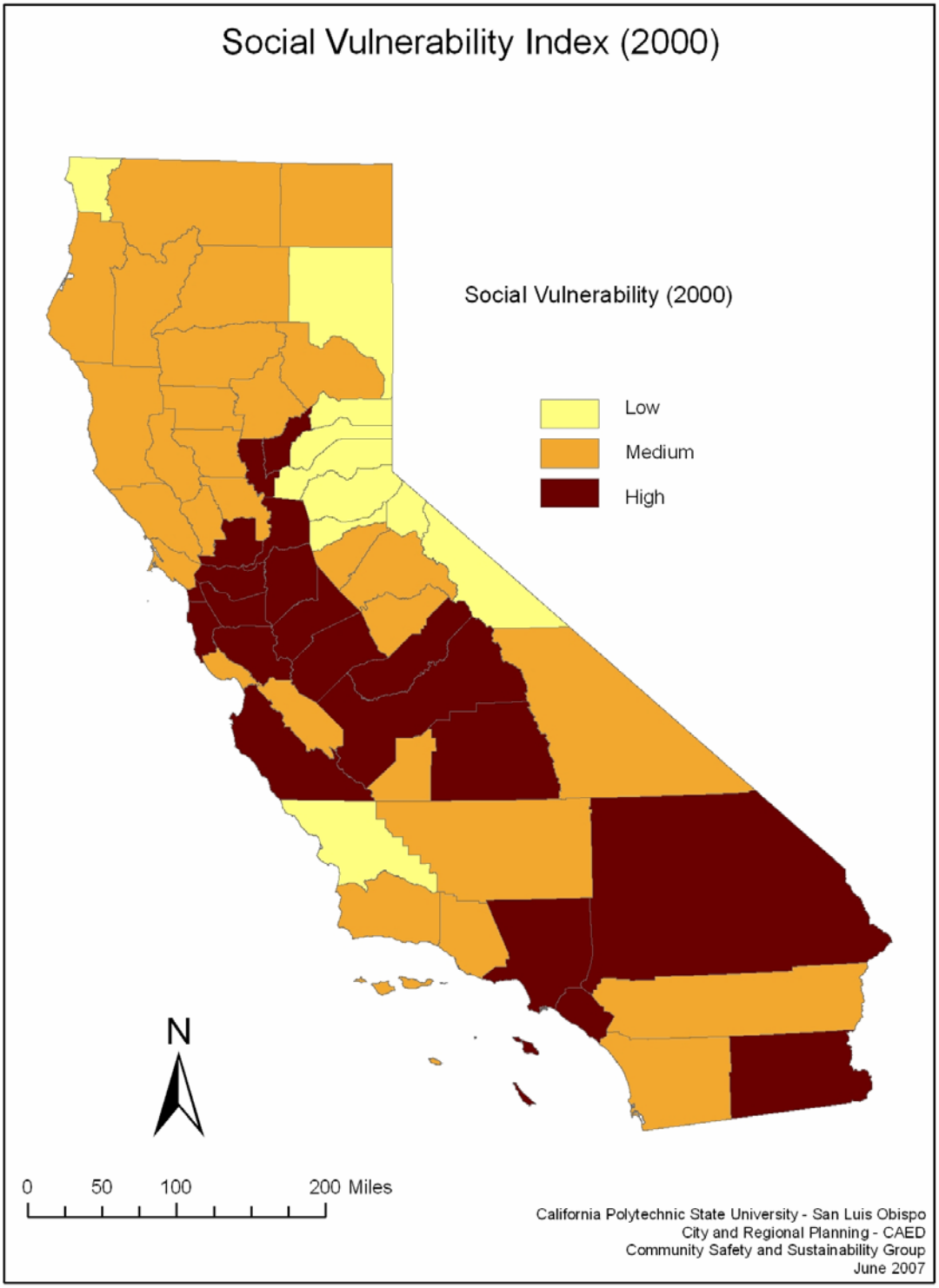
[17] Cutter, Susan L., et al. 2003. "Social Vulnerability to Environmental Hazards," *Social Science Quarterly* 84 (1): 242-261

Map 5.4.1A Distribution of Total Population



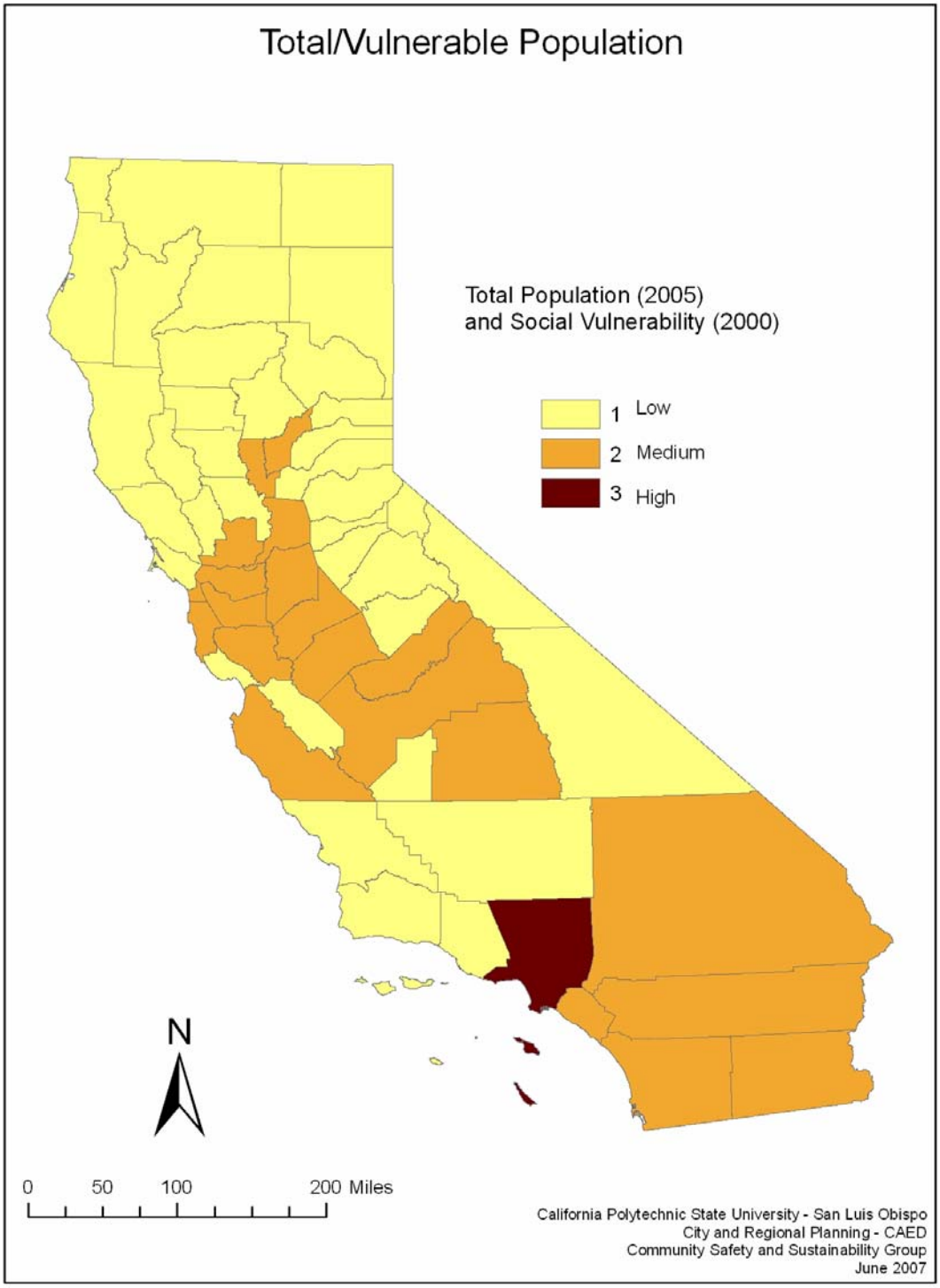
California's population is heavily concentrated in southern counties. Los Angeles County is the most populous county, with over 10 million of California's 37 million people.

Map 5.4.1B Distribution of Vulnerable Population



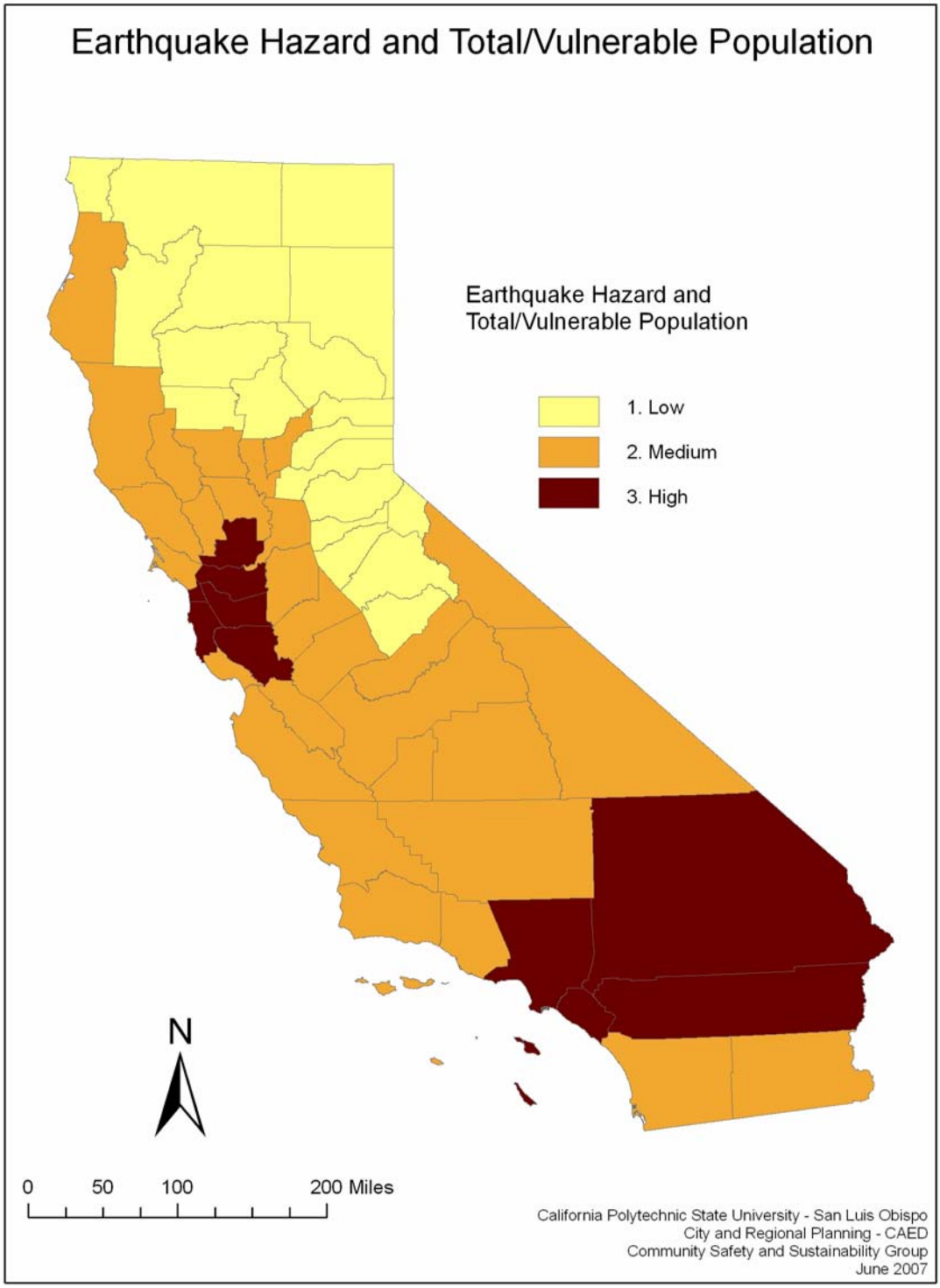
Within California's populated areas, the proportion of socially vulnerable populations varies widely, with high levels in southern California, the Central Valley, and the San Francisco Bay Area.

Map 5.4.1C Combined Total/Vulnerable Population



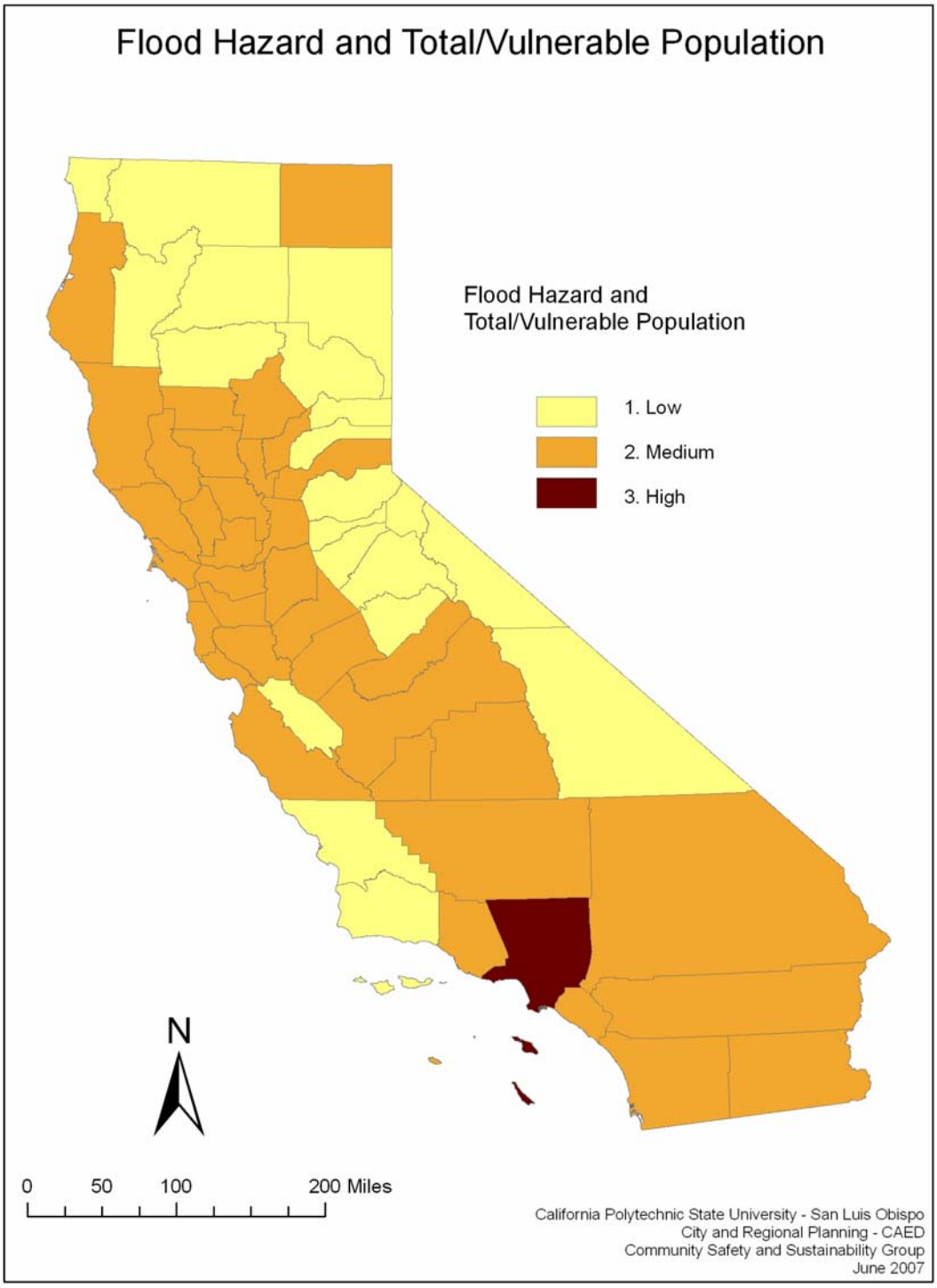
Map 5.4.1C above shows high concentrations of combined total and vulnerable populations in Los Angeles County, with medium concentration in adjoining Southern California counties, in the San Francisco Bay Area, and Delta Area counties.

Map 5.4.1D Earthquake Shaking Exposure with Total/Vulnerable Population



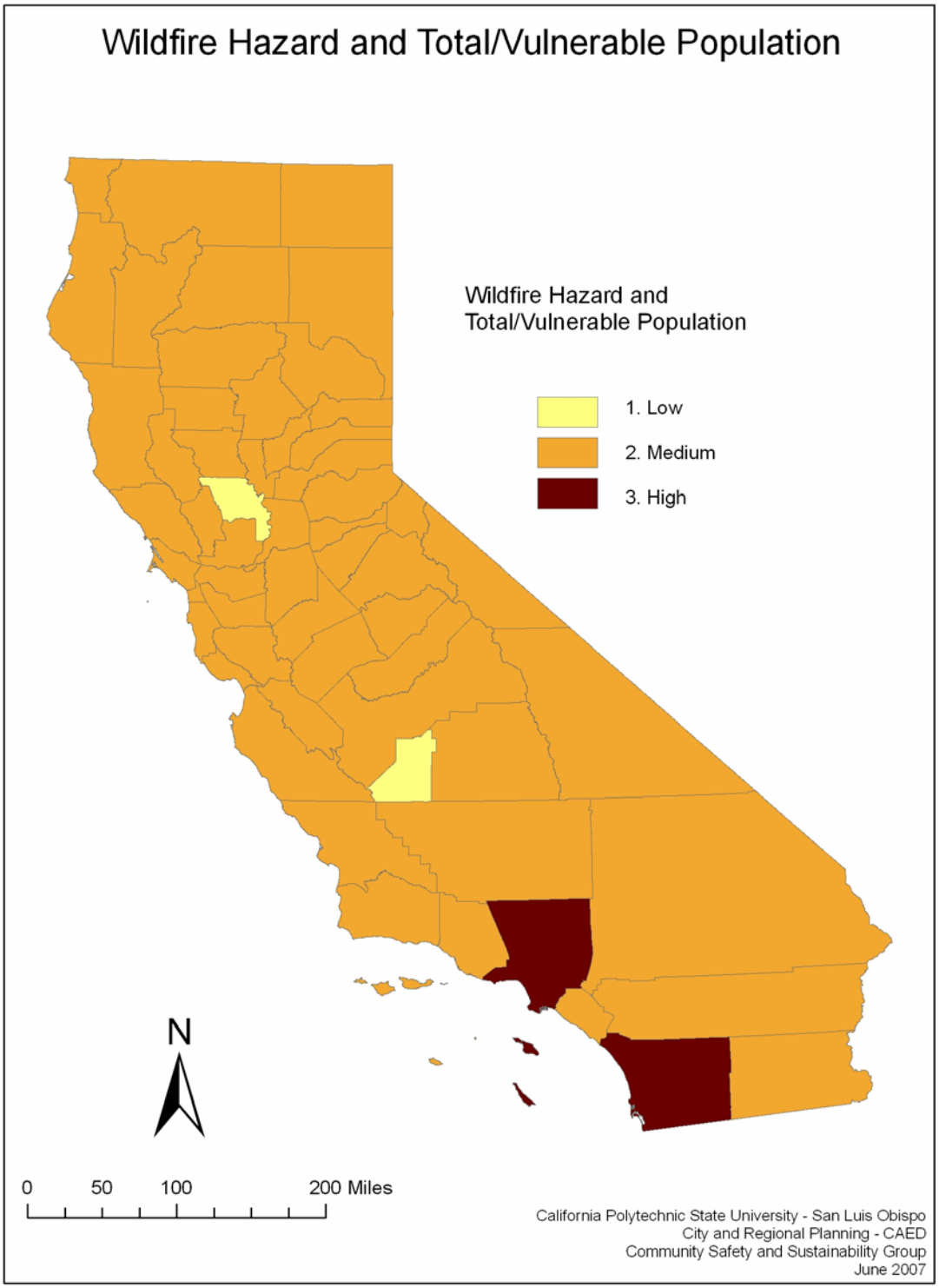
Map 5.4.1D above shows high earthquake shaking hazard risk exposure for total/vulnerable populations in southern California counties and northern counties near the San Francisco Bay Area, with medium risk exposure in other counties along the coast and inland.

Map 5.4.1E Flood Hazard Exposure with Total/Vulnerable Population



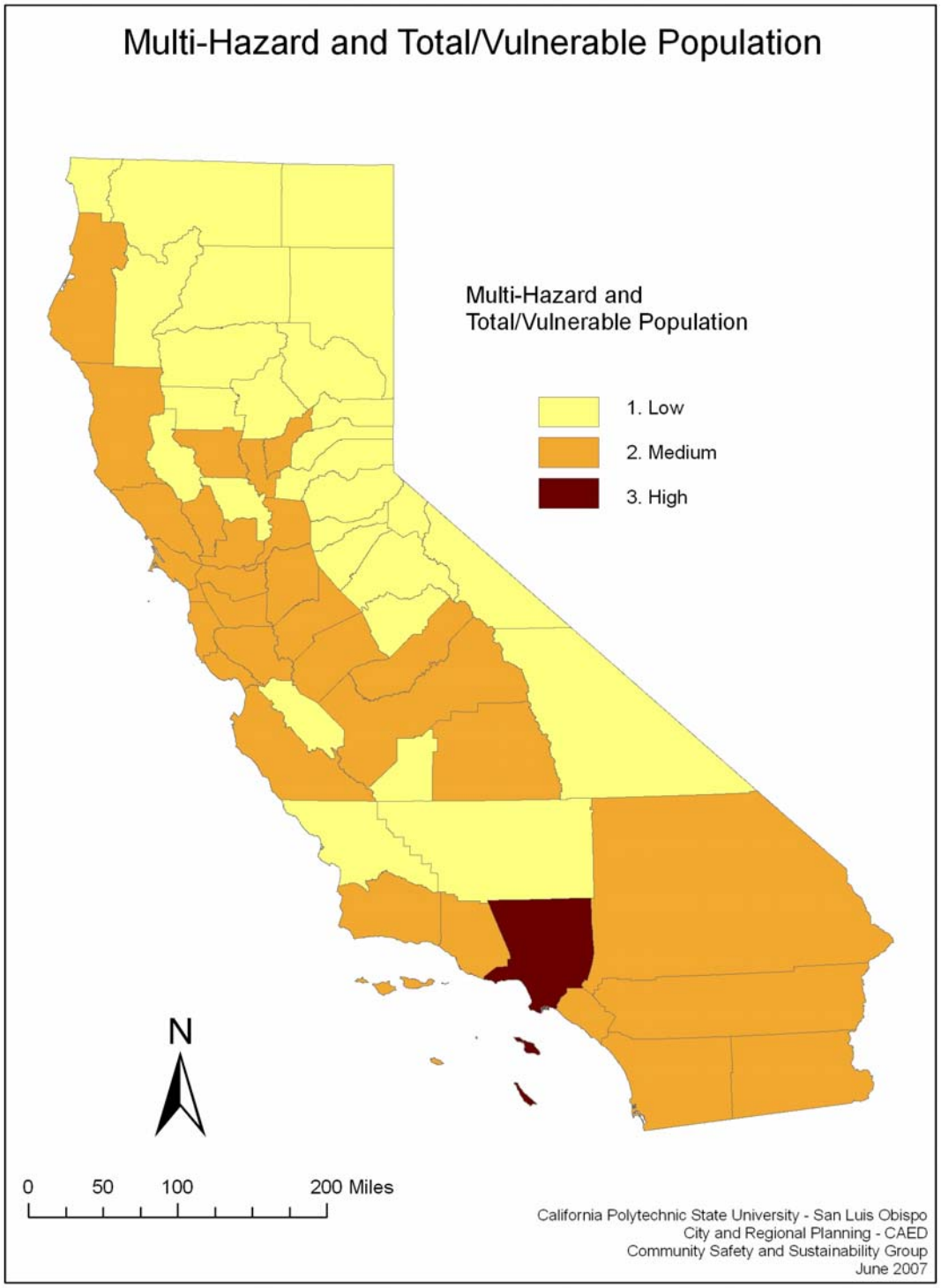
Map 5.4.1E above shows high flood hazard risk exposure in Los Angeles County and medium risk exposure in other southern California counties, northern California counties near the San Francisco Bay Area, Delta Area, Central Valley, and along the Pacific Coast.

Map 5.4.1F Wildfire Hazard Exposure with Total/Vulnerable Population



Map 5.4.1F above shows high wildfire hazard risk exposure to total/vulnerable populations in Los Angeles and San Diego Counties and medium risk exposure in all but two other counties in the state.

Map 5.4.1G Combined Hazard Exposure with Total/Vulnerable Population



Map 5.4.1G above shows combination of exposure risk for all three hazards, with a high level in Los Angeles County, the most populous county, and medium levels in other Southern California counties, San Francisco Bay Are, Central Valley, Delta Area, and along the coast.

GIS Risk Exposure Analysis Findings

The following overall findings summarize the preceding GIS-based hazard risk exposure analysis.

- Substantially populated counties with vulnerable populations are found in southern California, the San Francisco Bay Area, Delta region, and Central Valley.
- High proportions of these same regions are affected by multiple hazards.
- Populated counties, some with high concentrations of vulnerable populations, are exposed to substantial potential earthquake shaking hazards in southern California, the San Francisco Bay Area, Delta region, Central Valley, and along the Pacific Coast.
- Substantially populated counties with vulnerable populations are in flood-prone areas of southern California, the San Francisco Bay Area, Delta region, and Central Valley.
- Depending upon terrain and vegetation, wildfire hazard risk exposure is generally pervasive, with high concentrations in southern California.
- When comparing the GIS risk exposure maps with Maps 4.3.1B and Map 4.3.1C in Chapter 4 which show 2000-2006 population and construction growth, a substantial overlap can be found between heavily populated areas with socially vulnerable populations and high to medium risk exposure to various hazards.

Comment On: Chapter 5 Section 4.2

5.4.2 Planning, Policy, and Action Implications

These GIS multi-hazard hazard risk exposure findings contain implications for priority setting with respect to both hazard mitigation and emergency preparedness strategies.

1. Historically, mitigation priority setting has been done largely on an ad hoc basis, taking into account specifics of particular disasters regarding the loss and damage locations and scales.
2. The preceding multi-hazard risk analysis, together with historical analysis of declared disasters in California since 1950, reveal that earthquakes, floods, and wildfire hazards are pervasive, primary determinants of disaster losses.
3. The need is clear for an accelerated pre-disaster mitigation planning program by the State of California which takes more directly into account the geographic patterns of hazards, vulnerability, and risk of earthquakes, floods, and wildfires.

A long-term program should be developed on an inter-agency basis during the implementation phase of the 2007 SHMP to develop a GIS modeling system capable of modeling on a sub-county basis.

Comment On: Chapter 5 Section 5

5.5 Earthquake Hazards, Vulnerability, and Risk

Section Content

5.5.1 Identifying Earthquake Hazards
5.5.2 Profiling Earthquake Hazards
5.5.3 Assessment of State Vulnerability and Potential Losses
5.5.4 Assessment of Local Vulnerability and Potential Losses
5.5.4.1 Vulnerability and Mitigation of Buildings
5.5.4.2 Vulnerability and Mitigation of Utilities and Transportation
5.5.5 Current Earthquake Hazard Mitigation Efforts
5.5.6 Opportunities for Enhanced Earthquake Hazard Mitigation

Comment On: Chapter 5 Section 5.1

5.5.1 Identifying Earthquake Hazards

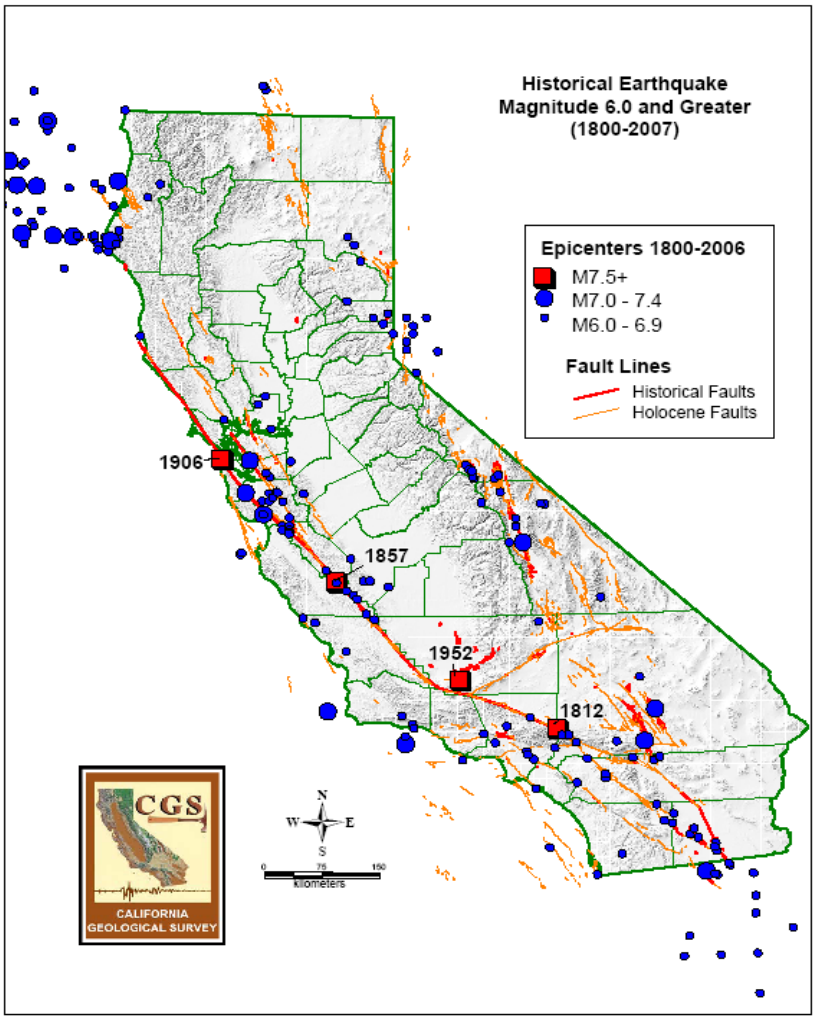
Causes of Earthquakes: Plate Tectonics

California always has been seismically active because it sits on the boundary between two of the earth's tectonic plates. Most of the state - everything east of the San Andreas Fault - is on the North American Plate. Monterey, Santa Barbara, Los Angeles, and San Diego are on the Pacific Plate, which is constantly moving northwest past the North American Plate. The relative rate of movement is about two inches (50 millimeters) per year. Although the San Andreas Fault is considered the boundary between the two plates, some of the motion (also known as slip) is taken up on faults as far away as central Utah. In California, about forty millimeters per year of the slip occurs on the faults of the San Andreas system, and about ten millimeters per year occurs in the Mojave Desert and in the Basin and Range area east of the Sierra Nevada on a fault system known as the eastern California shear zone.

The constant motion of the plates causes stress in the brittle upper crust of the earth. These tectonic stresses build as the rocks are gradually deformed. The rock deformation, or strain, is stored in the rocks as elastic strain energy. When the strength of the rock is exceeded, rupture occurs along a fault. The rocks on opposite sides of the fault slide past each other as they spring back into a relaxed position. The strain energy is released partly as heat and partly as elastic waves called seismic waves. The passage of these seismic waves produces the ground shaking in earthquakes.

California has thousands of recognized faults. Only some are known to be active and pose significant hazards. The motion between the Pacific and North American plates occurs primarily on the faults of the San Andreas system and the eastern California shear zone. Faults are more likely to have future earthquakes on them if they have more rapid rates of movement, have had recent earthquakes along them, experience greater total displacements, and are aligned so that movement can relieve the accumulating tectonic stresses. Geologists classify faults by their relative hazards. "Active" faults represent the highest hazard. Those have ruptured to the ground surface during the Holocene period (about the last 11,000 years). "Potentially active" faults are those that displaced layers of rock from the Quaternary period (the last 1,800,000 years). Nearly all movement between the two plates is on active faults.

Map 5.5.1A Historical Earthquake Magnitude 6.0 and Greater, 1800-2006



Earthquake Hazards: Shaking

The amount of energy released during an earthquake is usually expressed as a magnitude and is measured directly from the earthquake as recorded on seismographs. An earthquake's magnitude is expressed in whole numbers and decimals (e.g., 6.8). Seismologists have developed several magnitude scales. One of the first was the Richter Scale, developed in 1932 by the late Dr. Charles F. Richter of the California Institute of Technology. The most commonly used scale today is the Moment Magnitude (Mw) Scale which is related to the total area of the fault that ruptured and the amount of offset (displacement) across the fault. It is a more uniform measure of the energy released.

The other commonly used measure of earthquake severity is intensity. Intensity is an expression of the amount of shaking at any given location on the ground surface. While an earthquake has only one magnitude it may have many intensity values which will generally decrease with distance from the epicenter. The Modified Mercalli Intensity

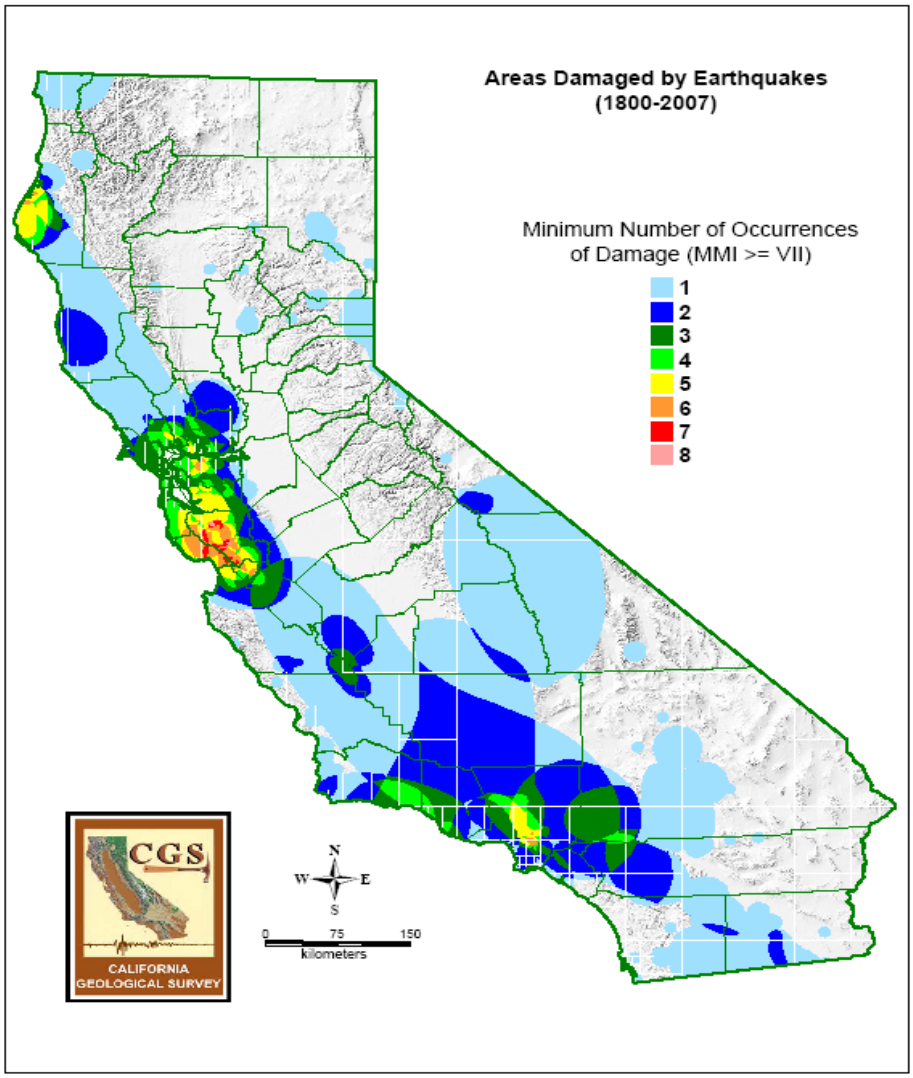
(MMI) Scale has been used historically to describe earthquake shaking terms related to observable effects. While more scientifically exact methods have been identified to describe earthquake shaking, the MMI can be useful in reconstructing shaking levels of earthquakes recorded prior to scientific instrumentation. With the advent of strong-motion recording instruments, shaking intensity measures have become more quantitative.

Table 5.5.1A (2004 SHMP) The Modified Mercalli Intensity Scale

Intensity	Effects
I	Not felt except by a very few who are favorably situated.
II	Felt by persons at rest, on upper floors, or favorably placed.
III	Felt indoors. Hanging objects swing. Vibration like passing of light trucks. Duration estimated. May not be recognized as an earthquake.
IV	Hanging objects swing. Vibration like passing of heavy trucks; or sensation of a jolt like a heavy ball striking the walls. Standing vehicles rock. Windows, dishes, doors rattle. Glasses clink. Crockery clashes. In the upper range of IV, wooden walls and frame creak.
V	Felt outdoors; direction estimated. Sleepers wakened. Liquids disturbed, some spilled. Small unstable objects displaced or upset. Doors swing, close, open. Shutters, pictures move. Pendulum clocks stop, start, change rate.
VI	Felt by all. Persons walk unsteadily. Windows, dishes, glassware broken. Knickknacks, books, etc., off shelves. Pictures off walls. Furniture moved or overturned. Weak plaster and masonry D cracked. Small bells ring (church, school). Trees, bushes shaken (visibly, or heard to rustle).
VII	Difficult to stand. Noticed by drivers of vehicles. Hanging objects quiver. Furniture broken. Damage to masonry D, including cracks. Weak chimneys broken at roofline. Fall of plaster, loose bricks, stones, tiles, cornices (also unbraced parapets and architectural ornaments). Some cracks in masonry C. Waves on ponds; water turbid with mud. Small slides and caving in along sand or gravel banks. Large bells ring. Concrete irrigation ditches damaged.
VIII	Steering of vehicles is affected. Damage to masonry C; partial collapse. Some damage to masonry B; none to masonry A. Fall of stucco and some masonry walls. Twisting, fall of chimneys, factory stacks, monuments, towers, elevated tanks. Frame houses moved on foundations if not bolted down; loose panel walls thrown out. Decayed piling broken off. Branches broken from trees. Changes in flow or temperature of springs and wells. Cracks in wet ground and on steep slopes.
IX	Masonry D destroyed; masonry C heavily damaged, sometimes with complete collapse; masonry B seriously damaged. (General damage to foundations.) Frame structures, if not bolted, shifted off foundations. Frames racked. Serious damage to reservoirs. Underground pipes broken. Conspicuous cracks in ground. In alluvial areas sand and mud ejected, earthquake fountains, sand craters.
X	Most masonry and frame structures destroyed with their foundations. Some well-built wooden structures and bridges destroyed. Serious damage to dams, dikes, embankments. Large landslides. Water thrown on banks of canals, rivers, lakes, etc. Sand and mud shifted horizontally on beaches and flat land. Rails bent slightly.
XI	Rails bent greatly. Underground pipelines completely out of service.
XII	Damage nearly total. Large rock masses displaced. Lines of sight and level distorted. Objects thrown into the air.

Map 5.5.1B below shows the history or damage by earthquakes from 1800 to 2007 using the Mercalli scale, with damage notably concentrated along the San Andreas fault system.

Map 5.5.1B Areas Damaged by Earthquakes, 1800-2007



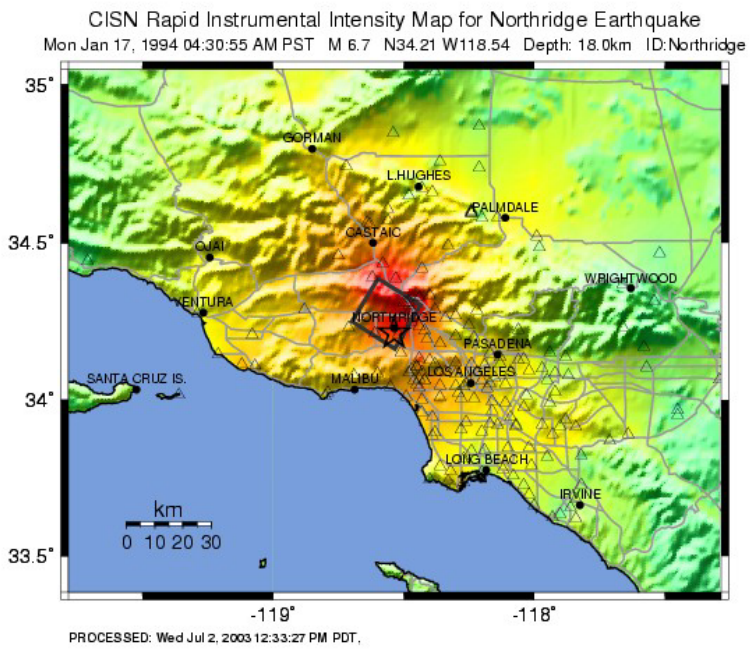
Earthquake "ShakeMaps"

Earthquake shaking is measured by instruments called accelerographs that are triggered by the onset of shaking and record levels of ground motion at strong motion stations throughout the state operated by the California Geological Survey (CGS), the US Geological Survey (USGS), the California Institute of Technology, and the University of California Berkeley. The CGS and USGS rapidly convert the data from the accelerographs into ShakeMaps that show the distribution of earthquake shaking in terms of MMI ground acceleration and ground velocity.

Based on actual measured motions, ShakeMaps such as Map 5.5.1C for the 1994 Northridge Earthquake are a major step forward in guiding emergency response to earthquakes. They are used by emergency responders to evaluate the extent and variation of shaking within the area affected by an earthquake and to send resources to the areas that most likely sustained heavy damage. The more quantitative maps help guide response for specific types of structures; short small structures versus tall long structures.

Simulated Shake Maps are also generated for specific future earthquake scenarios based on intensity models. In addition, more sophisticated models of earthquake shaking at any place consider the potential for all future earthquakes on surrounding faults and their related ground motion affecting that place. Integrating all of the potential for ground motion statewide produces a map such as Map 5.5.3B showing the long-term seismic hazard anywhere in the state. Such maps help identify vulnerabilities which is useful in pre-disaster mitigation planning.

Map 5.5.1C Shake Map



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Amplification of Seismic Shaking

Although seismic waves radiate from their source like ripples on a pond, the radiation is not uniform due to the complex nature of an earthquake rupture, the different paths the waves follow through the earth, and the different rock and soil layers near the earth's surface. Large earthquakes begin to rupture at their hypocenter deep in the earth and the fault ruptures outward from that point. Because the speed of an earthquake rupture on a

fault is similar to the speed of seismic waves, waves closer to the epicenter can be compounded by waves from farther along the rupture, creating a pulse of very strong seismic waves that moves along the fault in the direction of the fault rupture. Seismic waves may also be modified as they travel through the earth's crust. Shaking from the 1989 Loma Prieta earthquake was concentrated to the north, toward San Francisco and Oakland, possibly due to the reflection of seismic waves off the base of the earth's crust.

As seismic waves approach the ground surface, they commonly enter areas of loose soils where the waves travel more slowly. As the waves slow down, their amplitude increases, resulting in larger waves with frequencies that are more likely to damage structures. Waves can also be trapped within soft sediments between the ground surface and deep, hard basement rocks, their destructive energy multiplying as they bounce back and forth, producing much greater shaking at the ground surface. CGS and USGS recorded large ground waves at many locations during both the Loma Prieta earthquake and the 1994 Northridge earthquake.

Unexpectedly large ground waves and their resulting damage may be produced from a relatively distant earthquake. Shaking from the 1999 Hector Mine earthquake in the Mojave Desert produced waves with amplitudes of up to 15 cm in the Los Angeles basin, more than 200 kilometers from the epicenter. While there was little damage from the Hector Mine earthquake, other large earthquakes have caused damage in distant places. For example, Nevada's 1954 Dixie Valley earthquake damaged critical facilities in Sacramento due to water sloshing.

Loma Prieta Earthquake Damage, San Francisco

Source: USGS

Mitigation of Seismic Shaking Hazards

Seismic shaking, which caused over 98 percent of the losses in the Loma Prieta Earthquake, has long been recognized as the main threat to structures during earthquakes. To mitigate this hazard, building codes have been steadily improved over the past 80

years as understanding of seismic shaking has improved based on strong motion data gathered by CGS and USGS. Current California building codes include provisions for considering the potential shaking from earthquakes, including stronger shaking near faults and amplification by soft soils. The building code has been the main mitigation tool for seismic shaking in most buildings, although hospitals, schools, and other critical facilities are subject to additional mitigation measures, as will be discussed below.

Earthquake Hazards: Ground Failure

Fissuring, settlement, and permanent horizontal and vertical shifting of the ground often accompany large earthquakes. Although not as pervasive or as costly as the shaking itself, these ground failures can significantly increase damage and under certain circumstances can be the dominant cause of damage. The majority of damage from the 1964 Alaskan Earthquake was attributed to the extensive ground failures that accompanied the event. Studies after the 1994 Northridge Earthquake showed that when ground failure was involved, damage to residential dwellings was three to four times greater than average shake damage. Because of their geographic extent, network infrastructures such as water, power, communication, and transportation lines are particularly vulnerable to ground failures.

Fault Rupture

The sudden sliding of one part of the earth's crust past another, releases the vast store of elastic energy in the rocks as an earthquake. The resulting fracture is known as a fault, while the sliding movement of earth on either side of a fault is called fault rupture. Fault rupture begins below the ground surface at the earthquake hypocenter, typically between three and ten miles below the ground surface in California. If an earthquake is large enough, the fault rupture will actually travel all the way to the ground surface, wreaking havoc on structures built across its path. Recent large earthquakes in Turkey and Taiwan have shown that few structures built across the surface traces of faults can withstand the large displacement that occurs during an earthquake.

Fault Surface Rupture, Landers Earthquake, 1992

Liquefaction

In addition to the primary fault rupture that occurs right along a fault during an earthquake, the ground many miles away can also fail during the intense shaking. One common type of failure occurs with liquefaction, when soft, water-saturated soil settles suddenly during earthquake shaking. Seismic soil liquefaction can be described as significant loss of strength due to increase in pore pressures, resulting in ground deformation potential. This phenomenon turns the soil into a fluid-like substance, causing it to lose the ability to support buildings and other structures. Areas susceptible to liquefaction include places where sandy sediments have been deposited by rivers along their course or by wave action along beaches. Alameda Naval Air Station runways and Port of Oakland equipment suffered damage from liquefaction during the 1989 Loma Prieta Earthquake.

Landslides

Landslides are the result of the down-slope movement of unstable hillside materials under the influence of weathering and gravity over time. Strength of rock and soil, steepness of slope, and weight of the hillside material all play an important role in the stability of hillside areas. Weathering and absorption of water can weaken slopes, while the added weight of saturated materials or overlying construction can increase the chances of slope failure. Sudden failure can be triggered by earthquake shaking, excavation of weak slopes, and heavy rainfall, among other factors.

Because landslides occur often without earthquakes, landslide hazards are discussed in a separate section of this Plan. See Section 5.8.2 Landslide Assessment.

Mitigation of Ground Failure

Because the safety and stability of buildings, bridges, and other engineered structures depend on strong, stable foundations, catastrophic ground failures of the type discussed here must be avoided by choosing safe construction sites or by reducing risk through prudent civil engineering practice. The latter includes constructing appropriate foundation systems and modifying unstable ground to increase stability through grading, compacting, or reinforcing soils. Experience has repeatedly shown that use of these methods in design and construction can greatly reduce damage and loss during earthquakes.

The 1971 San Fernando Earthquake was caused by rupture along the San Fernando fault that resulted in total loss to many structures built across its path. That event clearly demonstrated that active faults must be avoided when constructing new buildings and led to passage of the Alquist-Priolo Earthquake Fault Zoning Act of 1972. The Act prohibits the construction of buildings for human occupancy across active faults in California. Similarly, the extensive damage caused by secondary ground failures during the 1989 Loma Prieta Earthquake focused attention on landslides and liquefaction and led to the Seismic Hazards Mapping Act, which increases construction standards at sites where ground failures during earthquakes are likely.

Ground Failure Hazard Zones

Where and when to mitigate ground failure hazards is facilitated by seismic hazard zone maps and earthquake fault zone maps. These maps identify where such hazards are more likely to occur based on analyses of faults, soils, topography, groundwater, and the potential for earthquake shaking sufficiently strong to trigger landslide and liquefaction. Both types of maps are based on the concept of "special study zones" and are used to identify locations where specially adapted construction standards are necessary for public safety and welfare. Local planning and building departments must use such maps as a screening tool to identify when to undertake detailed geotechnical or fault investigations in order to validate the level of hazard suspected at proposed development sites. A city or county can only issue a construction permit in hazard areas when the developer agrees on an appropriate level of mitigation against landslides or liquefaction, or when selected building sites are offset from active fault traces (usually at least 50 feet).

California disclosure laws require that sellers inform buyers if a property for sale is located within an earthquake fault zone or a seismic hazard zone. The Alquist-Priolo Earthquake Fault Zoning Act has been in effect for 35 years and over 5000 miles of active fault are now zoned throughout the state. The Seismic Hazards Zone Mapping Act has been in effect for over 15 years and more than 4000 square miles of land have been zoned in Los Angeles, Ventura, and Orange counties and in portions of the San Francisco Bay Area. The area zoned under the Seismic Hazards Mapping Act encompasses over 165 incorporated cities having a total population of more than 12 million and an average annual volume of new construction over $10 billion. Two hundred high-risk cities remain to be zoned, representing a total population of about nine million and an average annual construction volume of over $13 billion

Earthquake Hazards: Tsunami

Tsunamis are large waves caused by sudden disturbances in the ocean, usually on the ocean floor. Seiches are similar large waves in lakes. Tsunamis are commonly caused by fault rupture on the ocean floor or by underwater landslides. The Southeast Asia Tsunami of December 2004 has given new visibility to this threat in California. A separate section has been added to this Plan. See Section 5.8.4, Tsunami Risk Assessment for a more detailed discussion.

5.5.2 Profiling Earthquake Hazards

Recent Earthquake Events

Earthquakes large enough to cause moderate damage to structures—those of M5.5 or larger—occur three to four times a year. For example, the Magnitude 6.5 San Simeon Earthquake of December 22, 2003 caused two deaths, 47 injuries, and $263 million in damage. The 2000 Napa Earthquake of Magnitude 5 resulted in $5 million in FEMA aid and $17 million in Small Business Loans.

Strong earthquakes of Magnitude 6 to 6.9 strike on an average of once every two to three years. An earthquake of this size, such as the 1994 Northridge Earthquake (M6.7) or the 1983 Coalinga Earthquake (M6.5), is capable of causing major damage if the epicenter is

near a densely populated area. The Northridge Earthquake caused over $40 billion of disaster losses, 57 deaths, and 11,846 injuries.

Major earthquakes (M7 to 7.9) occur in California about once every ten years. Two recent major earthquakes, the 1992 Landers Earthquake (M7.3) and the 1999 Hector Mine Earthquake (M7.1) caused extensive surface fault rupture but relatively little damage because they occurred in lightly populated areas of the Mojave Desert. In contrast, earthquakes of smaller magnitude but in densely populated areas, such as the 1989 Loma Prieta Earthquake (M6.9), have caused extensive damage over large areas.

California's Catastrophic Earthquake Potential

The two largest earthquakes in California, the 1857 Fort Tejon Earthquake and the famous 1906 San Francisco Earthquake were similar in magnitude (M7.9 and M7.8) and resulted from movement along the San Andreas Fault. Earthquakes of this size (M7.7 to M7.9) can cause more extensive damage over a larger area than the M7.1 to M7.4 earthquakes that have struck California in recent decades.

Although a great earthquake (M8 or greater) has never been officially recorded in California, evidence suggests that one occurred in the early eighteenth century. Native American oral histories, tree-ring studies, geological studies that show the uplift or subsidence of large areas of coastal land, and records of a tsunami that struck Japan and cannot be correlated with an earthquake anywhere else around the Pacific indicate that an M9 earthquake occurred in January 1700 on the Cascadia Subduction Zone, extending north from Cape Mendocino in Northern California to British Columbia. An earthquake of this size is similar to the one that struck Alaska in 1964 and is capable of extensive damage over a very broad region.

A recent study[18] points out that since the 1906 San Francisco Earthquake, the Bay Area region's population has increased about ten-fold. Losses in the 1906 losses included 3,000 deaths, $524 million in direct building losses in 1906 dollars which would equal about $42 billion in 2006 dollars, and 28,000 destroyed buildings, many by fire following the earthquake. It was estimated that a repeat of the 1906 earthquake in 2006 would result in 800 to 3,400 deaths, $90 billion to $120 billion in losses, and 90,000 to 127,000 extensively or completely damaged buildings.

According to a recent communication from the California Seismic Safety Commission, although California is capping deaths reasonably effectively with upgraded codes, the rate of population and per capita wealth growth is still outstripping California's ability to cap growth in [earthquake] disaster dollar losses as well as numbers of damaged facilities. On average, growth generates a 2% increase in constructed environment annually, helping to replace older facilities built to lesser standards, however, less than 1% of unreinforced masonry buildings are being strengthened or replaced annually. Overall, 15% of the current building stock was built prior to earthquake codes. There

[18] Kircher et al, "When the Big One Strikes Again – Estimated Losses due to a Repeat of the 1906 san Francisco Earthquake," EERI Spectra V22, No S2, April 2006.

remains an urgent need to increase the pace of retrofitting or replacement of such buildings to reduce potential losses in the next catastrophic earthquake.

Table 5.5.2A Earthquake Losses (Updated)

Earthquake	Date	Magnitude	Direct Losses (1)	Deaths (4)	Injuries (4)
San Fernando	Feb. 9, 1971	6.6	$2,200 (2)	58	2000
Imperial Valley	Oct. 15, 1979	6.5	$70 (2)	0	91
Coalinga	May 2, 1983	6.4	$18 (2)	1	47
Whittier Narrows	Oct. 1, 1987	6.0	$522 (3)	9	200+
Loma Prieta	Oct. 17, 1989	6.9	$10,000 (4)	63	3757
Cape Mendocino	Apr. 25, 1992	7.0	$80 (3)	0	356
Landers/ Big Bear	June 28, 1992	7.3	$120 (3)	1	402
Northridge	Jan. 17, 1994	6.7	$46,000 (2)	57	11,846
Hector Mine	Oct. 16, 1999	7.1	Minor	0	11
San Simeon	Dec. 22, 2003	6.5	$263(5)	2	46

(1) Estimate in millions of 2000 dollars
(2) Estimate from FEMA (1997)
(2) Estimate from U.S. Office of Technology Assessment
(3) Estimate from National Research Council (1994)
(4) Estimate from OES
(5) Estimate from CSSC Publication 2004-02

Comment On: Chapter 5 Section 5.3

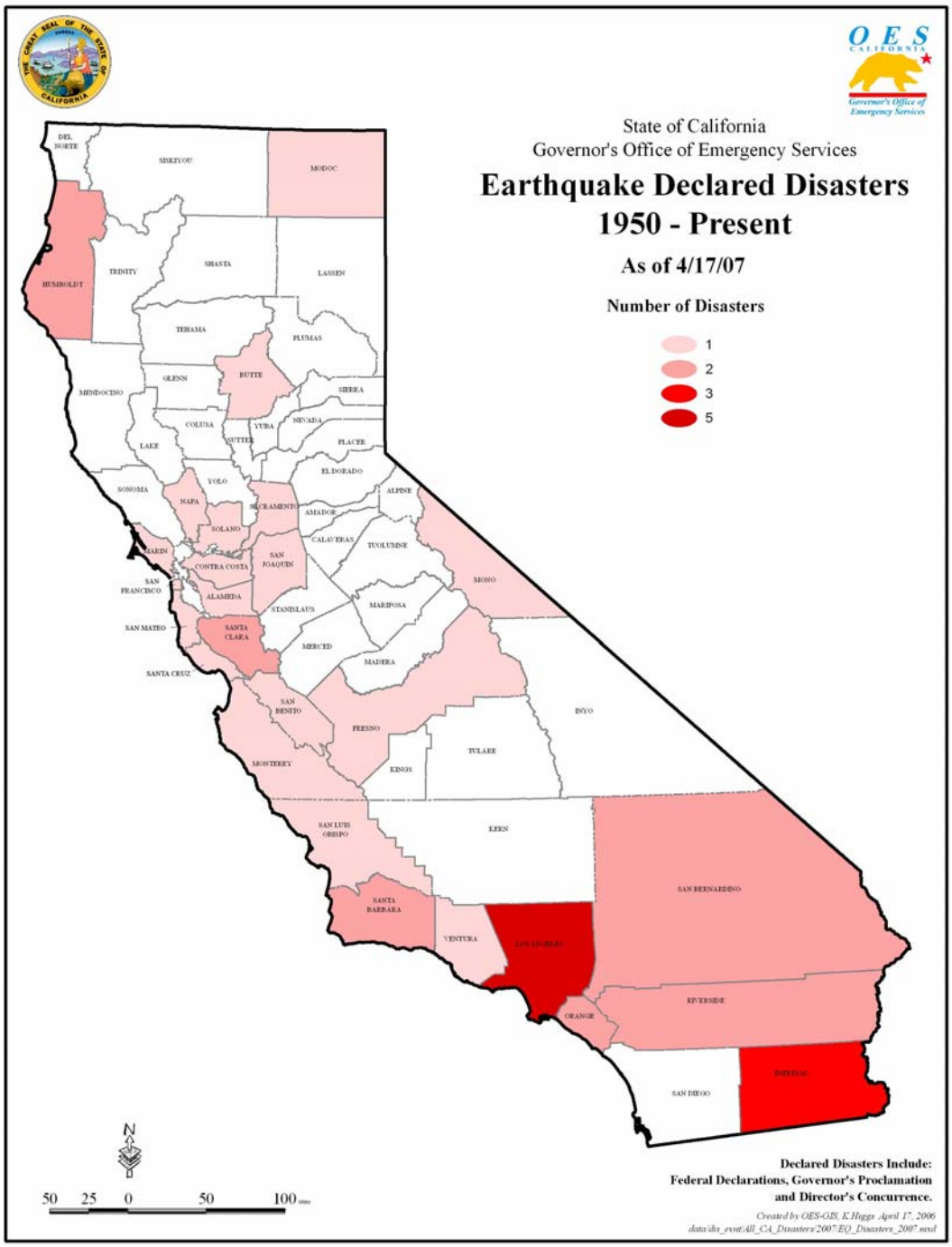
5.5.3 Assessment of State Vulnerability and Potential Losses

Map 5.5.3A on the following page illustrates the distribution of state earthquake disaster proclamations and declarations by county from 1950 to 2007:

- Los Angeles County – 5
- Imperial County – 3
- Mendocino, Riverside, San Bernardino, Santa Barbara, Santa Clara Counties – 2
- Alameda, Butte, Contra Costa, Fresno, Marin, Modoc, Mono, Monterey, Napa, San Benito, Sacramento, Santa Cruz, San Francisco, San Luis Obispo, San Mateo, San Joaquin, Solano, and Ventura -1.

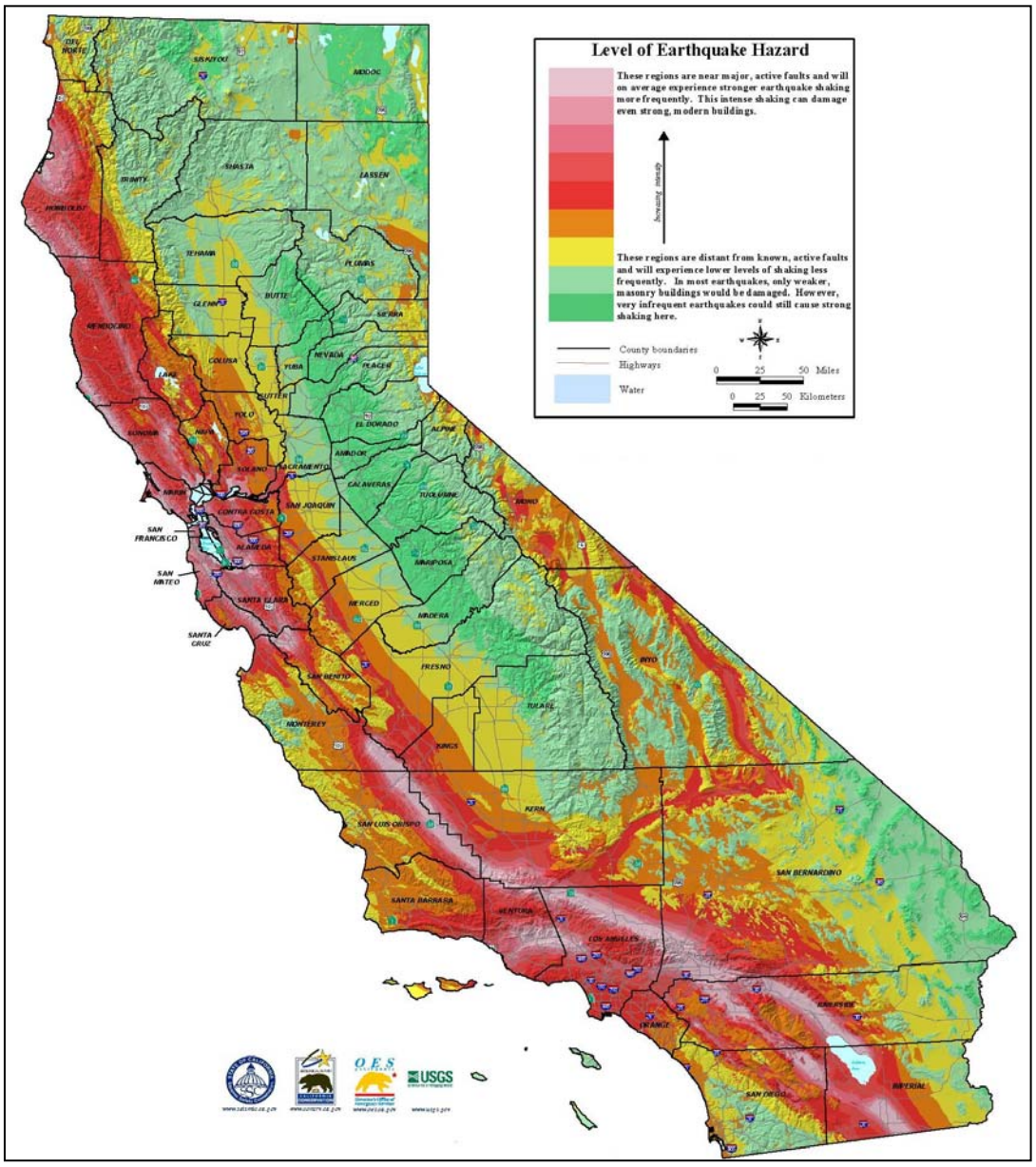
Together, these represent 25 of California's 58 counties.

Map 5.5.3A State Earthquake Disaster Proclamations and Declarations



Map 5.5.3A above shows the distribution within California of earthquake disaster proclamations and declarations from 1950 to 2007. Though this period of time is extremely short in relation to geological time, the geographic distribution of these events appears to generally related to potential earthquake shaking hazards levels in California shown in Map 5.5.3B.

Map 5.5.3B Levels of Earthquake Hazards in California



Map 5.5.3B above shows the distribution within California of a range of earthquake hazard levels, according to the California Geological Survey, USGS and others. The most intense potential shaking areas are shown in light pink-to-red areas which form a linear pattern traversing most of the state from the border with Mexico, parallel to the Pacific Coast, to a point in Pacific Ocean near the Oregon border. Comparison with Map 5.5.3A suggests similarities in patterns of potential shaking intensities along the San Andreas Fault system and actual earthquake disaster declarations during the past 57 years.

Vulnerable Populations

Earthquake vulnerability is primarily based upon population and the built environment. Urban areas in high hazard zones tend to be the most vulnerable, while uninhabited areas generally are less vulnerable. In the past, the California Geological Survey and USGS have done considerable work using GIS technology to identify populations in seismic hazard zones. In the 2004 SHMP Appendix, Table 4.3A, Vulnerable California Populations, listed the percentage of each California county's population residing in a seismic hazard zone. In 17 counties, more than 90 percent of the population lived in the 40 percent g peak ground acceleration or higher seismic hazard zone. These 17 counties are home to 19 million people, or 55 percent of the state's population. Statewide, approximately 22 million people live in the 40 percent g or higher seismic hazard zone.

Hurricane Katrina revealed the additional vulnerability of groups within the general population who may have fewer resources or lesser mobility than others. Preceding Map 5.4.1D shows potential earthquake shaking exposure with combined total population and vulnerable population as measured by an index developed by Dr. Susan L. Cutter. That map shows high earthquake hazard risk exposure in southern California counties and northern counties near the San Francisco Bay Area, with medium risk exposure in many other counties along the Pacific Coast and inland.

Statewide Earthquake Loss Potential

Unfortunately, the number and variations of all potential earthquakes are so large that it is not possible to develop scenarios for all of them, nor would it be possible to prioritize them by importance if they were developed. To get an idea of the overall scope of the risk of losses from earthquakes and to determine which areas are most vulnerable, CGS uses an alternate approach based on probabilistic seismic hazard analysis (PSHA), which considers all possible earthquakes on all of the possible sources. Using this approach, CGS estimates an expected direct annual loss in California of about $2.2 billion. This is approximately 0.14 percent of the $1.6 trillion total value of the building inventory in the HAZUS database. Indirect losses, such as unemployment, business interruption, loss of market share to other regions or countries, and other economic effects could be as much as twice the direct losses.

Potential Earthquakes

Past earthquakes may not provide a realistic estimate of future earthquakes' effects. Large earthquakes in lightly populated regions, such as Landers and Hector Mine, show the potential earthquake shaking from major earthquakes, while moderate earthquakes in populated areas, particularly Northridge, give a sense of California's vulnerability to earthquake shaking. A major earthquake near one of California's urban centers could cause unprecedented losses.

On the basis of research conducted since the 1989 Loma Prieta earthquake, USGS and other scientists have concluded that there is a 62 percent probability that at least one earthquake of M6.7 or greater, capable of causing widespread damage, will strike the San

Francisco Bay Area before 2032. Similarly, research coordinated by the Southern California Earthquake Center (SCEC) concluded that there is an 80 to 90 percent probability that an earthquake of M7.0 or greater will hit Southern California before 2024. Major quakes could occur in any part of these two highly urbanized and rapidly growing regions. The probability that a major quake will hit in some part of California in the next thirty years is over 95 percent.

Estimating Losses from Future Earthquakes

With HAZUS, a standardized methodology and GIS modeling software developed by FEMA, it has become possible in recent years to estimate losses from future earthquakes in California. By combining ShakeMaps with a statewide computerized inventory of population and buildings using HAZUS, OES has estimated casualty and damage losses from various potential earthquakes for the two largest metropolitan regions of the state.

Results of this study are summarized in Table 5.5.3A on the following pages. The figures in Table 5.5.3A have been partially updated. However, several qualifications on their probable accuracy should be made.

1. Use of 1990 Census. OES used the 1990 census as the basis for estimating the building inventory. Greater than expected growth in California since 1990 suggests that loss estimates made at that time are likely to turn out low.

2. Losses to Critical Infrastructure. Additionally, potential losses to other to other types of property, including transportation systems, lifelines, and utilities, which OES did not estimate, could be several times greater than losses to buildings.

3. Ground Motion Instruments. The accuracy of ShakeMaps and the resulting HAZUS estimates are strongly dependent on recorded ground motion. Therefore, places with too few instruments have the potential for significant discrepancies between estimated and actual ground motions.

The California Integrated Seismic Network and the federal Advanced National Seismic System have been working together to fund and install additional seismic instruments. Both programs are funded less that what is required to meet project objectives. Instrumentation is still sparse in some areas of the state, including the epicentral regions of the 2000 Napa and 2003 San Simeon earthquakes.

Table 5.5.3A – Earthquake Scenario Losses, Northern California

Potential Earthquake Scenarios	M_w	Projected Building Damage in Millions	Projected Range of Deaths	Projected Range of Injuries
Northern California				
San Andreas Fault: Repeat of the 1906 San Francisco[1] Earthquake	7.9	$94,000	800 -1,600	22,000 -32,000
San Andreas Fault: Santa Cruz + Peninsula + North[1] Coast segments	7.9	$122,000	1,800 -3,400	39,000 -59,000
San Andreas Fault: Santa Cruz + Peninsula segments[2]	7.4	$30,000	2,100	105,000
San Andreas Fault: Santa Cruz segment[2]	7.0	$5,900	N/A	N/A
San Andreas Fault: Peninsula segment[2]	7.2	$24,000	1,300	66,000
Southern Hayward: Repeat of the 1868 Earthquake[2]	6.7	$15,000	800	42,000
Northern Hayward[2]	6.5	$9,000	200	12,000
Southern Hayward + Northern Hayward[2]	6.9	$23,000	400	20,000
Rodgers Creek[2]	7.0	$8,000	150	10,000
Southern Calaveras + Central Calaveras[2]	6.4	$3,200	N/A	N/A
Northern Calaveras[2]	6.8	$10,000	200	15,000
Southern + Central + Northern Calaveras[2]	6.9	$13,000	N/A	N/A
Concord[2]	6.2	$2,800	200	9,000
Green Valley[2]	6.5	$3,200	N/A	N/A
Concord + Green Valley[2]	6.7	$6,800	N/A	N/A
San Gregorio[2]	7.4	$15,000	350	19,000
Mount Diablo[2]	6.7	$7,000	40	3,000

Sources: 1) "When the Big One Strikes Again – Estimated Losses due to a Repeat of the 1906 San Francisco Earthquake," Kircher, Seligson, Bouabid and Morrow, EERI Spectra V22, No S2, April 2006.

2) Governor's Office of Emergency Services Geographical Information Systems (GIS) Unit, Kevin Miller, 2007. Ranges of deaths and injuries are not available from these HAZUS scenarios.

Table 5.5.3B – Estimated Earthquake Scenario Losses, Southern California

Potential Earthquake Scenarios	M_w	Projected Building Damage in Millions	Projected Range of Deaths	Projected Range of Injuries
Southern California				
Puente Hills fault[2]	7.1	$69,000	40-700	1,700 -11,000
Newport-Inglewood[2]	6.9	$49,000	150-1,900	5,200 -33,000
Palos Verdes[2]	7.1	$30,000	80-1,050	2,400 -19,000
Whittier Fault[2]	6.8	$29,000	30-500	2,300 -13,000
Verdugo Fault[2]	6.7	$24,000	100-1,300	3,150 -18,700
San Andreas Fault: Southern Rupture[2]	7.4	$18,000	50-420	1,700 -8,100
San Andreas Fault: Repeat of the 1857 Earthquake (Fort Tejon)	7.9	$150,000[1]	60-900[2]	2,200 -15,000[2]
Santa Monica[2]	6.6	$17,000	40-160	2,000 -13,000
Raymond Fault[2]	6.5	$17,000	60-520	2,150 -11,700
San Joaquin Hills[2]	6.6	$15,000	60-920	2,200 -15,500
Rose Canyon[2]	6.9	$14,000	40-600	1,300 -9,000
San Jacinto[2]	6.7	$7,000	30-400	1,500-7,000
Elsinore Fault[2]	6.8	$4,000	40-70	450 -2,000

Sources: 1) 1857 Fort Tejon Earthquake: 150 Year Retrospective, Risk Management Solutions, Special Report, 2007.
2) Governor's Office of Emergency Services Geographical Information Systems (GIS) Unit, HAZUS scenarios, Douglas Huls, 2007.

Comment On: Chapter 5 Section 5.4

5.5.4 Assessment of Local Vulnerability and Potential Losses

Editor's Note: This section has been restructured to conform with FEMA content requirements. Some material redundant of California Earthquake Loss Reduction Plan content originally included in this draft of the 2007 SHMP may be relocated to the Appendix (Appendix) in the final publication.

Comment On: Chapter 5 Section 5.4.1

5.5.4.1Vulnerability and Mitigation of Buildings

Compared to other earthquake vulnerabilities, buildings pose the largest risk to life, injury, property and economic welfare. California has approximately 12 million buildings, with an average of 2.7 occupants per building. Approximately 95 percent are low rise (one to three stories), five percent are medium rise (four to seven stories), and 0.03 percent are high rise buildings (eight or more stories) (ATC 13, Jones et al). Observations after earthquakes indicate that building safety is most often compromised by poor quality in design and construction, inadequate maintenance, a lack of code enforcement at the time of original construction, and improper alterations to the original building. (Turning Loss to Gain, CSSC 95-01)

A less common cause of damage is the poor performance of older buildings built to earlier seismic codes. Approximately 15 percent of California's buildings were constructed before 1933, when explicit requirements for earthquakes first began to be incorporated into building codes and when the state first required local governments to create building departments and issue permits. About 20 percent of California's buildings were constructed before 1940, when the first significant strong motion recording was made in El Centro. About 45 percent of the state's buildings were constructed before the Structural Engineers Association of California's first statewide consensus on recommended earthquake provisions were published in 1960. About 65 percent were built before the mid- to late-1970s, when significant improvements to lateral force requirements began to be enforced throughout the state. California did not have uniform adoption of the same edition of model codes in every jurisdiction until the early 1990s. Thus, well over half of all existing buildings in California are built to earlier standards that in many cases can result in inadequate earthquake performance.

Damage due to ground shaking produces over 98 percent of all building losses in typical earthquakes. In addition, buildings are also vulnerable to ground displacements associated with primary fault rupture, liquefaction, differential settlement, and landslides. Inundations from tsunamis seiches, and dam failures can also be major sources of loss to buildings.

Mitigation of Building Losses

The most effective single element in mitigating earthquake losses to buildings is the consistent application of a modern set of design and construction standards, such as those incorporated in modern building codes. The codes are updated regularly to include the most effective design and construction measures that have been found by testing and research or observed in recent earthquakes to reduce building damage and losses. Local government building departments using a modern code, such as the 2007 International Building Code, regulate the vast majority of buildings. Exceptions include acute care hospitals, public K-14 schools, and state-owned buildings, which are regulated by state agencies in accordance with an even more stringent set of building code provisions that are incorporated in the 2007 California Building Code.

For new buildings, state and local governments enforce the California Building Standards Code (CBSC) that includes earthquake safety provisions from the 2006 International

Building Code with enhancements for hospitals, public schools, and essential services buildings.

A small percentage of older buildings have been strengthened or "retrofitted" to improve their resistance to earthquake shaking. Observations after recent earthquakes suggest that retrofitted buildings on the whole perform noticeably better than similar buildings that have not been retrofitted (ATC 31, 1992, CSSC 94-06, WJE 1994). However, in many respects their performance has been mixed. Less than five percent of California's existing buildings have been structurally retrofitted; the actual number has not been determined.

California has recently adopted a national standard, ASCE 41-06, Seismic Rehabilitation of Existing Buildings, as a retrofit regulation for public schools and state-owned buildings which will be effective January 1, 2008. California has also adopted retrofit regulations for hospitals and unreinforced masonry (URM) buildings, (see Chapter 34 of the 2007 CBC and Title 24 Part 10 of the CBSC). The CBC allows retrofits of any nature provided that they make existing buildings no less safe. These regulations and the 2006 International Existing Building Code are available for use at the discretion of all state and local regulatory agencies. They include a compilation of seismic evaluation and retrofit provisions for unreinforced masonry, tilt-up, wood frame dwelling, and older concrete buildings. A separate California Historical Building Code contains provisions for evaluating, rehabilitating, and altering historical buildings.

National standards for building seismic evaluations and retrofits are published by the American Society of Civil Engineers as ASCE 31-03 "Seismic Evaluation of Existing Buildings" and ASCE 41-06 "Seismic Rehabilitation of Existing Buildings." (www.asce.org) The latter is included as an allowed reference standard in Chapter 34 of the 2007 CBC.

Mitigation measures for ground displacement include strengthening foundations, locating new facilities to avoid sites with the potential for large displacements during earthquakes, and modifying soils below foundations. Refer to CGS Special Publication 117, "Guidelines for Evaluating and Mitigating Seismic Hazards in California." (www.conserv.ca.gov/cgs)

Mitigation of Losses in Nonstructural Systems

California did not begin to regulate the earthquake safety of nonstructural systems and heavy contents in buildings, such as water heaters, ceilings, light fixtures, and heating equipment, until the 1970s. Buildings built before the 1970s and newer buildings that were not regulated and that have unbraced systems can be made safer with retrofit projects. FEMA offers guidelines for the evaluation and retrofit of building contents and nonstructural building systems (FEMA 74). These retrofits can significantly reduce the risks of injuries and business interruption from earthquakes and are often feasible at very low costs. OES offers guidelines for evaluating and retrofitting nonstructural falling hazards common to schools at www.oes.ca.gov. The *Homeowner's Guide to Earthquake Safety* and the *Commercial Property Owner's Guide to Earthquake* also contain

recommendations on how to identify and retrofit contents and nonstructural systems in buildings that are vulnerable to earthquakes.

Water heater bracing kits that are certified for use by the State Architect are available at most hardware stores. The State Architect also offers strapping instructions at www.dsa.dgs.ca.gov/Publications/default.htm. Bracing can prevent fires and serious water damage caused by toppled water heaters. State law requires all replacement water heaters to be braced and all existing residential water heaters to be braced upon sale of buildings. (Health and Safety Code 19210 *et seq* www.leginfo.ca.gov).

Fire Following an Earthquake

While ground shaking may be the predominant agent of damage in most earthquakes, fires following earthquakes can also lead to catastrophic damage depending on combination of the building characteristics and density, meteorological conditions, and other factors. Fires following the 1906 San Francisco Earthquake, the 1923 Tokyo Earthquake, and the 1995 Kobe Earthquake caused extensive damage and killed thousands.

Fires following the 1906 San Francisco Earthquake led to more damage than due to ground shaking. Most recently, fires in the Marina District of San Francisco following the 1989 Loma Prieta earthquake and in Los Angeles following the 1994 Northridge earthquake demonstrate that fires following earthquake pose significant hazard, especially in densely populated urban areas, and a potentially serious problem due to severe strain on the fire departments which must respond to multiple simultaneous ignitions. Fire department response is often impeded by impaired communications, water supply and transportation, together with other demands of earthquake emergencies such as structural collapses, hazardous materials releases, and emergency medical aid.

Fires following earthquakes may result from multiple causes, e.g., overturned burning candles, electrical sparking from downed power-lines, broken natural gas pipelines[19]. Numerous instances of fires following earthquakes have occurred in major urban areas during past earthquakes.

Fires following earthquakes can occur immediately after an earthquake or may be delayed. Causes of fires occurring immediately include: power lines are fused or broken and the resulting arcing comes into contact with combustible fuel; water heaters, stoves and lighting fixtures/lamps are dislodged and come into contact with combustible fuel; natural gas mains, lines and service are severed and the released gas finds a source of ignition; combustible liquids can leak and find a source of ignition.

Fires that are delayed are generally human caused or preventable, for example, fire caused by the restoration of electricity to an area not properly checked and secured.

[19] A complete list may be found in *Fire Following Earthquake*, Edited by Charles Scawthorn, John Eidinger, and Anshel Schiff, Technical Council on Lifeline Earthquake Engineering, Monograph No. 26, Published by the American Society of Civil Engineers, January, 2005.

When power is restored heating of electrical appliances can occur, followed by ignition. Inexperienced people can start fires by trying to relight gas pilots.

Vulnerability to fires following earthquake can be assessed for communities by well established simulation models. Several computer programs, e.g., HAZUS, EQEFIRE, URAMP, SERA, RiskLink, are available to assess the fire following earthquake vulnerability of a community in future earthquakes. Details of various computer modeling techniques are described in the book *Fire Following Earthquake*[20].

A general framework for mitigation includes the following components provided in advance of the earthquake disaster: 1) *reduction in damage* through advance mitigation; 2) presence of functioning *automatic sprinklers* or other suppression systems; 3) *citizens* able to extinguish the fire if water is available or to call the fire department; 4) functioning *communications* (i.e., telephone) are required to contact fire departments; 5) available *fire department personnel* and their assets (i.e., apparatus); 6) functioning *transportation* networks (i.e., roads); 7) an adequate *water* supply; 8) advance provision of *firebreaks*, via urban planning process, is the last opportunity for mitigation of fires following earthquake.

In addition, mitigation for the prevention of natural gas system leakage has included localized upgrading of natural gas pipelines and automatic seismic shut-off switches which cut off natural gas to customers. It is critical that restoration of gas service following an earthquake be coordinated through the local gas utility and the fire department to ensure that service is not restored until leak detection and minimum safety requirements are met on the distribution side of the gas meter. Restoration of gas and electrical services for areas known or suspected to have sustained damage may not be restored until the utilities and the fire department are prepared to have service restored.

An additional mitigation technique is the use of seismic pressure wave-triggered automatic garage door openers and alarms at fire stations. These devices help ensure that firefighters and fire equipment are not trapped in damaged fire stations following earthquakes.

Sub-Inventories of Existing Buildings

The following building types are discussed in the text that follows:

1. Unreinforced Masonry (URM) Buildings
2. Hospitals
3. Locally Regulated Essential Services Facilities
4. State-Regulated Essential Services Buildings
5. Other State-Owned Normal Occupancy Facilities
6. State Criminal Justice Buildings
7. State-Owned Health Services
8. K-12 Public Schools
9. Community Colleges

[20] Scawthorn et al, January, 2005.

10. Public Universities
11. Tilt-Ups
12. Single-Family Wood Frame Dwellings
13. Multi-Unit Wood Frame Residential Buildings
14. Locally Regulated Non-Ductile Concrete Buildings
15. Steel Frame Buildings
16. Seismic Gas Shutoff Valves
17. High-Rise Buildings
18. Mobile Homes

Earthquake Mitigation of Key Building Inventories

2007 SHMP Appendix Table 5.5.4.1F titled "Draft Overall Progress Toward Earthquake Mitigation of Key Building Inventories in California" summarizes the progress in making some of these types of buildings safer. Appendix Maps 5.5.4.1B-C depict the location of state owned and leased structures in relation to earthquake faults in Northern, Central, and Southern California, respectively.

Locally Regulated Unreinforced Masonry Buildings

Unreinforced masonry (URM) buildings are made of brick, stone, or other types of masonry and have no reinforcing steel to keep them from falling down in earthquakes. Most URM buildings have features that can threaten lives during earthquakes. These include parapets, walls, and roofs that are poorly connected to each other. When earthquakes occur, inadequate connections in these buildings can allow masonry to fall. Floors and roofs can collapse, placing occupants and passersby in harm's way.

Mitigation of URM Buildings

The risk to life from URM buildings can be significantly reduced by the regulation of alterations to existing buildings and seismic retrofits. California has prohibited the construction of new URM buildings since 1933. However, over 22,000 URM buildings still remain in use today in California's historic, commercial, and industrial districts in high seismic hazard regions.

In 1986, California passed a law requiring local governments in high seismic regions nearest active faults (Seismic Zone 4) to inventory their URM buildings, establish a risk reduction program, and report to the CSSC. Ninety-three percent of the jurisdictions affected by the URM law comply with its provisions. State government buildings are exempt from the URM law but are partially addressed by other laws and regulations.

In 1990, there were an estimated 30,000 URM buildings statewide; approximately 26,000 were located in Seismic Zone 4, with the remainder in Seismic Zone 3. Ninety-eight percent of the URM buildings in Seismic Zone 4 (283 jurisdictions) have been inventoried. Statewide, URM buildings average 10,000 square feet of floor area and retrofits costs average $50 per square foot and range from $10 to $150 per square foot. The following is a summary of their status in Seismic Zone 4.

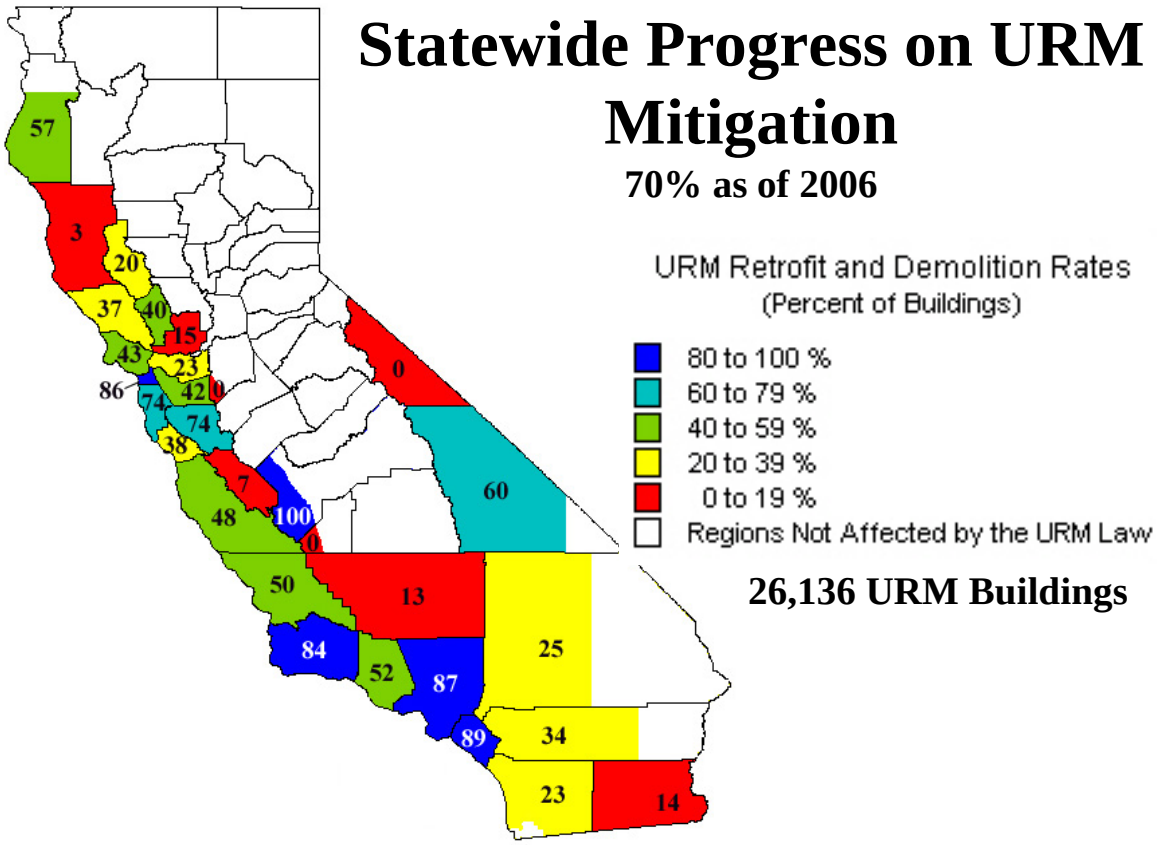
Table 5.5.4.1A Status of Unreinforced Buildings in Seismic Zone 4

Number	Status	%
18,144	Mitigated	70
14,203	Retrofitted to various standards	55
10,762	Retrofitted to the UCBC	41
3,441	Retrofitted to other standards	13
3,941	Demolished	15
7,801	Unretrofitted	30

Source: Status of the Unreinforced Masonry Building Law, SSC 2006-04,url: www.seismic.ca.gov/sscpub.htm

Map 5.5.4.1A depicts the geographic distribution of URM retrofit progress in Seismic Zone 4 as of 2006.

Map 5.5.4.1A URM Retrofit Progress in Seismic Zone 4



The state adopted retrofit standards for URM buildings in Title 24, Part 10 of the 2007 California Building Standards Code. These reference the 2006 International Existing Building Code Appendix Chapter A1. Of California's cities and counties, 169 have

adopted some form of these standards. See "Status of the Unreinforced Masonry Building Law" (SSC 2006-04) for the mitigation status for each jurisdiction affected by the state's URM Law.

Hospitals

Since 1973, hospitals have been required to be built to higher standards than other buildings so that they can be reoccupied after major earthquakes. However, most hospitals built before 1973 still remain in service, some of which pose risks to life or are not expected to be available for occupation after future earthquakes.

The Office of Statewide Health Planning and Development (OSHPD) requires hospital owners to survey the earthquake vulnerability of their buildings as summarized in the table below. Structural Performance Category (SPC) 1 is the most vulnerable ranking for buildings. Many SPC 1 hospitals pose significant collapse risks. SPC 5 hospitals pose the least structural risk. Similarly, rankings for Nonstructural Performance Categories (NPC) range from 1 (most vulnerable) to 5 (least vulnerable).

Table 5.5.4.1B Hospitals

Type	Category	Number of Buildings	%	Vulnerability
Structural Performance (SPC)	SPC-1	975	39	Most Vulnerable
	SPC-2	211	8	
	SPC-3	291	12	
	SPC-4	672	27	
	SPC-5	323	13	Least Vulnerable
SPC not reported	N/A	35	1	N/A

Table 5.5.4.1C Hospitals Continued

Type	Category	Number of Buildings	%	Vulnerability
Non-Structural Performance (NPC)	NPC-1	1,807	72	Most Vulnerable
	NPC-2	430	17	
	NPC-3	63	3	
	NPC-4	143	6	
	NPC-5	15	1	Least Vulnerable
NPC not reported	N/A	49	2	N/A

Source: Hospital Seismic Performance Ratings, OSHPD, April 2001. For more information visit www.oshpd.ca.gov.

Mitigation of Hospital Buildings

Senate Bill 1953 (SB 1953), enacted in 1994 after the Northridge Earthquake, expanded the scope of the 1973 Alquist Hospital Seismic Safety Act. SB 1953 required the retrofit

of all critical nonstructural components in surgery and emergency medical rooms by 2002. The law also requires that by 2013, all hospital buildings built before 1973 be replaced or retrofitted so that they can reliably survive earthquakes without collapsing or posing threats of significant loss of life. It further mandates that all existing hospitals be seismically evaluated and retrofitted, if needed, by 2030, so that they are reasonably capable of providing services to the public after disasters. SB 1953 applies to all acute care facilities (including those built after 1973) and affects approximately 2,500 buildings across 475 hospital facilities. State-owned hospitals are exempt from SB 1953. OSHPD has adopted and enforces regulations for the seismic evaluation and retrofit of existing hospital buildings (Chapter 34A, 2007 California Building Code) that are applicable to all existing urgent care hospitals.

Locally Regulated Essential Services Facilities

California has no statewide inventory of locally regulated essential services facilities, including fire, police, ambulance, and emergency communication facilities. Most of these facilities were built prior to 1986, before state standards began to require enhanced seismic safety, and are not expected to be reliably functional after severe earthquakes, delaying emergency response and in some cases posing significant risks to life. DGS estimates that there are approximately 450 fire stations, 400 emergency operations centers, and 450 police stations throughout California.

Mitigation of Locally-Regulated Essential Services Buildings

To mitigate the risk of earthquakes to locally regulated essential services facilities, California enacted the Essential Services Buildings Seismic Safety Act in 1986. Pursuant to the Act, the Division of the State Architect within DGS adopted regulations that apply to the construction of all new essential services buildings (California Code of Regulations, Title 24, Part 1, §4-201 to §4-249). There are no statewide regulations for evaluating and retrofitting locally regulated essential services buildings that existed prior to 1986, except for unreinforced masonry buildings in some jurisdictions. Some local governments and state agencies have voluntarily retrofitted or replaced their vulnerable buildings.

In 1990, the state passed the Earthquake Safety and Public Buildings Rehabilitation Bond Act (Proposition 122). Up to $50 million was allocated for the seismic retrofit of essential services facilities. As of 2000, 147 retrofit projects totaling $46 million were underway. Approximately 70 fire stations, 12 emergency operations centers, and 9 police stations completed retrofits by 2000. Many local governments and special districts have retrofitted their essential services buildings with local funds.

State-Regulated Essential Services Buildings

California has no statewide inventory of state-regulated essential services facilities, including fire, police, ambulance, and emergency communication facilities. Most of these facilities were built before state standards began to require enhanced seismic safety and are not expected to be reliably functional after earthquakes, delaying emergency response and in some cases posing significant risks to life. Key state agencies owning essential services facilities include:

- California Department of Forestry and Fire Protection
- CalTrans
- The California Highway Patrol
- The Department of Water Resources

Mitigation of State-Regulated Essential Services Buildings

California enacted the Essential Services Buildings Seismic Safety Act of 1986 and DSA adopted regulations that apply to all new construction (Title 24, Part 1). For existing essential services buildings owned by the state, the CBSC adopted regulations in Chapter 34 of the 2007 California Builing Code that apply to building seismic evaluations and retrofits. California has also recently adopted a national standard, ASCE 41-06, Seismic Rehabilitation of Existing Buildings, as a retrofit standard for state-owned Essential Services Buildings which will be effective January 1, 2008.

Other State-Owned Normal Occupancy Facilities

California has an asset management program for non-university buildings that maintains an inventory of approximately 17,000 buildings with a total of almost 90 million square feet of space. Proposition 122 of 1990 included $250 million for the identification and seismic retrofit of deficient state-owned buildings.

Mitigation of Other State-Owned Normal Occupancy Facilities

As of 2003, 70 state-owned buildings had been retrofitted and an additional 76 retrofits were in progress. Combined with other funding, as of 2003 this total effort provided $262 million in seismic safety improvements in buildings owned or occupied by 13 state agencies.

In 1990, CSSC estimated the average seismic retrofit cost for state buildings at $45 per square foot. In 1999, DGS' Real Estate Services Division estimated the cost for retrofitting all state buildings as $0.84 to $1.7 billion.

In 2002, the state began a program to transfer facility funding and operations for county courthouses to the Judicial Council. Seismic evaluations are required as part of the negotiation between the counties and the state.

For existing buildings owned by the state, the CBSC adopted regulations now in chapter 34 of the 2007 California Building Code that apply to seismic evaluations and retrofits.

State Criminal Justice Buildings

A 1979-1980 renovation and planning study funded by the Department of Corrections included seismic evaluations and identification of remedial actions for major state prison buildings. Since then, some prisons have been retrofitted in conjunction with other planned modernization projects. Together the Department of Corrections, the Department of Justice, and the California Youth Authority own:

- 33 prisons
- 38 correctional conservation camps
- 11 youthful offender institutions
- 12 crime laboratories

Mitigation of State Criminal Justice Buildings

CBSC has adopted regulations now in Chapter 34 of the California Building Code for the seismic evaluation and retrofit of state criminal justice buildings. California has also recently adopted a national standard, ASCE 41-06, Seismic Rehabilitation of Existing Buildings, as a retrofit standard for state-owned criminal justice buildings which will be effective January 1, 2008.

State-Owned Health Services

The state manages seismic risk in its health care facilities through DGS, CDHS, and DDS. The state owns:

- Four mental health hospitals with 4 million square feet of space
- Five developmental centers 5 million square feet of space
- Two public health laboratories

Mitigation of State-Owned Health Services Buildings

The state's acute care hospitals are exempt from the Alquist Hospital Seismic Safety Act. However, the state remains responsible for the public's seismic safety in these facilities. For state-owned buildings, the CBSC has adopted regulations (Chapter 34A, 2007 California Building Code) that are applicable to seismic evaluations and retrofits. California has also recently adopted a national standard, ASCE 41-06, Seismic Rehabilitation of Existing Buildings, as a retrofit standard for state-owned buildings which will be effective January 1, 2008.

K-12 Public Schools

Since 1933, public schools have been constructed in accordance with the Field Act, which requires thorough reviews of construction plans, strict inspections, and quality control. By 1977, nearly all public schools that were built before the Field Act had either been retrofitted or were no longer being used for instructional purposes. The Field Act did not begin to regulate nonstructural systems and building contents in schools until the 1970s. Many schools, particularly older public schools contain falling hazards that can injure occupants.

In 2006, Proposition 1D set aside up to $200 million for the seismic retrofit of early Field Act Buildings.

In 2002, the Division of the State Architect (DSA) released a report on a survey of early Field Act buildings that were constructed to regulations that, for certain types of construction, are no longer considered to provide reliable life safety. Survey results include:

- 42,000 Field Act building construction projects were submitted to DSA before the major building code changes effective 1978
- Buildings built before 1933 were either removed from use or retrofitted by 1976
- 9,659 buildings (92 million square feet of space) with non-wood construction were constructed prior to 1978 when major changes were made to the Field Act regulations.
- 2,122 Category 1 Buildings (expected to perform well and achieve life safety)
- 7,537 Category 2 buildings (not expected to perform as well as Category 1 Buildings and require more seismic evaluations)
- DSA anticipates needing $4.7 billion to evaluate and retrofit Category 2 buildings to meet a damage control and life safety performance objective

Source: Seismic Safety Inventory of California Public Schools, Division of the State Architect, Department of General Services, November 15, 2002

Mitigation of Public School Buildings

California has adopted the Field Act and its regulations for new construction in the California Building Standards Code. For existing K-12 public schools and community colleges: in 2003 DSA adopted emergency seismic evaluation and retrofit regulations (Chapter 34, 2007 California Building Code) that are applicable to public school buildings and conversions of non-Field Act buildings to public school use. California has also recently adopted a national standard, ASCE 41-06, Seismic Rehabilitation of Existing Buildings, as a retrofit standard for public schools buildings which will be effective January 1, 2008. Several older school districts throughout the state have or are currently retrofitting early Field Act schools.

The HMGP identified non-structural mitigation as a priority for schools and essential facilities following the 1994 Northridge Earthquake. OES offers guidelines for the retrofit of building contents and nonstructural building systems such as ceilings, light fixtures, and mechanical equipment (Guide and Checklist for Nonstructural Earthquake Hazards in California Schools, available at www.oes.ca.gov).

Community Colleges

In 2000, the Community Colleges Chancellor's office funded a rapid seismic evaluation of buildings constructed to early Field Act standards. The survey found that the community college system has 20 district offices, 108 campuses, 54 off-campus centers, 4,366 buildings overall, and 52.2 million square feet of space. Of the total buildings, 1,600 were given a rapid seismic evaluation to identify retrofit needs that are now integrated into future capital outlay plans.

Up until June 30, 2006, Community Colleges also had to comply with the Field Act. On and after July 1, 2006, Community Colleges can choose not to comply with the seismic safety provisions of the Field Act. This change in law was triggered by the passage of Proposition 1D on the November 2006 ballot pursuant to Assembly Bill AB 127 (Nunez, Section 81052 Education Code) which provided funds for Field Act seismic upgrades.

Mitigation of Community College Buildings

At this time, no information is available regarding efforts to mitigate known vulnerable Community College buildings

Public Universities

The University of California (UC) and California State University (CSU) systems together have 192 primary and satellite campuses and 10,000 buildings with 138 million square feet of space. Since the early 1970s, UC has been evaluating and retrofitting buildings on its campuses. The system has ranked the seismic safety of its major buildings from “good” to “very poor” and has embarked on capital outlay programs to retrofit those that are ranked “poor” or “very poor.”

In the early 1990s, CSU initiated a similar program. As of 2003, CSU had evaluated 1,364 major facilities, identified 145 as potentially hazardous, and required further evaluation and retrofits in many cases.

Mitigation of Public University Buildings

As discussed further below, most facilities identified as hazardous now have retrofit projects undergoing design or construction or completed. The greatest vulnerability aspects of public universities are the potential for loss of life, research, and educational functions, and damage to state property.

For existing public university buildings owned by California State University (CSU) system and University of California (UC) system, the CBSC has adopted regulations (Chapter 34, 2007 California Building Code) that are applicable to their seismic evaluations and retrofits. Both university systems have active seismic safety programs with major long-term capital programs including billions of dollars in mitigation investments.

CSU Seismic Peer Review Board

Since 1993 the CSU has had a vigorous program of reducing the unacceptable seismic risk of existing buildings and managing current construction programs to limit future seismic risk to acceptable levels. Seismic peer review is a mandatory part of the construction process of the CSU. Consistent with Title 24, the CSU has adopted minimum seismic parameters. These campus-specific coefficients seek to provide more accurate guidance for structural calculations. Site-specific site soil conditions are determined by a geotechnical engineer as part of the development of each project.

The CSU has a seismic emergency response protocol that was adopted in 2000 based on efforts of the Seismic Peer Review Board established in 1992. The CSU Seismic Safety Requirements strive to build and maintain facilities "that provide an acceptable level of earthquake safety for students, employees, and the public." The Seismic Review Board is comprised of seven, independent engineers (six structural, and one geotechnical) who review and advise the CSU of existing policy and code requirements. The six engineers are assigned specific campuses, and have developed a base of knowledge about each campus, site-specific soil issues, and fault proximity. The Seismic Policy includes

provisions for emergency response by the Seismic Review Board in the event of a significant seismic event. The Chairman of the Seismic Review Board acts as the Designated Building Official for the purposes of safety determination of structures. When an earthquake occurs, the Designated Building Official evaluates the safety of buildings on campus and indicates recommendations for engineering investigations to determine the condition of individual buildings.

The CSU Risk Management Authority (CSURMA) performs a tri-annual appraisal of approximately 3,000 buildings ($14 billing approximate value). The appraisal methodology identifies buildings in flood plains and with earthquake exposure.

In 2006, the CSU obtained FEMA Pre-Disaster Mitigation Grant Program supplemental funding for three planned projects that included a seismic retrofit as a part of their overall construction program. This federal program was designed to help fund projects that could help reduce the severity of loss in potential disaster scenarios such as flooding or seismic events. The Cal Poly Pomona and San Bernardino campuses were awarded $2.166 million and $1.712 million, respectively, in supplemental funding.

The Disaster Resistant Universities Program

In the last decade, disasters have affected university and college campuses with high frequency, sometimes causing death and injury and always resulting in monetary losses and disruptions in teaching, research, and public service. Damage to buildings and infrastructure and interruption of the institutional mission result in significant losses that can be measured by faculty and student departures, decreases in research funding, and increases in insurance premiums. These losses could have been substantially reduced or eliminated through comprehensive pre-disaster planning and mitigation actions.

The FEMA Disaster Resistant Universities (DRU) program was initiated in 1998 as a pilot project at UC Berkeley. Major UC Berkeley DRU reports include an Earthquake Loss Estimation study, a Strategic Plan for Loss Reduction and Risk Management, and a case study focused on strategies for Seismic Protection of Laboratory Contents.

In addition, UC operates five major medical centers and is the largest public health care provider in the nation besides the Federal Veterans Administration. All hospital facilities are being seismically retrofitted in accordance with the Alquist Hospital Seismic Safety Act of 1983 as part of UC's system-wide seismic safety program.

Building A Disaster Resistant University is both a how-to guide and a distillation of the experiences of six universities and colleges across the country that have been working to become more disaster-resistant. The guide, that can be downloaded from: www.fema.gov/fima/dru.shtm

The guide provides basic information designed for institutions just getting started as well as concrete suggestions for institutions that have already begun to take steps towards becoming more disaster resistant.

The SAFER Program

The Seismic Action Plan for Facilities Enhancement and Renewal at UC Berkeley is known as the SAFER Program. UC Berkeley created the SAFER program in 1997 to improved campus seismic safety, with highest priority on life safety, and also to ensure sustained campus operations in the aftermath of a major earthquake on the Hayward Fault that runs through campus. SAFER implementation is estimated to cost UC Berkeley over $1 billion over the next thirty years, with funding from multiple federal, state, university, corporate, and donor sources.

According to program's website, "The review was undertaken and the action plan developed with one goal: to do all we can to improve the safety of the campus in the event of a major earthquake on the nearby Hayward Fault. Our number one priority is the protection of the life and safety of students, faculty and staff." For more information, visit www.berkeley.edu/news/extras/1997/SAFER/index.html.

Tilt-Ups

Tilt-up buildings are typically one- or two-story buildings constructed of concrete walls that are tilted into place and connected to wood or steel roofs. If the connections between the walls and roofs are weak, the walls can pull away from roofs and collapse during ground shaking. There is no statewide inventory of tilt-up buildings. However, a 1991 estimate suggested that there were approximately 57,000 throughout the state (EQE, 1991). Forty percent of these were built prior to 1976, after which building codes began to require stronger wall-to-roof connections. Many tilt-up buildings have been constructed in the past decade, generally to more current construction standards. Additional enhancements to the building code for new tilt-up construction were adopted in 1997.

The average building size for older tilt-up buildings is 30,000 square feet. Average retrofit costs are $5 per square foot. Much of California's light industrial and commercial properties are tilt-up buildings or buildings with reinforced masonry or concrete walls with vulnerabilities in connections between walls, roofs, and floors. These buildings pose significant risks of casualties and losses in business continuity and market share from earthquake damage.

Current retrofit provisions are available in Appendix Chapter A2 of the International Existing Building Code or ASCE 41-06. The state also encourages sellers of tilt-up buildings and other vulnerable commercial buildings to disclose to buyers any typical earthquake weaknesses defined in the *Commercial Property Owner's guide to Earthquake Safety*. Additionally, state law encourages the disclosure earthquake weaknesses in commercial properties at the time of sale. The following jurisdictions have established inventory or retrofit programs for tilt-up buildings:

Table 5.5.4.1D Mitigation of Tilt-Ups and Similar Buildings

Jurisdiction	# of Buildings	Program Type
Los Angeles	2,618	Mandatory Retrofit
Los Angeles County & Contract Cities	N/A	Mandatory Retrofit
Fullerton	220	Mandatory Retrofit
Hayward	130	Voluntary Retrofit
La Palma	N/A	Mandatory Retrofit
Brisbane	N/A	Voluntary Retrofit
Santa Monica	N/A	Mandatory Retrofit
Berkeley	75	Inventory Only

Single-Family Wood Frame Dwellings

There is no statewide inventory of single-family wood-frame dwellings, but approximately 1.5 million single-family dwellings were built in California before 1960 when jurisdictions began to require adequately braced walls. Homes can slide or fall off their foundations if not adequately anchored and braced.

A 1999 survey by the Association of Bay Area Governments (ABAG) determined that two percent to 38 percent of all Bay Area homes were retrofitted to variable levels in different jurisdictions. The average retrofit rate was well below 10 percent. Similarly, the California Earthquake Authority has surveyed its policyholders and found that about 6 percent have retrofitted their homes.

The primary risk posed by single-family wood frame buildings is the potential for loss of housing and property after earthquakes. In addition, poorly braced homes on steep hillsides can slide down hills and present significant threats to life. Falling chimneys can also cause casualties and damage.

Mitigation of Single-Family Wood Frame Dwellings

The following cities have voluntary dwelling retrofit programs:

- Los Angeles 6000 retrofitted as of February 2006 (also adopted a hillside dwelling retrofit ordinance)
- Berkeley
- San Leandro
- Oakland
- Santa Barbara
- Santa Monica.

The most current retrofit provisions are available in Appendix Chapter 3 of the International Existing Building Code. Local governments in the San Franciso Bay Region have adopted more stringent retrofit provisions called Standard Plan A

(www.abag.ca.gov/bayarea/eqmaps/fixit/plansets.html). The state also requires sellers of dwelling buildings to disclose to buyers any typical earthquake weaknesses defined in the *Homeowner's Guide to Earthquake Safety.*

Multi-Unit Wood Frame Residential Buildings

There is no statewide inventory of multi-unit wood frame residential buildings. However, approximately the number ofbuildings can be inferred from local inventories available from select cities as summarized in the tables below. A significant number—perhaps one third—of all apartments and condominiums have parking at the lower levels, which can create earthquake vulnerabilities. These buildings can collapse and cause casualties and property loss and be rendered uninhabitable after earthquakes. Up to 84 percent of the loss of housing in a Hayward earthquake scenario is expected to occur in multifamily residential buildings *(ABAG 1999).*

The estimated numbers of apartment buildings statewide are as follows:

- 160,000 total buildings with five or more units (DOF);
- 130,000 apartment buildings in high Seismic Zone 4;
- 46,000 soft story in Zone 4 (36 percent in SCC);
- An average of 16 units per building.

Sources: Department of Finance Demographics Unit at www.dof.ca.gov
Santa Clara County Survey, EERI Spectra Vol 22, No 4, Nov 2006, Vukazich, Selvaduray & Tran

Mitigation of Multi-Unit Residential Buildings with Soft, Weak, Open Fronts

The following jurisdictions have established inventory or retrofit programs for multi-unit residential buildings with soft stories, weak stories or open fronts:

- Los Angeles – 20,000 soft-story buildings estimated – Voluntary Strengthening Ordinance - 90 buildings retrofitted as of February 2006;
- Fremont – 28 soft-story buildings with 1000 units – Mandatory Strengthening as of March 2007.
- Berkeley – 400 soft-story buildings with 5000 units – Ordinance requires seismic evaluations, warning notices to tenants and warning placards – Updates to Ordinance planned for 2007.
- Santa Monica – 2000 buildings – Mandatory Seismic Evaluation and Strengthening Ordinance temporarily on hold
- San Francisco – Inventory of 3 story and higher residential buildings.
- Santa Clara County Confidential Inventory of Soft Story Buildings:
- San Jose 1093, Sunnyyale 415, Santa Clara City 320, Campbell 221, Palo Alto 130, Mountain View 111, Los Gatos 96, Gilroy 71, Milpitas 55, Cupertino 53, Morgan Hill 37, Los Altos 19, & Saratoga 9
- Burbank – Inventory and mitigation under consideration

The most current retrofit provisions are available in Appendix Chapter A4 of the International Existing Building Code 2006 Edition or ASCE 41-06.

Locally Regulated Non-Ductile Concrete Buildings

There is no statewide inventory of concrete buildings. However, an approximate figure of 40,000 buildings can be inferred from local inventories. These buildings, particularly older ones with high numbers of occupants, can collapse and kill hundreds. This type of building is the fastest growing cause of earthquake losses around the world (Coburn, 2002). California instituted changes in building codes in the mid-1970s that were intended to stem losses in newer buildings constructed to later standards. However, the great majority of these buildings constructed before the mid-1970s have not been evaluated or retrofitted.

The Pacific Earthquake Engineering Research Center was awarded a $3.6 million grant from the National Earthquake Engineering Simulation Center to assess these buildings' collapse risks and develop enhanced risk management methods.(PEER.Berkeley.edu)

The most current retrofit provisions are available in ASCE 41-06 and Appendix Chapter A5 of the International Existing Building Code. The following jurisdictions have retrofit programs for non-ductile concrete buildings.

Table 5.5.4.1E Mitigation of Older Concrete Buildings

Jurisdiction	Buildings	Type of Program
Long Beach	Non-bearing URM, including non-ductile concrete with URM	Mandatory Retrofit
Los Angeles	N/A	Voluntary Strengthening
Fremont	City Hall	Voluntary Strengthening
Palo Alto	49 buildings	Voluntary Strengthening
Petaluma	5 buildings	Partial Strengthening
Santa Monica	N/A	Mandatory Retrofit

Repair of Steel Frame Buildings

After the Northridge Earthquake, the City of Los Angeles enacted an ordinance that required the repair of existing damaged steel frame buildings. Many of these buildings were restored to their pre-earthquake conditions and are likely to suffer similar or worse damage in future earthquakes. Elsewhere in the state no surveys of such buildings exist, although several similarly damaged buildings were discovered in the Bay Area years after the 1989 Loma Prieta Earthquake. The state has since changed its building code for constructing new buildings with this type of framing. There are no efforts in the state to require retrofits or enact post-disaster repair provisions.

Mitigation of Steel Frame Buildings

The cities of Los Angeles and Santa Monica have post-earthquake repair ordinances. Los Angeles required owners to remove the finishes from joints in 242 buildings and repair the ones that were cracked.

The most current recommended evaluation and retrofit provisions are in AISC 41-06 and FEMA 350 to FEMA 353 and in the American Institute of Steel Construction Seismic Provisions (AISC 341). See www.atc.org and www.aisc.org for more information.

As of February 2006, the City of Los Angeles has reported cracks repaired in welds in 500 buildings in the region of strongest Northridge Earthquake shaking.

High Rise Buildings

There is no statewide inventory of high-rise buildings. Only approximately 0.03 percent of all buildings in the state have eight or more stories. However, much of California's corporate, finance, legal, and insurance commerce takes place in these buildings. The potential for loss of market share in the economy from the closure of these buildings after earthquakes due to nonstructural damage is significant. The Council on Tall Buildings and Urban Habitat maintains an inventory of high-rise buildings at www.ctbuh.org.

Mitigation in High Rise Buildings

Guidelines are available for the retrofit of building contents and nonstructural building systems, such as ceilings, light fixtures and mechanical equipment (FEMA 74). Structural retrofits can be accomplished using ASCE 41-06 or the International Existing Building Code. A Tall Buildings Initiative has been launched by the cities of Los Angeles and San Francisco to develop performance-based engineering for future new tall buildings. (http://peer.berkeley.edu/research/tall_building.html)

Mobile Homes

California has approximately 473,000 mobile homes. HCD regulates installations and alterations to mobile homes in approximately 3600 of the state's 5800 mobile home parks. Local governments have enforcement jurisdiction over the remaining parks, as well as over all manufactured home installations outside of parks. In 1974, HCD began to require engineered tie-down devices for wind loads in excess of 15 pounds per square foot for singlewide homes. However, most mobile homes installed from 1974 to 1994 were multi-wide or were installed in regions with lower wind speed and were exempt from this requirement. Therefore, most homes installed prior to 1994 are not attached to their foundations or otherwise braced to resist earthquake loads.

Numerous studies have determined that the performance of pre-1994 mobile homes in California earthquakes is significantly worse than that of conventional wood-frame dwellings. The primary earthquake weaknesses are the temporary foundations on which such homes are commonly placed. Homes on inadequate foundations can shift and fall several feet in earthquakes, severing gas lines. Doors can become stuck, trapping occupants and creating serious threats to life in events with fires (SSC 95-01, Turning Loss to Gain).

Mitigation of Mobile Homes

In 1981, the state began to regulate the design and construction of optional Earthquake Resistant Bracing Systems that can be installed under existing mobile homes at the owners' discretion. Since 1994, the state has required that new or relocated mobile homes be braced to resist earthquakes in one of three ways:

- Conventional foundation systems similar to wood frame dwellings
- Engineered tie-down systems
- Earthquake-Resistant Bracing Systems

Mitigation of Natural Gas Systems in Buildings

The CSSC has developed guidance for local governments for mitigating natural gas systems in buildings, titled Improving Natural Gas Safety in Earthquakes (SSC 02-03). The most cost effective mitigation method is training the public to know when and how to manually shut off existing gas valves. The following local governments have adopted mandatory seismic gas shutoff valve ordinances.

Table 5.5.4.1F Seismic Gas Shutoff Valves

Jurisdiction	Ordinance Number(s)	Year(s)
Los Angeles – Installed 168,000 valves as of February 2006.	171874	1995, 1998, 2002
Martinez	1269	1999
Contra Costa County	2000-11	2000
Richmond	32-00	2000
Alameda County	0-2001-54 & 0-2001-55	2001
Marin County	3322	2001
Hercules	9-2.09	2001
West Hollywood	01-592	2001
Danville	2007-02	2007

Comment On: Chapter 5 Section 5.4.2

5.5.4.2 Vulnerability and Mitigation of Utilities and Transportation

Due to the extensive nature of utility and transportation infrastructure in California, utilities will be discussed first and will be followed by a summary of transportation systems. Utilities include

1. Electric transmission systems
2. Electric power plants (hydroelectric and fossil fuel)
3. Electric distribution systems
4. Water supply pipelines (potable and non-potable)
5. Water treatment systems

6. Wastewater collection systems
7. Natural gas and oil supply pipelines
8. Telecommunication systems

The table below summarizes the overall progress towards earthquake mitigation of key utilities and transportation systems.

Table 5.5.4.2A Mitigation of Utilities and Transportation Systems

Inventory Category	Number of Miles	Geo-located	Mitigation Program	Seismic Evaluation	Mitigation Progress	Responsible State Agencies
Utilities	31,720 miles	Yes	◓	◓	◓	CEC, PUC, Cal EPA, California Independent System Operator (ISO), DWR
Ports and Harbors	10	Yes	◓	◓	◓	State Lands Commission, Coastal Commission
Highways	50,000 miles	Yes	◕	◕	◕	Caltrans
Railways	7,000 miles	Yes	○	○	○	PUC
Bridges-State	2,194	Yes	●	◕	◕	Caltrans
Bridges-Local	1,211	Yes	◓	◔	○	Caltrans
Dams	1200+	Yes	●	●	◕	DWR

● Most nearly completed, needs updating ◕ nearly completed ◓ halfway completed
◔ Partially completed, needs significant work ○ begun

General Observations on Utilities and Transportation Systems

In addition to various laws, ordinances, regulations, standards and guidelines, construction activities for utilities and transportation systems must abide by the California Environmental Quality Act (CEQA). If a utility or transportation activity is considered a "project" under CEQA, then the owner of the proposed project must either obtain an exemption from the requirements or use CEQA guidelines to see if their project may pose an impact on the environment. This includes following a checklist to determine if there may be an impact on the environment from a seismic hazard. If the answer is yes, then the owner is required to address questions about seismic hazard assessment and possible mitigation. If the answer is no, then the owner is not required

under CEQA to address seismic hazard assessment or mitigation, but may be required by a local ordinance, law, or standard, or their insurance company, to address seismic hazard issues.

There is no comprehensive database for seismic hazard assessment or mitigation of utilities as a group or as just a particular type of utility. However, various groups have collected data on the performance of utilities and transportation systems during and after earthquakes in California and elsewhere. The data collection and analysis effort has been applied on an irregular level to various utility components. This is primarily due to the fact that a great deal of California's utility infrastructure has been in existence since before the 1971 San Fernando earthquake. As new standards and guidelines have been developed, utilities have been using new data and design techniques to assess seismic hazards for power plants, electrical transmission and distribution systems, natural gas pipelines, water supply lines (including canals and aqueducts), and dams for new projects and seismic retrofit projects.

Caltrans and local governments have also been retrofitting bridges using new design techniques and new standards and guidelines. Data regarding locally owned transportation retrofit activities are not monitored in California. However, several facilities are known to have taken action for seismic hazard mitigation including ports and airports.

Experience gained after assessing earthquake performance of utilities and transportation systems points to the following.

1. Various degrees of damage affect the functionality of utilities, roads, bridges, ports, or airports. The extent of damage is related to the severity of the seismic hazard at the facilities in question, the quality of the soils or rock at and adjacent to the site, the design criteria used in building the facilities, and the age and condition of the facilities. Those facilities of high quality construction and built on good performing soil or rock tend to perform better than those built on poorly performing soils.

2. Typical building codes for utilities and transportation system focus on the preventing the loss of lives and reducing property damage but do not guarantee that the facility will remain functional after an earthquake.

3. Fault rupture has caused breakage of pipes and offsets in the foundations of electrical power towers, roads, and buildings.

Electrical Utilities

California has 31,721 miles of electric transmission lines and up to double that amount for the electric distribution system. In addition California has 188 operational power plants varying in size from 50 megawatts to over 2,000 megawatts, generating a total of up to 53,700 megawatts *(CEC Power Plant Data Base, Summer 2003)*. California also imports, to various degrees throughout the year, electric power from outside of the state. No complete seismic hazard mitigation inventory for electrical power generation,

transmission and distribution exists in California. This is due to the lack of a requirement and funding for such a task, and the fact that either private companies or investor-owned utilities own the majority of electric power generation and transmission. However, several assessments of electric power generation, transmission and distribution systems have been performed following California earthquakes, as well as, earthquakes in Japan and elsewhere *(See Schiff 1999).*

The greatest aspect for vulnerability is from strong ground shaking. This tends to occur in high voltage substations or switchyards due to two reasons:

Substations and switchyards tend to be key facilities in the ability of a distribution or transmission system to reroute power around or to areas affected by earthquakes; and,

Some high voltage substation and switchyard equipment is relatively brittle.

The amount of recorded substation and switchyard damage after the 1971 San Fernando earthquake, the 1986 Palm Springs earthquake, and the 1994 Northridge earthquake highlights these two vulnerabilities. The ground motion hazard is generally the greatest hazard overall. In regions struck by earthquakes, it can be likely that vulnerable electric power equipment is in the area of strong ground shaking. Earthquake shaking can cause electrical lines to slap together, causing the lines to catch fire. In California significant seismic hazard mitigation research has been conducted by electric utilities and by researchers through organizations such as the Pacific Earthquake Engineering Research Center. Mitigation research products and results are making their way into new construction, purchasing, and siting decisions for all aspects of the electric utility industry in California.

Other vulnerable aspects of electrical transmission distribution and generation facilities include:

- Landslides that can damage electric transmission or distribution towers, substations, or switchyards;
- Ground deformation such as subsidence or liquefaction that can cause a misalignment in the power train of an electric power plant. Typically such problems can be mitigated by careful assessment of the potential for on-site liquefaction or subsidence and the proper design of foundations.

Interdependency on Electric Power

A key aspect of vulnerability is the potential for loss of electrical power in:

- Natural gas pipelines, including compressor and pumping stations;
- Oil transmission pipelines and pumping stations;
- Oil, natural gas, or water storage facilities;
- Water supply systems and pumping stations; and
- Waste water treatment and disposal systems.

All these systems rely on electric power, so when disrupted, services are interrupted. In some cases automatic shut-off valves and emergency power systems such as diesel generators have reduced this risk. Ground waves move at speed of sound – electronic signals travel at the speed of light providing an opportunity for smart valve intervention.

Pipeline Networks- Natural Gas, Oil, and Water

California is reported to have 11,600 miles of natural gas transmission pipeline (CEC, 2003). No complete seismic hazard mitigation inventory for pipeline networks exists in California. However, several regional utilities have assessed their natural gas pipe works with respect to seismic hazard. An incomplete seismic hazard inventory is due to the lack of a requirement and funding for such a task, and because utilities and private companies own most of the pipeline systems. Municipalities, special jurisdictions, and the State also own pipelines.

A significant contributor to pipeline failure after an earthquake is liquefaction. When soil liquefies it can loose all shear strength or shear resistance, essentially becoming a fluid with the density of soil. If a pipeline or any other underground structure has a density less than the liquefied soil then it is subjected to buoyant forces and is thrust to the surface. This happens with underground pipes, tanks, and other low density structural and non-structural components.

Pipelines subjected to significant displacement may develop leaks or breaks. This may be caused by ground deformation or by strong ground shaking. Ground deformation may include fault rupture as well as landslides, liquefaction or subsidence. Typical mitigation measures to offset this vulnerability include assessing siting requirements, flexible couplings, and aboveground fault crossings. Mitigation for fault crossings may also be accomplished by making pipes flexible enough and pipe supports big enough to allow pipelines to move to accommodate the anticipated ground displacements without rupture. Mitigating of areas prone to landslides prior to installation, or rerouting of pipelines around areas prone to land sliding are possible.

Ground deformation can cause significant damage to older pipe works made of cast iron or clay. At the end of 2003, there are several natural gas and water supply pipeline replacement projects underway in California. These projects tend to focus on replacing older pipes, valves, and pumps in an effort to maintain the reliability and to modernize systems.

The East Bay Municipal Utilities District recently completed a $662 million Seismic Improvement Program. (Reference *Mitigation Success Stories,* SSC 99-05, www.seismic.ca.gov) The San Francisco Public Utilities Commission is embarking on a $4.3 Billion Water System Improvement Program to be completed over the next decade. (www.SFWater.org)

Water Supply, Waste Water Treatment, and Disposal Systems

Water filtration plants and wastewater treatment facilities are often located in areas subject to severe ground shaking and liquefaction, flooding, or tsunami inundation.

Damage to water filtration plants can result in disruptions of clean water supplies. Damage to waste water treatment facilities or their intake pipe works or effluent disposal systems can result in immediate serious public health hazards.

Loss of power can also lead to discharges of partially treated or untreated effluent into waterways or the ocean. One mitigation technique to prevent an effluent discharge due to the loss of power is to include back up power at such plants to keep facilities operational.

Dams, Reservoirs, Canals, and Levees

California utilizes over 1,200 dams and thousands of miles of levees to meet its water supply, conveyance, and flood protection demands. The greatest weakness of this system is liquefaction-induced failures caused by strong ground shaking. (Torres, et al., 2000)

During the 1971 Sylmar earthquake the Lower San Fernando Dam, which is upstream from a heavily populated area, was severely damaged from liquefaction. The dam condition was an issue of concern for potential breech and inundation of the community. The dam, though heavily damaged, was not breeched and no dam failure induced flooding occurred. Later, another dam and a reservoir were built upstream from the Lower San Fernando Dam. The San Fernando Dam, which was being used only for flood control purposes, was damaged again during the 1994 Northridge earthquake.

Several other dams have experienced damage during earthquakes. DWR Division of Safety of Dams has been working with dam owners to periodically assess the safety of dams in their jurisdictions and several dam owners have rehabilitated their dams.

Earthquake instrumentation of dams was begun after the 1971 Sylmar earthquake, and though the effort continues with strong motion instrumentation projects in CGS and DWR, less than 45 dams currently have adequate instrumentation. Modern adequate instrumentation can provide the data to assist rapid assessment of the health of a dam after significant earthquakes.

Two major seismic hazard mitigation efforts include the East Side Reservoir Project in Riverside County and the Olivehain Dam in San Diego County. The East Side Reservoir Project includes canals, pipeworks, a new dam, and reservoir intended to provide water to a large portion of the Los Angeles metropolitan region for up to six months should an earthquake take the California Aqueduct out of service. The Olivehain Dam and reservoir is intended to provide San Diego with water should there be interruptions of water from the Colorado River after earthquakes.

The San Francisco Bay-San Joaquin-Sacramento Delta region contains levees critical for delivering irrigation water to 3 million acres, and drinking water to over 23 million people. A failure in one of the Delta levees in 1972 interrupted the State and Federal water supply systems and required approximately 500,000 acre-feet of fresh water to restore export water to acceptable quality (Senate Hearings on the 1972 Levee Failure at Andrus-Brannan Islands). Recent studies indicate the levees in the Delta are susceptible

to significant damage in a near-field seismic event. For a more extensive discussion of this issue see Section 5.8.1 of this risk assessment.

Other Vulnerabilities

Observations of damage from California earthquakes have also shown that ground shaking may be locally attenuated but then be amplified farther away due to differential soil conditions and structural response. Such was the case for the Hector Mine earthquake when an oil storage tank near Wilmington (over 100 miles away) was damaged while minimal or no damage was observed in cities between the epicenter and the tank. Ground shaking may also damage aboveground pipelines and their support framing.

Petrochemical Facilities: Oil Refineries and Liquefied Natural Gas Facilities

California has several petrochemical facilities, which include

- Oil refineries
- Oil storage facilities
- Gasoline storage facilities
- Liquefied natural gas facilities, and
- Marine oil terminals.

There is no statewide inventory of seismic hazard mitigation activities of petrochemical facilities. There are two seismic hazard guidelines for petrochemical facilities. These are

- *Guidelines for Seismic Evaluation and Design of Petrochemical Facilities* by the American Society of Civil Engineers; and
- *Marine Oil Terminal Engineering and Maintenance Standards* (MOTEMS) by the California State Lands Commission Marine Facilities Division.

Both guidelines contain general seismic hazard assessment and mitigation for design information. The Guidelines for Seismic Evaluation and Design of Petrochemical Facilities provides information for engineers to develop project specific seismic hazard mitigation designs and also contains information for emergency contingency planning, post-earthquake damage assessment and seismic retrofit design.

MOTEMS

The seismic portions of the MOTEMS have been inserted into a recognized international reference entitled “Seismic Design Guidelines for Port Structures”, 2001, by the Working Group No. 34 of the Maritime Navigation Commission of the International Navigation Association (PIANC). In addition, the MOTEMS is now included as a guidance document in the National Earthquake Hazard Reduction Program (NEHRP) reference (FEMA -368), published in 2003. MOTEMS is also recognized as the seismic analysis/design resource for the US military “Unified Facilities Criteria, Design: Piers and Wharves, 28 July 2005.

During the MOTEMS development, however, there was no additional consideration given for the special requirements of Liquefied Natural Gas Terminals (LNG) terminals. As of mid-2005, there were a number of planned or proposed LNG terminals along the California coast, from Eureka to Los Angeles. The basic performance-based design criteria of MOTEMS are applicable to these facilities, but because of the nature and risk associated with LNG, there are significant differences in design criteria. Seismic criteria may be higher than that for a conventional oil terminal, as well as criteria for fire detection/suppression, pipeline systems, mooring/berthing and mechanical/electrical systems. These differences and additional risk studies justify an extension of the MOTEMS to include LNG terminals.

The CSLC has started a project to develop engineering standards for LNG marine terminals. Four separate configurations are being investigated for this new standard, including: 1) a deep-water offshore type which processes the LNG and converts it to natural gas which is then pumped to shore; 2) a conventional pier/wharf type, currently in a preliminary design phase (proposed for the Port of Long Beach); 3) a deep water mooring of two LNG vessels, adjacent to an existing oil platform; and 4) a gravity-based structure that was proposed for offshore Southern California, but did not advance to the application process. CSLC has obtained funding to complete a set of engineering/maintenance standards for these four configurations, proposed for California. Without these standards, each potential project would have a set of unique standards that will not be consistent throughout the state, and may not provide a uniform level of protection of the public health, safety and the environment.

Since Title 24, CCR, Part 2, Chapter 31F (Marine Oil Terminals) has been completed, CSLC staff has continued to improve its understanding of engineering issues associated with these facilities. In 2005 a tsunami hazard study for the San Francisco Bay area was completed. This study indicated that the run-up heights in the current version of the MOTEMS should be reduced from earlier less accurate studies. Another recent project has been completed with the US Naval Academy, to more accurately assess forces on moored vessels, from vessels passing nearby. The results of these studies will be included in the next edition of the MOTEMS. CSLC currently has a contract in place to simplify and more accurately determine the seismic capacity and demand of wharf/pier types of structures. This work will be completed in 2007, and the results will be inserted into the MOTEMS. MOTEMS and related studies can be downloaded at: http://www.slc.ca.gov/Division_Pages/MFD/MOTEMS.html

The Marine Oil Terminal Engineering and Maintenance Standards are in alignment with Seismic Design Guidelines for Port Structures, which were published by the International Navigation Association in 2001. The NEHRP Recommended Provisions for Seismic Regulations for New Buildings and Other Structures (FEMA Publication No. 368) is also being revised. Once revised FEMA 368 is anticipated to include seismic hazards guidelines for ports. The guidelines are to be equivalent to the guidelines published by the State Lands Commission for marine oil terminals.

An initial code to develop standards for LNG receiving terminals is the 2006 National Fire Protection Agency guidelines (NFPA 59). This code is incomplete and not entirely applicable to offshore facilities, but it is a starting point.

Solid Waste Disposal Systems (Municipal and Hazardous Waste Landfills)

There is no inventory of municipal or hazard waste landfill seismic hazard mitigation activities. However, there are over 200 municipal and hazardous waste landfills in California. During the siting, permitting or closure process a landfill owner may be required to submit a stability analysis for the liner and/or final cover systems. The purpose of the liners and the final cover is to prevent the uncontrolled release of leachate or landfill gas (a gas that is made up mainly of methane) from the landfill. This may vary from a simple analysis for flat slopes to a sophisticated seismic hazard assessment and slope stability analysis.

In general, the greatest vulnerability for landfills with respect to seismic hazards may be the damage to the final cover or the landfill gas collection and control system caused by ground deformation (in this case the deformation of the landfill). Another significant vulnerability of landfills is the loss of electrical power to run leachate collection and control systems and landfill gas collection and control systems.

Transportation

Transportation systems are generally categorized as follows:

- Highways (including freeways)
- Bridges
- County or City Roadways
- Railways
- Ports and Harbors (including airports).

California has approximately 50,000 lane miles of highways. There are an unknown amount of lane miles of county and city roadways since there is no single database that includes all the roadways in the State.

There are over 12,800 state and 12,300 local bridges. 2,194 state bridges were determined to need seismic retrofitting as of January 2007; all but eight have been retrofitted. 1,235 local bridges were determined to need seismic retrofitting. As of January 2007, 699 of these have been retrofitted.

There are also seven state-owned toll bridges that have been determined to require seismic hazard mitigation. As of January 2007, the retrofitting of six bridges has been completed. In addition, there is one local-owned toll bridge (Golden Gate Bridge) that is in the process of being retrofitted.

Due to the numerous changes in seismic design practices that have occurred in recent years, a comprehensive assessment of the potential need and scope for seismic retrofit of two additional state-owned toll bridges (Antioch and Dumbarton) is planned. Seismic

vulnerability studies and a sensitivity analysis are currently underway for these two bridges.

Fault ruptures and strong ground shaking, as evidenced in the Kocaeli, Turkey and Chi-Chi, Taiwan earthquakes, are key concerns. A third hazard is the potential for landslides blocking tunnels or mountain roadways. Caltrans research engineers, designers, construction, and maintenance staff are addressing all three issues.

Roadways and bridge approaches with minor deformation might be acceptable for limited use, while similar degrees of deformation for airport runways may not be acceptable. Ground deformation may also affect harbors and ports by changing the alignments of tracks for large cranes.

Strong ground shaking causes more damage over a larger area than fault rupture. This is because damage from surface rupture is confined typically along the fault. Earthquake induced landsliding and liquefaction may also be localized and not necessarily cover an area as extensive as strong ground shaking.

Caltrans, working with the CGS Strong Motion Instrumentation Program, embarked on an important bridge instrumentation effort after the Loma Prieta earthquake. Over 60 bridges currently have strong motion instrumentation, and the 7 major toll bridges are also slated for full instrumentation. After an earthquake, the data from this instrumentation will provide key information about the necessity for detailed inspection by Caltrans to establish whether the structure should be closed for repair. Although this is a small percentage of the total number of bridges, the instrumentation can be a very important part of event response and recovery.

There are approximately 7,000 miles of railroad track in California *(CPUC 2002).* A significant number of track-miles are vulnerable to landslides, liquefaction, fault rupture, and settlement. The greatest vulnerability that trains have from seismic hazards is from strong ground shaking, causing trains to derail, followed by ground deformation causing bending or breaking of railroad track and damage to railroad bridges. The American Railway Engineering and Maintenance-of-Way Association (*2003 Manual for Railway Engineering)* has developed recommended practices for the design and maintenance of railroad bridges, embankments, culverts, tunnels, and other components for improved performance during and after earthquakes. In addition, CGS has guidelines that are applicable to railways and similar projects for assessing and mitigating seismic hazards. This document is the *Special Publication 117, Guidelines for Evaluating and Mitigating Seismic Hazards in California, 1997.*

Ports and Harbors

There is no systematic integrated database or inventory on seismic hazard assessment or mitigation for ports and harbors in California. However, most of the large ports and harbors have initiated some sort of seismic hazard study for various projects in recent years.

Ground deformation is a significant vulnerability in various ports and harbors since significant piers and quays are built out of dredge tailings or fill. Landfills do not typically perform well in large earthquakes as evidenced by damage to man-made ground in the Marina District of San Francisco and in Kobe, Japan. Ground deformation on landfills at ports and harbors can affect harbors and ports by changing the alignments of tracks for large cranes used to load or off load cargo ships. Such deformation may occur from lateral spreading, liquefaction, dynamic compaction, or secondary ground rupture. After the 1989 Loma Prieta Earthquake, some of the Oakland Airport's runways experienced severe ground deformation. This damage impacted airport operations.

Depending on the location and geometry and depth of the port or harbor it may be susceptible to a tsunami or seiche. To date, California has had only one series of tsunamis that significantly damaged a port or harbor. That event was a series of tsunamis that hit the Port of Crescent City after the M9.2 earthquake in Alaska on March 26, 1964.

The American Society of Civil Engineers has created *Seismic Guidelines for Ports*. The guidelines provide generalized information for assessing seismic hazards for use in developing seismic hazard mitigation design criteria. The guidelines are based on observations of the performance of ports and harbors after earthquakes around the world. Several ports and harbors have also conducted seismic hazard mitigation projects.

Communication Systems

California has no seismic hazard inventory for its communication systems. However, there is a guideline for the improvement of their performance during earthquakes titled *Methods of Achieving Improved Seismic Performance of Communications Systems (Tang and Schiff, 1996).*

The greatest vulnerability of communication systems depends on what communications aspects are under consideration. For example, strong ground shaking tends to affect switches and other aboveground components more than liquefaction. However, liquefaction may affect belowground conduits more than shaking.

In prior strong urban earthquakes, there has been little damage to cellular telephone or internet systems. However, their use has grown exponentially since the 1994 Northridge Earthquake. Their typical vulnerabilities stem from the loss of electrical power and from surges in customer use potentially swamping the capacity of the systems.

The seismic vulnerability of radio and television communication systems is typically from the loss of power and shaking damage to unsecured equipment.

Comment On: Chapter 5 Section 5.5

5.5.5 Current Earthquake Hazard Mitigation Efforts

The preceding discussion included a description of most recent and current earthquake hazard mitigation efforts classified by type of buildings, infrastructure, and transportation. These efforts represent a substantial public and private investment in hazard mitigation.

From 1990 through June of 2003, Californians spent in excess of $19 billion on seismic hazard mitigation activities (CSSC, 2003). This is an indicator of the level of effort to mitigate seismic hazards and reduce life and property loss after earthquakes. Additional loss mitigation is provided by approximately $10 billion in earthquake insurance currently in place.

One of the more significant mitigation activities that cannot be assigned a specific cost is mitigation by hazard avoidance. A good example is the requirement that buildings and facilities in California no longer be built over ground rupture traces of active faults, setbacks from geologically unstable areas, and reduction of building densities in geologically hazardous areas through planning and zoning (see Chapters 2 and 3).

Comment On: Chapter 5 Section 5.6

5.5.6 Opportunities for Enhanced Earthquake Hazard Mitigation

California's mitigation plan for seismic hazards, the California Earthquake Loss Reduction Plan, was last updated and signed by the governor in 2002. The plan articulates the state's priorities for earthquake hazard mitigation. It contains three overarching goals, eleven elements, and 148 initiatives, half of which are designed to continue indefinitely.

Key parts of the California Earthquake Loss Reduction Plan include:

- Goals for 2010 (Table 5.5.6A);
- Critically Important Initiatives (Table 5.5.6B);
- Cost Estimates for Seismic Hazard Mitigation.

Table 5.5.6A on the following page describes the California Earthquake Loss Reduction Plan's goals to be achieved by 2010.

Table 5.5.6A Earthquake Loss Reduction Plan Goals for 2010

Goal	Description
Advancement in Learning About Earthquakes	Applicable and effective research in geoscience, engineering, and social sciences about earthquakes, including techniques for mitigating their effects, will be the basis of California's mitigation strategies. The full spectrum of educational opportunities and communication strategies will effectively transfer that knowledge to the policy makers, the professions, and the public.
Advancement in Building for Earthquakes	Public policy affecting the design and retrofit of vulnerable existing structures will encourage cost-effective mitigation. The design and construction of all new structures will be based on higher performance standards that increase reliable levels of protection for both the lives and property of its citizens, and will ensure continued strength in the California economy.
Advancement in Living with Earthquakes	Preparedness and emergency response systems will effectively minimize the pain and suffering from potentially disastrous earthquakes. Both short- and long-term efforts to accomplish personal and economic recovery will significantly reduce the impact. Californians will be better prepared to understand, respond, and recover.

Eleven Elements of California Earthquake Loss Reduction Plan

The California Earthquake Loss Reduction Plan has eleven elements: Geosciences, Research and Technology, Education and Information, Economics, Land Use, Existing Buildings, New Buildings, Utilities and Transportation, Preparedness, Emergency Response and Recovery. Each element has a series of related initiatives, which are divided into three categories: critically important, very important, and important. The table on the following page describes the critically important initiatives.

Table 5.5.6B Critically Important Initiatives

Initiative	Description	Approximate Time to Accomplish
1.1.1	Geosciences: Ensure efficient, accurate, and reliable completion of the statewide Seismic Hazard Mapping Program for California's high-risk developed and developing areas. Utilize independent review and acceptance of appropriate procedures to compile the data and construct the maps. Include end users and others affected as part of the independent review.	10 Years
2.1.1	Research & Technology: Support and co-fund California-based seismic research programs funded by federal agencies or the private sector.	Ongoing

Table 5.5.6B Critically Important Initiatives (Continued)

Initiative	Description	Approximate Time to Accomplish
3.2.1	Education & Information: Develop educational approaches and tools in seismic hazard mitigation including earthquake fundamentals, seismic hazards identification, safety information about potentially hazardous building contents, workplace safety, emergency plans, and risk assessment techniques and tools for those responsible for facilities operation and management.	5 Years
4.1.1	Economics: Develop economic models and real case studies that demonstrate the cost-effectiveness of specific design, construction, and retrofit methods based on increased levels of property, contents, functionality, and tax base protection. Make those findings available to policymakers and to lending, insuring, and taxing agencies.	3-5 Years
5.1.1	Land Use: Require geotechnical and geological reports addressing seismic hazards for all subdivisions pending completion and adoption of mapping under the Seismic Hazards Mapping Act for any jurisdictional area.	2 Years
6.1.1	Existing Buildings: Encourage economic incentives, such as improved mortgage terms, reduced insurance rates, and positive tax benefits, for upgrading structural and non-structural elements in buildings.	10 Years
6.4.3	Existing Buildings: Identify and prioritize all seismically vulnerable public and private buildings. Establish a mitigation plan to reduce the risk posed by those buildings, including structural and non-structural elements, equipment and contents. The most vulnerable and the most essential buildings should be addressed as the highest priority.	10 Years
7.3.1	New Buildings: Amend statute to allow California to adopt seismic-specific amendments to national model building codes that meet the specific needs of the state and that apply to all State and local jurisdictions.	2 Years
8.4.3	Utilities & Transportation: Identify potentially vulnerable public and private utility systems including electric, gas, oil, water, and communication. Upgrade vulnerable systems to ensure the operation and timely restoration of essential systems to reasonable levels of service.	5 Years
9.4.1	Preparedness: Require compliance with the Standardized Emergency Management System (SEMS). Ensure school and district boards and administrators develop and implement school emergency plans and staff training as required by the current Education Code.	3-5 Years

Table 5.5.6B Critically Important Initiatives (Continued)

Initiative	Description	Approximate time to Accomplish
10.1.1	Emergency Response: Provide interoperable upgraded regional and local emergency communications, including: 1) mutual-aid channels for police, fire, and emergency medical services; 2) regional emergency communications councils with authority to establish regional standards for emergency communication; and 3) response and recovery public broadcast channels for the public.	3 Years
11.2.1	Recovery: Establish plans for accommodating large displaced populations on an interim basis by using military facilities, publicly owned parks and recreational facilities, manufactured housing, and other appropriate options	5 years

NOTE: For information on other initiatives see the California Earthquake Loss Reduction Plan at www.seismic.ca.gov.

Cost Estimates for Seismic Hazard Mitigation

The total amount of seismic hazard mitigation and risk management by insurance is not known. However, a recent survey by CSSC revealed that from 1990 to 2002, Californians spent over $575 billion on construction and alterations. Roughly $19 billion of that, or just over three percent, was for seismic hazard mitigation, an average of just over $1.5 billion per year. Seismic hazard mitigation costs for individual projects ranged from zero (no seismic hazard mitigation required or done) to 100 percent (the project was done only to mitigate a seismic hazard-related risk) of a project's total cost. In the same time period, Californians spent $10 billion on earthquake insurance for residences.

Chart 4.4.2A, California Earthquake Loss Reduction Plan Elements and Initiatives, in the 2004 SHMP Appendix, illustrates the progress of California Earthquake Loss Reduction Plan elements and initiatives. The table below summarizes the dollar amount spent on selected earthquake mitigation in California from 1990 through 2002.

Table 5.5.6C Estimated Expenditures on Earthquake Mitigation

Program or Project	Amount Spent in Millions
CalTrans Bridge Retrofit, Replacement, and Toll Bridge Program	$3,248
Bridge Retrofit by Local Governments	$1,000
CalTrans Earthquake Research	$52
Proposition 122 State Building Retrofits	$223.5
Local Government Essential Services Building Retrofits	$45.4
Technology Development	$3
AB 300 Public School Survey	$.5

Table 5.5.6C Estimated Expenditures on Earthquake Mitigation (Continued)

Program and Project	Amount Spent in Millions
Alquist Act Hospital Evaluation and Retrofi Program	$11
OES/DSA Nonstructural Pamphlet for Schools	$.05
OES Hazard Mitigation Program (HMGP)	$70
Division of the State Architect K-12 School Seismic Hazard and Retrofit/Design	$1,550
Community College Seismic Evaluation Survey	$.9
UC Berkeley SAFER Program	$250
CSU Seismic Retrofit Program	$300
UC Seismic Retrofit Program	$300
Department of Insurance Retrofit Grants Program	$6.4
Pacific Earthquake Engineering Research Center	$20
PUC/CEC Earthquake Research	$5.5
TriNet/CISN	$13.8
DWR Levee Study in the Delta	$2.3
State Lands Commission Marine Oil Terminal Project	$.1
OES New State Operations Center	$26.5
DWR:	
• Seismic Instrument Operation	$6
• Water Project Review	$7
• Division of Safety of Dams	$5
OPR	$225
PUC	$.6
CSSC	$10
Seismic Hazard Mapping Program	$32
UC Seismographic Station and Research Center	$23
BART Retrofit Program	$28
CEA Mitigation Program	$5
Strong Motion Instrument Program	$45
Hospital Seismic Hazard mitigation 1989-2002 (all California Hospitals)	$7,120
City of Los Angeles ATC 50 Residential Grading Plan	$1
San Francisco Bond Measure for URM Retrofits	$350
URM Building Seismic Retrofits	$1,730
San Francisco Community Action Plan for Seismic Safety	$7
Los Angeles Historic Property Contracts Retrofit Program	2.5

Table 5.5.6C Estimated Expenditures on Earthquake Mitigation (Continued)

Program and Projects	Amount Spent in Millions
East Side Reservoir Project (Lost Angeles)	$2,000
Local Match for FEMA Post-Northridge Earthquake Seismic Hazard Mitigation	$249.7
Total	$18,970.6

NOTE: Due to rounding, table may not add.

The table below summarizes some of California's future mitigation funding commitments through 2030. All of these projects are currently being developed or are under construction.

Table 5.5.6D Selected Future State Seismic Hazard Mitigation Commitments

Projects Underway or Obligated	Millions Obligated
SB 1953 Hospitals Seismic Hazard Compliance (to be paid by hospital owners)	$23,800*
Proposition 47 School Construction and Modernization Seismic Hazard Assessment and Retrofit	$735
PG&E Projects	$2,175
San Diego County Water Authority	$827
San Francisco PUC	$3,600
EBMUD Retrofit Program	$189
East Bay Bridge Span Replacement Project	$2,900
Carquinez Straights Bridge Replacement Project	$480
San Rafael Bridge Seismic Retrofit Project	$484
State Water Project	$30
Total	$35,220

**Denotes projected expenses from 2002 through 2030.*

The table on the following page identifies the amount of federal funding supplied to the state for earthquake mitigation between 1990 and 2003. One of the major mitigation successes funded in cooperation with the federal government has been CGS' Seismic Hazard Mapping Program. This effort has been ongoing since the passage of the Seismic Hazards Mapping Act in 1990.

Table 5.5.6E Selected Federal Seismic Hazard Mitigation Investments in California

Principal Funding Sources	Amount Spent in Millions
FEMA Post-Northridge Earthquake (includes $11 million in Seismic Hazard Mapping funds)	$760
USGS	$300
National Science Foundation	$75
Federal Highway Funds (Seismic hazard mitigation)	$940
Total	$2,075

Local Capability Assessment

CSSC has developed a progress chart of earthquake mitigation in jurisdictions in high seismic areas of California (Zone 4). The chart lists cities and counties that have adopted mitigation programs for unreinforced masonry buildings, tilt-ups, wood frame dwellings, and apartments building, and also lists financial incentives. For more information, see *Building Mitigation Progress in California's Jurisdictions* at www.seismic.ca.gov

Future Updates

This portion of the Plan was compiled with existing resources through the cooperative efforts of CGS and CSSC. The following are recommended for future updates to this Plan:

- Develop and maintain a Living Earthquake Risk Model with enhanced samples of inventories or actual inventories reflecting their specific vulnerabilities;
- Expand efforts to track statewide mitigation progress by governments and the private sector, particularly local government regulatory efforts to identify and mitigate geologic hazards

Comment On: Chapter 5 Section 6

5.6 Flood Hazards, Vulnerability and Risk Assessment

Section Content

5.6.1 Identifying Flood Hazards
5.6.2 Profiling Flood Hazards
5.6.3 Assessment of State Vulnerability and Potential Losses
5.6.4 Assessment of Local Vulnerability and Potential Losses
5.6.5 Current Flood Hazard Mitigation Efforts
5.6.6 Opportunities for Enhanced Flood Hazard Mitigation

Comment On: Chapter 5 Section 6.1

5.6.1 Identifying Flood Hazards

OES identified flood hazards as a significant concern for the State of California through several sources. First, California has a chronic and destructive flood history. Since 1950, 14% of federally declared disasters in the state were for floods (18 of 129). Since 1990, federally declared flood disasters occurred in every county, claimed 124 lives, and resulted in over $5.7 billion in damages. Second, California has widespread vulnerability to flood as indicated by the FEMA floodplain designations and their common presence in populated areas. Third, nearly all local governments that have submitted Local Government Hazard Mitigation Plans (LHMPs) have identified flooding as a hazard.

Comment On: Chapter 5 Section 6.2

5.6.2 Profiling Flood Hazards

Every county in the state experiences floods although the nature of these events varies due to the state's diverse climatology and geography. Disparate climatological patterns present challenges to flood mitigation planning in California, including:

- El Nino conditions
- La Nina conditions
- Drought
- Desert monsoons
- Northwest coastal conditions
- Tropical storms
- Gulf of Alaska storms
- "Pineapple Express" patterns.

In addition, California's geographic diversity represents a difficult challenge to planning for flood mitigation. As pointed out Chapter 4, California has: a 1,100-mile-long coastline; 2,407 square miles of inland water surface; 172,000 miles of rivers, with 70,000 miles of rivers downstream from dams; prominent coastal and inland mountain ranges, including the Sierra Nevada; and, extensive and highly varied deserts. These geographical factors combine to create various types of floods: alluvial fan, coastal, flash, fluvial, lake, levee, mudslide, riverine, seiche, and tsunami.

Hydrologic Regions

Disparate hydrologic regions present further challenges to flood mitigation planning in California, which has ten hydrologic regions (see Map 6.2A in 2004 SHMP Appendix):

- North Coast
- San Francisco Bay
- Central Coast
- South Coast
- North Lahonton
- South Lahonton
- Colorado River-Desert
- Sacramento River
- San Joaquin
- Tulare Lake.

North Coast Region

The North Coast hydrologic region runs along the Pacific Coast from the California-Oregon border to the mouth of the Russian River. On its eastern border, the region runs from the middle of Modoc County through the Trinity, Shasta, Tehama, Glenn, and Lake county lines, then bisects the southeast portion of Mendocino County and the northeast portion of Sonoma County. This region is sparsely populated, with the majority of settlement in the Humboldt Bay area. The area receives larger rain totals than any other region and experiences some of the State's most spectacular and devastating flood events. The typical type of flooding that occurs in this area is represented by the 1964 late winter storms that caused $213 million in property damage.

San Francisco Bay Region

The San Francisco Bay hydrologic region extends along the north central coast and encompasses most of the Bay Area counties. It reaches to just north of Ukiah in Mendocino County, south to the Coyote Creek watershed in Santa Clara County, and inland to just east of the Sacramento-San Joaquin Delta. The area around San Francisco Bay is heavily populated and the entire region is marked by hills, river valleys such as those along the Russian River, and marshlands. The region is most vulnerable to classic stream flooding, landslides, and some urban flooding. Flooding along the coastal and bay shorelines can be severe when winter storms coincide with high tides. Sonoma County, most of which is located in this region, records the most NFIP repetitive losses of any area in California. FEMA NFIP lists 806 repetitive loss properties in Sonoma County with $56,316,053 in insurance claims between 1992 and 2007. Most of these properties are located along the Russian River.

Central Coast Region

The Central Coast hydrologic region reaches from Ano Nuevo Point in San Mateo County down the Pacific Coast to near the crest of the coast range in Santa Barbara County. The region is mountainous with very narrow strips of flat coastal plain. Generally, the mountain streams and rivers in this area run directly into the Pacific Ocean and lack significant delta areas. This region includes major agricultural areas and urban

centers and is characterized by stream flooding and slides. A typical flooding event occurred in the coastal community of Cambria in San Luis Obispo County in January 1995. The west end of the community suffered extensive damage, with many businesses and homes flooded up to their rooflines.

South Coast Region

The South Coast hydrologic region extends up from the U.S.-Mexico border to the Tehachapi, San Bernardino, San Gabriel, and San Jacinto mountains. Nearly one-third of the area is coastal plain. This region contains major urban centers, including the counties of Los Angeles, Orange, and San Diego. Much of the flooding is sudden and severe, resulting in massive slides, debris flows, and mudflows. Typical of the flooding that occurs in this area were the 1969 winter storms that killed forty-seven and resulted in $300 million in property damage. During these storms, an alluvial flood and debris flow on Deer Creek in San Bernardino County killed eleven. Normally Deer Creek is dry and is not considered a special flood hazard area on the National FIRMs. However, the region has experienced tremendous population growth since 1969 and the area of the Deer Creek alluvial fan is now home to several public schools and Ontario International Airport.

North Lahontan Region

The North Lahontan hydrologic region lies in the extreme northeast portion of the state. It is bounded by the Sierra Nevada, Cascade, and Warner mountain ranges on the west and the Nevada border on the east and runs south to Bridgeport in Mono County. Lake Tahoe is located in the center of the region. All streams in the region terminate in lakes or playas because they have no outlet to the ocean. This region is sparsely settled with the exceptions of the communities around Lake Tahoe and the City of Susanville. It experiences flooding from winter rainstorms, snowmelt, and intense late spring and early fall thunderstorms. During the January 1997 floods, the Walker River overflowed its banks and flooded the communities of Walker and Colville. The river supports an alluvial fan that runs through these communities.

South Lahontan Region

The South Lahontan hydrologic region is nestled between the Sierra Nevada, San Bernardino, and San Gabriel mountains, the Nevada state line, the Mono Lake Valley, and the Northern Colorado Desert. Despite its generally dry conditions, this sparsely populated region experiences periodic winter storms and thunderstorms that often result in flash floods. Under storm conditions, the region's generally dry stream systems pose a significant threat. The Mojave River runs through three growing San Bernardino county communities: Hesperia, Victorville, and Barstow. The desert community of Hesperia is located at the base of an alluvial fan that forms the headwaters for the Mojave River. This area experiences significant flood damage during both winter storms and summer monsoon events. Examples of the flooding are the 1982 winter storms that killed thirty-three and caused $274 million in property damage and the 1983 summer storms that killed three and caused $35 million in damage in Inyo, Riverside, and San Bernardino counties.

Colorado River-Desert Region

The dominant hydrologic features of this region are the Colorado River, which forms its eastern boundary, and the Salton Sea, which lies just shy of its western boundary, which is marked by the San Bernardino and San Jacinto mountains. The region is also bounded by the U.S.-Mexico border to the south and the South Lahontan region to the north. This is a mostly sparsely populated agricultural region that experiences irregular flooding. However, both common winter storm events and tropical flows from Mexico's Pacific Coast can bring massive rainstorms and flash floods. During the summer months, monsoonal flows come up over the mainland of Mexico. Typical of this type of event was the June 1982 Colorado River Flood, which caused $4.6 million in property damage. The flood destroyed thirty-two homes and damaged an additional 114 homes and thirteen businesses. The 1983 summer storms, highlighted in the South Lahontan profile above, also affected this area.

Sacramento River Region

The Sacramento River hydrologic region includes the northern half of the Central Valley. The Sacramento River drains through the Sacramento-San Joaquin Delta and is bounded by the Sierra-Nevada Mountains, the Coast Range, the Cascade Range, and the Trinity Mountains. This is a major agricultural area, with the Sacramento metropolitan area comprising the largest concentration of population. Flooding in this region is predominantly caused by runoff from either major winter storm events or snowmelt. While massive dams and levee systems have significantly reduced this region's historic flood problems, the area remains vulnerable to flooding along small streams due to levee failures and in urban drain areas dependent upon pumping stations. This region includes portions of the Sacramento-San Joaquin Delta, which is addressed separately at the end of the region profiles. Flooding from a 1950 event killed nine and caused $32 million in damage throughout both the Sacramento River and San Joaquin regions.

San Joaquin Region

The San Joaquin hydrologic region encompasses the middle portion of the Central Valley bounded by the Sierra Nevada Mountains, the Coast Range, the divide between the American and Consumnes river watersheds, and the divide between the San Joaquin and Kings river watersheds. The region also includes portions of the Sacramento-San Joaquin Delta, although that area is described separately in this Plan. Although predominantly agricultural, this region has experienced increased urbanization in recent years and is subject to flooding from winter storm events and snowmelt. Flooding occurred in this region during the 1969 storms, as highlighted above in the description of the South Coast region.

Tulare Lake Region

The Tulare Lake hydrologic region comprises the extreme southern portion of the Central Valley. It is defined by the Sierra Nevada Mountains, the divide between the San Joaquin and Kings rivers, the Coast Range, and the Tehachapi Mountains. The Kaweah, Tule, Kern, and Kings rivers all historically drained into the Tulare Lake bed. Through the late 1800s, Tulare Lake was of substantial size during wet periods, although its level fluctuated. A number of small reclamation districts were established in the area in the

early 1900s that, over the years, built levees and reclaimed the more than 200,000-acre lakebed for agriculture. Though now predominantly agricultural, this region contains the large urban centers of Fresno and Bakersfield. It is subject to flooding from winter storms and snow runoff. Typical of the type of events that occur were the 1969 heavy snow melt runoff, the 1986 flooding event, and the 1997 snow melt/flooding events.

Past Hazard Events

Since 1950, the state has had 32 state declared flood disasters and 18 federally declared flood disasters (see Table 5.6.2A). Since 1992, every county in California was declared a federal disaster area at least once for a flooding event.

Table 5.6.2A Flood Disasters Since 1992

Disaster #	Date	Scope (# of Counties)	# of Deaths	Damage in $
935-DR-CA	February 1992	6	5	$123.2 Million
979-DR-CA	January 1993	25	20	$600 Million
1044-DR-CA	January 1995	45	11	$741.4 Million
1046-DR-CA	February 1995	57	17	$1.1 Billion
1155-DR-CA	January 1997	48	8	$1.8 Billion
1203-DR-CA	February 1998	40	17	$550 Million
1498-DR-CA[21]	June 2003	2	16	
1529-DR-CA	June 2004	1	0	$57 Million
1577-DR-CA	February 2005	8	24	$573.1 Million
1585-DR-CA	April 2005	7	0	$198.7 Million
1628-DR-CA	February 2006	40	5	$327.8 Million
1646-DR-CA	June 2006	16	1	$129.5 Million

Sources: OES, Origins and Development—A Chronology 1917-1999
FEMA: California Disaster History (http://www.fema.gov/news/disasters_state.fema)
OES After Action Reports

Comment On: Chapter 5 Section 6.3

5.6.3 Assessment of State Vulnerability and Potential Loss to Flood Hazards

The assessment of state vulnerability to floods uses counties as the primary unit of analysis. Included are several methods available for assessing the areas of the state that are the most vulnerable to flood hazards:

- GIS risk modeling;
- Analysis of population in FIRM designated floodplains;
- Analysis of damage from historic flood events.

Collectively the results of analyses can be used to establish current and future vulnerability and potential loss with measures of space and magnitude.

[21] DR-1428, the 2003 Southern California Fires, caused the elimination of vegetation securing soils to the hillsides. In December of 2003, mild flooding caused mudflows and landslides killing 16 people. The costs of the flood damages were not segregated from the fire damages.

Population in Flood Insurance Rate Map (FIRM) Designated Floodplains

The standard references for establishing the location of flood hazards are the FEMA Flood Insurance Rate Map designated floodplains (see Map 6.2C 2004 SHMP Appendix). In 2000, over 5 million Californians lived in a FIRM designated floodplain (15% of total population) and nearly 2 million lived in the 100-yr floodplain (5.8% of total population). Thus, California can expect approximately 20,000 people per year to be affected by floods.

The state's flood risk is not evenly distributed. Approximately 84% of 5 million Californians living in a FIRM-designated floodplain are in 13 counties. Each has more than 100,000 people living in a FIRM-designated floodplain (see Table 5.6.3A) The leader by far is Orange County with 1.4 million people at risk.

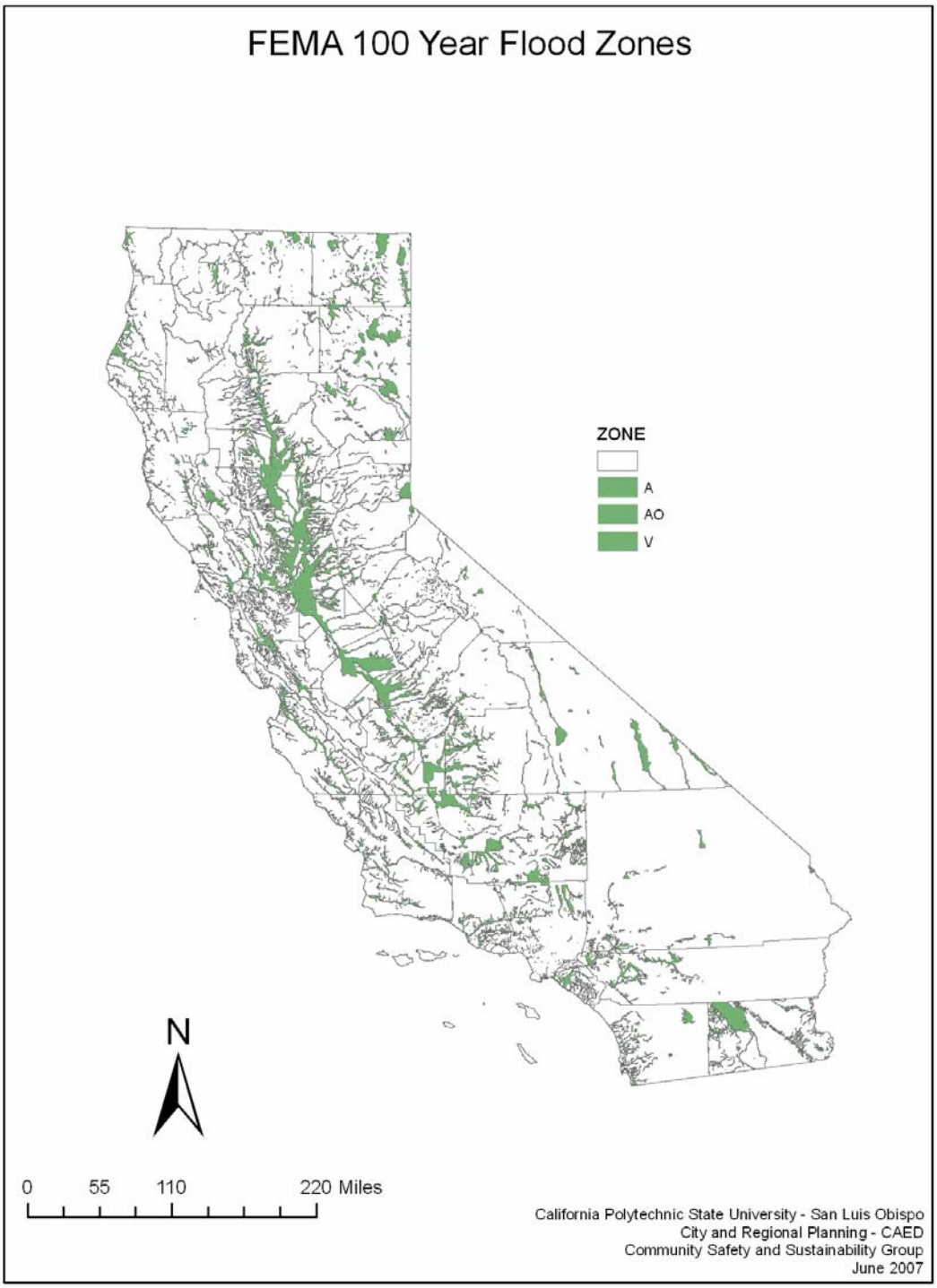
Patterns of Flooding

Map 5.6.3A on the following page shows FEMA-designated 100-year floodplains, part of a national insurance system maintained by the National Flood Insurance Program (NFIP), as described in Chapter 2. Appendix Maps 5.6.3B-C depict the location of state owned and leased structures in relation to 100-year flood plains in Northern, Central, and Southern California, respectively.

San Joaquin County Home on Robert's Island
1996-97 Storm Floods

Source: OES
The county was required to meet hazard mitigation requirements for the Design Flood Elevation Level.

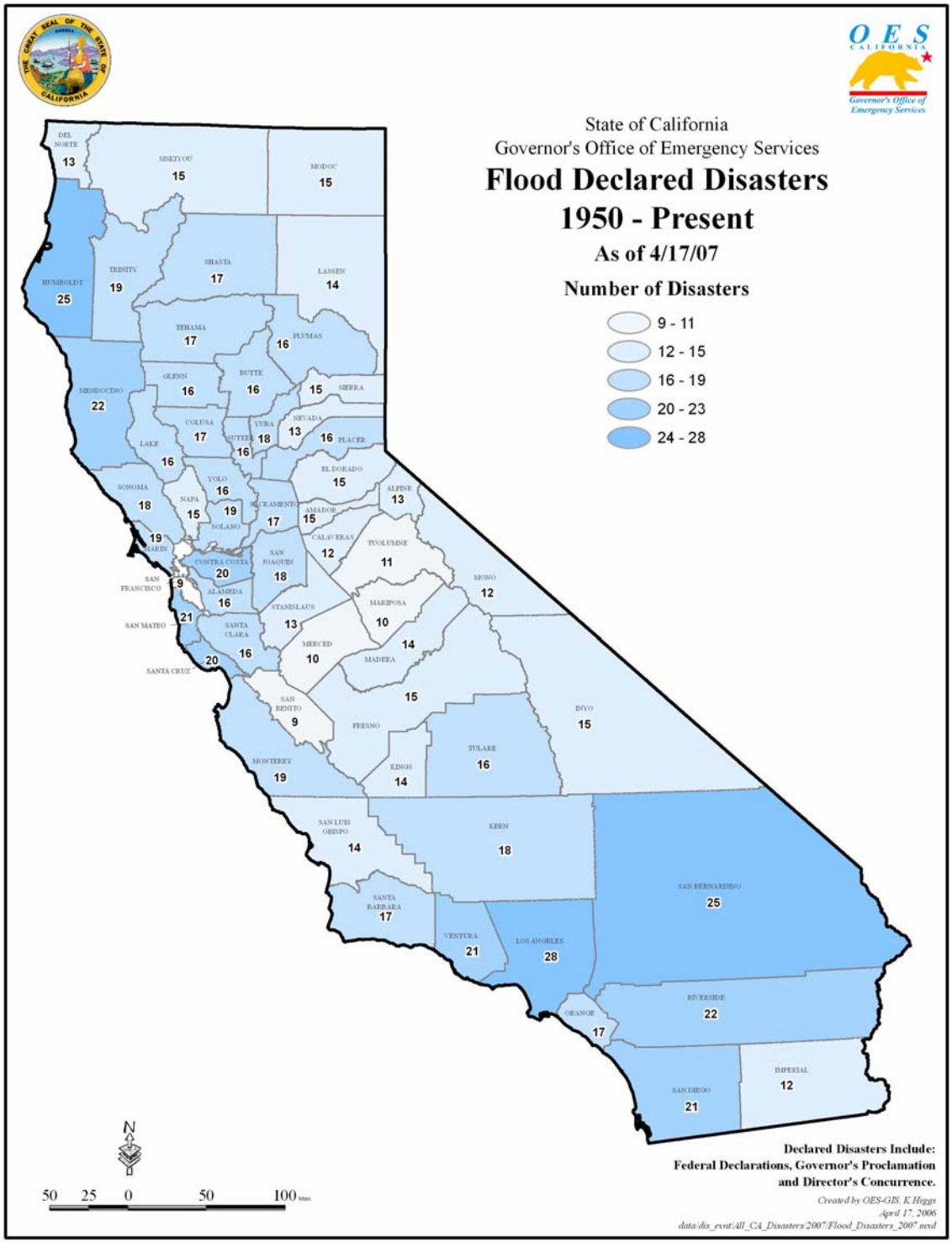
Map 5.6.3A FEMA 100-Year Floodplains



Map 5.6.3A shows a high concentration of 100-year floodplains throughout the Central Valley, especially in the Delta region, as well as in selected other inland regions.

However, a more widely dispersed set of more frequent than 100-year floods have caused disaster events depicted in Map 5.6.3B, which shows state and federally declared disasters from 1950-2007, including many outside of 100-year floodplains.

Map 5.6.3B Flood Disaster Declarations by County, 1950 - 2007



Areas flooded in the past continue to be inundated repeatedly. The repetitive nature of flood damage causes the greatest concern. FEMA, in coordination with the state, identifies California's top Repetitive Loss (RL) communities, which account for 84 percent of the state's total NFIP losses. For a list of RL Communities in California, see the 2007 SHMP Appendix.

Table 5.6.3A Counties with 100,000+ People Living in FIRM-Designated Floodplains

County	Total Population in FIRM Zone
Orange	1,384,403
Sacramento	490,014
Los Angeles	390,305
Santa Clara	304,511
Riverside	295,081
San Joaquin	287,742
Fresno	205,235
Monterey	198,283
San Bernardino	196,945
Ventura	187,179
San Diego	181,757
Tulare	154,184
Alameda	103,162

This standard alone has several shortcomings. First, the FIRM maps do not provide full coverage of the state and contain inaccuracies due to changes in development and infrastructure since the original surveying. According to DWR:

> The federal government started regulatory floodplain mapping on a nationwide basis in the late 1960s. FEMA has now mapped over 15,000 miles of stream systems using both detailed and approximate study methods. This represents less then 10 percent of all the streams in California. These figures do not include the coastline or alluvial fans. Compounding current floodplain management issues, over the next 25 years California is expected to have about a 14 million increase in population. The demand for development will put a heavy load on the remaining floodplains that are not mapped. It is currently estimated that about one-third of California's stream reaches are or will be experiencing development pressures within the next 25-year period. This results in approximately 35,000 miles of unmapped streams that still need floodplain mapping.
>
> (DWR, http://www.fpm.water.ca.gov/mapping/existing_mapping.cfm, retrieved 16 April 2007.)

Analysis of Damage from Historic Flood Events

Damage data from California's historic flood events is useful for characterizing flood risk and identifying areas that probability-based assessments such as FIRM floodplains may miss. To illustrate, a study of population living in a floodplain as of 1998 indicates that a majority of NFIP flood loss claims occur during flood events that do not rise to the level of a federal disaster declaration. Thus, the extent of flood disaster declarations is not a complete measure of vulnerability.

Table 5.6.3B provides a summary analysis of historic IA and Public Assistance (PA) damage claims and Repetitive Loss (RL) payments from 1992-2002. Most of the historic damage was occurring in nine counties, three of which are not shown as high risk using the FIRM floodplain measure described above. These three include:Santa Barbara, San Mateo, and Sonoma counties.

Table 5.6.3B Individual Assistance, Public Assistance, & Repetitive Loss Analysis

IA: Counties with greatest number of damage locations (Accounts for 45% of total state dollar damage claims)	Los Angeles
PA: Counties with greatest dollar damage claims (Accounts for 50% of total state dollar damage claims)	Los Angeles Santa Barbara Monterey Ventura Orange San Mateo Santa Clara Alameda Sonoma
RL: Counties with greatest dollar payments (accounts for 34% of total state dollar payments)	Sonoma

In addition to showing the spatial extent of vulnerability, the IA and PA data can be used to estimate future annual damage locations and claims. Based on historic trends, the state can expect 25,000 IA claims per year and $59 million in PA damage claims.

Repetitive Loss Communities

Repetitive loss communities in California account for nearly $166 million in total payments, representing 8014 losses on 2,988 properties in varied location throughout the state. The top 10 Repetitive Loss Communities in California alone account for over $101 million in total payments, or 61% of total payments for Repetitive Loss Communities. In order of losses, the top 10 include:

- Sonoma County
- City of Malibu
- Lake County
- City of Los Angeles

- County of Sacramento
- Monterey County
- Marin County
- Santa Cruz County
- Los Angels County
- City of Napa.

The top 30 communities account for about 75% of all repetitive loss claims and over 77% of all repetitive loss properties in California. Comparison of Repetitive Loss Communities in 2004 with RL communities in 2007 show a generally steady pattern, with relatively few changes in top 30 and top 10. Table 5.6._ in the 2007 SHMP Appendix shows the top 30 Repetitive Loss Communities in California as of January 31, 2007.

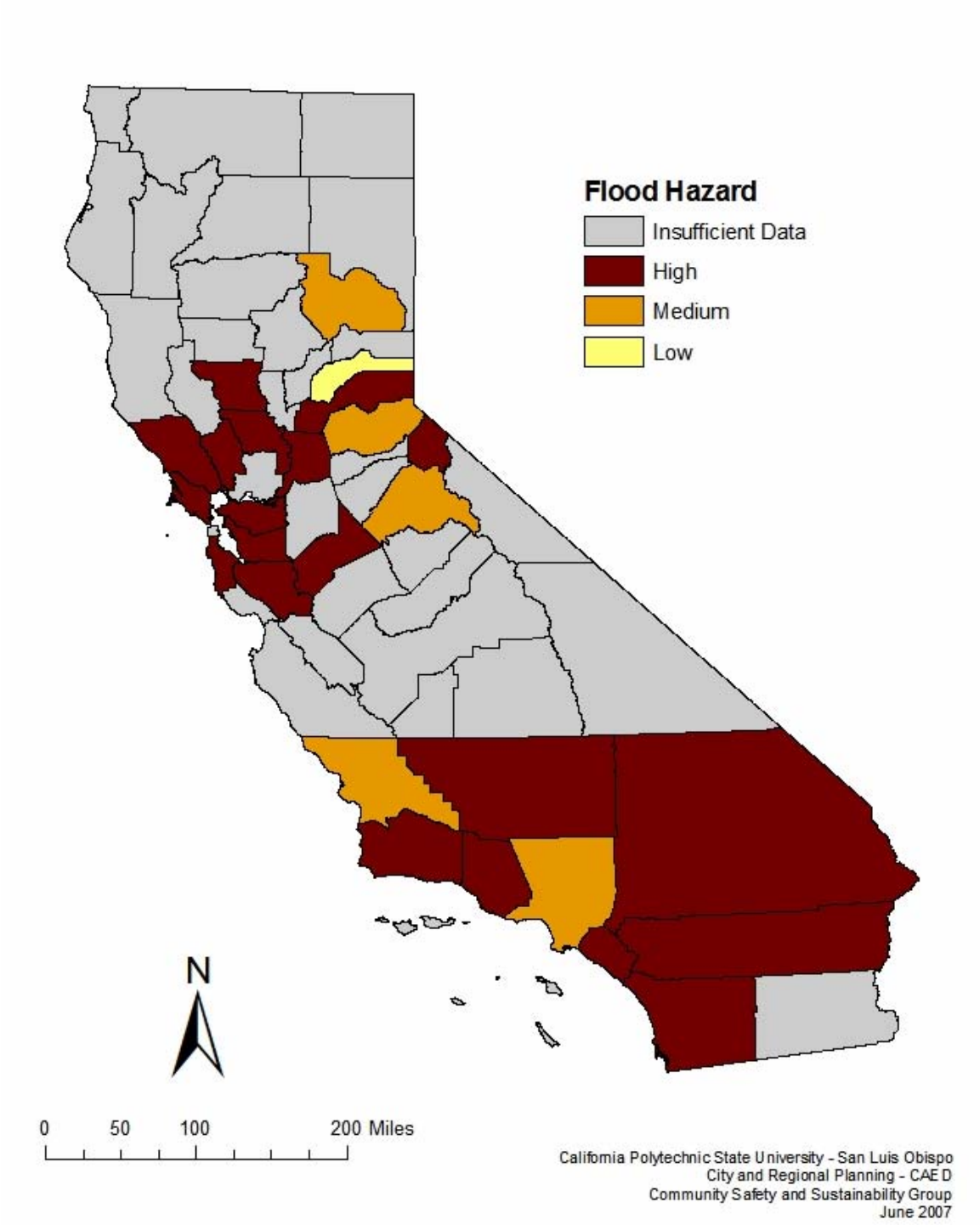
Comment On: Chapter 5 Section 6.4

5.6.4 Assessment of Local Vulnerability and Potential Loss to Flood Hazards

The preceding findings are generally borne out by Map 5.6.4A on the following page which shows flood hazards ratings in FEMA-approved Local Hazard Mitigation Plans (LHMPs) prepared since passage of the Disaster Mitigation Act of 2000. Ratings indicate that a majority of local jurisdictions considered floods to be of high, medium, or low concern.

Source: OES
As the water rises, the damage is being surveyed in a mobile home park. Floods, 1997

Map 5.6.4A Flood Hazard Ratings in Local Hazard Mitigation Plans



Comment On: Chapter 5 Section 6.5

5.6.5 Current Flood Hazard Mitigation Efforts

The state seeks to reduce repetitive flood losses by:

- Working with FEMA to reduce NFIP claims by encouraging communities to participate in the FMA planning process and in developing FMA projects that address NFIP repetitive loss properties;
- Working with communities to develop HMGP projects that address NFIP losses;
- Coordinating FMA and HMGP projects with communities to provide the greatest reduction of losses to the most vulnerable areas in the state.

Community Rating System Participation

Of the top California Repetitive Loss (RL) communities, less than half participate in the Community Rating System program. The state encourages all RL communities to participate in the CRS program. Of all California communities within the NFIP, only 10 percent participate in the CRS program. California's CRS communities save a total of $8.7 million per year on flood insurance premiums. For a list of California communities participating in the Community Rating System program, see url: http://www.fema.gov/business/nfip/crs.shtm

1996 State Flood Hazard Mitigation Plan

In 1996, FEMA approved the State of California Flood Hazard Mitigation Plan which was developed in response to two federally declared disasters: the 1995 winter storms and the 1995 late winter storms. Over twenty state agencies and regulatory bodies participated in the development of the plan.

The 1996 plan covered the entire state and promoted the following three strategies:

1. Consider watersheds as singular units. Watershed management must emphasize the need for multi-agency involvement regardless of jurisdictional boundaries;

2. Stress adequate floodplain management through
- Avoiding risks in the floodplain,
- Minimizing the effects of those risks when they cannot be avoided,
- Mitigating the effects of damage when it occurs, and
- Accomplishing the above in such a way that diminishes negative environmental impacts;

3. Emphasize nonstructural over structural mitigation when feasible. For example, the enactment of codes and standards requiring structures to be elevated above the 100-year flood level rather than construction of diversion channels or levees.

The 1996 flood plan produced ten recommendations.

1. Promote a cause-and-effect approach to streams and watersheds in developing flood hazard mitigation measures.

2. Control future development in floodplains and flood-prone areas by promoting the establishment and enforcement of zoning regulations, codes and standards, permitting regulations, and effective planning at the state and local levels. This includes development on bluffs and hillsides and in coastal zones.

3. Promote the acquisition or elevation of existing properties located in the floodplain that are vulnerable to repetitive damage.

4. Implement other flood control measures where acquisitions, elevations, or other nonstructural measures are not feasible. This includes the improvement or installation of levees, culverts, and channels.

5. Ensure that citizens receive information on storm-related hazards affecting their communities, and on the practices necessary to diminish their vulnerability through public education.

6. Assist local governments by endorsing effective regulation and maintenance practices for private flood control facilities.

7. Work with local floodplain managers to promote participation in and ensure compliance with the NFIP and to update the FIRM for their communities.

8. Work with the DWR and regional and local entities to document historic flood patterns across the state's watersheds.

9. Ensure OES participation in existing interagency groups (or establish such groups as necessary) to improve the awareness and adequate implementation of effective mitigation actions.

10. Create an inventory/database on flood vulnerability and risk, the status of floodplain management, and mitigation practices at the state and local level.

On January 30, 1997, FEMA conditionally approved Phase I of the State Flood Hazard Mitigation Plan, subject to the completion of Phase II. This work was completed on July 30, 1998, and approved by FEMA on September 3, 1998. Phase II included:
(1) Assurances that the activities, programs, and policies of all state agencies related to hazard evaluation, vulnerability, and mitigation would be coordinated and contribute to the overall lessening or avoiding of vulnerability to natural hazards.
(2) Integration of local government risk analyses and mitigation planning efforts into the State Flood Hazard Mitigation Plan.

FloodSAFE California

FloodSAFE California is a strategic initiative under development by the Department of Water Resources to improve flood protection for the people of California, and will have a direct impact on addressing flood hazards statewide. The record of flood action by the administration of Governor Schwarzenegger includes the following:

- Led rapid response to Jones Tract levee breach, 2004;
- Issued flood warnings: responding to California's flood crisis, 2005;
- Declared emergency to respond to floods of January and April, 2006;
- Improved DWR levee inspections, channel maintenance;
- Completed repair of 33 critical erosion sites;
- Initiated repair of 71 new critical sites and PL 84-99 Sites;
- Proposed flood management bonds as part of Strategic Growth Plan;
- Initiated evaluation of 350 miles of urban levees;
- Developing Delta Risk Management Strategy and Delta Vision.

The goals of FloodSAFE California are to (1) reduce flood risk to the people of California, their homes and property, the state's infrastructure, and the public trust resources; (2) develop a sustainable flood management system for the future, resilient to ongoing changes such as global warming; and (3) reduce the adverse consequences of floods when they do occur, through emergency planning which addresses residual risk.

The guiding principles for a FloodSAFE California are to (1) approach flood risk management on a system-wide basis, taking into account varied land uses and flood protection needs; (2) integrate land use planning with flood risk management; (3) promote and fund regional flood management planning; (4) adapt flood management systems to cope with climate change; (5) support and fund projects that offer multiple or regional benefits, including those that restore natural floodplain processes or integrate regional water management; and (6) provide accurate information about flood risks to help families and communities to make safer decisions.

The program elements through which FloodSAFE California will be managed are:

1. Conduct urgent repairs and improvements within Central Valley and the Delta, including development of cost estimates, funding strategies, and plans for improving urban areas behind state-federal project levees (Sacramento, West Sacramento, Stockton, Lathrop, Yuba City, and Marysville/Plumas Lake), develop regulations for cost-sharing and revised selection criteria for state-federal flood control system modification projects, identify funding mechanisms for most rural levees to receive some funding for levee repairs, identify no-regrets improvements for the Delta, including improved emergency response/preparation measures, and establish independent consulting board or peer review programs for all major flood management projects;

2. Manage and operate the state-federal flood control system in the Central Valley, including maintenance of nearly 300 miles of levees and channels within the

Sacramento River Flood Control Project, inspection of all 1600 miles of Project levees and other facilities of the State Plan of Flood Control, enforcement of levee maintenance standards for locally maintained levees; and gather and publish snow pack and hydrology information annually;

3. Plan for future flood management needs through preparation and update of California Flood Plan and State Plan of Flood Control for the Central Valley, propose framework and issue grants statewide for preparation of Regional Flood Management Plans, evaluate additional funding needs throughout the state to provide adequate flood management systems, and provide community outreach and information regarding flood protection and FEMA programs;

4. Conduct engineering evaluations and assessments of the state and federal project system within the Central Valley and the Delta, including completion of levee flood protection zone maps, evaluations of urban and rural project levees, hydrologic/hydraulic model analyses of Central Valley flood systems, and floodplain delineation/mapping studies for submittal to FEMA;

5. Fund statewide flood management programs, including payment of partial reimbursement for local agencies share of federal flood control projects under the Flood Control Subventions Program, completion of guidelines for Stormwater Flood Management project grants in urban areas, guidelines for flood corridor programs, and guidelines for providing bond-funded grants for non-project critical levee repairs, evaluations, and feasibility studies;

6. Provide emergency preparedness and flood response services, including flood fight and SEMS training statewide, install additional instrumentation to provide improved real-time information on flood conditions, conduct pre-flood coordination meetings and table top exercises, purchase pre-deployed flood fighting supplies and communication equipment, operate the Flood Operations Center during flood events, coordinate with OES, the Corps of Engineers and reservoir operators during and after flood events, provide flood forecasts, collect and disseminate hydrologic data through operation of the California Data Exchange Center, and recover from floods and obtain reimbursement from FEMA.

Geographic distribution of bond funding is as follows:

- $3.275 billion is allocated for conducting urgent repairs and improvements on state-federal flood project facilities in the Central Valley and the Delta. A minimum of $1 billion of this total is designated for urban project levees, a minimum of $300 million for rural project levees, and a minimum of $775 million for the Delta. $348 million is allocated in the FY 2007-08 Governor's Budget for critical levee repairs, existing and early implementation projects, urban levee improvements, rural levee repairs, sediment removal, continuation of the Delta Levee Program, and implementation of Delta Vision strategies. An additional $30 million is allocated in FY 2007-08 for

conducting engineering evaluations/assessments of State-federal flood project facilities.

- $680 million outside the Central Valley for partial reimbursements to local agencies (primarily in Southern California and the Bay Area) for federal flood control projects under the State Flood Control Subventions Program.
- $935 million for Statewide programs, including California Flood Plan, regional flood management planning, floodplain mapping, flood corridors, stormwater flood projects, local levee urgent repairs and evaluations, and feasibility studies.

A total of $700 million in bond funds from Proposition 1E and Proposition 84 is included in the FY 2007-08 Governor's Budget. $622 million of this amount, or 89% is for design and construction work; $52 million is for non-structural flood corridor projects and mapping, and $26 million is for development of the California Flood Plan and Regional Flood Plans.

FloodSAFE California will be implemented through a Two-Track Process:

1. Near-Term Programs/Funding Opportunities moving forward in FY 2007-08 include critical levee repairs; geotechnical evaluations of state-federal project levees; early implementation of modifications and/or improvements to facilities of the State Plan of Flood Control in the Central Valley; increases in Delta Levee Program; flood control subventions; and statewide grants for regional flood management planning, non-project levee evaluations, flood protection corridor projects, and stormwater flood management projects;

2. Strategic Long-Term Programs/Projects include update of State Plan of Flood Control for the Central Valley; development of Regional Flood Management Plans; floodplain delineation and mapping; reservoir re-operation; improved levee maintenance; catastrophic emergency response plan for the Delta; implementation of Delta Vision Strategy; and development of California Flood Plan for long-term improvements statewide.

State-federal Flood Control System Modifications Program

The passage of the Disaster Preparedness and Flood Prevention Bond Act of 2006 (Proposition 1E) and the Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006 (Proposition 84) authorizes the California Department of Water Resources (DWR) to issue grants to local agencies under the State-Federal Flood Control System Modification Program. These grants will be for: (a) rehabilitation, reconstruction, or replacement of levees, weirs, bypasses and facilities of the State Plan of Flood Control, and (b) improving or adding facilities to the State Plan of Flood control to increase levels of flood prevention for urban areas. To be eligible, projects must be ready for early implementation in Fiscal Year 2007-08, for which a total of two hundred million dollars ($200,000,000) has been allocated.

Alluvial Fan Task Force

The Department of Water Resources (DWR) is partnering with California State University, San Bernardino's (CSUSB) Water Resources Institute to develop an Alluvial Fan Task Force. The proposed task force will address issues related to unique flood hazards associated with the rapid rate of housing development on alluvial fans. An alluvial fan is a fan-shaped deposit formed where fast flowing water flattens, slows, and spreads – typically at the exit of a canyon or mountain pass onto a flatter plain. Principal hazards associated with alluvial fan flooding are high-velocity, debris-laden flows resulting from a series of storms, particularly following wildfires in semi-arid regions. Alluvial fans are prevalent throughout Southern California and are most common in San Bernardino, Riverside, Los Angeles, Ventura, Santa Barbara, San Luis Obispo, Kern, Orange, Imperial and San Diego counties.

Broad representation is expected from local communities to include developers, elected officials, flood control district members, stormwater managers, water suppliers, water quality regulators, Native Americans and the environmental community.

Members of the task force will be charged with reviewing alluvial fan flood history to develop a model ordinance that will reduce long-term flood damages, and with creating land use guidelines for development on alluvial fans. The ordinance will be developed collaboratively by members of the proposed task force under the guidance of a professional facilitator. Findings of the proposed Alluvial Fan Task Force will be reported to the Legislature.

FEMA, the Federal Emergency Management Agency, is funding the task force under the Pre-Mitigation Disaster Planning Grant Program.

The Flood Protection Corridor Program (FPCP)

The FPCP was established when California voters passed Proposition 13, the "Safe Drinking Water, Watershed Protection and Flood Protection Act," in March of 2000. The FPCP authorized bond sales of $70 million for primarily nonstructural flood management projects that include wildlife habitat enhancement and/or agricultural land preservation. Of the $70 million, approximately $5 million was for educational programs and administrative costs and another $5 million was earmarked for the City of Santee, leaving approximately $60 million for flood corridor protection projects throughout the state.

Any local agency or nonprofit organization with interest in flood management issues is eligible to sponsor projects under FPCP that seek to acquire, restore, enhance, and protect real property for the purposes of flood control protection and agricultural land preservation and/or wildlife habitat protection. Sponsoring agencies or organizations that meet the criteria can partner with other types of agencies and organizations as necessary to ensure diverse funding sources and necessary expertise on the project team.

Fundable activities under the FPCP include:

- Non-structural flood damage reduction projects within flood corridors;

- Acquisition of real property or easements in a floodplain;
- Setting back existing flood control levees or strengthening or modifying existing levees in conjunction with levee setbacks;
- Preserving or enhancing flood-compatible agricultural use of real property;
- Preserving or enhancing wildlife values of real property through restoration of habitat compatible with seasonal flooding;
- Repairing breaches in the flood control systems, water diversion facilities, or flood control facilities damaged by a project developed pursuant to Chapter 5, Article 2.5 of the Clean Water, Watershed Protection and Flood Protection Act of 2000;
- Establishing a trust fund for up to 20 percent of the money paid for acquisitions to generate interest in maintaining the acquired lands;
- Paying the costs associated with the administration of projects.

Urban Streams Grant Program

The Urban Streams Restoration Program seeks to assist communities in reducing damage from floods and stream bank and watershed instability while restoring the environmental and aesthetic values of streams, and to encourage stewardship and maintenance of streams by the community. Funds can be used to restore watersheds, reduce property damage, and renovate town centers

Since 1985, the program has provided over 170 grants ranging from $1,000 to $200,000 to communities throughout California. Program funding increased from $2 million in the 2000-2001 fiscal year to $10 million in the 2001-2002 fiscal year. Because of the increased funding, DWR amended the regulations for the program, including raising the grant cap from $200,000 to $1 million per project. This change allows DWR to provide funds for larger, more complex stream restoration and flood management work in addition to funding smaller projects.

Projects funded under the Urban Streams Grant Program include:

- Stream cleanups;
- Bank stabilization projects;
- Re-vegetation efforts;
- Day-lighting of culvert creeks;
- Re-contouring of channels to improve floodplain function;
- Occasional acquisition of strategic floodplain properties or easements.

For more detailed information on the many projects that have been funded through this program, visit http://endeavor.des.ucdavis.edu/nrpi, the website for the University of California, Davis' Natural Resource Project Inventory.

Coastal Resources Grant Program

Part B grants under the Coastal Resources Grant Program fund projects to help coastal cities and counties effectively exercise their responsibility for improving the management

of the state's coastal resources. Only those jurisdictions with Local Coastal Programs approved by the California Coastal Commission are eligible to apply for grant funding.

The types of expenditures eligible for funding through Part B grants include:

- Protection of coastal habitat – projects that provide for the protection of wetlands, floodplains, estuaries, beaches, dunes, and fish and wildlife and their habitat within coastal areas;
- Protection of life and property – projects that minimize the loss of life and property in coastal flood-prone, storm surge, geologic hazard, and erosion prone areas;
- Protection of recreational resources – projects that provide public access to the coast for recreational purposes, to acquire coastal view sheds, and to preserve, maintain, and restore historic, cultural, and aesthetic coastal sites;
- Protection of coastal economic resources – projects that facilitate siting major facilities along the coast related to fisheries, recreation, ports, and other coastal-dependent commercial uses;
- Projects that promote other coastal management improvements that are determined by the secretary of the Resources Agency to be consistent with the state's coastal management program.

HMGP Projects

During the past ten years, local government and state agencies requested $377,608,766 in flood mitigation projects from the HMGP and received a total of $137,307,925. The following is a list HMGP projects in five categories:

- Acquisition
- Elevation
- Acquisition/Elevation/Relocation
- Erosion Control
- Flood Control.

FMA Program

The Flood Mitigation Assistance (FMA) program assists states and local communities in implementing flood hazard mitigation measures before a major disaster occurs. The program targets NFIP communities with numerous repetitive loss structures. The program offers two types of grants to local communities: planning and project grants. A community must have a FEMA-approved Floodplain Management Plan (FMP) to be eligible for FMA grant funding.

A community has two years to develop an FMP and three years to complete a project with FMA funds. Eligible communities may apply for up to $50,000 in FMA planning funds once in a five-year period. The total planning grant funding made available in any fiscal year to any state, including all communities located in the State, cannot exceed $300,000. Project grant funding during any five-year period cannot exceed $10 million to any state or $3.3 million to any eligible community. States also receive technical

assistance grants to administer the FMA program. The total assistance grants in any fiscal year during a five-year period cannot exceed $20 million.

Opportunities for Enhanced Flood Hazard Mitigation

Editor's Note: This subsection will be completed during the public comment period using examples being pursued by DWR in the California FloodSAFE program.

Comment On: Chapter 5 Section 7

5.7 Wildfire Hazards

Section Content

5.7.1 Identifying Wildfire Hazards
5.7.2 Profiling Wildfire Hazards
5.7.3 Assessment of State Vulnerability and Potential Losses
5.7.4 Assessment of Local Vulnerability and Potential Losses
5.7.5 Current Wildfire Hazard Mitigation Efforts
5.7.6 Opportunities for Enhanced Wildfire Hazard Mitigation

Comment On: Chapter 5 Section 7.1

5.7.1 Identifying Fire Hazards

Editor's Note: During the public comment period on this Plan, information on wildfire mitigation may be updated from a planning effort currently being undertaken by the Department of Forestry and Fire Protection (CAL FIRE). CAL FIRE is re-mapping fire hazard severity zones for lands where the State has fiscal responsibility for wildland fire protection (State Responsibility Area) and is preparing Very High Fire Hazard Severity recommendations for local responsibility areas. This mapping is being done under authorities defined in the Public Resources Code Section 4201 and Government Code Section 51175. This effort incorporates improved wildland fire behavior science, datasets, and understanding of structure ignition mechanisms during conflagrations.

The California Building Commission adopted the Wildland-Urban Interface codes in late 2005 with an effective date of January 2008. These new codes include provisions for ignition resistant construction standards in the wildland urban interface. The updated fire hazard severity zones will be used by building officials to determine appropriate construction materials for new buildings in the wildland urban interface. The updated zones will also be used by property owners to comply with natural hazards disclosure requirements at time of property sale. It is likely that the fire hazard severity zones will be used by local government as they update the safety element of general plans.

For more information on the update process, see: http://www.fire.ca.gov/wildland.php

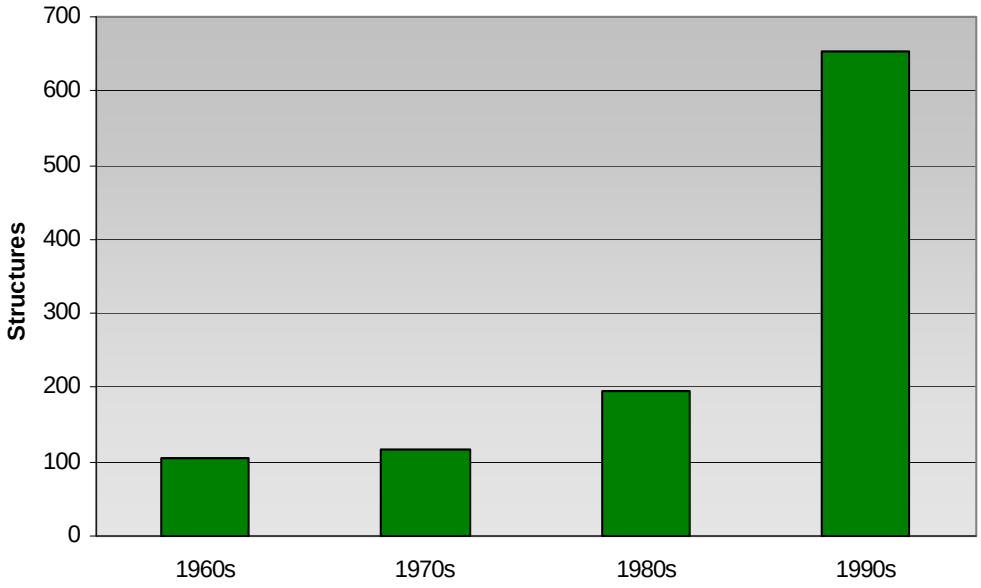
The Challenge of Wildfire

The recent Angora Fire in Lake Tahoe has demonstrated once again what is a well-recognized fact—fire is an integral component of many of California's ecosystems. However, uncontrolled wildfires are costly, putting lives and property at risk and compromising watersheds, open space, timber, range, recreational opportunities, wildlife habitats, endangered species, historic and cultural assets, wild and scenic rivers, other scenic assets, and local economies. The challenge is how to manage fires across California's diverse ecosystems to reduce both costs and losses.

On average, 10,000 wildfires burn half a million acres on an annual basis in California. While the actual number of acres burned fluctuates considerably from year to year, one trend that has remained constant for over a decade is the rise in wildfire-related financial

losses. From 1947 to 1990, dollar damages (in 2001 dollars) to structures and other resources in State Responsibility Areas (SRAs) exceeded $100 million only once. Between 1990 and 2001, losses exceeded $100 million on five separate occasions. Chart 5.7.1A summarizes wildfire damage in SRAs from 1947 to 2001 in acres and dollars. For an update of wildfire losses in SRAs from 2000-2006, see Charts 5.7.1B and 5.7.1C in the 2007 SHMP Appendix.

Chart 5.7.1A. Wildfire Damage



CAL FIRE's Goal

CAL FIRE's goal for wildland fire protection is to contain 95 percent of fires at ten acres or less. Statewide, approximately 97 percent of all vegetation fires are contained within the first few hours after they are reported. The remaining 3 percent either move too quickly or are too intense for available fire suppression resources to handle. Multiple large fires can quickly draw down the pool of fire suppression resources, making it more difficult to bring the fires under control.

Comment On: Chapter 5 Section 7.2

5.7.2 Profiling Fire Hazard Events

The term "risk" generally refers to the potential damage or loss to a specific asset. Risk from the same fire for one resource may be fundamentally different than for another resource. Analyzing fire risk involves two components: the probability of a fire event occurring and the potential of such an event to cause change (Bachman and Allgower, 1999). The chance of a wildfire occurring is measured using an index of "expected fire frequency." The potential of a fire event to cause change is based on the measure of "potential fire behavior." Together, these two measures comprise the "fire threat." All of these measures are part of the *California Fire Plan* and are described in greater detail in *The Changing California: Forest and Range 2003 Assessment*, available at www.frap.cdf.ca.gov/assessment2003

Wildfire Risks to People and Property

Wildfire poses significant risk to the people of California and their homes, as evidenced by an increasing trend in structure loss from wildland fires (Martin and Sapsis, 1994, Figure 1). The risk is predominantly associated with Wildland-Urban Interface (WUI) areas. WUI is a general term that applies to development interspersed or adjacent to landscapes that support wildland fire. WUI areas have been a major focus of CAL FIRE's fire management strategy since at least 1972. The diversity of WUI settings and disagreement about alternative mitigation strategies led to confusion and different methods of defining and mapping WUI areas. The work presented here is an attempt to provide an integrated analysis of WUI issues for statewide and regional assessment regarding local land use planning and pre-fire project development.

Defining Wildland-Urban Interface Areas

The California Fire Plan formalizes much of the work that has been done on assessing the threat of wildfire in California's WUI areas. CAL FIRE's work in this area also helped in the development of the National Fire Plan.

CAL FIRE has developed an estimate of fire risk in WUI areas that is consistent with National Fire Plan methods but is more refined in terms of both mapping extent and quantification of risk. Within California, both wildfire risk and asset characteristics can vary in the same area. To account for these multiple combinations, CAL FIRE uses spatial data to distinguish fire-related characteristics from assets and applies spatial rules for determining relative risk of loss (see www.frap.cdf.ca.gov/assessment2003). Terms such as high, very high, and extreme indicate threat levels, with extreme being the highest level. CAL FIRE uses this information to create a GIS map of fire threats, then superimposes on this map a spatial representation of housing unit density based on 2000 census data. Housing unit density is classified into the categories, and all classes other than wildlands are considered as potential WUI.

Table 5.7.2A below describes housing density classes in California for areas exposed to significant fire risk. All classes other than wildland are considered WUI.

Table 5.7.2A. Housing Unit Density Classes

Class	**Description**
Wildland	Less than one housing unit per twenty acres
Rural	From one housing unit per five acres to one housing unit per twenty acres
Interface	From one housing unit per acre to one housing unit per five acres
Urban	Greater than one housing unit per acre

Source: FRAP, 2003 Assessment

Table 5.7.2B in the 2007 SHMP Appendix details wildfire losses by event between 2000 and 2006.

Significant WUI Fire Events

Significant wildfire events in recent California history include the Tunnel Fire in the Oakland Hills in October 1991 and the 2003 Southern California Wildfires. These events signal major conflagrations of recently urbanized areas in WUI areas.

The Tunnel Fire ignited on October 20, 1991 in the Oakland Hills north of the Caldecott Tunnel in an upscale residential area of large homes perched on hillsides, some on very steep slopes, and landscaped with abundant shrubbery and trees. The area had seen fires before, including one in 1923 in the nearby Berkeley Hills that burned into Berkeley and destroyed more than 600 homes in one hour, and one in September of 1970 in the same neighborhood as the Tunnel Fire that burned 200 acres and destroyed thirty-seven homes. This sort of repetitive fire occurrence and structure loss in a given area is not uncommon in California, where weather and fuel conditions often combine to create a cyclical potential for major fire losses. With structure loss five times greater and loss of life twice as great as any previously recorded wildfire in California, the Tunnel Fire became the baseline for discussing fire loss potential in the state.

A major fire disaster in California in 2003 was the Southern California Wildfires event. This event consisted of 13 fires that burned a total of 750,043 acres and claimed 22 lives between October 21, 2003 and November 4, 2003. Affected counties were Los Angeles, Riverside, San Bernardino, San Diego, and Ventura. As of February 3, 2004, federal and state officials had approved more than $218 million to help residents, business owners, local government agencies, and non-profit organizations recover from these wildfires and prepare for future disasters. Many millions more were subsequently authorized.
Source: California Fire Siege 2003—The Story, USFS and CDF

More recently, the Augora Fire in South Lake Tahoe burned 3,100 acres, destroyed 242 homes, and 67 commercial structures during late June 2007. This event illustrates the critical need for more vigorous deployment of vegetation management and defensible space practices in WUI areas.

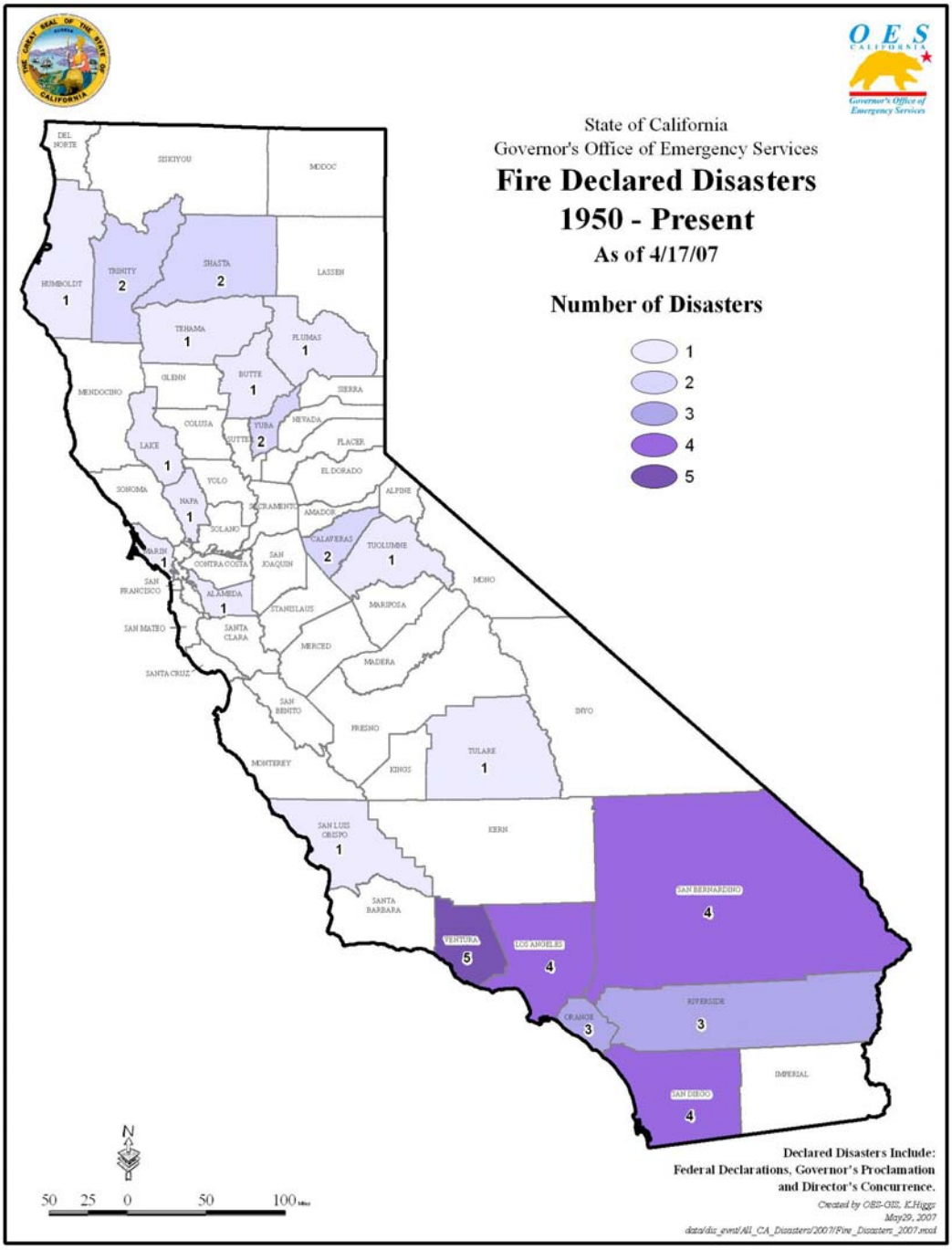
Photo 5.7.2A. Threatened Homes in Wildland Urban Interface Area

Source: CAL FIRE

Wildfire History and Threat

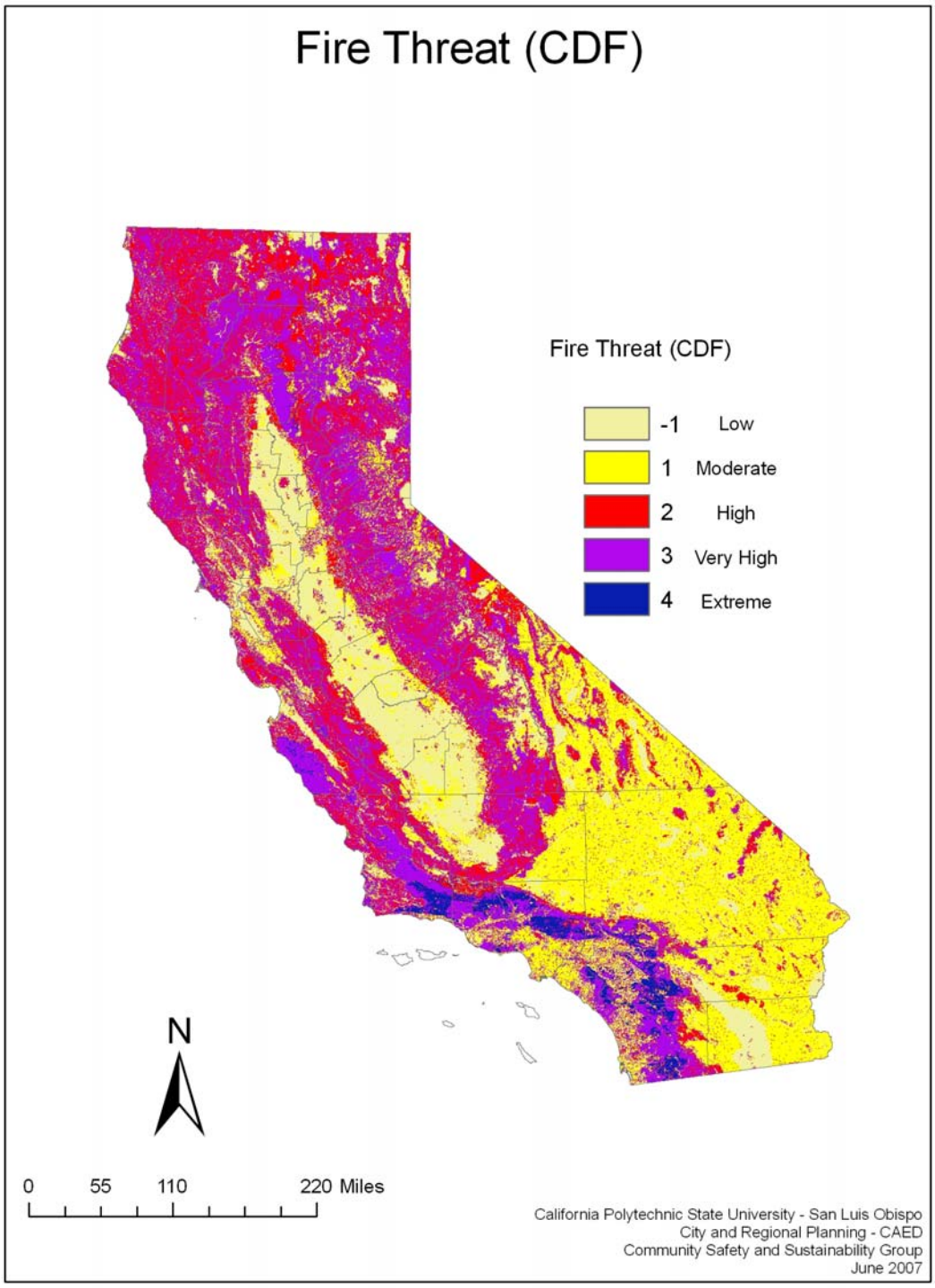
Map 5.7.2A shows declared wildfire disasters from 1950 to 2007. Highest numbers occurred in southern California, showing the influence of major populated urban areas in Los Angeles, Ventura, and other nearby counties.

Map 5.7.2A Declared Fire Disasters, 1950-2007



Map 5.7.2B below shows wildfire threat, based on mapping published by CDF/CAL FIRE in 2003, indicting a broad distribution of fire threat throughout California.

Map 5.7.2B. Wildfire Threat



Source: FRAP, 2003 Assessment

Note: Map 5.7.2B is presented here for graphic representation purposes, i.e., to show the wide extent of wildfire threats in California. Changes may be made following a series of public hearings being undertaken by CAL FIRE throughout most of California's counties.

Comment On: Chapter 5 Section 7.3

5.7.3 Assessment of State Vulnerability and Potential Losses

Relative WUI Fire Threat by Acreage and Housing Density

A total of 7.8 million acres are developed at densities considered to meet the WUI criteria. Of this total, 920,000 acres are exposed to an Extreme Fire Threat, 3.4 million acres to a Very High threat, and an additional 1.2 million acres to a High threat. If we consider all WUI lands with threat levels greater than Moderate to be at significant risk to damage from fire, the total area at significant risk is 5.5 million acres, or 59 percent of the total WUI area. The density breakdown of this group shows that 1.7 million acres (32 percent) of the WUI at risk are Urban, 1.2 million acres (21 percent) are Interface, and the remaining 2.6 million acres (47 percent) are Rural. Table 5.7.3A below lists a statewide summary of total acres in the WUI by housing density and proximate threat classes.

Table 5.7.3A WUI Acreage by Density Class & Fire Threat

Density class	Total acres	WUI By Fire Threat Class				
		Extreme	Very High	High	Moderate	None
Rural	3,126,844	459,507	1,733,775	392,808	475,188	65,564
Interface	1,322,621	249,996	722,877	176,144	156,197	17,406
Urban	3,391,217	209,799	909,622	609,386	1,608,606	53,802
Total	7,840,682	919,302	3,366,274	1,178,338	2,239,991	136,772

Source: FRAP, 2003 Assessment

While the majority of areas considered WUI are low-density rural areas, when viewed in terms of assets at risk, most housing assets are concentrated in urbanized areas. Of the 4.9 million homes exposed to High or greater fire threat, 4.1 million homes (84 percent) are in the Urban density class. The dominant density/threat class is the Urban/Very High threat class, comprising 2.1 million homes. Table 5.7.3B on the following page summarizes the total number of housing units in WUI areas as of 2000. (www.frap.cdf.ca.gov/assessment2003).

Table 5.7.3B Housing Units by Density Class and Fire Threat

Density class	Total housing units	Housing Units by Fire Threat Class				
		Extreme	Very High	High	Moderate	None
Rural	323,284	49,167	178,491	41,793	47,842	5,989
Interface	597,498	109,892	316,246	83,347	80,000	8,012
Urban	10,886,540	380,220	2,131,667	1,624,185	6,627,360	123,104
Total	11,807,323	539,279	2,626,404	1,749,325	6,755,202	137,105

Source: FRAP, 2003 Assessment

Fire's Effect on Water and Watersheds

As noted in the California Fire Plan, wildfires can have significant adverse effects on watershed lands, watercourses, and water quality. Large, hot fires cause serious, immediate damage from which a watershed can take decades to recover. By burning off vegetation and exposing mineral soil, fire impairs the ability of a watershed to hold soil in place and to trap sediment before it enters stream systems. Loss of vegetation also means less water being absorbed by plants, causing a short-term increase in the quantity and the delivery rate of water entering streams. This can have significant effects downstream from the site of a fire. In the wrong place at the wrong time, such as with the fire-flood cycle commonly experienced in Southern California. This increased runoff and its large sediment load can cause costly damage to downstream assets such as homes, roads, debris basins, and other infrastructure. It can also result in the loss of human life when at-risk residents are not evacuated.

Fire-Associated Risks to Ecosystems in the National Fire Plan

As part of the ongoing national strategy to protect ecosystems from degradation, loss of diversity, and possible loss or conversion, a classification system was developed to assess fire-related risk to basic ecological health. A coarse-scale assessment of this measure, termed "Condition Class," was conducted for the lower 48 states in support of the initial policy development for the National Fire Plan (Hardy et al., 2001; Schmidt et al., 2002; USFS, 1999). The process continues to be refined, to better meet the needs of local and regional efforts to reduce risks to ecosystem health and stability, while maintaining a centralized and consistent approach nationwide (Hann, 2002).

Ecological Risk from Fire

Roughly 37 million acres in California are ecologically at risk from fire, with 17 million acres high risk. The areas at risk span diverse ecosystems, ranging from pine forests in the Klamath/North Coast to coastal sage scrub communities along the South Coast. Numerous areas of the state are dominated by ecosystems at risk from wildfire. The only area without significant widespread ecosystems at risk is the southeastern desert region, where fire has and continues to be a relatively rare phenomenon.

Fire Risk to Timberlands

Timberlands, defined as conifer-dominated habitat types that likely support 20 cubic feet of volume growth per year and are not in reserved status, are a significant economic resource in California and are the primary economic base in some rural areas. Fire can pose significant risk to timber assets through direct loss from combustion, mortality of growing stock, and fire-induced susceptibility to insect, pathogen, and decay mechanisms. The actual loss of timber value associated with a given fire event is a function of tree structure, fire severity, and post-fire salvage opportunity.

FRAP presents risk to timberlands using the fire threat class. Roughly three-quarters of California's timberland faces a high fire threat or greater, and over half of these lands have very high or extreme fire threat conditions. Only about one-fifth of California's timberlands face a moderate fire threat, where expected losses to timber assets are likely to be low. While some of the standing timber value can be salvaged following a wildfire, much of California's timber assets are exposed to significant risk from wildland fire.

Fire Risk to Woodlands

California's extensive distribution of woodland vegetation, especially hardwood woodlands, provide key habitat for many species. The risk of habitat loss associated with fire in woodland areas is highly variable, due both to varying habitat quality and the unique fuel and vegetation response characteristics of specific areas. Habitat characteristics such as tree canopy height and closure, presence or absence of a developed shrub understory, and occurrence of special habitat elements—such as snags and downed logs—are important determinants of habitat quality for many species. There is little information on the role the structural characteristics of hardwood woodlands play in determining the level and value of associated wildlife use (Tietje et al., 1997). Consequently, it is difficult to reliably assess the effects of fire as a habitat-altering agent in hardwood areas. As recently as 2002, California researchers were unaware of any published research related to the effects of prescribed fire on California oak woodland habitats and associated wildlife species (Vreeland and Tietje, 2002).

Roughly two-thirds of California's hardwood woodlands are exposed to Very High or Extreme fire threat. While many areas may respond favorably to wildland fire, initial changes in the post-fire environment may cause temporary habitat loss and species dislocation.

Fire Risk to Soils

Fire presents a significant risk to soil, especially in denuded watersheds, through accelerated erosion potential in the immediate post-fire environment, particularly when subjected to severe rainstorms prior to any vegetation recovery (Wells et al., 1979). FRAP has developed a statewide risk assessment based on the expected marginal increase in surface erosion from a potential fire.

Erosion is a natural process that occurs across a watershed at varying rates, depending on soils, geology, slope, vegetation, and precipitation. The intensity of a fire and the subsequent removal of vegetative cover increases the potential rate of soil erosion and

new sediment sources. Wildfires affect surface erosion in a watershed by altering detachment, transport, and deposition of soil particles. Most wildfires create a patchwork of burned areas that vary in severity. Severely burned areas suffer increased erosion due to loss of the protective forest floor layer and creation of water-repellent soil conditions that can cause flooding, downstream sedimentation, and threats to human life and property.

Fire Risks to Riparian and Aquatic Habitats

Wildfire can produce a wide range of water quality and aquatic habitat outcomes, from beneficial to catastrophic. Wildfire outcomes are determined by weather, fuels, terrain, and to a lesser extent, suppression efforts. Large wildfires pose the greatest risk to water quality and riparian habitat. If a wildfire encounters fuel levels that have been reduced through prescribed burning and/or mechanical means, there is a good chance the fire would produce conditions more favorable to maintaining good water quality and aquatic habitat. Highly destructive fires are thus minimized.

Effects on Aquatic Habitat

Fire can also dramatically affect aquatic habitat. Increased erosion and sediment deposition can result in channel aggradation (i.e. wider, shallower channels), filling of pools that provide important fish habitat, increased turbidity that makes it harder for fish to find food and can damage gills, and changes in water chemistry.

Fire Risks to Recreation and Open Space

After a wildfire, significant alteration of watershed lands and the associated stream systems is noticeable for periods varying from a few years to decades. In the short term, the presence of partially burnt vegetation reduces recreational and open space values. Fires can also destroy campgrounds, trails, bridges, and other recreational facilities within the area. Increased amounts of downstream sedimentation may significantly affect streams and lakes, which tend to be the most heavily used spots within larger recreational areas. As the vegetation grows back and damaged recreational infrastructures are replaced, the recreational and open space values would increase. However, it may take decades before vegetation types such as mature forests return to their pre-burn character. Grasslands and shrublands, on the other hand, can return to their pre-burn character within a decade. The recovery of riparian areas depends on the level of alteration caused by the increased sediment delivery and the restoration of the site through normal hydrologic cycles of in-stream downcutting and deposition.

Fire's Affect on Water Quality

Wildfires can potentially affect water quality through increased sedimentation and increased turbidity, and through increases in nutrient loadings. Concentration of nutrients (phosphorous and nitrogen) are increased from burned vegetation and delivered to streams through surface runoff. Stream temperatures often increase after fire occurs, typically through the removal of overhead protective vegetation. Elevated stream temperatures are detrimental to most cold-water fish species.

Fire's Affect on Water Infrastructure

Water delivery systems may be dramatically affected by fire. With the exception of the North Coast, most watersheds in California have extensive downstream water supply infrastructures serving rural residents, larger municipalities and agricultural users. Increased sediment can decrease storage capacity in dams and reservoirs. For example, the Denver Water Board lost an estimated $20 million worth of storage capacity in Strontia Springs Reservoir following the 1996 Buffalo Creek wildfire.

Comment On: Chapter 5 Section 7.4

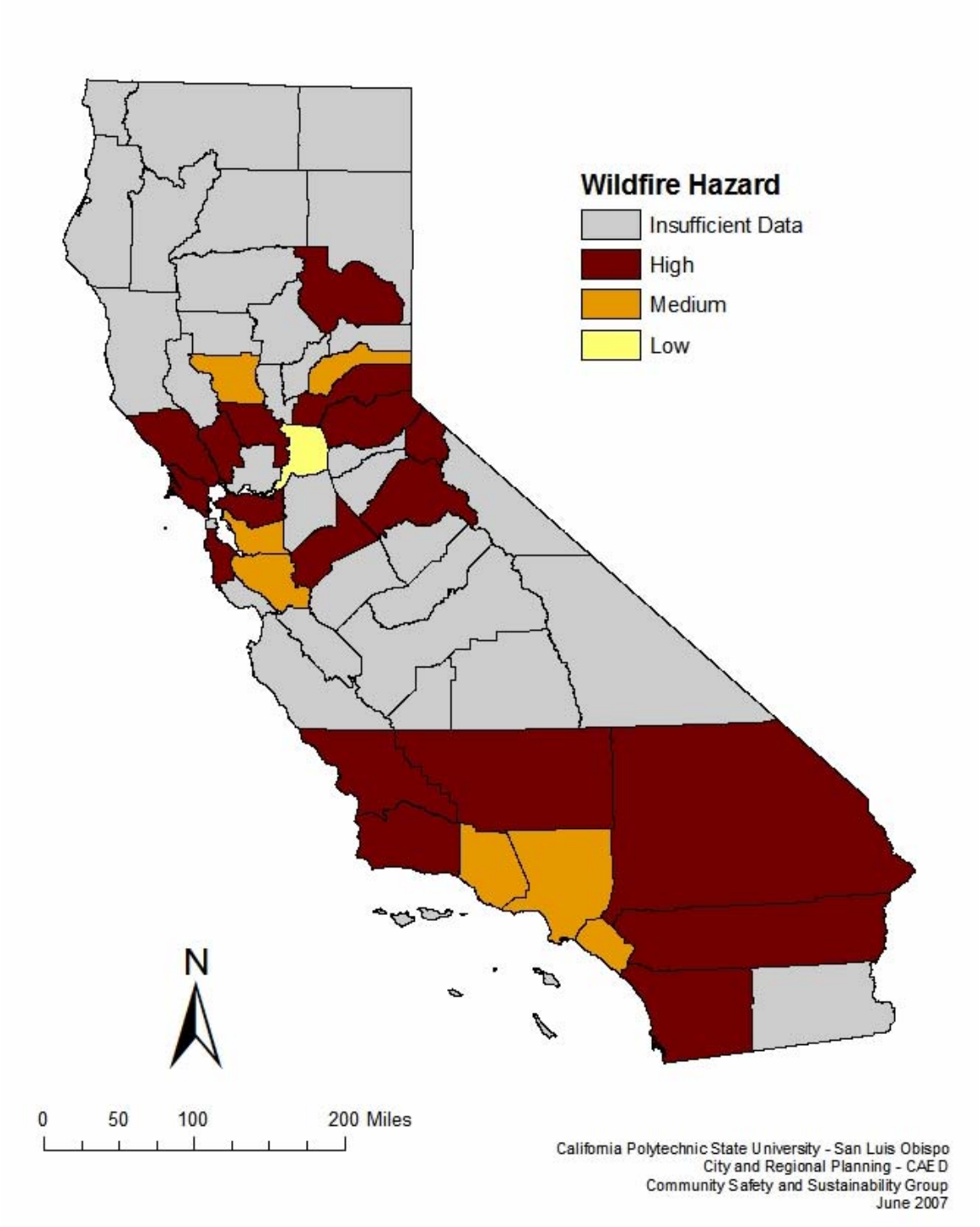
5.7.4 Assessment of Local Vulnerability and Potential Losses

When looking at local vulnerability, an emerging source of local perspectives on wildfire threats is the collection of FEMA-approved Local Hazard Mitigation Plans (LHMPs) described further in Chapter 6. Map 5.7.4A on the following page shows wildfire hazards ratings in FEMA-approved Local Hazard Mitigation Plans (LHMPs) prepared since passage of the Disaster Mitigation Act of 2000.

East Bay Hills Fire 10/91

Source: OES

Map 5.7.4A Wildfire Hazard ratings in Local Hazard Mitigation Plans



Comparison of wildfire hazard ratings made by local agencies in their LHMPs with the statewide GIS risk exposure analysis presented earlier in Chapter 5 (Section 5.4.1) indicate certain disparities between local and statewide perspectives. For example,

wildfires are rated high by counties which in the statewide analysis are seen as having a medium risk exposure and vice versa. Variations in perspective will be examined during the next round of local hazard mitigation planning during the implementation of the 2007 SHMP (see Chapters 3, 6 and 8).

Comment On: Chapter 5 Section 7.5

5.7.5 Current Wildfire Hazard Mitigation Efforts

Once thought of as a seasonal hazard, wildfires are an almost everyday occurrence in California. However, much of the state's approach to dealing with wildfire is still seasonal in nature. Flammable expanses of brush, diseased timberland, overstocked forests, hot and dry summers, extreme topography, intense fire weather wind events, summer lightning storms, and human acts all contribute to California's wildfire threat.

Wildfire and Human Development

Wildfire and human development have always been in conflict. Wildfire is a natural part of our environment and human development in wildlands is an accepted practice. This inherent conflict requires careful management in order to reduce or eliminate losses to life, property, and resources from wildfires. Some past management practices have failed to address the comprehensive nature of the human/wildfire conflict and have exacerbated conditions that can lead to more damaging fires. One example is wildfire suppression without aggressive management of hazardous fuels. Another is wildfire suppression without performance-based fire-resistant construction standards or fire-safe development requirements. Daily actions and decisions often fail to consider wildfire risks and the potential for resulting losses.

Managing the Human/Wild-fire Conflict

Managing the human/wildfire conflict requires a commitment of resources and a focused mitigation plan over the long term. The approach must be system-wide and include the following:

- An informed, educated public that takes responsibility for its own decisions relating to wildfire protection
- An effective wildfire suppression program
- An aggressive hazardous fuels management program
- Land use policies and standards that protect life, property, and resource protection
- Construction and property standards that provide defensible space

The California Fire Plan

The overall goal of the California Fire Plan is to reduce total costs and losses from wildland fire by protecting at-risk assets through focused pre-fire management efforts and increased initial attack success. The following are excerpts from the California Fire Plan which will be further shortened prior to final publication of this Plan.

To view details of the California Fire Plan, go to www.fire.ca.gov/FireEmergencyResponse/FirePlan/pdf/fireplan.pdf.

California Fire Plan Objectives

The plan has five objectives:

Objective	Description
1	To create wildfire protection zones that reduce the risks to citizens and firefighters.
2	To assess all wildlands, not just the state responsibility areas (SRAs). Analyses will include all wildland fire service providers—federal, state, and local government, and private. The analysis will identify high risk, high value areas, and develop information on and determine who is responsible, who is responding, and who is paying for wildland fire emergencies.
3	To identify and analyze key policy issues and develop recommendations for changes in public policy. Analysis will include alternatives to reduce total costs and losses by increasing fire protection system effectiveness.
4	To have a strong fiscal policy focus and monitor the wildland fire protection system in fiscal terms. This will include all public and private expenditures and economic losses.
5	To translate the analyses into public policies.

California Fire Plan Framework

The California Fire Plan (Fire Plan) lists five major components as the basis of an ongoing fire planning process to monitor and assess California's wildland fire environment:

	Component	Description
1	Wildfire Protection Zones	A key product of the Fire Plan is the development of wildfire safety zones to reduce citizen and firefighter risks from future large wildfires.
2	Initial Attack Success	The Fire Plan defines an assessment process for measuring the level of service provided by the fire protection system for wildland fire. This measure can be used to assess CAL FIRE's ability to provide an equal level of protection to lands of similar type, as required by Public Resources Code §4130. This measurement is the percentage of fires that are successfully controlled before unacceptable costs are incurred. Knowledge of the level of service will help define the risk to wildfire damage faced by public and private assets in the wildlands.

	Component	Description
3	Assets Protected	The Fire Plan will establish a methodology for defining assets protected and their degree of risk from wildfire. The assets addressed in the plan are citizen and firefighter safety, watersheds and water, timber, wildlife and habitat (including rare and endangered species), unique areas (scenic, cultural, and historic), recreation, range, structures, air quality. Stakeholders, including national, state, local, and private agencies, interest groups, will be identified for each asset at risk. The assessment will define the areas where assets are at risk from wildfire, enabling fire service managers and stakeholders to set priorities for pre-fire management project work.
4	Pre-Fire Management	This aspect focuses on system analysis methods that assess alternatives to protect assets from unacceptable risk of wildland fire damage. Projects include a combination of fuels reduction, ignition management, fire-safe engineering activities, and forest health to protect public and private assets. The priority for projects will be based on asset owners and other stakeholders' input and support. Pre-fire management prescriptions designed to protect these assets will also identify who benefits and who should share in the project costs.
5	Fiscal Framework	The State Board of Forestry and CAL FIRE are developing a fiscal framework for assessing and monitoring annual and long-term changes in California's wildland fire protection systems. State, local, and federal wildland fire protection agencies, along with the private sector, have evolved into an interdependent system of pre-fire management and suppression forces. As a result, a change to budgeted levels of service of any of the entities directly affects the others and the services delivered to the public. Monitoring system changes through this fiscal framework will allow the Board and CAL FIRE to address public policy issues that maximize the efficiency of local, state, and federal firefighting resources.

California Fire Plan Framework

The framework of the Fire Plan consists of:

- Identifying those areas of concentrated assets and high risk for state, federal, and local officials and for the public
- Allowing CAL FIRE to create a more efficient fire protection system focused on meaningful solutions for identified problem areas
- Providing citizens with an opportunity to identify public and private assets to carry out projects necessary to protect these assets
- Identifying where cost-effective pre-fire management investments can be made to reduce taxpayer costs and citizen losses from wildfires before they occur
- Encouraging an integrated intergovernmental approach to reducing costs and losses
- Enabling policymakers and the public to focus on what can be done to reduce future costs and losses from wildfires

The Planning Process

The California Fire Plan is a unique strategic wildland fire planning process, utilizing computer modeling to identify highest hazard and highest risk areas that are targeted for fire loss mitigation activities. The Plan:

- Utilizes state of the art technology and fire science modeling to assess planning elements
- Requires local stakeholder input and validation of assessments
- Uses computer modeling to develop federally required "Communities at Risk" list for National Fire Plan grant allocation
- Promotes community involvement to develop local solutions for local problems
- Is recognized nationally for innovativeness and success

Community Involvement

Development in California has led to high-risk WUI communities amid the states fire dependant landscapes. The resulting increased demand for fire services in the WUI can be effectively met with a proactive, community based response. The solution to the state's wildfire crisis lies in creating proactive communities that can withstand wildfire and work with wildfire agencies to reduce flammable fuels that contribute to catastrophic wildfires. For residents and business owners, being in California means learning to prepare for and live with wildfires.

The key to the success of the Fire Plan is community involvement. The Fire Plan is created at the local level to address local problems and identify and implement local solutions. Local community-based Fire Safe Councils are actively involved in developing community awareness, creating community fire protection plans, and implementing critical pre-fire management projects throughout the state.

Utilizing the combined expertise, resources, and communication channels of its members, the Fire Safe Council fulfills its mission to preserve California's natural and manmade

resources by mobilizing all Californians to make their homes, neighborhoods, and communities fire safe.

California Fire Safe Council facts:

- More than 100 Fire Safe Councils are active statewide
- Comprised of homeowners, business owners, insurance and real estate representatives, public utilities, and many others
- Involved in 300 community based fire defense projects
- Have secured $13 million of grant funded projects
- Is duplicated nationally
- Recognized by the National Association of State Foresters, National Academy of Public Administrators, and Western Governors Association

Vegetation Management Program

The state's Vegetation Management Program (VMP) is a cost-sharing program that focuses on the use of prescribed fire and mechanical means to address wildland fire fuel hazards and other resource management issues on State Responsibility Area (SRA) lands. The use of prescribed fire mimics natural processes, restores fire to its historic role in wildland ecosystems, and provides significant fire hazard reduction benefits that enhance public and firefighter safety. The VMP strives to:

- Significantly reduce damages from wildfire, floods, and accelerated erosion
- Increase the productivity of range and forest lands
- Increase water yields
- Improve wildlife and fish habitat
- Improve air quality and protect irreplaceable soil resources.

Under the VMP, private landowners may contract with CAL FIRE to conduct prescribed burns, with the state assuming up to 90 percent of the cost based on the degree of benefit to the public. CAL FIRE personnel inspect, prescribe, and prepare the site and perform the burn on a cost-share basis. Implementation of VMP projects is the responsibility of individual CAL FIRE units. Units select projects based on fit with the unit's priority areas (those identified through the Unit Fire Plan) and value to the unit. The VMP typically treats about 40,000 acres each year.

The program started in 1981 as a way to deal with unmanaged, shrub-covered lands, which can lead to disastrous, uncontrollable wildfires. CAL FIRE has identified approximately five million acres of highly hazardous shrub-covered land throughout the state. Prescribed burning remains the most cost-effective and environmentally sound method of reducing fire risk on these lands and achieving the VMP's other objectives. In the program's first five years, burns were completed on more than 200,000 acres. All VMP projects involve the development of a land management plan, many of which use the Coordinated Resource Management Planning approach due to multiple ownerships issues. Air quality considerations related to the burning are addressed by a smoke management plan.

Pre-Fire Grant Projects

Through various programs, CAL FIRE continues to participate in hazardous fuels reduction projects. Through the Conservation Camp program, inmate, ward, and Conservation Corps fire crews construct and maintain strategic fuel breaks, reduce roadside fuels, and contribute significantly to CAL FIRE's pre-fire mission in numerous ways. Funding for this work traditionally comes from the state general fund in the form of daily operating funds. Those that benefit from this work are limited in what they can offer CAL FIRE in terms of reimbursement for work related expenses. With the deployment of the National Fire Plan, Congress set aside pre-fire grant funds for ten years to assist the states in reducing the huge backlog of flammable vegetation that exists throughout the nation. Beginning in 2001, federal funds were directed to state projects with awards being determined through a competitive process. See Table 5.4.5A, Wildland Urban Interface Grant Awards in the 2004 SHMP Appendix.

Building Codes, Zoning, and Residential Flammable Vegetation Regulations

Since the 1960s, the state and local governments in California have enacted numerous laws related to protecting communities from wildfire. Many of the laws focus on either roofing or vegetation, the two major factors that affect structure loss during wildland fires. In many cases, these laws were passed immediately following a major fire, repealed later, sometimes re-enacted, and so on. Roofing regulations in WUI communities, such as Berkeley and Los Angeles, have histories of this sort due to recurring fires alternating with pressure from private-sector interest groups. Today, state law requires Class A roofs in areas designated as having a severe fire hazard and Class B roofs are required in all other parts of the state.

California's residential flammable vegetation regulations began with legislation following the 1961 Bel Air Fire that destroyed nearly 500 structures. Now codified in Public Resources Code §4291, the law requires a minimum of 30 feet of clearance around structures in SRAs. Additional clearing of up to 100 feet may be required in the most severe conditions. Numerous local jurisdictions have adopted more stringent standards.

Natural Hazard Disclosures (NHDs) in real estate transactions have been required for wildland fire hazards since 1990, but were not widely used until the late 1990s. NHDs are required in Very High Fire Hazard Severity Zones (VHFHSZs) in LRAs and in all areas of state responsibility fire protection, regardless of fire hazard.

Fire hazard rating and fire severity zoning have been a part of the WUI toolbox in California for decades. The need to adopt an effective zoning method is significant for both fire protection costs and insuring homes in high fire hazard areas. California uses the Fire Hazard Severity Zone process as required by statute. In addition to vegetation management, fire hazard zones are subject to various requirements for fire safe construction, emergency access and egress, and water supply.

Comment On: Chapter 5 Section 7.6

5.7.6 Opportunities for Enhanced Wildfire Hazard Mitigation

Local General Plans and the Safety Element

California law requires each city and county to adopt a general plan "for the physical development of the city or county, and any land outside its boundaries which…bears relation to its planning" (Government Code §65300). The general plan is the "constitution" for all local development. It expresses the community's goals and embodies public policy relative to the distribution of future land uses, both public and private. The general plan must contain seven mandatory elements—land use, housing circulation, conservation, open space, noise, and safety. Although WUI issues could be addressed in almost any of the mandatory elements, the most logical place for them is the safety element.

The goal of the safety element is to reduce the potential risk of death, injuries, property damage, and economic and social dislocation resulting from hazards such as fires, floods, earthquakes, and landslides. Within the safety element local jurisdictions must address fire safe standards, including evacuation routes, water supplies, road widths, and clearance around structures. Although this information has been required to be included in general plans since 1974, compliance is not universal (OSFM, 1999).

In 2002, OPR provided specific guidance for incorporating fire issues in the general plan in a publication entitled *Fire Hazard Planning*, which is part of the General Plan Technical Advice Series. The document can be downloaded at www.opr.ca.gov/publications/PDFs/Fire_Hazard_Planning-Final_Report.pdf. The purpose of the document is to help local jurisdictions develop effective general plan policies related to fire hazard mitigation and to help Fire Safe Councils, concerned citizens, and other interested parties develop fire plans that contain policies can easily be integrated into local general plans.

Fire Hazard Planning encourages a collaborative approach to hazard mitigation planning that links local mitigation efforts with local land use decision-making and that involves state and local government agencies, elected officials, local planners, community members, non-profit organizations, fire districts, and others. This approach maximizes community safety and can help link planning and funding decisions. The publication of *Fire Hazard Planning* was OPR's first step in developing a larger guidance toolkit for incorporating multi-hazard mitigation planning policies into the general plan and associated local prevention, response, and mitigation plans.

Trade-offs in Fire Hazards vs. Societal Benefits of Vegetation

To facilitate sustainable, disaster-resistant communities, there is a critical need to assess the tradeoffs in vegetation's potential to facilitate destructive wildfires versus the biological and economic benefits that it provides. Paradoxically, vegetation is both an asset and a liability to residents living in the wildland-urban interface (WUI). The same vegetation that regularly burns with great intensity and destruction simultaneously provides both tangible and intangible benefits to local communities (Dicus and Zimmerman *in press*).

Minimizing fire hazard while maximizing the economic, biological, aesthetic, and social values that vegetation provides are seemingly conflicting objectives in the WUI, particularly to those living in high hazard areas with elevated population densities. Continued immigration to highly fire-prone areas in California will likely continue unabated in the near future. For example, the population of San Diego, Los Angeles, Orange, Riverside, San Bernardino, and Ventura Counties in southern California was 19.2 million in 2000 and is expected to grow by at least 15% over the next 10 years (California Dept. of Finance 2004), which will increase both wildfire risk and the likelihood of ignition (Keeley et al. 2004).

Immigration to fire-prone areas in California has exponentially increased the costs and losses associated with WUI fires in the last two decades. Indeed, in spite of increased fire agency staffing, equipment, and training, 7 of the 10 most destructive wildfires in California history have occurred in the last 15 years, resulting in the loss of 53 lives and almost 12,000 homes (California Department of Forestry & Fire Protection 2006). The 2003 southern California fires alone burned ~750,000 acres, killed 22 people, consumed over 4,800 homes, and cost $1.3 billion to suppress (California Department of Forestry & Fire Protection 2004). Given the ever-increasing immigration to California's WUI, similar destructive wildfires are projected for the foreseeable future. Thus, effective fuel treatments in the WUI are critical to maintain sustainable communities.

However, treatment- and development-induced losses in tree and shrub canopy cover cost society in many direct and indirect ways. Vegetation is more than fuel, providing various levels of tangible and intangible benefits to society, dependent on its composition and structure. For example, WUI vegetation not only enhances community attractiveness, but also reduces home cooling costs and air pollution (Taha et al. 1997), lessens needed stormwater runoff infrastructure (Sanders 1986), sequesters carbon (Nowak and Rowntree 1991), provides wildlife habitat, and others. From 1985-2002, the City of San Diego experienced a 41% increase in urban lands coupled with a subsequent loss of 29% in tree canopy cover and 8% of shrubland canopy cover, which had profound impacts on societal benefits (American Forests 2003). Fuel treatments will only serve to further reduce vegetation and their subsequent social and economic benefits.

The need to adequately understand how fuel treatments affect both fire hazard and societal benefits is especially critical in light of recent legislation, which calls for a significant increase in mandatory fuel treatments around structures. California Senate Bill 1369 was signed into law as a direct result of the 2003 California fires, which amended Public Resources Code 4291 to increase mandatory vegetation clearance around homes from a previous standard of 30 feet to a current standard of 100 feet in all designated areas where the State has primary suppression responsibilities. These new standards have the potential to significantly reduce the losses caused by wildfire, but will also likely reduce the many tangible benefits to society that vegetation provides.

Minimizing both destructive wildfires and loss of native vegetation are competing, yet integral objectives in the WUI. Thus, there is an acute need for California land managers

to develop fuel management strategies in the WUI that minimizes fire risk while simultaneously reducing loss of native vegetation and the many societal benefits that it provides.

References for preceding subsection:

American Forests. 2003. Urban Ecosystem Analysis, San Diego, California. <http://www.americanforests.org/downloads/rea/AF_SanDiego.pdf> (3-19-07)

California Department of Finance. 2004. Population Projections by Race/Ethnicity for California and Its Counties 2000–2050. <http://www.dof.ca.gov/HTML/DEMOGRAP/ReportsPapers/Projections/P1/P1.asp> (12-1-2006)

California Department of Forestry & Fire Protection. 2004. California fire siege 2003: The story. < http://www.fs.fed.us/r5/fire/information/story/2003.php> (3-19-07)

California Department of Forestry & Fire Protection. 2006. 20 Largest California Wildland Fires (By Structures Destroyed). <http://www.fire.ca.gov/about_content/downloads/20LSTRUCTURESFeb06.pdf> (3-19-07).

Dicus, C.A., and M.P. Zimmerman. In press. Quantifying fire behavior vs. community benefits of southern California shrublands and grasslands. Pages 000-000 in R.E. Masters and K.E.M. Galley (eds.). Proceedings of the 23rd Tall Timers Fire Ecology Conference: Fire in Grassland and Shrubland Ecosystems. Tall Timbers Research Station, Tallahassee, FL.

Keeley, J.E., M.S. Witter, and R.S. Taylor. 2004. Challenges of managing fires along an urban-wildland interface --- lessons from the Santa Monica Mountains, Los Angeles, California. In the Third International Wildland Fire Conference, Sydney, Australia

Nowak and Rowntree. 1991. "Quantifying the Role of Urban Forests in Removing Atmospheric Carbon Dioxide." Journal of Arboriculture 17(10):269.

Sanders, R.A. 1986. Urban vegetation impacts on the hydrology of Dayton, Ohio. Urban Ecology 9(3-4):361-376.

Taha, H., S. Douglas, and J. Haney. 1997. Mesoscale meteorological and air quality impacts of increased urban albedo and vegetation. Energy and Buildings 25:169-177.

Chapter 5 – Hazard, Vulnerability, and Risk Assessment

Part 3 – Secondary Hazards

Part 3 Organization

5.8.1 Levee Failure
5.8.2 Landslides
5.8.3 Tsunami Hazards

Comment On: Chapter 5 Section 8.1

5.8.1 Levee Failure

Editor's Note: Portions of this discussion will be enhanced during July-August 2007 by information coming in from the Department of Water Resources' FloodSAFE and levee enhancement program planning currently under way.

Identifying Levee Hazards

There are several areas in California that utilize levees to project land; a) from peak flood levels, and/or b) to protect land that is below sea level. The first type of levee should be designed to withstand peak flood levels that are caused by rapid snow melt or intense rain fall within the watershed. Examples are the levees along the Russian River or levees along the Sacramento River near Sacramento. The second type of levee should be design to withstand nominal water levels on a continuous basis as well as peak flood levels. An example is the levees throughout the Bay Delta.

Significance

The San Francisco Bay-San Joaquin-Sacramento Delta region (aka "the Delta") contains levees critical for delivering irrigation water to 3 million acres, and drinking water to over 23 million people. A failure in one of the Delta levees in 1972 interrupted the State and Federal water supply systems and required approximately 500,000 acre-feet of fresh water to restore export water to acceptable quality (Senate Hearings on the 1972 Levee Failure at Andrus-Brannan Islands). Recent studies indicate the levees in the Delta are susceptible to significant damage in a near-field seismic event.

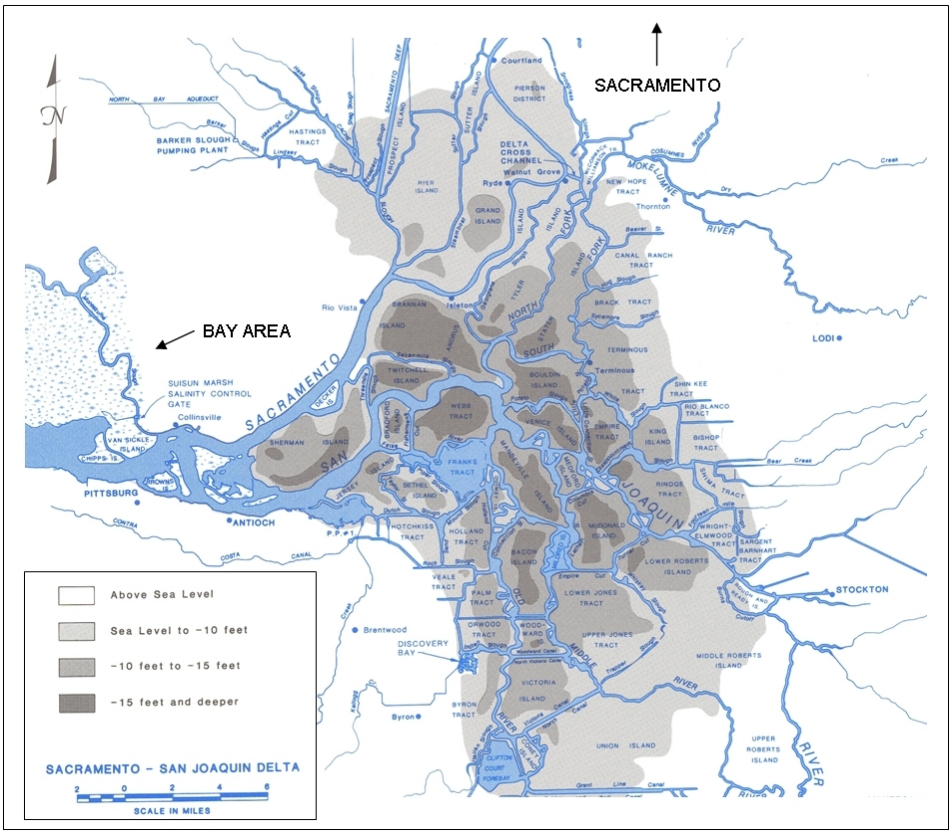
CALFED's "Seismic Vulnerability of the Sacramento-San Joaquin Delta Levees" report of April 2000 concludes that 3 to 10 failures are likely to occur on critical Delta levees during a 100-year earthquake. These failures would likely stop the export of Delta water until water quality is restored. Aside from the potential impact to water delivery to southern California, the encroachment of brackish or seawater into the delta could have significant environmental impact on salt-sensitive species. The Delta also has many fuel storage facilities and oil and gas pipelines located within the region. These lines may fail during a seismic event and cause large scale spills that will also inhibit the export of Delta water and severely impact one of the nation's largest natural salt water habitats.

Most levees in California are in the Bay Delta (over 1000 km) and in the most part protect land that is at or below sea level (Map 5.8.1A). Building of these levees began circa 1850 to protect or reclaim floodplains for agricultural purposes. The soil was rich for growing crops because of the river deposited silts or river nourished backwater peats in these locations, but these types of soils generally make for poor foundation material for levees. The original levees, from this era until about the 1940's-1950's were not engineered and have been augmented since then to produce what currently exists.

During the gold rush hydraulic mining was prevalent in the headwaters of the rivers that feed the Bay Delta. Huge amounts of sediment were flushed downstream as a byproduct of hydraulic mining. To prevent build up of this sediment, levees were built and/or heightened to increase flows through the low lying areas to aid in moving the sediment pulses through the Delta.

With the reclaimed floodplains not being replenished with new sediment, and the drying out of some of the boggy areas, the land protected by the levees began to drop in elevation via subsidence and wind erosion of topsoil. As can be seen in Map 5.8.1A, there are vast areas in the Delta that are currently below sea level. Land behind the levees will continue to drop in elevation, with the addition of potential sea level rise exacerbating the situation.

Map 5.8.1A Bay Delta Elevations Relative to Mean Sea Level (after DWR 1993)



In California levees protect farmland, ranchland, rural residential, urban residential, and infrastructure such as roads, highways, and waterways or canals. The Bay Delta is a complex system where there are three rivers bringing in fresh water, tidal fluctuations that cycle salt water or brackish water, and the Central Valley and State Water Projects that carry fresh water to upwards of 23 million citizens in Central and Southern CA.

Levee Stability

The stability of levees is a function of several variables. Loading of levees can be grouped into three main loading functions related to levee failure in CA; water level changes, ground shaking, and static loading (Moss and Eller, 2007). Water level changes can be due to peak flood levels or rapid draw down, both are known to adversely impact the stability of levees. Ground shaking is a function of earthquakes in and around the levees, but can occur up to 100 km distance or more and still impact levee performance. Static loading is the nominal loading conditions that exist, and documented levee failures have occurred with no adverse conditions other than static loading (for example the recent Jones Tract failure in 2004, http://www.publicaffairs.water.ca.gov/newsreleases/2004/jones04.cfm). The levees in the Bay Delta are designed nominally to 100 yr design flood levels. This should be put into perspective with the levee system that was built to protect the city of New Orleans against 250 yr design flood levels but recently failed catastrophically due to hurricane Katrina at flood levels much lower than the design (Seed et al. 2006).

Levee Failure Mechanisms

Failure can be grouped into six main failure mechanisms that are a function of the three loading functions described above; bearing failure, sliding failure, slump or spreading failure, seepage failure, erosion failure, and over topping (Moss and Eller, 2007).

- A bearing failure in levees is typically deep-seated and is most likely induced by seismic ground shaking. Failure is commonly triggered by a seismic event that either causes a loss of soil strength or produces destabilizing inertial loading conditions.
- A sliding failure may occur if the foundation soil has a weak or brittle zone resulting in a preferred failure plane. Both seismic induced inertial loading and high water levels can cause sliding failures.
- Slumping and spreading can be generated by two loading conditions. Cyclic loading from earthquakes may generate increased pore pressures and reduced soil strength, leading to volumetric and/or deviatoric strains in the foundation. The same results can also occur due to increased pore pressures from high water levels and increased seepage.
- Seepage is one of the most common failure mechanisms in levees. Levees are built in fluvial depositional environments and it is common to find levees with an existing sandy layer beneath the foundation. The sandy layer can be a conduit for flow underneath the levee, resulting in critical conditions at the inboard (or landside) toe. This leads to erosion of the foundation during high water or a consistent weakening of the foundation over a long period of time, both eventually leading to failure. Biogenic agents can also lead to destabilizing seepage. This can include rodent holes, tree roots, or other biological activity that create conduits for seepage.

- High velocity flows can erode material from the outboard or waterside of the levee, which may lead to instability and failure. Erosion can occur at once or over time as a function of the storm cycle and the scale of the peak storms.
- The failure mechanism of overtopping occurs when high water exceeds the elevation of the levee crest. The water energy is then concentrated at the inboard toe of the levee leading to soil erosion and decreased levee stability. Overtopping failure can be exacerbated by decreased levee crest height due to land subsidence.

Reengineering the Levees

The Army Corp of Engineers (USACE) has endeavored to reengineer the older levees and to build new levees to increasing design standards. One of the biggest issues of the existing levee system, particularly in the Bay Delta, is the quality of the foundation material the levees are founded on. Two seismic concerns related to CA levees are; liquefaction potential of levees founded on granular or sandy soils, and cyclic failure and post-cyclic deformations of levees founded on peaty organic soils. Some non-seismic concerns related to CA levees are; sufficient levee height to withstand peak flows, armoring levees against toe or face erosion, preventing detrimental seepage through and beneath levees, and mitigating against degradation of levee integrity due to biological agents or time-based strength degradation of levee materials.

One of the important lessons learned from the New Orleans levee failures (Seed et al. 2006) was that levees can be designed and built to appropriate standards, but where two levees abut or join should also be designed and built to the same standards. A number of failures in and around New Orleans can be attributed to this juncture or interface between different levees built at different times, built using different designs, or under different jurisdictions. Regardless of how well built each levee was, the interface or connection was substandard and failure occurred at that location. In engineering terms levees are considered a series system, a chain of connected engineered components. Levee hazard mitigation must be conducted on a system wide basis, and a levee system as with any series system is only as strong as the weakest “link” in the chain.

Profiling Levee Hazards

A list of levees failures in the Bay Delta from 1900 to the present is shown in Table 5.8.1A (DWR, 2006; DWR Public Affairs Chief Ted Thomas, personal communication, 2006; USACE, 2006). This list documents the spatial and temporal variability of levee failure but does not attribute the failures to a particular loading function or failure mechanism. Table 5.8.1A on the following page shows the Bay Delta Levee Failures that have occurred since 1900.

Table 5.8.1A Bay Delta Levee Failures 1900-Present

Delta Island/Tract	Acres Flooded	Year Flooded							
Andrus Island	7200	1902	1907	1909	1972				
Bacon Island	5546	1938							
Bethel Island	3400	1907	1908	1909	1911	1972	1981	1983	
Big Break	2200	1927							
Bishop Tract	2100	1904							
Bouldin Tract	5600	1904	1907	1908	1909	1972			
Brack Tract	2500	1904							
Bradford Island	2000	1950	1983						
Brannan Island	7500	1902	1904	1907	1909	1972			
Byron Tract	6100	1907							
Canal Ranch Tract	500	1958	1986						
Clifton Court Tract	3100	1901	1907						
Coney Island	900	1907							
Dead Horse Island	200	1950	1955	1958	1980	1986	1997		
Donlon Island	3000	1937							
Edgerly Island	150	1983							
Empire Tract	3500	1950	1955						
Fabian Tract	6200	1901	1906						
Fay Island	100	1983							
Franks Tract	3300	1907	1936	1938					
Glanville Tract*		1986	1997						
Grand Island*		1955							
Grizzly Island	8000	1983							
Holland Tract	4100	1980							
Ida Island	100	1950	1955						
Jersey Island	3400	1900	1904	1907	1909	1981	1983		
Little Franks Tract	350	1981	1982	1983					
Little Mandeville Island	22	1980							
Lower Jones Tract	5700	1907	1980						
Lower Roberts Island	10300	1906							
Lower Sherman Island	3200	1907	1925						
Mandeville Island	5000	1938							
McCormack Williamson Tract	1500	1938	1950	1955	1958	1986	1997		
McDonald Island	5800	1982							
Medford Island	1100	1936	1983						
Middle Roberts Island	500	1938							
Mildred Island	900	1965	1969	1983					
New Hope Tract	2000	1900	1904	1907	1928	1950	1986		
Palm Tract	2300	1907							
Pescadero	3000	1938	1950						
Prospect Island	1100	1980	1981	1982	1983	1986			
Quimby Island	700	1936	1938	1950	1955	1986			
RD 1007	3000	1925							
RD 17	4500	1901	1911	1950					
Rhode Island	100	1938							
Ryer Island	11600	1904	1907						
Sargent Barnhart Tract	1100	1904	1907						
Sherman Island	10000	1904	1906	1909	1937	1969			
Shima	2394	1983							
Shin Kee Tract	700	1938	1958	1965	1986				
Staten Island	8700	1904	1907						
Stewart Tract	3900	1938	1950	1997					
Terminous Tract	5000	1907	1958						
Twitchell Island	3400	1906	1907	1909					
Tyler Island	8700	1904	1907	1986					
Union Island	2400	1906							
Upper Jones Tract	5700	1906	1980	2004					
Upper Roberts Island	500	1938							
Van Sickle*		1983							
Venice Island	3000	1904	1906	1907	1909	1932	1938	1950	1982
Victoria Island	7000	1901	1907						
Webb Tract	5200	1950	1980						

* acreage unknown

Assessment of State Vulnerability and Potential Losses

This list of levee failures also documents the consequences of the levee failures in terms of area of land flooded per failure. The consequences of failure are critical for profiling the hazard and developing a rational risk based assessment. Ultimately the consequences should be in terms of dollar figures associated with crop loss, building destruction, life loss, or salt water intrusion that brings to a halt the pumping of fresh water to Central and Southern CA.

Assessment of Local Vulnerability and Potential Loss

Editor's Note: This section is to be developed further during July-August 2007 prior to preparation of the final draft 2007 SHMP using information from DWR and the Delta Protection Commission.

Current Levee Hazard Mitigation Efforts

Currently there is a state wide push to mitigate the most egregious hazards related to levees. Two bond measures were passed in the 2006 election by the citizens of California appropriating roughly 4.9 billion dollars to mitigate levee hazards (Prop 1E and 84). This money is going to both immediate measures to address backlogged hazard mitigation as well as long range planning and implementation of a state wide hazard mitigation and prevention policy.

The DRMS (Delta Risk Management Strategy) is a program to develop a comprehensive assessment of levee risk in the Delta so that rational mitigation decisions can be made. This program under the supervision of the DWR is currently inventorying the existing levee system, compiling existing subsurface data, collecting new subsurface data, and building a GIS-based platform containing all the relevant levee information. In addition, researchers, planners, and practitioners are working together to develop a risk-based framework to utilize this platform for identifying and ranking levee hazards so that the bond money can be spent in the most cost effective manner.

The CALFED (2000) report evaluated the seismic hazard associated with the Bay Delta. The DRMS project is updating this report using new information and new hazard assessment techniques.

The Governor recently declared a state of emergency in California counties affected by potential levees failure. The purpose of this was to free up emergency funding to address potentially weakened levees urgently needing repair. These levees were identified by the DWR as the most severe cases of erosion and the emergency funding was used to shore up the levees.

Opportunities for Enhanced Levee Hazard Mitigation

Editor's Note: This section is to be developed further during July-August 2007 prior to preparation of the final draft 2007 SHMP using information from DWR and the Delta Protection Commission.

References for the preceding subsection:

CALFED (2000). "Seismic vulnerability of the Sacramento-San Joaquin Delta Levees." Bay-Delta program, seismic vulnerability sub-team, April.

DWR (1993). Sacramento San Joaquin Delta Atlas. Department of Water Resources, Sacramento.

DWR (2006). Levee Repairs. May 25. www.levees.water.ca.gov

Moss, R.E.S. and Eller, J.M. (2007) "Estimating the Probability of Failure and Associated Risk of the California Bay Delta Levee System." GeoDenver, Feb.

Seed, R. B., Abdelmalak, R. E., Athanasopoulos, A. G., Bea, R. G., Boutwell, G. P., Bray, J. D., Briaud, J.-L., Cheung, C., Cobos-Roa, D., Cohen-Waeber, J., Collins, B. D., Ehrensing, L., Farber, D., Hannenmann, M., Harder, L. F., Inamine, M. S., Inkabi, K. S., Kammerer, A. M., Karadeniz, D., Kayen, R. E., Moss, R. E. S., Nicks, J., Nimala, S., Pestana, J. M., Porter, J., Rhee, K., Riemer, M. F., Roberts, K., Rogers, J. D., Storesund, R., Thompson, A., Govindasamy, A. V., Vera-Grunauer, X., Wartman, J., Watkins, C. M., Wenk, E., and Yim, S. (2006). "Investigation of the Performance of the New Orleans Flood Protection Systems in Hurricane Katrina on August 29, 2005." NSF Independent Levee Investigation Team, Draft Final Report, Report No. UCB/CCRM-06/01, May 22. www.ce.berkeley.edu/~new_orleans/report.

USACE (2006) "Sacramento – San Joaquin Delta Report to Congress." 18 May. http://www.spk.usace.army.mil/organizations/cespk-pao/delta/report.html.

Comment On: Chapter 5 Section 8.2

5.8.2 Landslides and Other Earth Movements

Identifying Landslide Hazards

Like its earthquake-generating faults, California's mountainous terrain is also a consequence of dynamic geologic processes in operation as the North American plate grinds past the Pacific plate. More than one-third of California is mountainous terrain that generally trends parallel to the coast, forming a barrier that captures moisture from offshore storms originating in the Gulf of Alaska and Mexico. Steep topography, weak rocks, heavy winter rains, and occasional earthquakes all lead to slope failures more frequently than would otherwise occur under gravity alone. A landslide is the breaking away and gravity-driven downward movement of hill slope materials, which can travel at speeds ranging from fractions of an inch per year to tens of miles per hour depending on the slope steepness and water content of the rock/soil mass. Landslides range from the size of an automobile to a mile or more in length and width and due to their shear weight and speed can cause serious damage and loss of life. Their secondary effects can be far

reaching such as catastrophic flooding due to the sudden release of river water impounded by landslide debris, or slope failure of an earthen dam. Although the area affected by a single landslide is orders of magnitude less than that of earthquakes landslides are pervasive in California's mountainous terrain, and occur far more often, resulting in cumulative losses approaching $200 million in a given year. Average annual landslide losses in California are estimated at about $100 million. Because landslides occur as isolated events in both time and location, and there is presently no systematic means in place for documenting their losses, landslide hazard is often underestimated or goes unrecognized in the policy arena, even though they continue to cause millions of dollars in cumulative damage to California's homes, businesses and infrastructure.

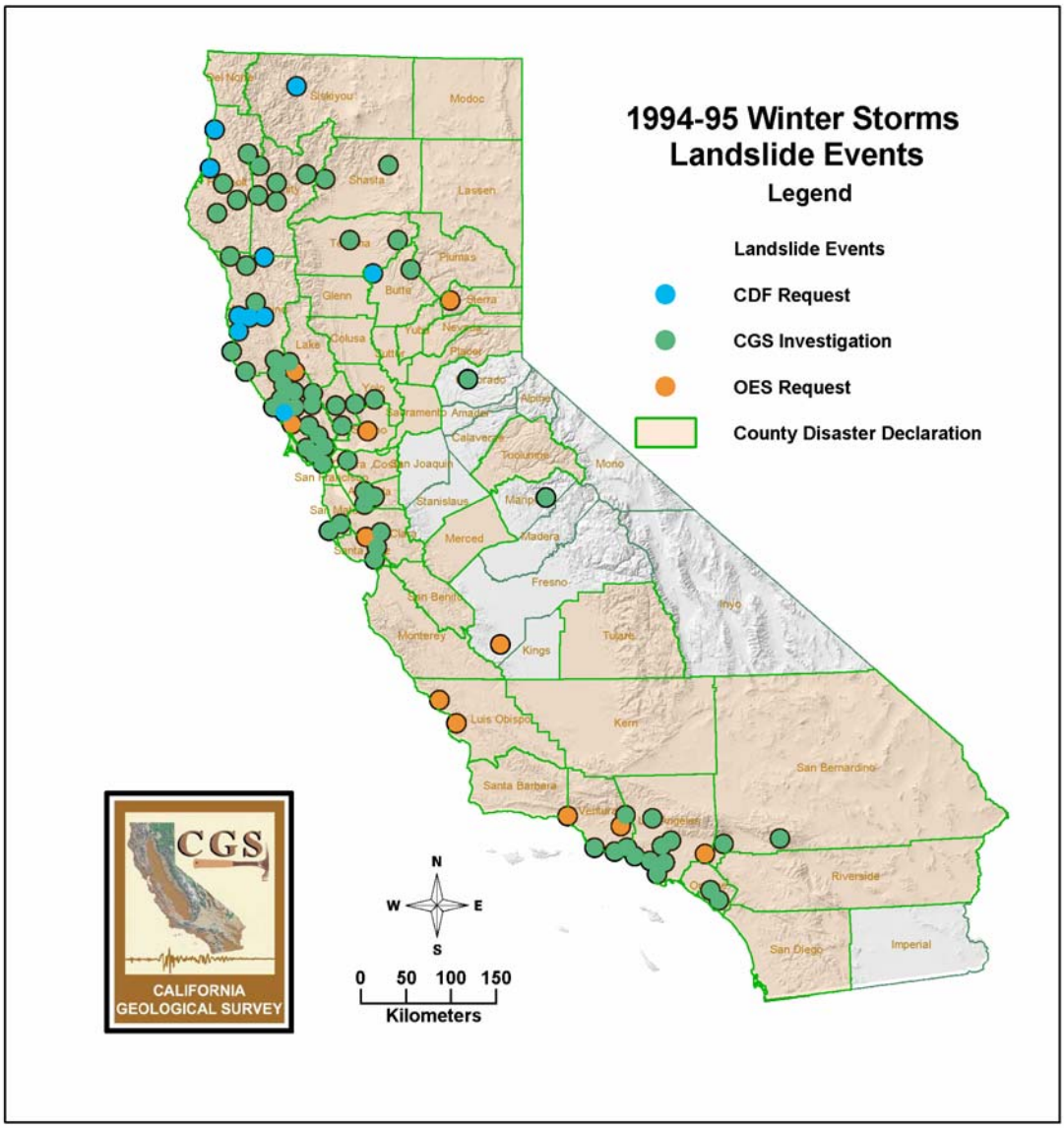
Profiling Landslide Hazard Events

Landslides are classified into many different types based on form and type of movement. They range from slow moving rotational sumps and earth flows, which can slowly distress structures but are less threatening to personal safety, to fast moving rock avalanches and debris flows that are a serious threat to structures and have been responsible for most fatalities during landslide events. Many large landslides are complex, being of a combination of more than one landslide type. This is well illustrated by the famous La Conchita landslide that lies along the coastal bluffs in Ventura County. Historically active since the turn of 19th century, it was reactivated as a slow moving rotation slide during the 1995 winter rains that destroyed a half dozen homes in the subdivision below. The slow movement allowed homeowners to evacuate safely, resulting in no injuries during the event. A portion of same landslide moved again during the heavy 2005 winter rains as a fast moving debris flow, which destroyed 30 more homes but caused 10 fatalities as the occupants had no time to escape.

Landslide risk is high in the coastal region of California which is home to over 75% of the state's population, industry and infrastructure. Particularly hazardous terrain lies where weak marine sedimentary rock layers are inclined in the same direction as the mountain slope, such as the Capistrano Formation in portions of the coastal southern California region. From central California almost to the Oregon border lies the landslide prone Franciscan formation, which consists of an easily eroded, weak rock/soil mixture that makes up much of the northern California Coast Ranges. Because past decades of development have been continuing to spread into mountainous terrain where hazard exposure is high, most reported landslide losses occur in these regions as illustrated in the cumulative landslide occurrences resulting from the 1995 El Nino winter storms, as shown in Map 5.8.2A.

General areas of landslide susceptibility in California are shown Map 5.8.2B in the 2007 SHMP Appendix. Map 5.8.2C in the Appendix indicates federally declared landslide disasters by county since 1950. All three maps reveal similar geographic distribution of landslide susceptibility and events.

Map 5.8.2A Landslide Damage Reports, 1995



Map 5.8.2 A shows landslide damage reports investigated by the California Geological Survey (CGS) during the 1995 El Nino winter storms. Orange circles represent those events that were investigated at the request of OES., blue circles are those investigated at the request of the California Department of Forestry and Fire Protection, and the green circles represent landslides investigated independently by the CGS. Orange shaded counties are those declared federal disaster areas during the 1994/95 winter season. Other El Nino winter seasons revealed similar patterns of landslide occurrences.

This statewide pattern of occurrences repeats itself during heavy winter seasons, which generally coincide with El Nino Southern Oscillation in the Pacific Ocean. Every few

years warm equatorial waters are driven northward bringing with it moisture-laden air that results in more frequent and severe winter storms in California (Chart 5,8.2A). The added weight of rain-saturated hill slopes and the weakening of slopes caused by the pressure the groundwater exerts on porous hillside materials are triggering agents of slope failure. Improved forecasting of El Nino events now provides advanced warning to better prepare and respond to potential slope failures and flood events.

Chart 5.8.2A ENSO Index

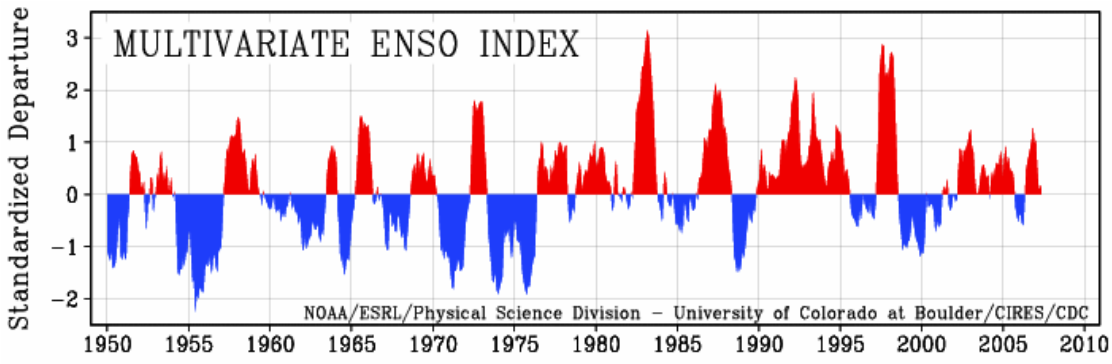


Chart 5.8.2A. shows a 57-year history of El Nino occurrences. Red region corresponds to warmer sea surface temperatures, which brings unusually moist air into the north Pacific producing wetter winters and more intense landslide and debris flow activity in California.

Chart 5.8.2B Property Losses

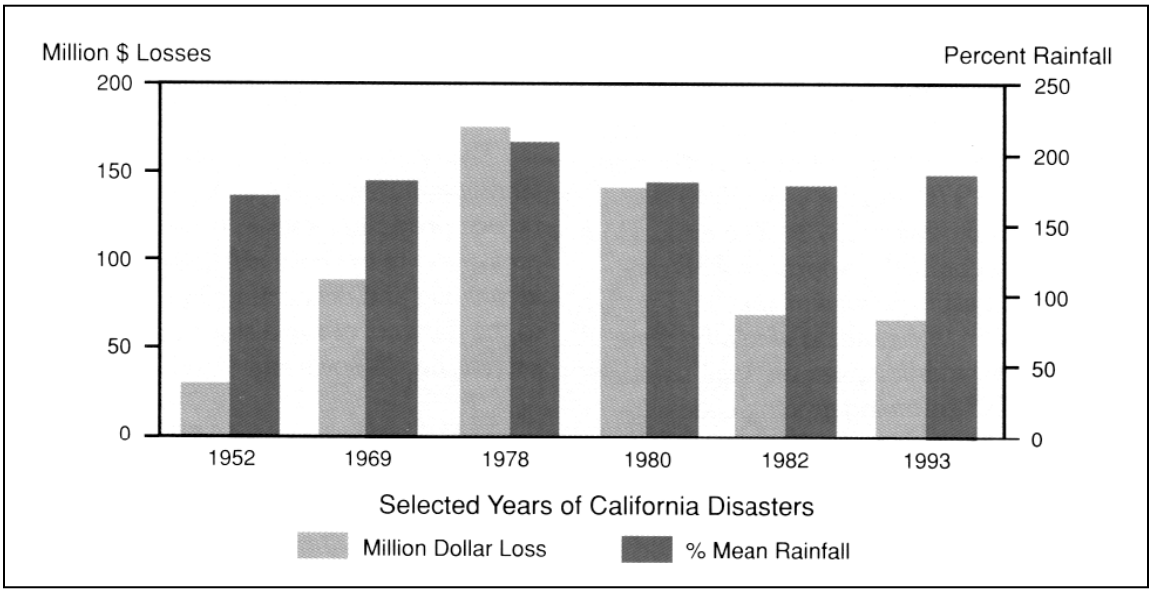


Chart 5.8.2B shows property losses from storm events in California gathered from a variety of sources (Barrows 1993). Note correspondence with El Nino history for roughly the same period shown in Chart 5.8.2A.

Although less frequent, the most devastating landslides worldwide have been triggered by earthquakes. Strong ground shaking can add the additional forces necessary to weaken and cause slopes that are already distressed by gravity to fail. The greatest landslide disaster in history occurred in 1920 in central China, where a magnitude 8.5 earthquake caused weak, wind-deposit slopes to collapse into a densely populated valley killing an estimated 180,000 people. Besides additional forces, earthquake shaking can rapidly weaken loose water-saturated sediments via liquefaction, which can greatly increase ground deformation and sliding even on gentle slopes. This happened when the soil beneath a juvenile detention facility and an earth fill dam partially liquefied and shifted, causing partial collapsed of both facilities during the 1971 San Fernando Earthquake. Those events resulted in over half billion dollars damage and the temporary evacuation of 80,000 people below the dam (Table 5.8.2A on the following page). Should an earthquake occur in California after heavy rains, landslide related damages could be catastrophic in California (see section on earthquake hazards).

Besides blocking the flow of streams and causing the potential for catastrophic flooding by sudden release of impounded waters, landslides can collapse into water bodies causing very large, destructive splash waves. In 1958, a magnitude 8 earthquake collapsed a hillside into Lituya Bay, Alaska, which caused a water splash wave that reached 1,720 feet up the mountain slope stripping all vegetation. A massive landslide into the Vaoint Reservoir, Italy in 1963 caused a tremendous water splash wave that swept 800 feet over the top of the dam, causing a major flood that killed an estimated 2, 600 people below. Grading during construction of reservoirs and alteration of the ground water regime due to the impounded water can weaken the adjacent hillsides, which must be taken into consideration during design and construction.

Assessment of Vulnerability Inventories and Mitigation Progress by Jurisdiction and Type of Construction

The impact of natural hazards on the built environment generally depends on exposure (proximity to the hazard and its severity), and the vulnerability of engineered structures (structure type, design, age). The closer a structure is to a hazard event the more damage that is likely to be sustained, while the larger a hazard event is the greater its impact at a given distance. Brick buildings resist storm and fire damage better than wood construction; however they are less resilient against earthquakes, particularly unreinforced masonry. The resistance a structure of a given type will have against natural hazards depends on the building code in effect at the time of construction and how closely its provisions are followed. Codes improve with time, so newer construction generally performs better than older construction; however, whereas structures can be designed to resist the forces of gravity, wind and earthquakes, it is not economically feasible to design structures to resist the large earth movements that can accompany large landslides. Consequently, landslide losses primarily result from hazard exposure (high population densities in mountainous terrain) rather than inferior structural design. With regard to impact, structures fall into two principal categories based on their extent, function, and vulnerability: buildings and lifelines.

Table 5.8.2A Notable historic landslides in California

Where	When	Impact (adjusted to 2006 dollars)
Laguna Beach	2005	Destroyed 18 homes, damaged 8 others. Slide repair nearly $21 million. Cost of damages about $35 million
Mission Peak	1998	Ancient slide reactivated during 1998 winter storms; largest slide in San Francisco Bay region. http://web.umr.edu/~rogersda/hazard_mitigation_techniques/landslides/fremont/MP.htm
Laguna Niguel	1998	Resulted in loss of 9 homes and 57 condominiums; $12 million awarded to homeowners in lawsuit; $16 million to stabilize slope. http://anaheim-landslide.com/laguna.htm
Rio Nido	1998	Triggered in 1998 El Nino storms, heavy mudflows and risk of major hillside collapse caused evacuation of 140 residents. Loss of thirty seven homes. http://www.sonoma.edu/geology/wright/rioslide.html
Laguna Beach	1998	Two lives lost, 18 homes destroyed 300 damaged http://wrgis.wr.usgs.gov/wgmt/elnino/scampen/laguna/index.html
La Conchita	1995/2005	6 homes destroyed. http://www.geog.ucsb.edu/~jeff/projects/la_conchita/apcg2001_article/apcg2001_article.html
Anaheim Hills	1993	25 acres, 30 homes destroyed over 200 damaged; $12 million
Big Rock Mesa	1979/83	200 acres, Movement began 13 homes destroyed, $114 million ; Highway 1 damage $1.26 billion. http://www.ci.malibu.ca.us/download/index.cfm?fuseaction=download&cid=3144
Laguna Beach	1978	3.5 acres; 19 homes destroyed, 45 homes damaged; $62 million http://www.consrv.ca.gov/cgs/geologic_hazards/landslides/Bluebird%20Canyon%20Landslide%20Cover.pdf
San Fernando	1971	Upper and Lower Van Norman Reservoirs; $354 million; Triggered by M6.7 San Fernando Earthquake
Saugus-Newhall	1971	Destroyed Juvenile Hall - $312 million Triggered by M6.7 San Fernando Earthquake
Palos Verdes	1956 on intermittently	280 ac; more than 100 homes severely damaged or lost; repair $34 million; $68 million in damage settlements. http://seis.natsci.csulb.edu/VIRTUAL_FIELD/Palos_Verdes/pvportuguese.htm

Anaheim Hills, California – Storms of 2005

Typical landslide damage to residential homes caused by intense ground deformation of the landslide mass. Slow movement of slide allowed residents to evacuate their homes.

Existing Buildings

Ignoring secondary effects, landslides directly damage engineered structures in two general ways: 1) disruption of structural foundations caused by differential movement and deformation of the ground upon which the structure sits; and 2) by the physical impact of debris moving down slope against structures located in the travel path. As a landslide breaks away from a slope and moves, it deforms the ground into an undulating, hummocky surface broken up by fissures and scarps. When situated on top of a landslide the deformation distresses structural foundations and the structures themselves, by settlement, cracking, and tilting. This can occur slowly, over years, or rapidly within days/hours. Water saturated, fast moving debris flows (coined mudslides by the media) can destroy all in its path, collapsing walls and shifting structures off their foundations. The 2005 La Conchita landslide in Ventura County traveled with such force that it destroyed 30 homes, scraping many off their foundation and piling them one on top of another three high.

Catastrophic damage caused by a fast moving debris flow. Ten lives were lost as 30 homes were swept off their foundations and piled 3 high when the fast moving, dense water-saturated hillside broke loose during heavy rains (La Conchita, 2005).

Utilities and Transportation

In addition to buildings, types of other engineered structures are vulnerable to the impact and ground deformation caused by slope failures, particularly utilities and transportation structures. These belong to a category of structures called lifelines. Transmission lines such as telephone lines, electric power, gas, water, sewage, roadways, and so on are necessary for today's functioning society. They present a particular vulnerability because of their geographic extent and susceptibility to physical distress. Lifelines are generally linear structures that because of their geographic extent have a greater opportunity for impact by ground failure (hazard exposure). Extension, bending, compression caused by ground deformation can break lifelines. Failure of any component along the lifeline extent can result in failure to deliver service over a large region. Once broken, transmission of the commodity through the lifeline ceases, which can have catastrophic repercussions down the line: loss of power to critical facilities such as hospitals, impaired disposal of sewage, contamination of water supplies, disruption of all forms of transportation, release of inflammable fuels, and so on. Therefore the overall impact of

lifeline failures, including secondary failure of systems that depend on lifelines, can be much greater than that of individual buildings or residential dwellings.

Mitigation Measures for Landslide Hazards

Exposure to landslide hazards can be reduced by effective land-use planning and hillside development practice. From an engineering perspective blaming landslide losses on the rain is like blaming the rain for a leaky roof. Like slope steepness and material strength, potential for water saturated hillsides (or earthquake shaking) is a design parameter that should be considered when preparing a building site. Reducing landslide hazard is accomplished by either reducing gravity forces acting on a slope by grading to decrease steepness, or increasing slope resistance and restraint using structural systems and effective dewatering and drainage. If either approach is not economically viable for a particular project, avoiding the hazard by relocating the project to a safer site is the alternative. Landslides that impact existing structures can often be stabilized using engineering resistance and retention systems and effective dewatering that strengthen the slope, and hold rock/soil mass in place.

Managing landslide risk is primarily the responsibility of local government where planning and building departments serve as lead agencies. Over 80% of California cities have landslide/mudslide ordinances, design standards, or guidelines for hillside development. California's Seismic Hazards Mapping Act designates landslide zones wherein cities and counties are required to condition construction permits upon adequate landslide site investigation and agreed upon mitigation. These efforts have proven effective in reducing losses over the past decades, but not all jurisdictions that face potential landslide hazards have such instruments nor has zoning of all landslide-prone areas been completed under the State program.

California Landslide Loss Reduction Plan

California's Landslide Hazard Identification Act established the Landslide Hazard Identification Program in 1986 within the Department of Conservation, California Geological Survey, which prepared maps of landslide hazards and distributed them to local governments until the program terminated by sunset law in 1995. Since then, much of the activity has been superceded by the Seismic Hazards Mapping Act, which began releasing landslide zones of investigation in 1998 until present. Because most of California is subject to seismic hazard, and landslides can be triggered by earthquake shaking, coordinated efforts to reduce landslide losses in California are, in effect, integrated into California's Earthquake Loss Reduction Plan prepared and updated regularly by the California Seismic Safety Commission.

The U.S. Geological Survey has published a national strategy to reduce landslide losses that, if enacted, would provide guidance, partnering and funding to states for landslide hazard identification and mitigation (Spiker and Gore, 2002). The National Research Council (NRC, 2004) has assessed the proposed strategy, and supports the plan. Such a plan would greatly enhance landslide hazard mitigation and reduce future losses. The plan calls for Increased research to develop a predictive understanding of landslide processes and triggering, a landslide hazard assessment and mapping grant program

similar to the national cooperative geologic mapping program, whereby states would receive financial assistance for such work. The plan also calls for more comprehensive and systematic loss assessment, public education and outreach, and landslide emergency preparedness, response and recovery at the local level.

Comment On: Chapter 5 Section 8.3

5.8.3 Tsunami Hazards

Identifying Tsunami Hazards

A tsunami is a large ocean wave triggered by any form of mass movement below the ocean surface. This can be submarine landslides or submarine dip slip fault rupture that results in seafloor uplift or downdrop. This mass movement translates to a tsunami or gravity wave within the overlying water. In a lake or fresh water body this phenomenon is usually called a seiche. A good general description for understanding tsunamis can be found in Chen and Scawthorn (2003).

Tsunamis travel radially outward from the point of initiation. The size of a tsunami is proportional to the mass movement that generated the tsunami. The speed of a tsunami is proportional to the depth of the water in which the tsunami originated. Tsunamis can travel at great speeds but in the open ocean result in relatively little wave height above the mean sea level as the energy is distributed throughout the water column. The wave length of a tsunami is much longer than wind generated waves also making it hard to detect in the open ocean. As a tsunami approaches the shore and the depth of the water column decreases the energy in the wave pushes the wave crest above the water surface resulting in a large wave height. Wave run-up is the elevation above mean sea level on dry land that a tsunami reaches. Run-up is what causes inundation of coastal areas that are below the run-up height.

Identifying tsunami hazards requires; 1) evaluating the potential for submarine mass movement both locally and at great ocean distances, and 2) identifying coastal regions within the direct or indirect path of a potential tsunami wave that are below the run-up height.

Tsunami Characteristics

There are two types of tsunamis—local and distant. Local tsunamis are more threatening because they afford at-risk populations only a few minutes to find safety. California is vulnerable to, and must consider, both types.

Tsunamis can travel at speeds of over 600 miles per hour in the open ocean and can grow to over 100 feet in height when they approach a shallow shoreline, causing severe damage to coastal development. In 1997, a large tsunami triggered by a magnitude seven (M7) earthquake killed more than 3,500 people in Papua, New Guinea. The 1964 Alaskan Earthquake produced a tsunami that killed thirteen people and caused over $10 million in damage in northern California; damage and losses were even greater in Hawaii. Recent studies of the continental shelf off the California coast indicate a potential for underwater landslides capable of generating damaging tsunamis that could threaten coastal communities.

Similar to tsunamis are large water splash waves caused by landslides landing in water bodies. Such a wave was responsible for the 1963 Vaiont, Italy, dam disaster, where a water wave rose 800 feet above the top of a dam, flooding a village across from the reservoir upstream of the dam as well as villages below killing 2,600 people. In 1958, an M8 earthquake in Alaska caused a landslide that produced a similar wave in Lituya Bay that reached 1,720 feet up the adjacent mountain slope.

Profiling Tsunami Hazards

Recent studies have documented historical tsunamis that have been recorded along coastal California. A study is included in Appendix 4 of the Marine Oil Terminal Engineering and Maintenance Standards (MOTEMS, 2005) which has a list of historical tsunamis that have impacted all of California. MOTEMS (2005) also contains estimated wave heights for Bay Area cities in Appendix 2 based on a study by Borrero et al. (2006).

For southern California the work by Legg et al. (2002) provides estimated wave height for coastal cities in that region. For northern California north of the Mendocino triple junction (roughly offshore due west of the town of Petrolia), this region falls within the Cascadia subduction zone which has wave heights documented by the state mapping agencies. (e.g. Oregon tsunami run-up maps, http://www.oregongeology.com/sub/earthquakes/Coastal/Tsumapsbycity.HTM; Washington tsunami run-up maps, http://www.dnr.wa.gov/geology/hazards/tsunami.htm#pubs.

National Geodetic Data Center (NGDC) provides a database cataloging all tsunami occurrences which can be used to evaluate past tsunami events at a particular site.

Assessment of State Vulnerability and Potential Losses

Assessing vulnerability and potential loss due to tsunami hazards is a field that is in its infancy. Spurred by the catastrophic tsunami in Sumatra (Iwan et al. 2006) a recent spate of research has been initiated to evaluate relative loss as a function of the built environment and tsunami loading. At this point there is little in the way of quantitative methods for analyzing vulnerability and loss. Some of the issues that are relatively unknown; structural response to tsunami wave loading, tsunami wave loading forces for design purposes, non-structural element response to wave loading, dynamic effects of tsunami wave travel throughout a built environment, to name a few.

Assessment of run-up heights is currently performed by tsunami modelers who have made significant improvements in their ability to properly model wave propagation with respect to complex sea floor topography and 3-D wave mechanics. Probabilistic run-up heights have been estimated for the Bay Area, LA Basin, and surrounding cities. However these probabilistic run-up heights do not account for temporal effects of the triggering mechanism, only variability of the wave mechanics and travel path with respect to a prescribed triggering mechanism. To have truly probabilistic run-up heights the triggering mechanism needs to be related to recurrence intervals such as with flood frequency or earthquake recurrence.

Assessment of Local Vulnerability and Potential Loss to Tsunami Hazards

Information related to community vulnerability and loss assessments may be found in Local Hazard Mitigation Plans.

Current Tsunami Hazard Mitigation Efforts

Regions that are below the projected run-up height are delineated, and evacuation plans are essentially the only mitigation method currently available. This has been implemented along the Cascadia subduction zone throughout Washington and Oregon, but most regions of coastal California have yet to adopt these preparations.

Federally directed mitigation programs are posted on the National Tsunami Hazard Mitigation website (nthmp-history.pmel.noaa.gov). More information can be accessed through the NOAA tsunami website (www.tsunami.noaa.gov). NOAA sponsors community based tsunami preparedness program with details described at the previous link.

A report issued by the California Seismic Safety Commission in 2005 states that "tsunamis, generated either locally or from events elsewhere in the Pacific Basin, pose a significant threat to life and property in California" and points out that losses from tsunamis can be reduced in four ways: 1) engineering standards creating more damage resistant buildings and port structures; 2) public education training Californians to recognize tsunami alerts and providing instruction on what to do; 3) warning systems alerting a population to a tsunami coming from a distant source; and 4) effective evacuation planning. The report recommends a series of actions to be taken to improve mitigation, preparedness, response, and recovery including:

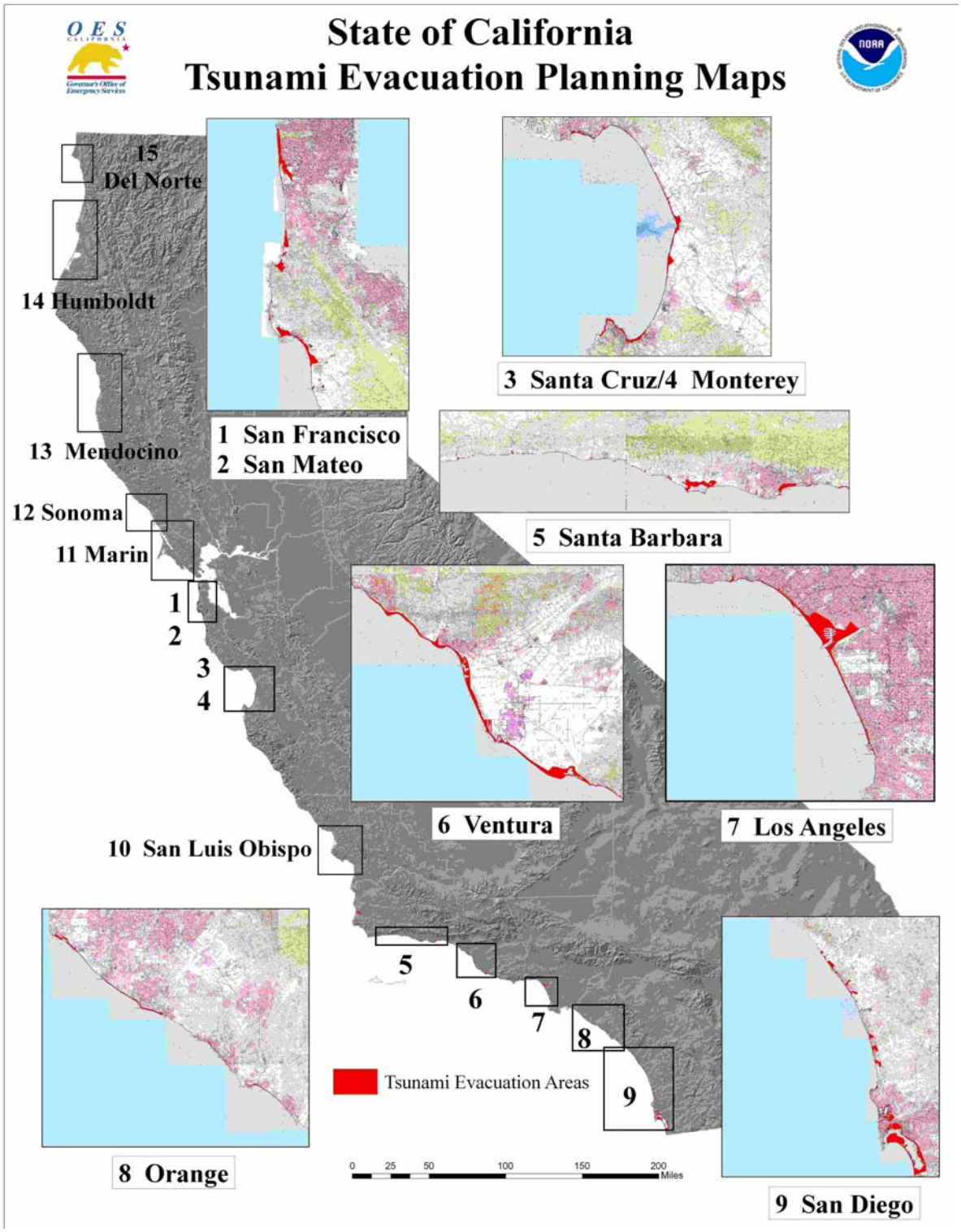
- Improvements in public education about tsunami issues, including multi-lingual information;
- Working with other coastal states to obtain an external expert review of the NOAA tsunami warning system criteria for issuing and canceling warnings;
- Working with federal agencies to develop guidelines for structures to resist both strong ground motion and tsunami wave impact;
- Supporting and providing matching funds for tsunami mitigation programs in coastal counties and in OES, including improvements to the communications and emergency response systems;
- Supporting and providing matching funds for development of improved technologies and methodology to assess the tsunami risk.

Local hazard mitigation plans reviewed in Chapter 6 identify tsunamis as a potential threat. Municipalities are undertaking their own planning efforts specifically directed toward this hazard. For example, a Tsunami Safety Plan is being prepared for the Town of Samoa in Humboldt County, working with the Redwood Coast Tsunami Working Group, and NOAA, currently are reviewing safety plan and a related brochure (janep@planwestpartners.com).

Evacuation Planning

Map 5.8.3A below shows OES' evacuation training and planning maps for various communities in California.

Map 5.8.3A OES Tsunami Evacuation Planning Maps



Mitigation of Tsunami and Seiche Hazards

Tsunamis cannot be prevented, but early warning and evacuation can dramatically reduce their threat to human safety. Modern warning networks can sense tsunamis hundreds, or even thousands, of miles from their location of impact and issue warnings to potentially threatened communities. Such warning systems, coupled with well-designed evacuation plans, can remove people from harm's way. Federal and state programs to educate local emergency response agencies and the public and to develop safe evacuation routes with appropriate signage are currently underway.

Life and property loss from tsunamis and seiches can also be reduced by limiting development along low-lying coasts and designing structures to allow swift water to flow around, through, or underneath without causing collapse.

Opportunities for Enhanced Tsunami Mitigation

For enhanced mitigation the run-up heights first need to be rendered in a probabilistic time frame similar to flood frequency or earthquake recurrence estimates. This would allow for a rational risk based approach to hazard and mitigation decisions. Current research is focusing an addressing mitigation procedures other than evacuation with some initial results pending OSU Tsunami Research Center (nees.oregonstate.edu). Eventually building codes will incorporate some type of design requirements with respect to tsunami wave loading, but that is still years in the future.

The primary goal for coastal CA is to identify which regions are within a projected run-up height and to prepare those communities accordingly. This would involve bringing CA up to speed with practices currently implemented along the Cascadia subduction zone per the NOAA preparedness program.

Tsunami warnings or tsunami alerts are a key to evacuation. These warning are issued by the Pacific Tsunami Warning Center (http://www.prh.noaa.gov/ptwc/) and local communities that are below the run-up height should have a communication avenue for broadcasting warnings.

Subsection References:

Borrero, J. Dengler, L. Uslu, B. and Synolakis, C. (2006) "Numerical Modeling of Tsunami Effects at Marine Oil Terminals in Sand Francisco Bay." Report prepared for the Marine Facilities Division of the California State Lands Commission.

California Seismic Safety Commission: The Tsunami Threat in California: Findings and Recommendations on Tsunami Hazards and Risks, December 2005.

Chen, W-F and Scawthorn, C. ed. (2003) Earthquake Engineering Handbook. CRC Press.

Iwan, W.D. ed. (2006) Summary Report on the great Sumatra Earthquakes and Indian Ocean Tsunamis of 26 December 2004 and 28 March 2005. EERI (Earthquake Engineering Research Institute.

Legg, M.R., Borrero, J.C., and Synolakis, C.E. (2002) "Evaluation of Tsunami Risk to Southern California Costal Cities." NEHRP Professional Fellowship Report, January.

MOTEMS (2005) Marine Oil Terminal Engineering and Maintenance Standards, (http://www.slc.ca.gov/Division_Pages/MFD/MOTEMS.html.

NGDC (National Geophysics Data Center) (2004), Digital Tsunami Database at: http://www.ngdc.noaa.gov/seg/hazard/tsu.shtml.

Chapter 5—Hazard, Vulnerability, and Risk Assessment

Part 4 – Additional Hazards

Part 4 Organization

5.9 Climate-related Hazards
- 5.9.1 Avalanches
- 5.9.2 Coastal Flooding, Erosion, Sea Level Rise
- 5.9.3 Drought
- 5.9.4 Extreme Heat
- 5.9.5 Freeze
- 5.9.6 Severe Weather and Storms
- 5.9.7 Tornadoes

5.10 Other Hazards
- 5.10.1 Dam Failure
- 5.10.2 Energy Shortage
- 5.10.3 Epidemic/Pandemic
- 5.10.4 Hazardous Materials Release
- 5.10.5 Insect Pests
- 5.10.6 Marine Invasive Species
- 5.10.7 Radiological Accidents
- 5.10.8 Terrorism
- 5.10.9 Volcanoes

5.11 Additional Hazards Summarized in the 2007 SHMP Appendix: Air/Groundwater Pollution, Airline Crashes, Civil Disturbances, Computer Breaches, Hurricanes, Train Derailments

Comment On: Chapter 5 Section 9

5.9 Climate-related Hazards

Climate change has been initially recognized in this risk assessment with the understanding that more specific information will be forthcoming in the coming months during the edit process preceding circulation of the public release draft. While flooding, discussed in Part 2 of this chapter, as well as levee failure and landslides, discussed in Part 3, are likely to be affected by climate change, the following risk assessments refer to hazards for which the effects may be more immediately discernible. As noted in Part 1, most hazards aggravated by climate change can be expected to intensify over the long-term, but there is will be need for near-term action to mitigate certain impacts.

Comment On: Chapter 5 Section 9.1

5.9.1 Avalanches

Identifying Avalanche Hazards

Avalanches occur in the steep mountainous areas of the state that receive significant amounts of snow. Avalanches are weather related threats to communities, residents, and visitors to the high mountain areas of the state.

Profiling Avalanche Hazards

Avalanches have caused property damage and loss of life. For the period beginning in 1950 and continuing through 1997, there were fifteen deaths reported as a result of avalanche. In all sixteen counties were affected by avalanche during that timeframe. Significant events have damaged or destroyed ski resorts at Mt. Shasta and Lake Tahoe. Avalanches have also blocked and damaged roadways. Avalanches pose a threat in the Sierra Nevada on the eastern side of the state and the Cascade Range in the north.

The Department of Water Resources monitors snow fall amounts and water content, but does not actively monitor avalanche probability or occurrences. It does, however provide a web site link to the Avalanche Center (CSAC), a 501c(3) organization which posts information on avalanche conditions for the United States. The organization is a partnership between the United States Forest Service and the private sector, and relies heavily on private contributions and volunteer support. There are three Avalanche Centers operating in California that provide up to date information on snow conditions and avalanche danger levels.

- Eastern Sierra Avalanche Center – Inyo National Forest in Mammoth Lakes
- Central Sierra Avalanche Center – Tahoe National Forest in Truckee
- Shasta Avalanche Center - Shasta-Trinity National Forest in Mt. Shasta

This information and avalanche warnings which the Centers provide are geared to the general public who engage in snow related recreational activities. The chart below describes the avalanche danger level, probability, degree of danger and recommended actions.

Comment On: Chapter 5 Section 9.2

5.9.2 Coastal Flooding, Erosion, Sea Level Rise

Identifying Coastal Flooding, Erosion, Sea Level Rise Hazards

As discussed earlier in this chapter, the potential impacts of global warming and climate change include increased opportunities for severe weather and winter storms that may result in coastal flooding and erosion, as well as seal level rise. California's land mass includes more than 1,100 miles of coastline with varying geologic features including steep coastal bluffs, beaches, wetlands, bays and deltas. It also supports varying levels of development and land use, including recreational, agricultural, industrial, commercial and residential.

Profiling Coastal Flooding, Erosion, Sea Level Rise Hazards

Coastal erosion is a natural geomorphic process. In California, coastal erosion can be accelerated or exacerbated to the level of emergency or disaster through a combination of factors, including winter storms, tidal action, wind generated high surf and wave action, and rising sea levels. Typically the highest sea level readings along California's coastline occur during periods of heavy rain which coincide with high tides, causing coastal flooding, coastal bluff erosion, and landslides such as were experienced during the 1998 El Nino storms. Conversely, gradual sea level rise progressively worsens the impact of

high tides and wind driven waves associated with severe storms. The frequency of high sea level extremes may be further increased if storms become more frequent or severe as a result of climate change. These events could expose the coast to severe flooding and erosion, damage to coastal structures and real estate, and salinity intrusion into delta areas and coastal aquifers. *(Source: Projecting Future Sea Level, A Report From the California Climate Change Center, 2006)*

Since the "Little Ice Age" in the 19th century, sea level has been rising about 1 to 2 millimeters per year due to the reduction in volume of ice caps, ice fields, and mountain glaciers in addition to the thermal expansion of ocean water. If present trends continue, including an increase in global temperatures caused by increased greenhouse-gas emissions, many of the world's mountain glaciers will disappear. For example, at the current rate of melting, all glaciers will be gone from Glacier National Park, Montana, by the middle of the next century. In Iceland, about 11 percent of the island is covered by glaciers (mostly ice caps). If warming continues, Iceland's glaciers will decrease by 40 percent by 2100 and virtually disappear by 2200. *(Source: United States Geological Survey Open File Report 2006-1219).* The Intergovernmental Panel on Climate Change and the 2006 California Climate Action Team Report project that mean sea level will rise between 12 and 36 inches by the year 2100.

The continued rise in sea level will increase inundation of low coastal areas. Nearshore wave heights and wave energy will increase, increasing the potential for storm damage, beach erosion and bluff retreat. Ports and harbors will have reduced cargo transfer capability as ships ride higher along the dock. Wetlands may be inundated if they are not able to migrate either upward or landward. Almost all coastal systems will be affected; even groundwater aquifers will be at greater risk from saltwater intrusion

Assessment of State and Local Vulnerability and Potential Loss

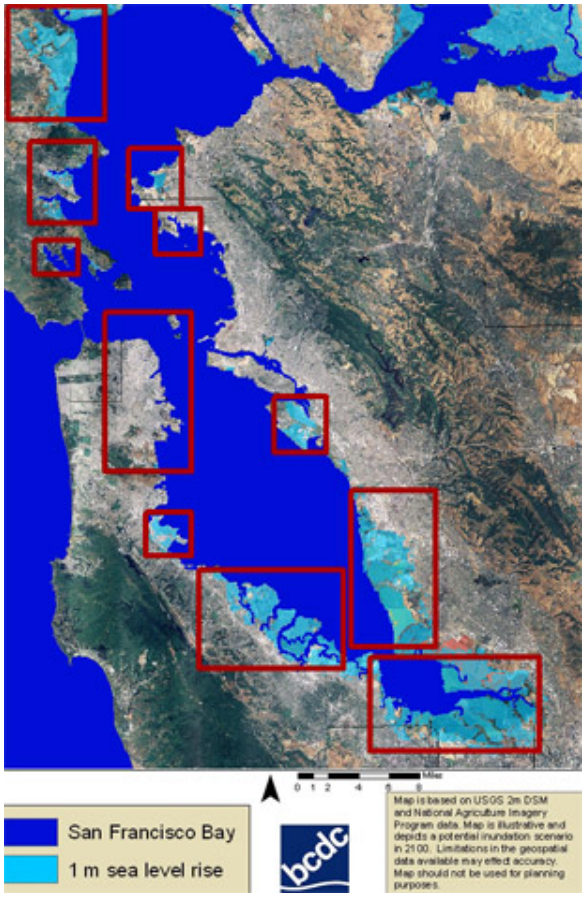
An early report prepared by California Coastal Commission staff in June 2001 identified a number of potential consequences from climate change induced sea level rise, including impacts to ports and harbors, seawalls and other engineered structures, groundwater, wetlands, beaches and coastal bluffs. In terms of overall economic impacts, the Coastal Commission projected areas of the coast where a long-term rise in sea level would be most severe and the areas that would experience the greatest economic losses. The projections were based on estimates of coastal population growth to over 32 million by 2025, with an anticipated 20 to 60 percent increase in coastal economic growth, except for San Diego which is anticipated to experience a 60 to 90 percent growth.[22]

The Bay Conservation and Development Commission, regulates development along the margins of the San Francisco Bay. Its 2006 Strategic Plan included a goal to: "play an integral role in developing and implementing a regional proactive strategy for dealing with global climate change." One significant activity undertaken to achieve that goal was the sea level rise mapping project summarized below by Map 5.9.2A below which

[22]California Coastal Commission (2001). Overview of Sea Level Rise and Some Implications for Coastal California

identifies the shoreline areas likely to be most impacted by sea level rise. The map series was based on USGS digital elevations and aerial imagery, and illustrate an impact scenario in which sea level rises one meter by the year 2100. Maps were developed for 12 sub-areas around the perimeter of the San Francisco Bay, outlined in red. One significant finding is that two of the three Bay Area International Airports (San Francisco and Oakland) will be rendered inoperable under this scenario unless mitigation measures are implemented.

Map 5.9.2A. Areas Potentially Flooded by 1 Meter Sea Level Rise



Source: Bay Conservation and Development Commission

Current Coastal flooding, Erosion, Sea Level Rise Hazard Mitigation Efforts

Mitigating the impacts of sea level rise is two-fold. First is a global effort to reduce greenhouse gas emissions which are leading to climate change, melting of the polar ice caps and glacial melting. Secondly, there is a need for appropriate land use planning and regulation at the federal, state and local levels. The Federal Coastal Zone Management Act states: "Because global warming may result in a substantial sea level rise with serious adverse effects in the coastal zone, coastal states must anticipate and plan for such an occurrence."[23]

[23] 16 US Code 1451(1)

In California, development decisions impacting coastal areas are regulated at the state, regional and local levels. The State Department of Parks and Recreation has jurisdiction over more than 300 miles of California coastline, and implements a Coastal Erosion Policy to avoid construction of new structures or coastal facilities in areas subject to ocean wave erosion, sea cliff retreat, and unstable cliffs. The State Lands Commission regulates the construction of marine oil terminals (MOTEMS program (see Section 5.5.5), oil platforms and drilling rigs, and liquid natural gas (LNG) facilities. The California Coastal Commission and Bay Conservation and Development Commission prepare and implement Local Coastal Plans which determine development along the California coastline.

There are a number of ways the California Coastal Commission currently addresses sea level rise in its planning and regulatory process. In accordance with the California Coastal Act, the Commission reviews new development proposals to require setbacks, site stability and structural integrity, and to ensure the project neither creates nor contributes significantly to erosion that would require the construction of protective devices that significantly alter natural landforms along bluffs and cliffs.

Opportunities for Enhanced Mitigation of Coastal Flooding, Erosion, Sea Level Rise

Because of the recent recognition of the potential for sea level rise, mitigation strategies and implementation programs are in their infancy. In order to proceed effectively, the impacts of sea level rise in California require a more consistent and rigorous assessment. Modeling efforts initiated by the BCDC and those being developed through the U.S. Climate Change Science Program can be adapted and applied for use along the entire length of the California coastline.

A 1999 report prepared by the California Coastal Commission for the Regional Cumulative Assessment Project recommends the Commission develop a long-term strategy to address the issue of sea level rise, including modifying permit requirements to address the potential for sea level rise in all development proposals and habitat restoration projects, and requiring that buffer areas adequate to address sea level rise are included in wetland restoration projects. Possible solutions identified in the 2001 Coastal Commission Report include hard engineering (such as seawalls, revetments, breakwaters, levees, and other structures built to protect inland areas), soft engineering (such as beach nourishment or vegetated buffers), accommodation/adaptation (elevating structures, transitioning from fresh water to salt water tolerant agriculture), and retreat (removal or abandonment of structures or land).

The 2006 Report from the California Climate Change Center, sponsored by the California Energy Commission and the California Environmental Protection Agency, provides excellent baseline information on potential sea level rise scenarios that can be used as the basis for future mitigation planning.The efforts underway to reduce greenhouse gas emissions through the California Global Warming Solutions Act of 2006, previously described in this plan, may result in a gradual slowing of climate change impacts in California. In the meantime, it is imperative that mitigation solutions be evaluated and implemented.

Comment On: Chapter 5 Section 9.3

5.9.3 Drought

Identifying Drought Hazards

Drought is a gradual phenomenon. Normally, one dry year does not constitute a drought in California, but rather serves as a reminder of the need to plan for droughts. California's extensive system of water supply infrastructure - reservoirs, groundwater basins, and interregional conveyance facilities - generally mitigates the effects of short-term dry periods for most water users.

Secondary Impacts

Drought is a major determinant of wildfire hazard, in terms of greater propensity for fire starts and larger, more prolonged conflagrations fueled by excessively dry vegetation, and reduced water supply for firefighting purposes. Drought is also an economic hazard. Significant economic impacts on California's agriculture industry can occur as a result of short and long term drought conditions, including hardships to farmers, farm workers, packers, and shippers of agricultural products. They can also cause significant increases in food prices to the consumer due to shortages.

Profiling Drought Hazards

Drought has impacted virtually every county in the State of California at one time or another causing more than $2.6 million in damages. Droughts exceeding three years are relatively rare in Northern California, the source of much of the state's water supply. The 1929-1934 drought established the criteria commonly used in designing storage capacity and yield for large Northern California reservoirs. The driest single year in California's measured hydrologic history is 1977.

Past experience with California droughts tells us that drought impacts are felt first by those most dependent on/affected by annual rainfall – agencies fighting forest fires, ranchers engaged in dryland grazing, rural residents relying on wells in low-yield rock formations, or small water systems lacking a reliable water source. California's last major statewide drought was 1987-92. At a regional level, parts of Southern California experienced a series of consecutive dry years in the late 1990s/early 2000s, with water year 2002 setting records for single driest precipitation year in cities such as Los Angeles and San Diego. The Colorado River Basin, an important source of water supply for Southern California experienced five consecutive years of drought in water years 2000-2004.

Water year 2007 was unusually dry across much of California. Although one dry year does not constitute a drought, especially when that dry year follows a very wet 2006, the 2006-07 water year was well below normal for the state, indicating another serious drought may be beginning.

The 1995-1977 Drought

From November 1975 through November 1977, California experienced one of its most severe droughts. Although people in most areas of the state are accustomed to almost no precipitation during the growing season (April to October), they expect it in the winter. In

1976 and 1977, the winters brought only one-half and one-third of normal precipitation, respectively, leading to the state's fourth and first driest years on record. Most surface storage reservoirs were substantially drained in 1976, leading to widespread water shortages when 1977 turned out to be even drier.

1987-1992 Drought

From 1987 to 1992 California again experienced a serious drought due to low precipitation and run-off levels. The hardest hit region was the Central Coast, roughly from San Jose to Ventura. For the Central Coast and central Sierra Nevada, 1987 to 1990 is the driest period on record. In 1988, 45 California counties experienced water shortages that adversely affected about 30 percent of the state's population, much of the dry farmed agriculture, and over 40 percent of the irrigated agriculture. Fish and wildlife resources suffered, recreational use of lakes and rivers decreased, forestry losses and fires increased, and hydroelectric power production decreased.

In February 1991, DWR and OES surveyed drought conditions in all 58 California counties and found five main problems:

- Extremely dry rangeland
- Irrigated agriculture with severe surface water shortage and low or no groundwater
- Widespread rural areas where individual and community supplies were going dry
- Urban area rationing at 25 to 50 percent
- Environmental impacts.

After four drought years and three winter months of meager precipitation, California's water prospects looked bleak at the start of 1991. Storage in major reservoirs had dropped to 54 percent of average, the lowest since 1977, a record dry year. Other supply systems were suffering more major shortages. The shortages led to stringent water rationing and severe cutbacks in agricultural production (including threats to survival of permanent crops such as trees and vines). Fish and wildlife resources were in critical shape as well. Not since the 1928-34 drought had there been such a prolonged dry period. Water was so scarce that most suppliers doubted the SWP and the CVP would be able to provide minimum carryover storage as a hedge against yet another dry year. In February 1991, the governor established the Drought Action Team. This team almost immediately created an emergency drought water bank to develop a supply for four critical needs:

- Municipal and industrial uses
- Agricultural uses
- Protection of fish and wildlife
- Carryover storage for 1992.

The large-scale transfer program, which involved over 800,000 acre feet of water, was implemented in less than 100 days with the help and commitment of the entire water

community and established important links between state agencies and local water interests and local government for future programs.[24]

Table 5.9.3A below summarizes California droughts during the period discussed in the July 2000 DWR report. The 1976-77 and 1987-92 droughts were among the worst in California history.

Table 5.9.3A Drought Incidents 1972 to 1992

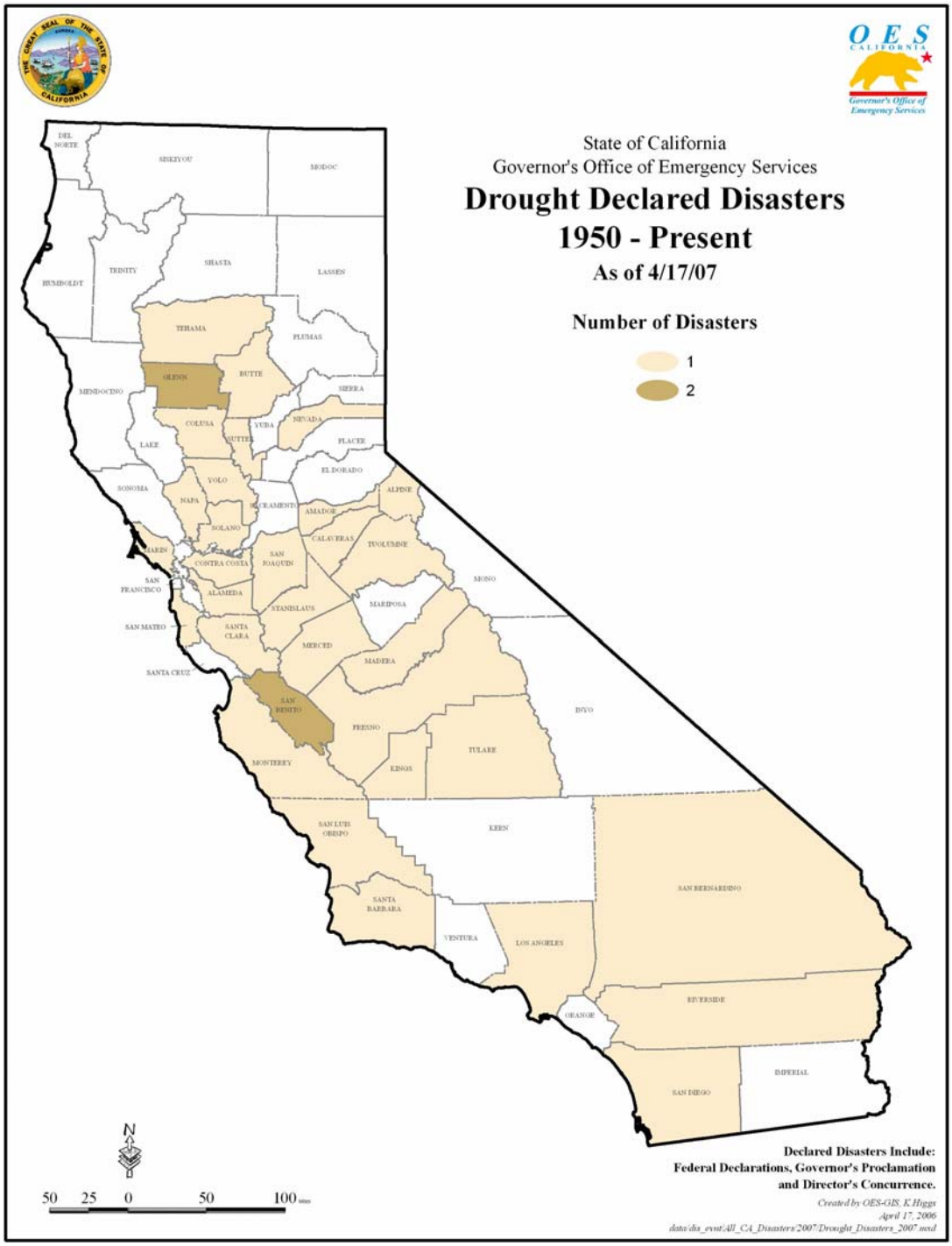
Year	Number of Incidents	Jurisdictions Affected	Crop Damage
1972	1	Glenn, San Benito, Santa Clara	$8 million
1976-1977	1	Alpine, Calaveras, Colusa, Fresno, Glenn, Madera, Merced, San Diego, San Joaquin, Solano, Stanislaus, Sutter, Tuolumne, Alameda, Butte, Contra Costa, Kings, Los Angeles, Riverside, San Luis Obispo, Tulare, Yolo, Amador, Monterey, Napa, Nevada, San Benito, San Bernardino, Tehama, San Mateo, Marin	$2.67 billion
1988	1	Madera County location emergency was ratified every two weeks through 1991	N/A
1990	2	Santa Barbara City and County	0
1991	1	Alameda, Alpine, Colusa, Fresno, City of Orange Cove, Glenn, Kern, Kings, Lake, Madera, Marin, Mendocino, Monterey, Placer, Santa Barbara, City of Santa Barbara, Shasta, Siskiyou, Solano, Sonoma, Sutter, Tehama, Tulare, Tuolumne, and Yuba. Many of these emergencies continued through 1992	USDA-nationwide: $995 million for 1990-91 crop loss. Additional, $775 million in emergency funds for 1990-92 crop losses.
2001	5	Del Norte, Modoc, Siskiyou, Inyo, Humboldt, Kern, Los Angeles, Ventura, Mono, Lassen, Plumas, San Bernardino, Santa Barbara, Sierra, Shasta, Trinity	N/A
2002	3	Alpine, Amador, Calaveras, Imperial, Modoc, Nevada, Orange, Placer, Riverside, San Bernardino, Sierra, Stanislaus	$12,100

Sources: OES Individual Assistance Section, 2001 & 2002 SBA Declarations/USDA Designations database; OES Origins and Development—A Chronology 1917-1999

[24] Department of Water Resources, Preparing for California's Next Drought – Changes Since 1987-92, July 2000.

Map 5.9.3A below shows the geographic patter of drought-based disaster declarations since 1950, showing a pattern of drought disasters from southern California, along the Pacific Coast, and inland into the Central Valley and north of Sacramento.

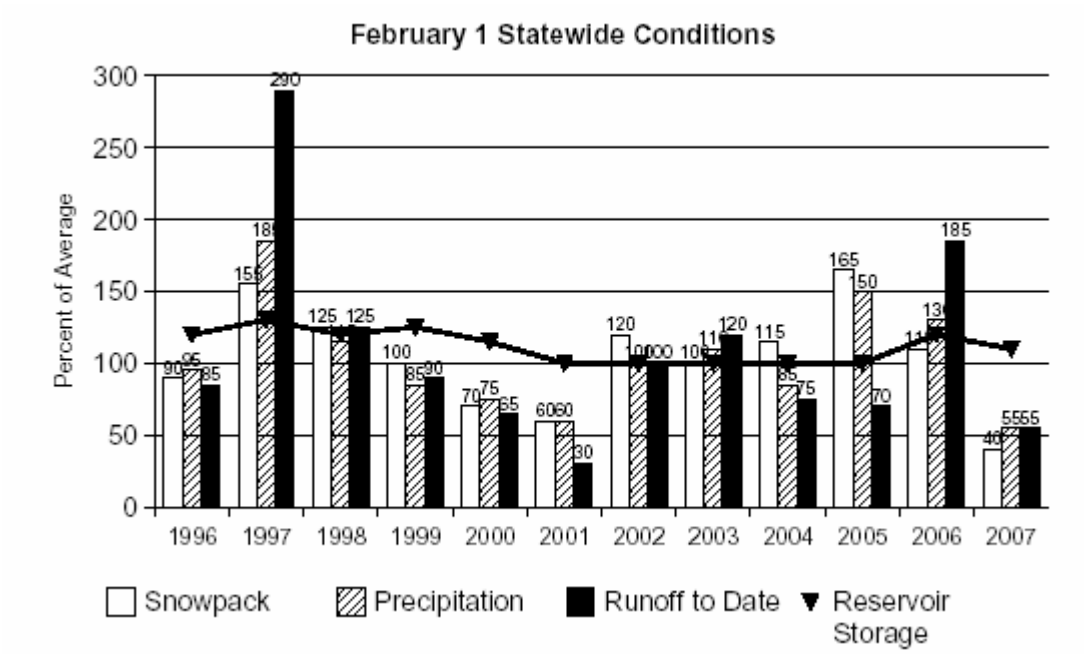
Map 5.9.3A Declared Drought Disasters, 1950 to Present



Tracking Water Conditions

Chart 5.9.3A below illustrates several indicators commonly used to evaluate water conditions in California. The percent of average values are determined by measurements made in each of the ten major hydrologic regions. The chart below describes water conditions in California between 1996 and 2007. The charts illustrate the cyclical nature of weather patterns in California. Snow pack and precipitation increased between 1996 and 1997, began decreasing in 1998, and began to show signs of recovery in 2002, increased in 2005 and decreased sharply in 2007.

Chart 5.9.3A Water Supply Conditions, 1996 to 2007



Source: DWR website

Assessment of State Vulnerability and Potential Losses

No known current assessment of state vulnerability or potential losses is available at this time.

Assessment of Local Vulnerability and Potential Losses

Information related to community vulnerability and loss assessments may be found in Local Hazard Mitigation Plans.

Current Drought Hazard Mitigation Efforts

Mitigation of drought impacts includes short- and long-term water conservation measures for urban areas. There is ample literature on urban water conservation measures. Agricultural water conservation measures reducing crop damage and losses:

- Drought plan
- Water management
- Land management
- Crop management

Source: Defending Against Drought, available at www.nrcs.usda.gov/feature/highlights/drought.html

Opportunities for Enhanced Drought Hazard Mitigation

There are no additional opportunities identified at this time to prevent or mitigate the impacts of drought hazards.

Comment On: Chapter 5 Section 9.4

5.9.4 Extreme Heat

Identifying Extreme Heat Hazards

Tables 5.9.4A and 5.9.4B below show the Heat Index as a function of heat and relative humidity. The Heat Index describes how hot the heat-humidity combination makes it feel. As relative humidity increases, the air seems warmer than it actually is because the body is less able to cool itself via evaporation of perspiration. As the Heat Index rises, so do health risks.

- When the Heat Index is 90°F, heat exhaustion is possible with prolonged exposure and/or physical activity.
- When it is 90°-105°F, it is probable with the possibility of sunstroke, heat cramps or heat exhaustion with prolonged exposure and/or physical activity.
- When it is 105°-129°F, sunstroke, heat cramps or heat exhaustion is likely, and heatstroke is possible with prolonged exposure and/or physical activity.
- When it is 130°F and higher, heatstroke and sunstroke are extremely likely with continue exposure. Physical activity and prolonged exposure to the heat increase the risks.

Table 5.9.4A Air Temperature and Relative Humidity

Chart #1

	The Heat Index												
Air Temp (° F)	**Relative Humidity**												
	40	**45**	**50**	**55**	**60**	**65**	**70**	**75**	**80**	**85**	**90**	**95**	**100**
110 °	136	143	152										
105°	123	129	135	141	148								
100°	111	115	119	124	129	135	141	147					
95°	*101*	*104*	107	110	114	117	122	126	131	136	141		
90°	*92*	*94*	*96*	*98*	*100*	*103*	106	109	112	115	119	127	132
85°	84	85	86	88	89	*91*	*93*	*95*	*97*	*99*	*102*	*104*	107
80°	80	80	81	81	82	82	83	84	84	85	86	86	87
Exposure to full sunshine can increase Heat Index values by up to 15° F.													

Source: National Weather Service

The National Weather Service (NWS) will initiate its Heat Index Program Alert procedures when the high is expected to exceed 105° - 110° (depending on local climate) for at least two consecutive days.

Table 5.9.4B Possible Heat Disorders by Heat Index Level

Chart #2

Heat Index	Category	Possible heat disorders for people in high risk groups
130°F or higher	Extreme Danger	Heatstroke risk extremely high with continued exposure.
105° - 129°F	Danger	Sunstroke, Heat Cramps and Heat Exhaustion likely, Heatstroke possible with prolonged exposure and/or physical activity.
90° - 105°F	*Extreme Caution*	*Sunstroke, Heat Cramps and Heat Exhaustion possible with prolonged exposure and/or physical activity.*
80° - 90 °F	Caution	Fatigue possible with prolonged exposure and/or physical activity.

Source: National Weather Service

Heat exhaustion occurs when the body is dehydrated resulting in an imbalance of electrolytes.

- Symptoms -- headache, nausea, dizziness, cool and clammy skin, pale face, cramps, weakness, profuse perspiration
- First Aid -- move to a cooler spot, drink water with a small amount of salt added (one teaspoon per quart)
- Without Intervention -- it can lead to collapse and heatstroke.

Heatstroke occurs when perspiration cannot occur and the body overheats.

- Symptoms -- headache, nausea, face flushed, hot and dry skin, no perspiration, body temperature over 101°F, chills, rapid pulse
- First Aid -- cool person immediately, move to shade or indoors, wrap in a cool, wet sheet, get medical assistance
- Without Intervention -- it can lead to confusion, coma, and death.

Profiling Extreme Heat Hazards

Heat waves do not cause damage or elicit the immediate response that floods, fires, earthquakes and typical disaster scenarios. They have, however, claimed more lives over the past 50 years than all other declared disaster events combined. For example, the 1989 Loma Prieta earthquake resulted in 63 deaths, while the 1992 Northridge earthquake was responsible for the loss of 55 lives. The catastrophic 2003 Southern California Firestorms resulted in 24 deaths. The worst single heat wave event in California occurred in Southern California in 1955, when an eight-day heat wave resulted in 946 deaths.

Typical summer temperatures in California contribute to the untimely demise of 20 people on average per year. The July 2006 heat wave in California caused the death of at least 136 people over a 13 day period (6 deaths are still under investigation). California did not experience the billions of dollars in damage as it did in the two earthquakes cited, nor did it experience over three thousand homes damaged, as in the year 2003 firestorm; but there were approximately twice the number of human deaths due to the heat wave as in each earthquake, and almost six times the fatalities from the heat wave as were observed in the devastating firestorm of year 2003. Heat waves are obviously less dramatic and more deadly.

Heat emergencies are often slower to develop. It could take a number of days of oppressive heat for a heat wave to have a significant or quantifiable impact. Heat waves do not strike victims immediately, but rather their cumulative effects slowly take the lives of vulnerable populations.

Situational and physical characteristics help to identify vulnerable populations that may not comfortably or safely access and use disaster resources. Specifically, when discussing heat related emergency preparedness, the following groups could be considered vulnerable or at greater risk in a heat emergency:

- Infants and small children under age three
- Women who are pregnant
- Elderly people (age 65 and older)
- The obese
- The bedridden
- Mentally ill
- Those with cognitive disorders
- Those with medical conditions (e.g., heart disease, diabetes, high blood pressure)
- Those requiring life-saving medications (e.g., for high blood pressure, depression, insomnia)
- Individuals with drug or alcohol addictions
- Those with mobility constraints
- Non-ambulatory
- Those under extreme working conditions
- The poor
- Socially isolated
- Non-English speakers who may not have access to information.

Animals, including domestic pets, livestock, and poultry are also susceptible to extreme heat. For example, dogs and cats are in danger of heat stroke in temperatures of 110 degrees Fahrenheit. The heat wave of 2206 resulted in 15 reported pet deaths and more than 25,000 cattle, and 700,000 fowl heat-related deaths.

Assessment of State Vulnerability and Potential Loss to Extreme Heat Hazards

No known current assessment of state vulnerability or potential losses is available at this time.

Assessment of Local Vulnerability and Potential Loss to Extreme Heat Hazards

Information related to community vulnerability and loss assessments may be found in Local Hazard Mitigation Plans.

Current Extreme Heat Hazard Mitigation Efforts

The California Office of Emergency Services has prepared a Contingency Plan for Excessive Heat Emergencies in December 2006. Although primarily designed to guide preparedness and response activities, it also includes mitigation actions to prevent life loss, including:

- Identifying location of vulnerable populations
- Establishing cooling centers
- Issues advisories and warnings
- Conducting pre-season public information campaigns.

Opportunities for Enhanced Extreme Heat Hazard Mitigation

There are no additional opportunities identified at this time to prevent or mitigate the impacts of extreme heat.

Comment On: Chapter 5 Section 9.5

5.9.5 Freeze

Identifying Freeze Hazards

Sustained temperatures below freezing in California's generally temperature regions can cause life loss and health risks to vulnerable populations. Freezing temperatures occurring during winter and spring growing seasons can cause extensive crop damage as well.

Secondary Impacts

Freeze disasters can have a major economic impact on farmers, farm workers, packers, and shippers of agricultural products. They can also cause significant increases in food prices to the consumer due to shortages.

Profiling Freeze Hazards

Although infrequent, freezes can severely affect California agriculture. Table 5.9.5A on the following page summarizes freeze disasters since 1950.

Assessment of State Vulnerability and Potential Loss to Freeze Hazards

No known current assessment of state vulnerability or potential losses is available at this time.

Assessment of Local Vulnerability and Potential Loss to Freeze Hazards

Information related to community vulnerability and loss assessments may be found in Local Hazard Mitigation Plans.

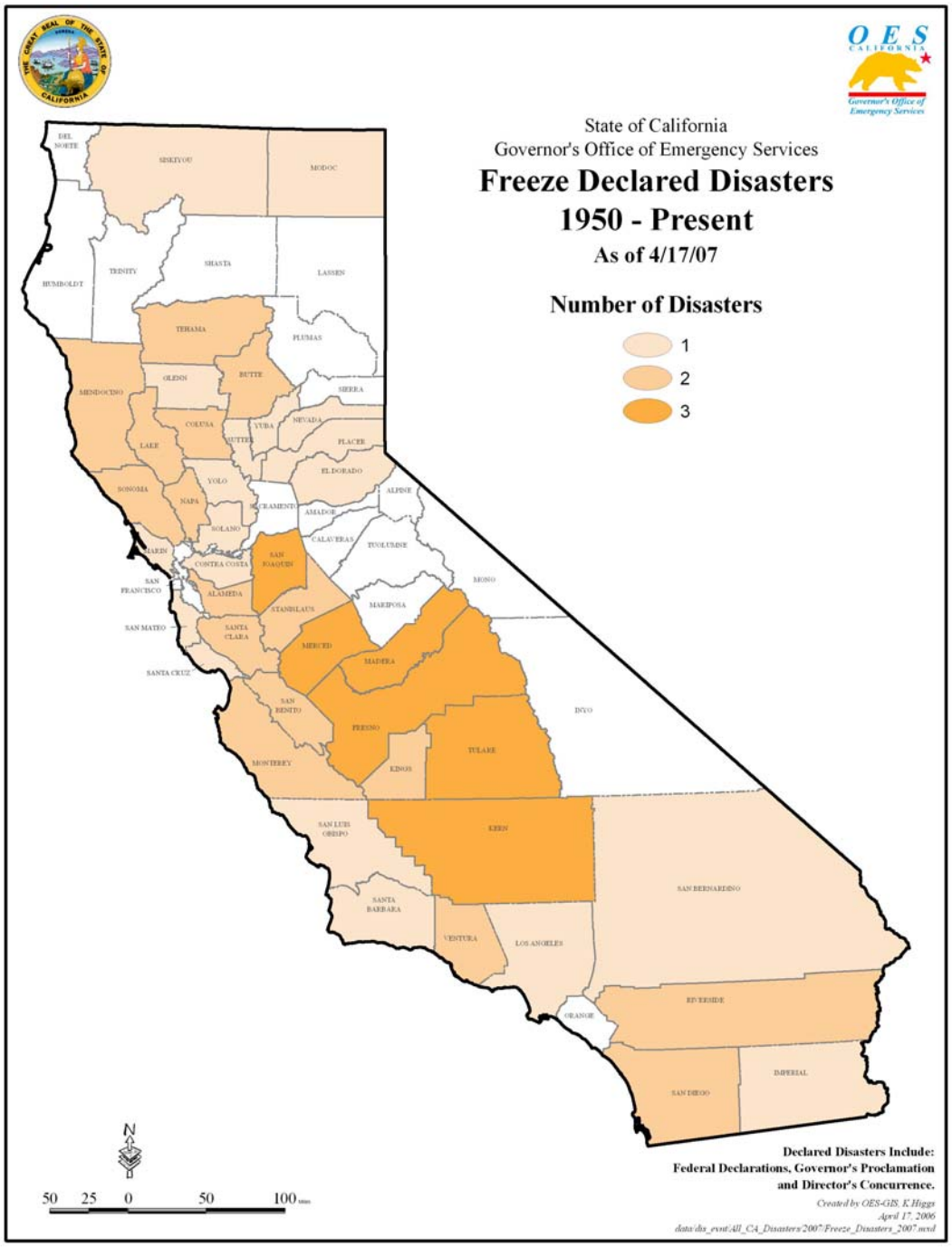
Table 5.9.5A

Year	Number of Incidents	Counties Affected	Crop Damage
1969	1	San Diego	$10 million
1972	2	Colusa, El Dorado, Fresno, Kern, Kings, Lake, Madera, Merced, Modoc, Nevada, Placer, San Benito, San Joaquin, Santa Clara, Stanislaus, Siskiyou, Tehama, Tulare	$113.5 million
1973	1	Alameda, Contra Costa	$8-$10 million
1990	1	Alameda, Butte, Colusa, Fresno, Glenn, Imperial, Kern, Los Angeles, Madera, Marin, Merced, Mendocino, Monterey, Napa, Riverside, Sacramento, San Benito, San Bernardino, San Diego, San Joaquin, San Luis Obispo, San Mateo, Santa Barbara, Santa Clara, Santa Cruz, Solano, Sonoma, Stanislaus, Sutter, Tehama, Tulare, Ventura, Yolo, Yuba	$852.4 million
1998-99	1	Fresno, Kern, Kings, Madera, Merced, Monterey, Tulare, Ventura	N/A
2001	3	Butte, Colusa, Fresno, Glenn, Madera, Mariposa, Merced, Plumas, Sutter, Tehama, Tuolumne, Yuba	N/A
2002	5	Butte, Colusa, Glenn, Lake, Marin, Mendocino, Napa, Orange, Riverside, Sacramento, Shasta, Sonoma, Tehama, Trinity	N/A
2007	?	Alameda, Amador, Calaveras, El Dorado, Fresno, Glenn, Imperial, Kern, Kings, Lake, Los Angeles, Madera, Marin, Mendocino, Merced, Monterey, Riverside, Sacramento, San Benito, San Bernardino, San Diego, San Luis Obispo, San Mateo, Santa Barbara, Santa Clara, Solano, Stanislaus, Tulare, Ventura, Yolo and Yuba	$1.3 billion

Sources: OES Individual Assistance Section – 2001 & 2002 SBA Declarations/ USDA Designations database; OES Origins and Development – A Chronology 1917-1999 OES web site

Map 5.9.5A below shows the geographic pattern of freeze-based disaster declarations since 1950, showing a pattern of disasters from southern California, along the Pacific Coast, inland through the Central Valley, and north of Sacramento.

Map 5.9.5A Declared Freeze Disasters, 1950 to Present



Current Freeze Hazard Mitigation Efforts

Freeze damage is another economic hazard. Mitigation measures for frost include:

- Warning systems
- Selective planting
- Crop insurance
- Frost-fighting equipment
- Biological ice nucleation[25]

Opportunities for Enhanced Freeze Hazard Mitigation

There are no additional opportunities identified at this time to prevent or mitigate the impacts of freeze hazards.

Comment On: Chapter 5 Section 9.6

5.9.6 Severe Weather and Storms

As pointed out in the discussion of global warming in Section 5.3, more extreme weather and severe storms can be expected among the future natural hazards challenges in California due to climate change.[26] Increases in severe weather, winter storms, flooding, temperature extremes, and other meteorological effects are anticipated.

While this subsection focuses on tornadoes, it also serves as a placeholder for future assessment of other hazards representing a broader variety of manifestations in this classification of extreme weather.

Identifying Tornado Hazards

While California has tornadoes, such storms represent a relatively low risk for most areas, compared to states in the Midwestern and Southern United States where risk exposure is severe and many lives and millions of dollars are lost annually due to this hazard.

Wind speeds in tornadoes range from values below that of hurricane speeds to more than 300 miles per hour. Unlike hurricanes, which produce wind speeds of similar values over relatively widespread areas (when compared to tornadoes), the maximum winds in tornadoes are often confined to extremely small areas, and vary substantially over very short distances, even within the funnel itself. Tornados are measured by the Fujita Tornado Scale (F0-F12) which classifies tornadoes into intensity categories, based on the maximum winds occurring within the funnel.

For a description of the Fujita Scale, see Table 5.9.6A on the following page.

[25] Mitigation Strategy Report, FEMA-DR-1267-Ca, The California Freeze of 1998, FEMA Region IX Mitigation Division.
[26] Intergovernmental Panel on Climate Change, *Climate Change 2007: Impacts of Climate Change – Impacts, adaptation and vulnerability – Summary for Policymakers*. Working Group II Report, April 2007.

Table 5.9.6A Fujita Tornado Scale

Category	Wind Speed	Description
F0	40-72 mph	Gale Tornado. Light Damage: Some damage to chimneys; breaks twigs and branches off tress; pushes over shallow-rooted trees; damages signboards; some windows broken; hurricane wind speed begins at 73 mph.
F1	73-112 mph	Moderate Tornado. Moderate damage: Peels surfaces off roofs; mobile homes pushed off foundations or overturned; outbuildings demolished; moving autos pushed off the roads; trees snapped or broken.
F2	113-157 mph	Significant Tornado. Considerable damage: Roofs torn off frame houses; mobile homes demolished; frame houses with weak foundations lifted and moved; boxcars pushed over; large trees snapped or uprooted; light-object missiles generated.
F3	158-206 mph	Severe Tornado. Severe damage: Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forests uprooted; heavy cars lifted off the ground and thrown; weak pavement blown off roads.
F4	207-260 mph	Devastating Tornado. Devastating damage: Well constructed homes leveled; structures with weak foundations blown off some distance; cars thrown and disintegrated; large missiles generated; trees in forest uprooted and carried some distance away.
F5	261-318 mph	Incredible Tornado. Incredible damage: Strong frame houses lifted off foundations and carried considerable distance to disintegrate; automobile-sized missiles fly through the air in excess of 300 ft (100 m); trees debarked; incredible phenomena will occur.
F6-12	Greater than 319 mph	The maximum wind speeds of tornadoes are not expected to reach the F6 wind speeds.

Profiling Tornado Hazards

Between 1950 and 2006, 355 tornadoes have occurred in California, impacting 42 counties, resulting in 87 injuries, and totaling more than $108 million in property damage, as well as $267,000 in reported crop damage. However, no known deaths have occurred as a result of California tornadoes, and the state has never proclaimed a state of emergency or declared a disaster as the result of a tornado event.

Table 5.9.6B Tornado Losses

Magnitude	Number	Injuries	Property Damage	Crop Damage
F0	208	8	$38 million	$212,000
F1	84	26	$18 milliom	$55,000
F2	22	47	$45 million	N/A
F3	2	6	$2.5 million	N/A

Source: The Tornado Project http://www.tornadoproject.com
NOAA National Climatic Data Center

Of these 355 tornadoes, only .5 percent reached F3, 6 percent were F2, whereas 24 percent were F1, and the remaining 59 percent were at F0. The biggest risks of tornadoes in California include light to moderate damage to homes, destruction of mobile homes, and injuries caused by light object projectiles. Based on the number of events within the recorded timeframe, in the 56 years between 1950 and 2006, the average recurrence interval of an F0 is about 3.7/year, an F1 is about 1.5/year, an F2 is approximately once every two years, and an F3 would be once every 28 years. However, both F3 tornadoes occurred within a five year period (1973-1978).

Assessment of State Vulnerability and Potential Loss to Tornado Hazards

No known current assessment of state vulnerability or potential losses is available at this time.

Assessment of Local Vulnerability and Potential Loss to Tornado Hazards

Information related to community vulnerability and loss assessments may be found in Local Hazard Mitigation Plans.

Current Tornado Hazard Mitigation Efforts

Tornado mitigation is achieved through the enforcement of wind engineering design and construction codes and standards.

Tornado watch and warning announcements are issued to local emergency management agencies and to the media through the Emergency Disaster Information System (EDIS), based on information provided by NOAA and the National Weather Service.

Opportunities for Enhanced Tornado Hazard Mitigation

There are no additional opportunities identified at this time to prevent or mitigate the impacts of tornado hazards.

Comment On: Chapter 5 Section 10

Comment On: Chapter 5 Section 10.1

5.10 Other Hazards

5.10.1 Dam Failure

Identifying Dam Failure Hazards

Dam failure is the uncontrolled release of impounded water from behind a dam. Flooding, earthquakes, blockages, landslides, lack of maintenance, improper operation, poor construction, vandalism, and terrorism can all cause a dam to fail. Dam failure causes downstream flooding that can affect life and property.

Profiling Dam Failure Hazards

There are 1483 dams in California. Los Angeles County leads the state with 104 and Modoc County is second with 79 dams. Del Norte County is the only county having no dams. California Water Code §6000 through §6000 identifies the dams and reservoirs that are under state jurisdiction. Dams and reservoirs owned by the federal government are not subject to state jurisdiction except as otherwise provided by federal law. There are approximately 45 federally owned dams in California. For information on these dams visit: www.usbr.gov/dataweb/html/cadams.html

Since 1950 there have been only nine dam failures. Overtopping caused two of the failures, and the others were caused by seepage or leaks. One failure, the 1963 Baldwin Hills Dam Failure resulted in three deaths because the leak turned into a washout. The historic record indicates California has had about 45 failures of non-federal dams. The failures occurred for a variety of reasons, the most common being overtopping. Other reasons include specific shortcomings in the dams themselves or an inadequate assessment of surrounding geomorphologic characteristics.

California's first notable dam failure was in 1883 in Sierra County, while the most recent failure occurred in 1965. The most catastrophic event was the failure of William Mulholland's infamous St. Francis Dam, which failed in 1928 and killed an estimated 450 people. The actual number of dead from the St. Francis Dam failure was likely substantially higher. San Francisquito Canyon, which was flooded in the event, was home to hundreds of transients and illegal immigrants who were never accounted for in the death totals.

Assessment of State Vulnerability and Potential Loss to Dam Failure Hazards

No assessment of state vulnerability or potential losses is available at this time.

Assessment of Local Vulnerability and Potential Loss to Dam Failure Hazards

Information related to community vulnerability and loss assessments may be found in Local Hazard Mitigation Plans.

Current Dam Failure Hazard Mitigation Efforts

Since 1929, the state has supervised all non-federal dams in California to prevent failure for the purpose of safeguarding life and protecting property. Supervision is carried out through the state's Dam Safety Program under the jurisdiction of DWR. The legislation

requiring state supervision was passed in response to the St. Francis Dam failure and concerns about the potential risks to the general populace from a number of water storage dams. The law requires:

- Examination and approval or repair of dams completed prior to August 14, 1929, the effective date of the statute;
- Approval of plans and specifications for and supervision of construction of new dams and the enlargement, alteration, repair, or removal of existing dams;
- Supervision of maintenance and operation of all dams under the state's jurisdiction.

The 1963 failure of the Baldwin Hills Dam in Southern California led the Legislature to amend the California Water Code to include within state jurisdiction both new and existing off-stream storage facilities.

Dams and reservoirs subject to state supervision are defined in California Water Code §6002 through §6004, with exemptions defined in §6004 and §6025. In administering the Dam Safety Program, DWR must comply with the provisions of CEQA. As such, all formal dam approval and revocation actions must be preceded by appropriate environmental documentation.

In 1972, Congress moved to reduce the hazards from the 28,000 non-federal dams in the country by passing Public Law 92-367, the National Dam Inspection Act. With the passage of this law, Congress authorized the USACE to inventory dams located in the United States. The action was spurred by two disastrous earthen dam failures during the year, in West Virginia and South Dakota that caused a total of 300 deaths.

The Water Resources Development Act of 1986 (P.L 99-662) authorized USACE to maintain and periodically publish an updated National Inventory of Dams (NID). The Water Resources Development Act of 1996 (P.L. 104-303), Section 215, re-authorized periodic updates of the NID by USACE.

Opportunities for Enhanced Dam Failure Hazard Mitigation

There are no additional opportunities identified at this time to prevent or mitigate the impacts of dam failure hazards.

Comment On: Chapter 5 Section 10.2

5.10.2 Energy Shortage

Identifying Energy Shortage Hazards

The 2000-2001 California electricity crisis brought to light many critical issues surrounding the state's power generation system, including post-deregulation market manipulation and its dependency on out-of-state resources, coupled with in-state transmission bottlenecks. Although California has taken effective measures to mitigate market manipulation, built more transmission to reduce bottlenecks, and implemented effective energy conservation programs, the state continues to experience both population growth and weather cycles that contribute to a heavy demand for power.

California has about 32,000 miles of electric transmission lines and up to double that amount for the electric distribution system. On the generation side, California has nearly 200 large operational power plants varying in size from 50 megawatts (MW) to over 2,000 MW, generating a total of over 54,000 MW. In addition, California has more than 750 smaller power plants totaling over 9,500 MW that range in size from 0.1 to 49.9 MW *(Source: California Energy Commission).*

Secondary Impacts

Secondary impacts of energy shortages are most often felt by vulnerable populations. For example, those who are reliant on electric power for life saving medical equipment, such as respirators are extremely vulnerable to power outages. Also, during periods of extreme heat emergencies, elderly and the very young are more vulnerable to the loss of cooling systems requiring power sources.

Profiling Energy Shortage Hazards

On January 17, 2001, the California Independent System Operator (CAIO), the entity that coordinates statewide flow of electrical supply, declared a Stage 3 Emergency and notified the Governor's Office of Emergency Services that PG&E was dropping firm load of 500 mega watts in Northern California (Rolling Black-outs). OES, in turn, issued an Electrical Emergency Message to all Emergency Services Agencies to prepare for rolling blackouts. This scenario was repeated the following day, January 18, 2001. On March 19, 2001, OES again issued an Electrical Emergency Message to Emergency Services Agencies that the CAIO declared a State 3 Emergency and would be conducting statewide rolling blackouts.

The July 2006 Heat Storm event affected the entire state as well as most of the West, producing record demand levels in California. The state was able to avoid rotating outages due to a combination of favorable factors, including no major transmission outages, lower than typical generator outages, significant customer response to pleas for energy conservation, high imports from the Pacific Northwest despite unusually high loads there, outstanding cooperation among western control area operators, and prompt response to fires that potentially threatened major interties.

However, the event brought to light the vulnerability of the electric distribution system, as over 3,500 distribution transformers failed, leaving over two million customers without power at various times over the ten-day event, many for several hours and a small minority for up to three days.

Hydro-generation provides approximately 20 percent of California's electric power, with the balance coming from fossil fuels, nuclear, and renewable sources. As experienced in 2000 and 2001, rotating outages and/or blackouts can occur due to losses in transmission or generation and/or extremely severe temperatures that lead to heavy electric power consumption.

The electric power industry does not have a universal agreement for classifying disruptions. Nevertheless, it is important to recognize different types of outages are

possible so that plans may be made to handle them effectively. Electric power disruptions can be generally grouped into two categories: Intentional and Unintentional.

There are four types of *intentional disruptions*.

1. Planned: Some disruptions are intentional and can be scheduled. For example, a disruption may be necessary when components of the power system are taken out of service for maintenance or upgrading. Scheduled intentional disruptions can last from several minutes to several hours, and customers are usually notified in advance.

2. Unscheduled: Some intentional disruptions must be done "on the spot." As a result, advance notice cannot be provided. For example, a fire department or a police department may request a disruption in service during a fire or an accident.

3. Demand-side Management: Some customers (i.e., on the demand side) have entered into an agreement with their utility provider to curtail their demand for electricity during periods of peak system loads. In return for agreeing to these disruptions, these customers receive a lower electric rate and/or a rebate.

4. Load Shedding: When the power system is under extreme stress due to heavy demand and/or failure of critical components, it is sometimes necessary to intentionally interrupt the service to selected customers to prevent the entire system from collapsing. In such cases, customer service (or load) is cut, sometimes with little or no warning. One form of load shedding - called a "rotating blackout" - involves cutting service to selected customers for a predetermined period (usually not more than two hours). As power is restored to one block of customers, power to another block of customers is interrupted to reduce the overall load on the system.

Unintentional or unplanned disruptions are outages that come with essentially no dvance notice. This type of disruption is the most problematic. The following are categories to classify unplanned disruptions:

- accident by the utility or utility contractor, or others
- malfunction, or equipment failure, due, for example, to age, improper operation, excessive operation, or manufacturing defect; special subcategories cover broken fuse links and underground cable, joint, or termination failures
- overload on either the utility's equipment or a customer's equipment
- reduced capability, that is, equipment that cannot operate within its design criteria
- tree contact other than from storms
- vandalism, or intentional damage
- weather, including ice/snow, lightning, wind, earthquake, flood and broken tree limbs taking down power lines
- wildfire that damages transmission lines.

The California Independent System Operator (CAISO) is tasked with managing the power distribution grid that supplies most of California, except in areas serviced by

municipal utilities. CAISO uses a series of stage alerts to the media based on system conditions. The alerts are:

- Stage 1 - When the reserve margin falls below 7%
- Stage 2 - When the reserve margin falls below 5%
- Stage 3 - When the reserve margin falls below 1.5%

Rotating blackouts become a possibility when Stage 3 is reached.

Assessment of State Vulnerability and Potential Losses

The staff of the California Energy Commission is providing technical assistance to the Critical Infrastructure section of California Office of Homeland Security (OHS) regarding the state's petroleum infrastructure. In particular, the OHS has received a confidential briefing regarding California's critical nodes for petroleum product pipeline distribution infrastructure. Information included importance of critical nodes and potential implications of disruption to specific points within the distribution infrastructure. Staff has also provided the OHS with background information for California's petroleum market and maps showing locations of refineries, primary petroleum pipelines, marine terminals, and distribution terminals.

Future collaborative work is anticipated as OHS continues to examine potential petroleum infrastructure vulnerabilities. One example is an assessment of current redundancy capabilities of the existing petroleum distribution infrastructure and what types of projects would need to be undertaken to enable the continued distribution of transportation fuels in the event that one or more of the "critical" distribution nodes are temporarily disrupted.

Assessment of Local Vulnerability and Potential Losses

Information related to community vulnerability and loss assessments may be found in Local Hazard Mitigation Plans.

Current Energy Shortage Hazard Mitigation

State and local governments can take steps that will improve their ability to cope with electric power disruptions in the longer term. These steps include the use of building codes, zoning ordinances, and growth and development projections.

Building codes are used to ensure that construction in a community meets minimum standards required for public health and safety and for quality workmanship. Building codes can also be used to increase a community's ability to deal with disruptions to the electric power infrastructure by requiring facilities to be adequately prepared for power disruptions. Modification of a building's use can significantly affect electrical service requirements, which may or may not be readily identified on building permits. Some examples of this type of project include the following:

- Conversion of conventional commercial or industrial facilities to computer-based company operations with extensive computer equipment and air-conditioning requirements;
- Conversion of a commercial building to residential condominiums; and
- Rehabilitation of residential buildings to increase their electrical service.

Local governments can use zoning change requests, permit applications, economic development plans, or other informal means to identify modification to rehab projects. Communities that adopt building codes as part of their municipal code - thus making compliance mandatory- frequently use several codes developed by national organizations. While model codes provide basic guidance, municipalities often amend and modify them to meet specific local requirements.

Zoning ordinances stipulate the type of land use that is acceptable in various locations in a community. Zoning can significantly affect the electric power requirements of an area. For example, an area zoned "residential" will have a very different electricity load profile than an area zoned "commercial" or "industrial." There are two ways in which zoning can affect the electric power. First, zoning plays a role in determining the location of a site for electric power facilities, including power plants, transmission lines, and substations. The current trend of constructing many small and medium scale "peaker" power plants has ignited zoning controversies. Many communities are now developing policies and zoning ordinances that will affect the location of these facilities.

It is important for a community to understand that the location (or restrictions on the location through zoning) of electric power facilities within its boundaries may (or may not) directly affect the reliability of the power supply to that community. A community that is home to a peaker plant, for example, does not necessarily enjoy more reliable service. Likewise, not having a power plant does not imply decreased reliability. Electric power plants are built to provide power to the entire electric grid, not just to the area in which they are located. However, a distribution substation, which connects customers to the grid, will directly affect the reliability of electrical service in the area in which it is located.

All electric power companies develop projections of long-term demand as a starting point for planning the expansion of electric power generation, transmission, and distribution facilities. Projections are made for a range of planning horizons (from 1 to 20 years) and for a range of geographical resolutions (for the entire system to individual distribution substations and feeder lines). In general, the shorter the planning horizon and the larger the geographic resolution used, the more likely the demand forecast will be reasonably representative of the actual situation.

Opportunities for Enhanced Energy Shortage Hazard Mitigation

In addition to monitoring energy supply and planning for energy production, energy conservation is an important element of energy policy. Reducing the energy consumption and energy demand per capita can offset the growth in energy supply needed to keep pace with population growth and urban development.

Based on data developed by the US Energy Administration in 2004, the distribution of energy consumption in the United States breaks down as follows: 33% industrial sector, 28% transportation sector, 21% residential sector, and 17% commercial sector.

There are opportunities for energy conservation in all sectors. The emerging issue of global warming and climate change, coupled with the goal of decreasing national dependence on foreign oil supply has spurred a renewed interest in developing low-cost efficient alternative energy sources. Stronger national and local policies and financial incentives are needed to support the development and production of alternative energy sources, such as solar and wind power, biodiesel, and other non fossil fuels. Additionally, encouraging the development and implementation of green building techniques designed for energy efficiency, and produced from renewable resources will have a cumulative effect on reducing energy consumption during the construction process and throughout the life of a structure or facility.

Of the energy used in the transportation sector, 65% of it is consumed by gasoline powered vehicles. There are a number of measures that can be taken to reduce energy consumption for gasoline powered vehicles, including the continued development of alternative energy vehicles, changing work commute patterns through telecommuting or land use policies which encourage mixed use development. Development and production of alternative energy vehicles combined with a reduction in vehicle trips will result in both reduced reliance on fossil fuels and reduced carbon emissions to lessen the impacts of global warming and climate change.

Comment On: Chapter 5 Section 10.3

5.10.3 Epidemic/Pandemic

Identifying Pandemic Flu Hazards

Influenza, also know as the flu, is a disease that attacks the respiratory system (nose, throat, and lungs) in humans. Although mild cases may be similar to a viral “cold,” influenza is typically much more severe, usually comes on suddenly, and may include fever, headache, tiredness (which may be extreme), dry cough, sore throat, nasal congestion, and body aches and more often results in complications such as pneumonia. Seasonal influenza is a yearly occurrence that kills primarily persons aged 65 and older and those with chronic health conditions and causes significant economic impact. Those who are exposed, but do not succumb, develop immunity to the strain circulating that year.

Worldwide pandemics of influenza occur when a novel virus emerges to which the population has little immunity. The 20th century saw three such pandemics, the most notable of which was the 1918 Spanish influenza pandemic that was responsible for 20 million deaths throughout the world.

Secondary Impacts

Significant economic disruption can occur due to loss of employee work time and costs of treating or preventing spread of the flue.

Profiling Pandemic Flu Hazards

Birds can contract avian flu. Some strains of the avian flu are more virulent than others. Public health experts are currently concerned about the risk of a pandemic, arising from the current epidemic of avian influenza that has been affecting domestic and wild birds in Asia and spreading to other parts of the world. People who have very close contact with infected birds (for example, people who live with chickens in their houses) have contracted a virulent form of avian flu and there has been a significant death rate from this disease. Thus far, the avian flu virus has not mutated and has not demonstrated easy transmission from person to person. However, were the virus to mutate in a highly virulent form and become easily transmissible from person to person, then the public health community would be very concerned about the potential for a pandemic influenza outbreak. Such a pandemic could disrupt all aspects of society and severely affect the economy.

Assessment of State Vulnerability and Potential Loss to Pandemic Flu Hazards

The impact of an actual pandemic cannot be predicted precisely, as it will depend on the virulence of the virus, how rapidly it spreads, the availability of vaccines and antivirals, and the effectiveness of medical and non-medical containment measures.

Assessment of Local Vulnerability and Potential Loss to Pandemic Flu Hazards

Information related to community vulnerability and loss assessments may be found in Local Hazard Mitigation Plans.

Current Pandemic Flu Hazard Mitigation Efforts

The California Department of Health Services (CDHS) is the lead pandemic planning agency in the state which coordinates the public health response to a pandemic with local health departments, the healthcare community, the federal government, and other key partners. CDHS prepared a Pandemic Preparedness Plan which will be implemented in collaboration with the Emergency Medical Services Authority (EMSA), the California Health and Human Services Agency, the Governor's Office of Emergency Services, Governor's Office of Homeland Security other state agencies, local health departments, and tribal entities.

While primarily a preparedness and response plan, the plan also identifies potential mitigation actions that can be taken to reduce the impacts of the pandemic, including:

- Ensure rapid and early detection of a novel virus;
- Confirm identity or type of a novel virus by laboratory identification;
- Identify the exposure source of the outbreak and the population at risk;
- Control and contain the spread of influenza through pharmaceutical and non-pharmaceutical community containment strategies, including isolation, quarantine, infection control, antiviral treatment and prophylaxis, and, if available, vaccination;
- Manage and disseminate accurate information for scientific, resource, and policy decisions in public health and healthcare delivery settings;

Opportunities for Enhanced Pandemic Flu Hazard Mitigation

There are no additional opportunities identified at this time to prevent or mitigate the impacts of this hazard.

Comment On: Chapter 5 Section 10.4

5.10.4 Hazardous Materials Release

Identifying Hazardous Materials Release and Toxic Substance Hazards

Hazardous materials are substances that are flammable or combustible, explosive, toxic, noxious, corrosive, an oxidizer, an irritant or radioactive. A hazardous material spill or release can pose a risk to life, health or property. An incident can result in the evacuation of a few people, a section of a facility or an entire neighborhood.

There are a number of Federal laws that regulate hazardous materials, including: the Superfund Amendments and Reauthorization Act of 1986 (SARA), the Resource Conservation and Recovery Act of 1976 (RCRA), the Hazardous Materials Transportation Act (HMTA), the Occupational Safety and Health Act (OSHA), the Toxic Substances Control Act (TSCA), and the Clean Air Act.

Title III of SARA, also known as the Emergency Planning and Community Right-to-Know (EPCRA) Act, was established to encourage and support emergency planning efforts at the state and local levels, and to provide the public and local governments with information concerning potential chemical hazards present in their communities.The law requires facilities to furnish information about the quantities and health effects of chemicals used at the facility, and to promptly notify local and State officials whenever a significant release of hazardous materials occurs.

California law established the Unified Program which consolidates, coordinates, and makes consistent the administrative requirements, permits, inspections, and enforcement activities of six environmental and emergency response programs. The programs are the Hazardous Materials Business Plan/Emergency Response Plan, Hazardous Waste/Tiered Permitting, Underground Storage Tanks, Above-ground Storage Tanks, California Accidental release Prevention Program, and the Uniform Fire Code Hazardous Materials Management Plan. The state agencies responsible for these programs set the standards for their program while local governments implement and enforce the standards. Cal/EPA oversees the implement of the program as a whole (California Code of Regulations, Title 27, Division I, Subdivision 4, Chapter 1, Sections 15100-15620.

The Unified Program is implemented at the local level by government agencies certified by the Secretary of Cal/EPA. These Certified Unified Program Agencies (CUPAs) have typically been established as a function of a local environmental health or fire department. Some CUPAs also have contractual agreements with one or more other local agencies, “participating agencies” (Pas), which implement one or more program elements under the oversight of the CUPA.

Highlighting the Hazardous Materials Business Plan/Emergency Response Plan (California Health and Safety Code, Chapter 6.95), its purpose is to prevent or minimize

the damage to public health and safety and the environment from a release or threatened release of hazardous materials and to satisfy community right-to-know laws. This is accomplished by requiring businesses that handle hazardous materials in quantities equal to or greater than 55 gallons, 500 pounds, or 200 cubic fee of gas or extremely hazardous substances above the threshold planning quantity (40 CFR, Part 355, Appendix A) to:

- Inventory their hazardous materials
- Develop an emergency plan
- Implement a training program for employees.

It should also be noted that a Hazardous materials Business Plan regulates most hazardous materials facilities in the state. There are approximately 140,000 businesses which range from the smallest gas station to the largest chemical facility.

Secondary Impacts

In addition to the immediate risk to life safety, public health, air quality, water source contamination and potential environmental impacts of accidental hazardous materials releases and toxic substances, there is concern for the long-term public health and environmental impacts that may result from the sustained use or exposure to certain substances. There is a growing recognition of the linkages between hazardous substances, environmental quality and global warming.

For example, when MTBE was introduced in 1979 as a fuel additive to gasoline to increase its oxygen content and to reduce carbon monoxide and ozone levels caused by auto emissions, it was considered to be an environmental breakthrough. However, over time, is was discovered that MTBE was being introduced into drinking ground and surface water supplies via leaking underground storage tanks and pipelines, spills, emissions from marine engines into lakes and reservoirs, and to some extent from air deposition. As part of implementing the Safe Drinking Water Act Amendments of 1996, the Office of Water has placed MTBE on the drinking water Contaminant Candidate List (CCL) for further evaluation to determine whether or not regulation with a National Primary Drinking Water Regulation (NPDWR) is necessary.

Profiling Hazardous Materials Release and Toxic Substance Hazards

Hazardous materials are everywhere and are accidentally released or spilled many times during any given day. The California State Warning Center receives approximately 10,000 hazardous material spill reports per year on hazardous material incidents and potential hazardous material incidents. Of these incidents most are minnow but some do cause significant impacts like injuries, evacuation, and clean-up.

Assessment of State Vulnerability and Potential Losses

There is no comprehensive statewide vulnerability assessment available at this time.

Assessment of Local Vulnerability and Potential Losses

Information related to vulnerability and loss assessments for California communities may be found in Local Hazard Mitigation Plans.

Current Hazardous Materials Release and Toxic Substance Mitigation Efforts

The following mitigation efforts are required and implemented through state and federal regulation pertaining to the handling, storage and transport of hazardous substances.

Fixed Facilities:

- Process Hazard Analysis (PHA) through Cal OSHA
- Policies and procedures, hazard communication, and training
- Placarding and labeling of containers
- Hazard assessment
- Security
- Process and equipment maintenance
- Mitigating techniques—flares, showers, mists, containment vessels, failsafe devices
- Use of inherently safer alternative products
- Emergency plans and coordination
- Response procedures

Transported:

- Placards and labeling of containers
- Proper container established for material type
- Random inspections of transporters
- Safe handling policies and procedures
- Hazard communications
- Training for handlers
- Permitting
- Transportation flow studies, e.g., restricting HAZMAT transportation over certain routes.

Additional programs are in place to combat the effects of existing hazardous materials releases and toxic substances.

Comprehensive Environmental Response, Cleanup, and Liability Act (CERCLA)

This program was established to ensure that injuries to natural resources are remediated and restored as part of any CERCLA action that is undertaken as the result of a hazardous substance spill or release. CERCLA identifies the processes and actions required by State or federal natural resource trustees when the environment has been contaminated by a hazardous substance release or spill. As a natural resource trustee for the State under CERCLA, the Department of Fish & Game has an obligation to guide remediation of contaminated sites for the protection of natural resources, and the opportunity to recover natural resource damages from responsible parties for costs associated with impact assessment, remediation, and restoration.

Brownfield Cleanup

Cal/EPA's regulatory boards and departments play an essential role in cleaning up contaminated sites to protect public health and the environment. However, with an estimated 90,000 properties in California that remain idle or underutilized because of real or perceived environmental contamination, it is clear that sufficient public resources could never be allocated to accomplish this goal. California's brownfields will not be restored to productive use without significant participation by the private sector. Discovering mutually beneficial ways to involve investors in the future of these polluted properties is crucial.

A more proactive approach to mitigation the impacts of hazardous materials releases or toxic substances is The Hazardous Waste Source Reduction and Management Review Act of 1989, also known as Senate Bill 14. This act requires hazardous waste generators to seriously consider source reduction as the preferred method of managing hazardous waste. Source reduction is preferable over recycling and treatment options because source reduction avoids waste generation costs and management liability. Source reduction also provides the best protection for public health and the environment. Facilities generating more than 12.000 kilograms of hazardous waste or 12 kilograms of extremely hazardous waste are required to do source reduction planning. Hazardous waste generators subject to SB 14 are required to prepare the following documents by September 1, 2007: 1) Source Reduction Evaluation Review and Plan; 2) Hazardous Waste Management Performance Report; and 3) Summary Progress Report.

Opportunities for Enhanced Hazardous Materials Release and Toxic Substance Mitigation

There are many opportunities for enhanced mitigation of hazardous materials releases and toxic substances in California. Increased research into the potential long term effects of various toxic substances and public awareness may lead to additional regulatory requirements and personal choices regarding the use of certain chemicals and other substances identified as potentially harmful. The growing trend toward the production, sales and marketing of organic foods to reduce daily exposure to herbicides, pesticides and potentially harmful fertilizers is one example. Another is the recent action by several California cities to propose and/or adopt ordinances banning the use of plastic shopping bags by large commercial enterprises.

The Hazardous Waste Source Reduction and Management Review Act of 1989, requires hazardous waste generators to seriously consider source reduction as the preferred method of managing hazardous waste. Businesses which routinely generated more than 12,000 kilograms of hazardous waste or 12 kilograms of extremely hazardous waste in 2006 are required to do source reduction planning including the following: 1) Source Reduction Evaluation Review and Plan; 2) Hazardous Waste Management Performance Report; and 3) Summary Progress Report.

Comment On: Chapter 5 Section 10.5

5.10.5 Insect Pests

Identifying Insect Pests Hazards

California is at risk from many insects that, under the right circumstances, can cause severe economic, environmental, or physical harm. Table 5.10.5A below identifies insects of concern to California.

Table 5.10.5A California Insect Hazards

Dangerous to	Insects
Plants and Crops	Asian longhorn beetle, Caribbean fruit fly, glassy-winged sharp shooter, guava fruit fly, gypsy moth, Japanese beetle, Mediterranean fruit fly, melon fruit fly, Mexican fruit fly, olive fruit fly, oriental fruit fly, bark beetle
Humans	Africanized honeybee, mosquito
Both	Red imported fire ant

Source: www.cdfa.ca.gov/phpps/pdep/insect_pests_and_diseases.htm

Secondary Impacts

Insect pests affecting crop production result in economic disasters. These hazards can have a major economic impact on farmers, farm workers, packers, and shippers of agricultural products. They can also cause significant increases in food prices to the consumer due to shortages. Insect pests and diseases such as Sudden Oak Death and Pitch Canker in trees can destroy large expanses of forest and woodland, increasing the fuel load and contributing to greater fire risk.

Profiling Insect Pests Hazards

West Nile virus (WNV) first appeared in the United States in 1999 in New York and rapidly spread to many regions of California in subsequent years. California has historically maintained a comprehensive mosquito-borne disease surveillance and control program. In anticipation of the arrival of WNV, the California Department of Health Services (DHS), in consultation with local mosquito and vector control agencies, developed a Mosquito-Borne Disease Surveillance and Response Plan. WNV first appeared in California in 2002 with the identification of one human case. In 2003, three human cases occurred in California and WNV activity was detected in six southern counties. By 2004, WNV activity was observed in all 58 counties in California and 830 human infections were identified.

In 2006, 278 human West Nile virus (WNV) cases were identified from 36 counties: Alameda (1), Butte (31), Colusa (4), Contra Costa (8), El Dorado (2), Fresno (11), Glenn (12), Imperial (1), Kern (49), Kings (1), Lake (2), Los Angeles (13), Marin (1), Merced (4), Modoc (2), Mono (1), Napa (1), Nevada (1), Orange (6), Placer (8), Riverside (4), Sacramento (15), San Bernardino (3), San Diego (1), San Joaquin (8), San Luis Obispo (1), Santa Clara (5), Shasta (4), Solano (8), Stanislaus (11), Sutter (12), Tehama (6), Tulare (6), Ventura (3), Yolo (27), and Yuba (5).

Of the 278 WNV cases in 2006, 83 (30%) were classified as West Nile neuroinvasive disease, and 190 (68%) as West Nile fever. The median age of all cases was 49 years (range: 8-86 years). Of the cases, 179 (64%) were male. Seven WNV-related fatalities were reported in 2006, from Butte (2), Contra Costa (2), Fresno (1), Riverside (1), and Shasta (1). Twenty-eight WNV-positive blood donation samples were identified; 14 of the individuals reported symptoms and were reclassified as cases.
Source: http://www.westnile.ca.gov/

This contrasts with only 45 human cases of West Nile Virus infection in California for the first 8 months of 2004. These figures indicate that either the incidence of West Nile Virus is increasing, or that increased detection and diagnosis is occurring as a result of heightened awareness.

In addition to insect pests causing health risks to humans, they also can have significant impacts on the agriculture industry in California. Table 5.10.5B below summarizes insect infestations that have occurred in California since 1950.

Table 5.10.5B California Insect Hazards

Type of Insect	Number of Incidents	Counties Affected	Crop Damage
Mediterranean Fruit Fly	7	Contra Costa, Los Angeles, Orange, Riverside, San Benito, San Bernardino, San Mateo, Santa Clara, Santa Cruz, Stanislaus, Ventura	$22 million
Mexican Fruit Fly	2	Los Angeles, San Diego	None—damage mitigated
Sweet Potato Whitefly	1	Imperial, Riverside	$12.7 million
Bark Beetle	1	San Bernardino, Riverside, San Diego	N/A

For current information on incidence of West Nile virus, see the web site maintained by the California Department of Public Health (part of the Department of health Services at:; http://westnile.ca.gov.

Assessment of State Vulnerability and Potential Loss to Insect Pests Hazards

No known state vulnerability or loss assessment is available at this time.

Assessment of Local Vulnerability and Potential Loss to Insect Pests Hazards

Information related to community vulnerability and loss assessments may be found in Local Hazard Mitigation Plans.

Current Insect Pests Hazard Mitigation Efforts

The California Department of Food & Agriculture has extensive responsibilities to protect the food supply, including protecting and responding to the invasion of plant diseases and pests. As part of the Plant Health and Pest Prevention Services and Pierce's

Disease Control Program, CDFA administers the statewide exterior exclusion program, border protection stations, pest detection and emergency projects, trapping, interior exclusion quarantine programs and the Integrated Pest Control weed eradication and biological control program.

The California Conservation Corp assists in mitigating the impacts of insect pests by providing human resources to assist in state and local eradication efforts, including surveying private yards and business landscapes to detect the Glassy Winged Sharpshooter, striping citrus fruit infected by the Mexican Fruitfly, and helping eradicate the Exotic Newcastle Diseast by cleaning and disinfecting backyards.

Agricultural pests are an economic hazard and, in some cases, a physical danger. Mitigation for pests should include an integrated pest management strategy.

Source: www.ipm.ucdavis.edu/GENERAL/tools.html

Opportunities for Enhanced Insect Pests Hazard Mitigation

There are no additional opportunities identified at this time to prevent or mitigate the impacts of

Comment On: Chapter 5 Section 10.6

5.10.6 Marine Invasive Species

Identifying and Profiling Marine Invasive Species

The introduction of non-indigenous species (NIS) into coastal marine and estuarine waters can cause significant and enduring economic and environmental impacts. One of the most widespread mechanisms by which introductions occur is through transport of ballast water in ships. Ballast water is taken on and released by a vessel during cargo loading and discharging operations, to maintain the vessel's trim and stability.

Assessment of State Vulnerability and Potential Loss to Marine Invasive Species

Ships may discharge ballast water that may have been obtained from waters throughout the world, including with it non-native organisms, untreated sewage and other contaminants. Once introduced, invasive species are likely to become a permanent part of an ecosystem, and may flourish, creating environmental imbalances and wreaking economic havoc. Examples include the zebra mussel infestation in the Great Lakes and the propagation of water hyacinth in the California delta.

Assessment of Local Vulnerability and Potential Loss to Insect Pests Hazards

Information related to community vulnerability and loss assessments related to marine invasive species, if any, may be found in Local Hazard Mitigation Plans.

Current and Future Marine Invasive Species Hazard Mitigation Efforts

The Marine Invasive Species Act of 2003 (the MISA) reauthorized, enhanced, and renamed the State's original ballast water management program, which established a statewide, multi-agency program to prevent or reduce the introduction and spread of NIS into the state waters. The MISA applies to all U.S. and foreign vessels, over 300 gross

registered tons that arrive at a California port or place after operating outside of California waters.

Opportunities for Enhanced Insect Marine Invasive Species Mitigation

In addition to the regulatory directives, the MISA included mandates to address gaps identified during the beginning years of the program that would improve the ability of the program to prevent NIS introductions. In January 2006, the California State Lands Commission (CSLC) submitted a report with recommendations to the Legislature on ballast water discharge standards for vessels operating in California waters. As a result of that report, legislation was passed in September 2006 (Coastal Ecosystems Protection Act (SB 497)), requiring the Commission to adopt those standards via regulations. This report can be downloaded at:
http://www.slc.ca.gov/Division_Pages/MFD/MFD_Programs/Ballast_Water/Ballast_Water_Default.htm

Comment On: Chapter 5 Section 10.7

5.10.7 Radiological Accidents

Identifying Radiological Accident Hazards

Radioactive materials are routinely transported in California. This includes the medical and industrial sources described below, as well as wastes that have radioactive components. Many of the radioactive waste shipments come from research and clean-up efforts at national laboratories.

There are two operating nuclear power plants (NPP) in California, Diablo Canyon Power Plant in San Luis Obispo County, and San Onofre Nuclear Generating Station in San Diego County. Two other nuclear power plants, Humboldt Bay and Rancho Seco, are not operational, but have spent fuel stored on-site.

Secondary Impacts

Radiological accidents which result in the release of radioactive materials may result in long-term health risks and contamination of the state resources, including air, water supply, groundwater, and agricultural lands.

Profiling Radiological Accident Hazards

Due to strict regulation of nuclear power plants in the United States, significant nuclear power incidents that can cause harm to the public have low probability of occurrence, and none have occurred in California.

Even though the probability of a catastrophic event involving a nuclear power plant is extremely low and these plants are extremely well protected, the consequences of a severe accident or a successful terrorist attack on a nuclear power plant that results in a release of radioactive materials could be very significant.

State and local governments having jurisdiction within ten miles of an operating nuclear power plant must plan, train, and conduct emergency exercises annually in accordance with federal regulations. Detailed emergency plans are maintained by each affected agency.

Four Emergency Classification Levels (ECLs) have been established in federal regulations to characterize the severity of the emergency and the response actions required. The ECLs must be used as the foundation for emergency response planning, training and exercises. ECLs are described in the table below.

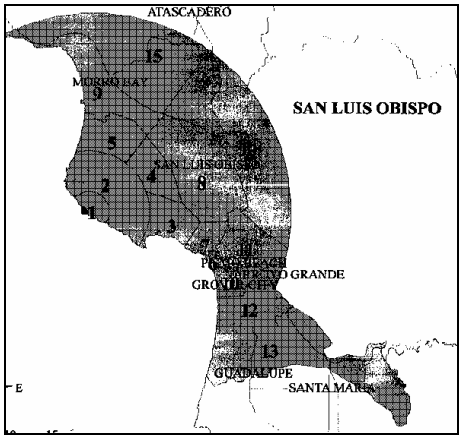
As part of the planning basis, affected agencies must establish emergency planning zones (EPZs), which is an approximate ten-mile radius drawn around each plant site. The exact EPZ size is established to provide for substantial reduction in early severe health effects in the event of a worst-case core melt accident.

Table 5.10.7A below describes the four levels of Nuclear Power Plant emergencies.

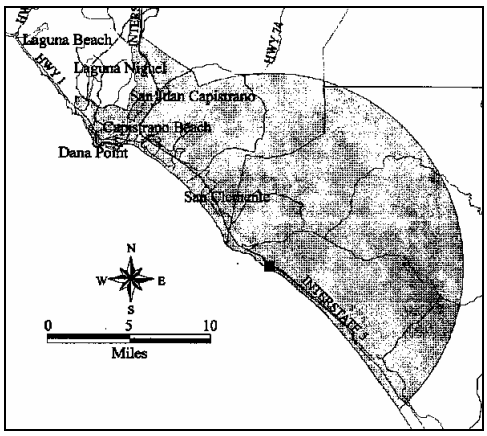
Table 5.10.7A Levels of Nuclear Power Plant Emergencies

Emergency Classification Levels	ECL Description and Purpose	Populations Effected	Occurrences
Notification of Unusual Event	Issued when events have occurred that potentially could degrade the level of plant safety. No radioactive releases requiring emergency response are expected.	On site only	Average 1-2 per year.
Alert	Issued when events have occurred that involves a substantial degradation of plant safety. Any radioactive releases are expected to be a fraction of federal exposure guidelines requiring protective actions.	On site only	1 (SONGS, March 1999) (San Onofre)
Site Area Emergency	Issued when events have occurred that involve the failure of major plant functions needed to protect the public. Radioactive releases are not expected to exceed federal exposure guidelines at the site boundary.	Site area, schools, beaches, & transient populations within the EPZ.	0
General Emergency	Issued when events have occurred that involve substantial core degradation or loss of containment integrity. Radioactive releases are expected to exceed federal exposure guidelines.	Designated areas within the (EPZ)	0

Map 5.10.7A Nuclear Power Plant EPZs



EPZ for the Diablo Canyon NPP



EPZ for SONGS

Assessment of State Vulnerability and Potential Loss to Radiological Accidents

[To be completed.]

Assessment of Local Vulnerability and Potential Loss to Radiological Accidents

For information on community vulnerability and loss, see Local Hazard Mitigation Plans.

Current Radiological Accident Mitigation Efforts

The Radiological Preparedness Unit (RPU) in the Governor's Office of Emergency Services plans, prepares for, responds to, mitigates, and assists in the recovery from radiological incidents that threaten public health and safety, property, and the environment. The goal of the RPU is to protect the public, property, and the environment from the possible harmful effects of radiation from incidents during transportation, at nuclear power plants and other fixed facilities, as well as acts of terrorism.

The RPU provides an effective and efficient emergency management system for radiological incidents by coordinating private entities, and federal, state, and local government organizations. The RPU is responsible for two programs:

- The California Radiological Emergency Preparedness (CalREP) Program, and
- The Nuclear Power Plant (NPP) Program

The CalREP Program includes planning for emergency response and recovery from threats of nuclear terrorism, transportation accidents involving radiological materials and wastes, and radiological accidents at "fixed facilities" (i.e., facilities that are not mobile and are not nuclear power plants). The program trains emergency response workers to recognize the various types of radiation, the effects of radiation, and the protective actions needed for a safe response. The primary focus is on protection of the public,

emergency workers, property, and the environment from the possible harmful effects of radiation and radioactive contamination.

The NPP Program covers emergency planning issues related to the State's operating nuclear power plants – San Onofre Nuclear Generating Station and Diablo Canyon Power Plant. The NPP program works with local, State, federal, and utility officials in emergency planning, training, and exercises to test emergency readiness.

Nuclear Power Plant Safeguards

Triple-safeguard features prevent the release of radiation:

1. Metal tubes or rods, which contain the fuel pellets, act as the first barrier.
2. Next, the fuel rods are contained in the reactor vessel within 8-inch thick steel walls.
3. Finally, an airtight containment building is constructed of metal and reinforced concrete walls, totaling more than four-feet thick.

Control and safety systems within the plant are designed to overlap for safety. Automatic systems have the ability to shut down the reactors within seconds if monitoring devices detect unusual conditions, such as an excessive heat build up. Should any individual safety component fail there are back-up systems that take over immediately.

The NRC has resident inspectors assigned to each plant site. The inspectors oversee plant operations and ensure compliance with regulations governing operational and occupational safety. There are automatic communications systems that contact the State Warning Center in Sacramento if certain conditions, such as an earthquake or certain plant conditions, occur. The State Warning Center will be able to contact key personnel needed in an emergency.

Nuclear Power Plant Emergency Preparedness

Planning, preparing, and training for nuclear power plant emergencies are also part of the safeguards. Federal, state, and local emergency management agencies work with the utilities to ensure that nuclear power plants are safe and that each agency and utility has an effective emergency plan describing the actions to be taken in response to an emergency. Residents and businesses near a nuclear power plant should prepare a disaster plan for all emergencies including nuclear power plant emergencies and should become familiar with the emergency preparedness information. You can find information regarding nuclear power plant safety issues in general, at the federal NRC (Nuclear Regulatory Commission) website at: www.nrc.gov. The NRC has primary jurisdiction over nuclear facilities in the United States and it works closely with state and local emergency agencies.

Planning Zones

A series of zones has been established around each nuclear power plant to clearly identify the required activities in the event of an accident. Although three specific zones are identified, efforts to protect public health and safety and the environment are made without regard to whether particular areas are inside or outside of these zones.

- The Emergency Planning Zone is an approximate 10-mile radius around the plants. Plans for this zone are in place to protect people, property, and the environment from the effects of exposure to a radioactively contaminated plume.
- The Ingestion Pathway Zone covers an approximate 50-mile radius around the plant. In this zone, plans are in place to mitigate the effects on of radioactive contamination to agriculture, and food processing and distribution.
- Within Public Education Zones, including areas approximately 35 miles from the plants, educational materials are distributed to inform the public about nuclear power plant operations, what to expect in the event of an accident, and what plans are in place for public protection. The utilities that operate the power plants are required to publish and disseminate information for residents and transient populations.

Since 1989 the staff of the Energy Commission has represented California on two Western state groups: the Western Governors' Association WIPP Transportation Advisory Group and the Western Interstate Energy Board's High-Level Radioactive Waste Committee. Both groups work with the U.S. Department of Energy and other state regional groups to develop accident prevention and emergency response plans for major federal non-classified shipments of radioactive waste. Staff also coordinates the California Nuclear Transport Working Group that develops and updates accident prevention and emergency response plans for federal shipments of transuranic waste to the Waste Isolation Pilot Plant in New Mexico.

Opportunities for Enhanced Radiological Accident Hazard Mitigation

There are no additional opportunities identified at this time to prevent or mitigate the impacts of radiological accidents.

Comment On: Chapter 5 Section 10.8

5.10.8 Terrorism

Identifying Terrorism Hazards

Terrorism is defined in 28 CFR Section 0.85) as:

> …the unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives.
>
> The threat of terrorism comes from domestic and international terrorists. The Federal Bureau of Investigation further divides the domestic terrorism threat by orientation. These orientations are: Right Wing, Left Wing, and Special Interest. The international terrorism threat can also be divided into four groups; state sponsors, formal terrorist organizations, loosely affiliated extremists, and rogue elements.[1]

Since September 11, 2001, terrorism has become a fact of life for all Americans. Planning for response to potential terrorist incidents has long been part of California's Emergency Preparedness Planning effort. California provides a target-rich environment for terrorists, with many facilities and venues and an easy place to hide in California's

diverse population. Effective hazard mitigation that reduces risk to terrorism must be based upon technical expert information and analysis of actual terrorist events.

Source: Terrorism in the United States 1999, www.usdoj.gov

Secondary Impacts

In addition to direct life loss and property damage that may result from terrorist acts, there is also potential for widespread disruption of infrastructure including transportation networks, power supply, and water supply. These damages and disruptions could also contribute to longer-term impacts on public health and the environment.

Profiling Terrorism Hazards

Many terrorist events have occurred in California, most recently the attempted attack on the Suburban Propane tanks in Elk Grove in 1999. Worldwide there were 457 incidents or planned acts during the period from 1980 to 1999. Of these, 135 were international, and 322 domestic terrorism. The majority of these incidents (321) have been bombings."[3] However, there is also a concern for the potential of Weapons of Mass Destruction (WMD) use in future terrorist events. The use of WMDs increases the potential for mass casualties and damage.

One of the special considerations in dealing with the terrorist threat is that it is difficult to predict. One must know the minds and capabilities of various terrorists and terrorist groups. These are characteristics terrorist organizations strive to conceal. Because all terrorists are not the same, the calculation is even more difficult. Two things are clear from the perspective of hazard mitigation. The most often used weapon of terrorists is bombs, and the greatest potential for loss is from WMDs.

Sources:
CONPLAN, United States Government Interagency Domestic Terrorism Concept of Operations, January 2001;
Terrorism in the United States 1999, U.S. Department of Justice, Federal Bureau of Investigation, page 41

The use of biological agents, such as anthrax and smallpox, and chemical agents in terrorism is of concern in the United States. However, biological terrorism may not be a major threat. According to the Chemical and Biological Weapons Non-proliferation Project, Henry L. Stimson Center, there are several reasons why terrorists have refrained from and may well continue to avoid poison gas and germ agents. These include:

- Moral objections by terrorists to use these agents
- The possibility that these materials may jeopardize their own health
- Effects of use would be delayed
- Materials are difficult to obtain and use
- The possibility of offending potential supporters and group members
- Severe retaliation by governments.

It is clear that terrorists continue to prefer showy displays of appalling destruction, and want to be identified as the perpetrators of this destruction. Therefore, when combined with the fact that terrorists can still attempt to achieve their goals using conventional weapons, these reasons make biological or chemical attacks unattractive options.

Source: Ataxia—The Chemical and Biological Terrorism Thread and the U.S. Response by Amy Smithson, Director of the Chemical and Biological Weapons Nonproliferation Project, Chapter 2, page 25

Assessment of State Vulnerability and Potential Loss to Terrorism Hazards

The following state assets have been identified as potentially vulnerable to terrorism:

- Water: 34 lakes and reservoirs; 1468 dams, 140 of which have a capacity greater than 10,000 acre-feet; 701 miles of canals and pipelines; and 1595 miles of levees.
- Transportation: 50,000 lane miles of highways; 257 public use airports, 42 are certified for air carrier operations; 186,076 miles of public roads; and 12,000 bridges.
- Agriculture: 74,000 farms, and $26 billion in farming related sales since 2002.
- Finance: 6619 commercial banks with deposits of $753 billion; 562 credit unions with $115 billion in assets.
- Oil and Natural Gas: 6,000 miles of hazardous liquid pipelines; 21 refineries and 100 terminal facilities.
- Electrical Power: 500 power plants; 25,000 circuit mile "electron highway"
- Chemical: Approximately 2,500 "high risk" facilities.
- Ports: California handles nearly half of all the port traffic in the United States. More than $4.5 billion in cargo moves through the Port of San Diego every year.

The threat level to various assets can change over time. Tracking the current vulnerability of various components is achieved through use various systems, including: the National Asset Database (NADB) inventory which can be used to determine which assets, systems, or networks are nationally critical, state critical, or locally critical based on the most current risk profile; the Automated Critical Asset Management System (ACAMS) which is a secure, web-based information management tool designed to capture, store, and view critical asset data; and Sector Partnerships and Communication Networks which partner with asset owners to identify high priority sites in each sector.

The State Terrorism Threat Assessment Centers (STTAC), is a partnership of the California Department of Justice, the California Highway Patrol and the California Office of Homeland Security (OHS), and includes participation of a number of state and federal agencies. The STTAC provides statewide analysis products, information tracking, pattern analysis, geographic report linkages and other statewide intelligence products to public safety agencies throughout California. The STTAC provides direct linkage to the National Counter Terrorism Center and their National Watch List through the Homeland Security Operations Center.

Assessment of Local Vulnerability and Potential Loss to Terrorism Hazards

The state prevention strategy also created four Regional Terrorism Threat Assessment Centers (RTTACs). Their areas of responsibility mirror those of the four FBI Field offices in California, minimizing reporting conflicts, providing statewide coverage and facilitating coordination with the FBI. The RTTACs and FBI field offices maintain daily contact and information exchanges. The RTTACs maintain a regional threat assessment, and directly connect to each other and the state to share information and produce reports and other products.

At the local level law enforcement and public safety agencies designate Terrorism Liaison Officers (TLO) who are trained in the review and assessment of local reporting and in conducting outreach to other public safety agencies, critical infrastructure operators and community groups. The TLO is the local agency point of contact for all terrorism-related alerts, requests for information, warnings and other notifications from regional, state or federal homeland security agencies. Through a single web-based state terrorism website, the TLO and his agency will have access to all available terrorism alerts, notices, information and documents through a searchable database and daily information exchange with key federal, state and local agencies.

Because of the dynamic nature of the terrorist threat and the open nature of California society, all jurisdictions within California are vulnerable to terrorist attack. Vulnerability and loss assessments for California communities may be found in Local Hazard Mitigation Plans.

Current Terrorism Mitigation Efforts

The Governor's Office of Homeland Security (OHS), established by Executive Order in 2003, is California's lead state organization for the gathering and dissemination of information critical to protecting state assets, creating the state's comprehensive security strategy and designing and implementing critical state, regional and local programs.

Since 2002, OHS has administered more than $1 billion at the state, regional and local levels to significantly improve physical security at critical sites, upgrade equipment and conduct exercises. OHS has established five Terrorism Threat Assessment Centers throughout California where representatives from federal, state and local law enforcement agencies can share vital information and direct investigations and resources appropriately.

Since 9/11, California has worked closely with the Federal Department of Homeland Security to enhance protection of California's complex and interdependent critical infrastructure systems and key resources. A broad range of state and federal initiatives have been designed to nurture public and private sector coordination of security-related activities prerequisite to infrastructure protection.

On December 17, 2003, President George W. Bush signed Homeland Security Presidential Directive Number 7 (HSPD7). This directive established a national policy to identify and prioritize United States critical infrastructure and key resources and to

protect them from terrorist attacks. HSPD7 also mandated the development of strategic enhancements, tactical security improvements must be rapidly implemented to deter, mitigate, or neutralize potential attacks.

To facilitate the accomplishment of HSPD7, California's Critical Infrastructure Protection Objectives, described in the State's Homeland Security Strategy, are three-fold. California is committed to:

- Identifying and assuring the protection of those infrastructures and assets within the state deemed most critical in terms of public health and safety, governance, economic and national security, and public confidence consequences;
- Providing timely warning and assuring the protection of those infrastructure and assets that face a specific, imminent threat; and
- Assuring the protection of other infrastructures and assets that may become terrorist targets over time by pursuing specific initiatives and enabling a collaborative environment in which federal, state, and local governments and the private sector can better protect the infrastructures and assets they control.

The California Office of Homeland Security's Critical Infrastructure Protection (CIP) Section works to address emerging issues relating to the many varied aspects of infrastructure protection. The CIP Section provides a mechanism to foster relationships and facilitate coordination between public-private partnerships throughout infrastructure sectors. The Section's products and services now include:

- Protected Critical Infrastructure Information (PCII) Program. - This program is designed to encourage private industry to voluntarily share their sensitive and proprietary business information with the Federal Government
- Buffer Zone Protection Plan (BZPP) Program - The BZPP Grant Program is designed to facilitate the reduction of vulnerabilities at critical infrastructure/ key resource (CI/KR) sites. This is done by working with local first preventers to extend the protected area around a site into the surrounding community.
- Homeland Security Center of Excellence, University of Southern California (USC) - The Center for Risk and Economic Analysis of Terrorism Events (CREATE) is a federally-funded institution at USC, the nation's first center for studies of risk analysis related to the economic consequences of terrorist threats and events.

The Critical Infrastructure Protection Section serves as an essential link and advocate for local public and private infrastructure entities. In cooperation with the DHS Risk Management Division and Protective Security Advisers, CIP facilitates on-site CI/KR vulnerability assessments.

Development and implementation of planning guidelines for Commercial Vehicle Inspection Radiological/Nuclear Detection (CVI Rad/Nuc) Program Management, Preventive Radiological/Nuclear Detection (PRND) Program Management, and Underwater Terrorism Prevention Plan (UTPP) Program.

Continued collaboration with the Western Institute for Food Safety and Security (WIFFS), California Department of Food and Agriculture (CFDA), California Department of Health Services and UC Davis. The institute is built on the functional relationships of these organizations and the private sector on the challenges of preventing intentional and unintentional contamination of food.

Continued collaboration with the Bio-watch program for deployment, sustain and maintain a 24/7 operational ability to detect, mitigate, respond to, and recover from a bio-terrorism event. This early warning system will detect intentional release of selected aerosol biological agents.

Because the primary mechanism for past terrorist incidents has been bombings and because of the potential for mass casualties from a WMD terrorist event, the primary focus of the state's hazard mitigation strategy for terrorism is on mitigation measures that reduce risk from bomb blast and nuclear, biological, and chemical attacks to critical state facilities and population. Measures include:

Hardening (construction/retrofitting)
- Relocation/retrofitting of air intakes
- Ventilation system upgrade/retrofit
- Protect tower bases of bridges
- Seismic retrofitting
- Upgrade/retrofit water main system
- Blast guard window film/glazing, frames
- Egress improvements.

Barriers and Fencing
- Fencing around air intakes
- Fencing around fuel supply
- Vehicle barriers, bollards, popup gates, hydraulic barriers
- Waterfront security system
- Perimeter fencing.

Redundant systems
- Fire protection system
- Communications systems
- Information technology
- Utility (Gas/Heat/Water)
- Utility (Electric).

Security Measures
- Security systems/early warning systems
- Warning and alarms systems directly related to system protection/shut down
- Smart utility management systems on all critical services.

Planning/Studies
- Telecommunications plans
- IT disaster recovery plans
- Business continuity/resumption plans
- Intelligence gathering and sharing
- Threat, vulnerability, and risk assessments
- Evacuation plans
- Site security planning.

HM Plan/Service Continuity Plan

Seismic Study
- Retrofitting
- Interior lighting
- Exterior lighting
- Staging areas.

Secure Access & Entry Points
- Card swipe system
- Magnetometer
- Metal detectors
- Surveillance cameras & closed circuit TVs
- Personnel detection equipment
- Vehicle detection equipment
- Radar systems
- Building access system
- Motion detectors
- Replacing door locks and keys.

IT systems
- Security management system
- Building access system
- Employee identification system
- Coding protocol for sensitive records

Opportunities for Enhanced Terrorism Hazard Mitigation

Gov. Schwarzenegger signed an Executive Order to create the California Maritime Security Council. The CMSC will be comprised of top officials from OHS, U.S. Coast Guard, BT&H, National Guard, U.S. Navy and other agencies as well as Directors of California's major ports and representatives from the labor and business communities. It is anticipated that there would be no additional cost to the state for the Council.

The specific duties of the CMSC would include: identifying potential threats, improving security measures, procedures, and communications; coordinating contingency planning; coordinating information sharing; conducting training exercises; developing a statewide

maritime security strategy; and preparing to quickly recover from a catastrophic event at a California port.

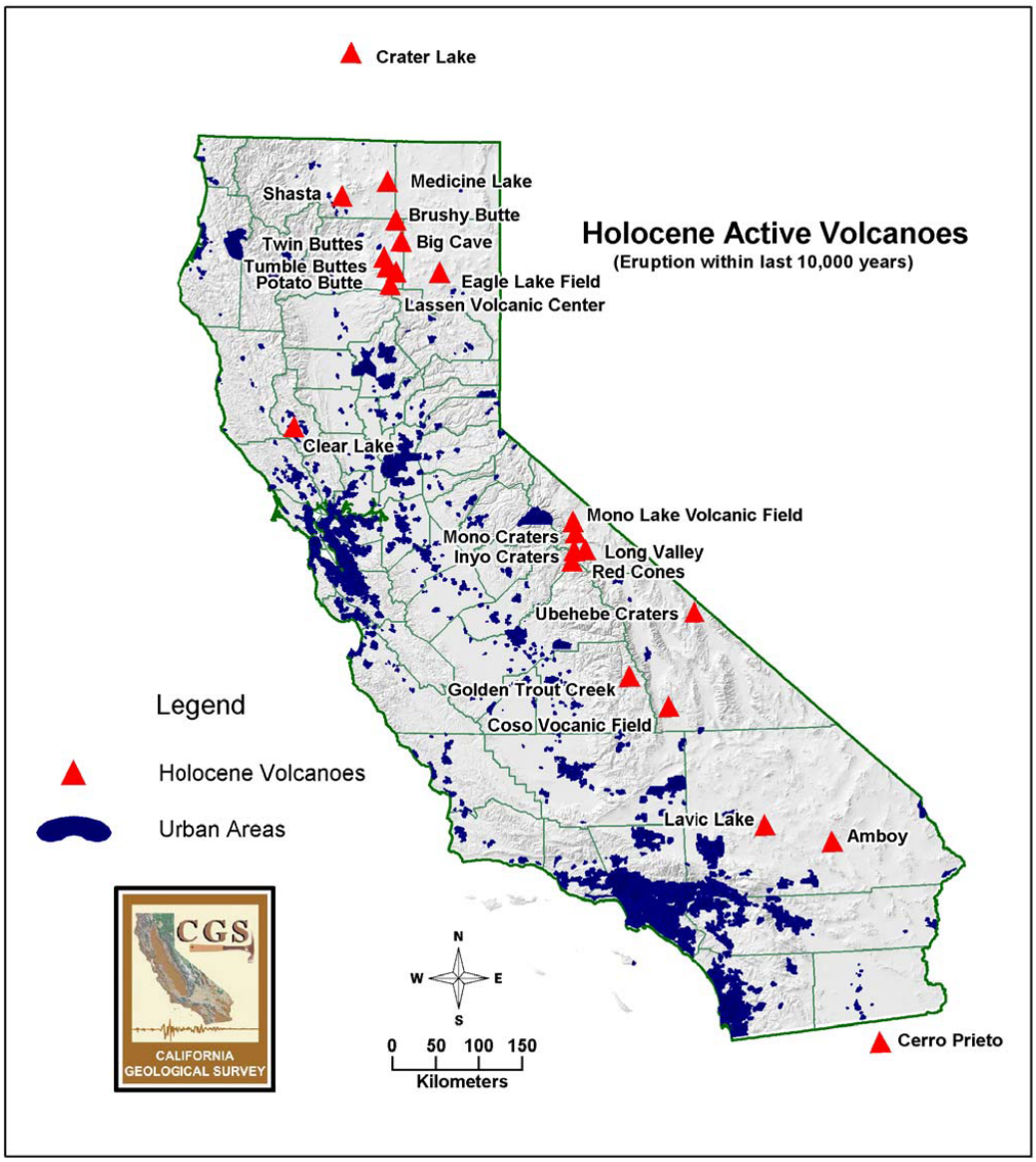
Comment On: Chapter 5 Section 10.9

5.10.9 Volcanoes

Identifying Volcano Hazards

California volcanoes are generally well removed from urban areas. Regions at greater risk of experiencing volcanic activity such as lava flows, ashfall, lahars (volcanic mudflows), and debris avalanches are limited to sparsely populated resort areas, for example, the Shasta and Mammoth Lakes regions. Map 5.10.9A illustrates the locations of Holocene active volcanoes (last 11,000 years), and urban areas in blue.

Map 5.10.9A Holocene Active Volcanoes



Profiling Volcano Hazards

Mount Shasta has erupted, on the average, at least once per 800 years during the last 10,000 years, and about once per 600 years during the last 4,500 years. The Long Valley Caldera and Mono-Inyo Craters volcanic chain has a long history of geologic activity that includes both earthquakes and volcanic eruptions. This activity is likely to continue long into the future.

Assessment of State Vulnerability and Potential Loss to Volcano Hazards

No known state vulnerability or loss assessment is available at this time.

Assessment of Local Vulnerability and Potential Loss to Volcano Hazards

Populations living near volcanoes are most vulnerable to volcanic eruptions and lava flows, although volcanic ash can travel and affect populations many miles away. While there are about 20 volcanic locations in California, only a few are active and pose a threat. The table below identifies the active volcanoes in California and those areas most vulnerable to eruption and/or ash.

Table 5.10.9A Vulnerable Jurisdictions

Volcano	Vulnerable Jurisdictions
Medicine Lake	Modoc County and the southeastern corner of Siskiyou County
Mount Shasta	Siskiyou, Shasta, and Trinity counties
Lassen Peak	Lassen County
Long Valley Caldera	Inyo and Mono counties and the northeastern corner of Fresno County

Information related to community vulnerability and loss assessments may also be found in Local Hazard Mitigation Plans.

Current Volcano Hazard Mitigation Efforts

Mitigation efforts to reduce life loss and injury from volcanoes include monitoring, warning, evacuation, and emergency public information.

Opportunities for Enhanced Volcano Hazard Mitigation

There are no additional opportunities identified at this time to prevent or mitigate the impacts of volcano hazards.

Comment On: Chapter 5 Section 11

5.11Additional Hazards Summarized in the 2007 SHMP Appendix

Air/Groundwater Pollution
Airline Crashes
Civil Disturbances
Computer Breaches
Hurricanes
Train Derailments
(See Document 5.11A in the Appendix.)

(This Page Intentionally Left Blank)

Comment On: Chapter 6

Chapter 6 - Local Hazard Mitigation Planning

Chapter Organization

6.0 Chapter Summary
6.1 Overview and Status of Local Mitigation Planning
6.1.1 California LHMP Program
6.1.2 Goal and Objectives of the LHMP Program
6.2 Analysis of Local Mitigation Plans
6.2.1 Assessment of Trends
6.2.2 LHMP Content Review and Survey Methods
6.2.3 Preparation Trends
6.2.4 Hazard and Risk Assessment Trends
6.2.5 Planning and Mitigation Trends
6.3 Local Mitigation Planning Assistance
6.3.1 Planning and Technical Assistance
6.3.2 Funding Assistance
6.4 Integration of Local and State Mitigation Efforts

Comment On: Chapter 6 Section 0

6.0 Chapter Summary

The preparation of Local Hazard Mitigation Plans (LHMPs) is a precondition for receipt of Hazard Mitigation Grant Project funds under the Disaster Mitigation Act of 2000 (DMA 2000) which also requires that states examine LHMPs as part of their state hazard mitigation plan process. FEMA has established mitigation planning requirements for local jurisdictions to meet, among other things, to demonstrate that proposed mitigation actions are based on a sound planning process that accounts for the inherent risk and capabilities of the individual communities.

The OES Hazard Mitigation Branch (HMB) administers the LHMP Program for the state. OES supports and assists local governments in the development of LHMPs and tracks their progress and effectiveness. The goal of the LHMP Program is for all local governments in California to have FEMA-approved LHMPs.

In updating the SHMP, OES undertook an evaluation of all FEMA-approved LHMPs. As of January 1, 2007, this totaled 436 plans. In addition to the LHMP analysis, OES conducted a survey of cities and counties concerning their LHMPs. The survey addressed similar areas as the LHMP analysis and included numerous open-ended questions aimed at providing OES with a better picture of the challenges faced by local jurisdictions. Thus the survey served as both a data instrument and a state-local planning feedback form.

From this analysis, several general observations of the LHMPs can be made:

- Important concepts are inconsistently defined and used from jurisdiction to jurisdiction, e.g., critical facilities, loss estimate, risk assessment;
- Hazards are inconsistently defined or categorized, e.g. landslide, tsunami;

- Hazard ranking schemes vary and make cross-jurisdiction comparison difficult;
- Methods are insufficiently documented.

The LHMPs identify the hazards that have affected or may affect the jurisdictions. The most commonly identified hazards are earthquake/seismic, wildfire, and flood. Including these three hazards, the plans identified a total of 57 distinct hazards. Only 61% of LHMPs prioritized the identified mitigation measures. The most common method (34% of plans) for prioritizing mitigation measures was the STAPLE/E method specified in the FEMA "How-to" Guides. Of concern is the observation that 17% of plans contained no explicit description of the method used to prioritize the mitigation measures. Of additional concern is that only 68% of the plans clearly linked choices about mitigations to the risk assessment. The risk is that the mitigation measures may not adequately address the specific hazards and vulnerabilities of the jurisdiction.

Based on the survey, only 15% of jurisdictions have chosen to adopt a LHMP with the Safety Element. Only 10% of the LHMPs had any linkage to the SHMP, although many of them were adopted or in preparation prior to adoption of the SHMP. Also of concern is that 47% of jurisdictions do not know how they will fund their identified mitigation measures (a majority will rely on general funds) and very few can even estimate how much money they will spend over the next five years. Over 80% cited insufficient funds and staff as constraints on implementation.

Potential actions for improving LHMP performance and consistency with state objectives include establishment by OES of consistent definitions for common concepts and hazards types as well as consistent reporting requirements, and involvement of the general public in preparing and updating LHMPs. Local jurisdictions should be encouraged to consider adopting their LHMP as part of their general plan safety element and to participate in multi-jurisdiction planning efforts reflecting regional integration. The state should distinguish mitigation measures from response and recovery measures, and ensure that LHMPs are focused on mitigation measures. State agencies should prepare guidance on how LHMPs can be developed to ensure consistency and coordination with state hazard plans. The state should address implementation of LHMPs, especially by providing assistance to local jurisdictions on how to finance their mitigation measures beyond dependency on federal grants (e.g., HMGP, PDM).

Comment On: Chapter 6 Section 1

6.1 Overview and Status of Local Mitigation Planning

The Federal Disaster Mitigation Act of 2000 (DMA 2000) requires that states examine Local Hazard Mitigation Plans (LHMPs) as part of their state hazard mitigation planning process. The intent is two-fold: to gather hazard, vulnerability, and mitigation information from the local level for use in state-level planning; and to ensure that state and local hazard mitigation planning is coordinated to the greatest extent practical.

As discussed previously in Chapter 2, DMA 2000 provided an opportunity for states, Tribes, and local governments to take a new and revitalized approach to mitigation planning. To implement the DMA 2000 planning requirements, FEMA published an Interim Final Rule in the Federal Register on February 26, 2002. This rule (44 CFR Part

201) established the mitigation planning requirements for states, Tribes, and local communities. For LHMPs, it states (§201.6):

> Local jurisdictions must also demonstrate that proposed mitigation actions are based on a sound planning process that accounts for the inherent risk and capabilities of the individual communities.

Comment On: Chapter 6 Section 1.1

6.1.1 California LHMP Program

The OES Hazard Mitigation Branch (HMB) administers the LHMP Program for the state. OES supports and assists local governments in the development of LHMPs and tracks their progress and effectiveness. It provides local governments with information on integrating hazard identification, risk assessment, risk management, and loss prevention into a comprehensive approach to hazard mitigation and helps them identify cost-effective mitigation measures and projects.

In addition to support and assistance, OES must review all LHMPs (per 44 CFR 201). Upon submission of an LHMP, HMB staff reviews the plan within 21 days for:

- Compliance with 44 CFR 201.6 using FEMA LHMP guidance documents ;
- Consistency with state mitigation goals and objectives ;
- Local hazards;
- Local capability assessment; and,
- Local mitigation measures and activities.

Once FEMA approves a LHMP, HMB staff forwards a recommendation to the State Hazard Mitigation Officer (SHMO) to update the State Plan if the LHMP identifies new hazards, project types, or significant information not already included in the State Plan. In addition, all FEMA-approved LHMPs become part of the State Plan as attachments.

Comment On: Chapter 6 Section 1.2

6.1.2 Goal and Objectives of the LHMP Program

The goal of the LHMP Program is for all local governments in California to have FEMA-approved LHMPs. Local governments must have an approved plan to be eligible for certain mitigation programs authorized under the Stafford Act.

The objectives of the LHMP Program are to:

- Integrate hazard mitigation activities in all pertinent local government programs;
- Maximize the use of hazard mitigation resources, grants, and funds to reduce the impact of future disasters at the local level;
- Maintain collaborative and cooperative relationships with local emergency managers, land use planners, and the scientific and technical communities involved in hazard mitigation;
- Provide technical assistance and guidance to local governments to improve hazard risk assessments, mitigation project identification and analysis, and the development of local hazard mitigation plans;

- Improve communications with stakeholders, legislators, and special interest groups involved in hazard mitigation;
- Continue to enhance OES Regional and Operational Area capability and coordination; and,
- Develop a statewide program of support for hazard identification and analysis and a risk-based approach to project identification, prioritization, and support for local governments.

As of January 1, 2007, the State of California had 214 cities, 27 counties, and 195 special districts with approved and adopted LHMPs. This totaled 436 plans as of January 1, 2007 (See Chart 6.1.2A).

Table 6.1.2A provides additional detail on the status of these LHMPs. LHMPs for cities and counties cover 22,958,487 people, or 60% of the California population. An additional 11% of the state's population will be covered by LHMPs currently in the review process, for a potential total of 71% of the population covered in the next few years. Many jurisdictions that are not participating in the LHMP process are smaller and more rural. OES regularly encourages local governments to develop LHMPs and expects over 150 cities and counties will submit them in the next few years.

Chart 6.1.2A Total LHMPs Approved & Adopted

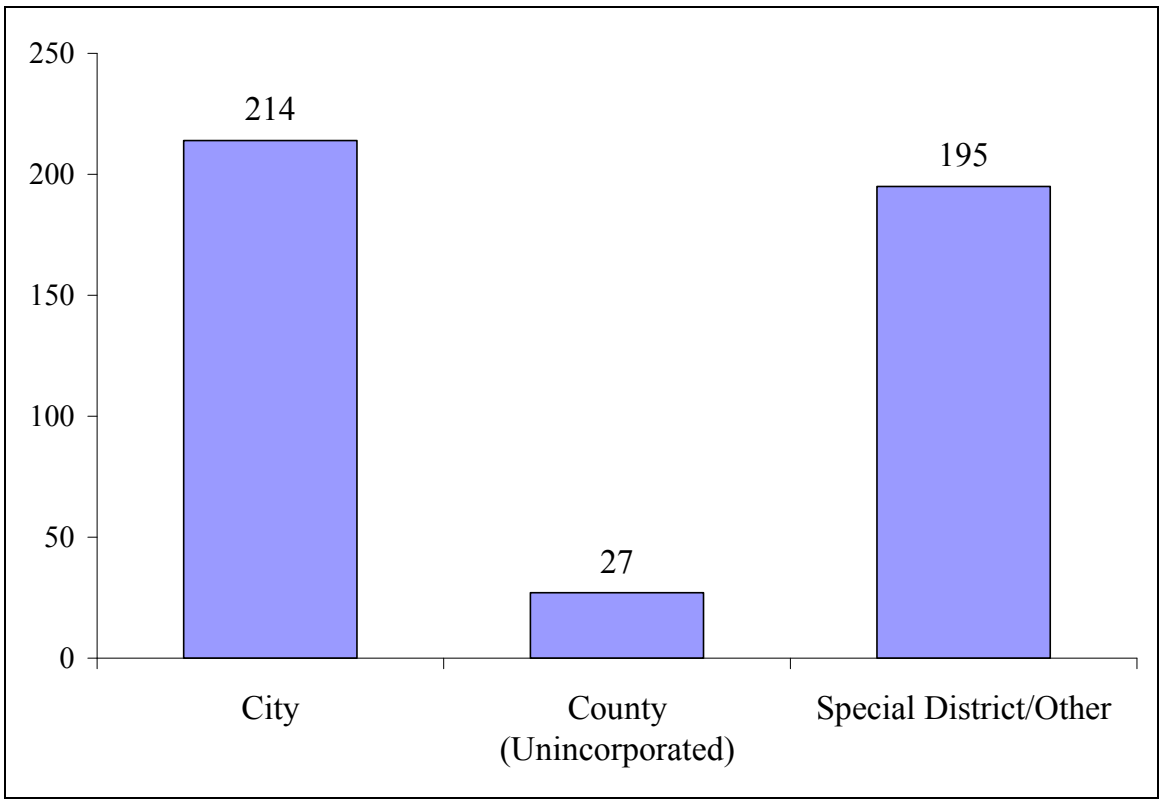


Table 6.1.2A LHMP Status

Jurisdiction Type	Total Number	Approved & Adopted Plans		In Process Plans
		Number & Pct. of Total	Population Covered & Pct. of State Total†	Population Covered & Pct. of State Total†
City	478	214 (45%)	18,241,667 (49%)	4,003,995 (11%)
County (Unincorporated)	58	27 (47%)	4,716,820 (11%)	235,251 (<1%)
Special District/ Other	4400	195 (4%)	NA	
TOTAL		436‡	22,958,487 (60%)	4,239,246 (11%)

†Based on 2006 DOF Population Estimates (State population total = 37,444,385)
‡ Estimated from California State Government Guide to Government from the League of Women Voters of California (Retrieved 6/15/07 from http://www.guidetogov.org/ca/state/overview/districts.html)

Comment On: Chapter 6 Section 2

6.2 Analysis of Local Mitigation Planning

For the update of the SHMP, OES undertook an evaluation of all approved and adopted LHMPs as of January 1, 2007. There were three objectives of the analysis. First, to describe the contents of the LHMPs based on standards from the FEMA guidance and on issues of concern to the OES update of the 2004 SHMP. Second, to identify areas of systematic deficiency in LHMP content and quality and to identify areas of systematic inconsistency with state plans and goals so that polices and programs can be developed to address these issues. Third, to assess the determinants of plan quality so that OES and FEMA can address the broader policy framework of the LHMP program.

In addition to the LHMP analysis, OES conducted a survey of cities and counties concerning their LHMPs. The survey addressed similar areas as the LHMP analysis and included numerous open-ended questions aimed at providing OES with a better picture of the challenges faced by local jurisdictions. Thus the survey served as both a data instrument and a state-local planning feedback form.

Comment On: Chapter 6 Section 2.1

6.2.1 Assessment of Trends

From this analysis, several general observations of the LHMPs can be made:

- Important concepts are inconsistently defined and used from jurisdiction to jurisdiction, e.g., critical facilities, loss estimate, risk assessment;
- Hazards are inconsistently defined or categorized, e.g. landslide, tsunami;
- Hazard ranking schemes vary and make cross-jurisdiction comparison difficult;
- Methods are insufficiently documented.

Comment On: Chapter 6 Section 2.2

6.2.2 LHMP Content Review and Survey Methods

LHMP requirements in §201.6 of the Rule apply to both local jurisdictions (cities, counties, school districts, and special districts) and Tribal governments that elect to participate in FEMA mitigation grant programs as a subapplicant or subgrantee. The requirements for these LHMPs are documented in *Multi-hazard Mitigation Planning Guidance Under the Disaster Mitigation Act of 2000* (March 2004), also known as the "Blue Book." FEMA evaluates the LHMPs using the Plan Review Crosswalk documented in the Blue Book. Each Crosswalk requirement includes separate elements. All elements of a requirement must be rated "Satisfactory" in order for the requirement to be fulfilled and receive a summary score of "Satisfactory." In addition, the Crosswalk contains optional elements that extend the normal requirements and indicate a more sophisticated plan.

The review instrument for gathering data from the LHMPs was a set of prompts based on the Plan Review Crosswalks and plan update needs. These prompts are provided in the Appendix. The review team consisted of one Cal Poly professor in City and Regional Planning and four graduate students. Data from the LHMPs is stored in quantitative and qualitative format in an MS Access database.

For the survey, all cities and counties with completed LHMPs (whether approved or still in process) were surveyed, totaling 317 jurisdictions, using a web-based survey instrument (SurveyMonkey). The survey link was e-mailed to the LHMP primary contact, as recorded by OES at the time of plan submittal, and followed-up with reminders. The response rate was 57%, thus achieving a sampling error of less that ±5% (95% confidence interval). The survey questions were designed to expand understanding of the LHMP process beyond what was documented in the LHMPs themselves. In addition, several questions were included to provide OES direct feedback on the LHMP program and OES's role.

The results detailed below are for cities and counties only, and do not include the multitude of special districts.

Comment On: Chapter 6 Section 2.3

6.2.3 Preparation Trends

This section identifies trends related to the process used by local jurisdictions for preparing LHMPs.

Local jurisdiction staff and OES were the primary initial motivators for preparation of an LHMP. From the survey, 85% of respondents reported that preparation and adoption of the LHMP was very or somewhat beneficial to the jurisdiction. Most of the plans (50%) were prepared in-house, 24% were prepared by consultants, and 18% were a mixture of the two. The plans identified a total of 18 different consulting firms, but three of those dominated in number of plans prepared. Of those jurisdictions using consultants, 20% were somewhat satisfied and 71% were very satisfied with their performance.

Departments of emergency services (i.e., police, fire, emergency management) were the lead agencies for the planning process in a vast majority of the jurisdictions with

administrative departments a distant second. Although planning and community development departments were the lead agencies on only 8% of LHMPs, they were cited as important or very important participants in the process by 86% of jurisdictions.

In 84% of jurisdictions, advisory bodies were established for preparation of the LHMPs. Over half had inclusive memberships, which may have included interest groups, other jurisdictions, and the general public (although only 28% reported including members of the general public specifically). In 75% of the jurisdictions, the public was involved in the planning process beyond the minimum requirement of public hearings. This primarily included public workshops (40%) and public outreach (44%).

Most jurisdictions looked to FEMA and OES for guidance and models on how to prepare their LHMP but they commonly looked to other jurisdictions as well. Only 38% commonly referenced their Safety Element as a source of information and 51% commonly referenced their Emergency Management Plan. Almost 1/3 of jurisdictions had Safety Elements older than 6 years which may have contributed to the lack of use.

Single and Multiple Jurisdiction Plans

Jurisdictions had the option of preparing multi-jurisdictional plans or going on their own and preparing a single jurisdiction plan. All of the multi-jurisdiction plans were organized at the county level with the exception of the Association of Bay Area Governments (ABAG) which chose a regional approach. Currently, 79% of jurisdictions that prepared LHMPs did so under the multi-jurisdictional optional; moreover, almost all were satisfied with this choice. Of these 82% expressed their belief in the effectiveness of a regional approach and 71% cited cost and time savings (efficiency). Only 14% cited OES incentives as important in their decision.

For the single jurisdiction LHMPs, most cited difficulties of collaboration or the desire to establish a unique LHMP for their reason to prepare their own LHMP. Respondents were about evenly spilt on whether they would consider participating in a multi-jurisdictional LHMP in the future.

Comment On: Chapter 6 Section 2.4

6.2.4 Hazard and Risk Assessment Trends

This section identifies preliminary trends related to hazard identification and ranking, risk assessment, and loss estimation.

Hazard Identification and Ranking

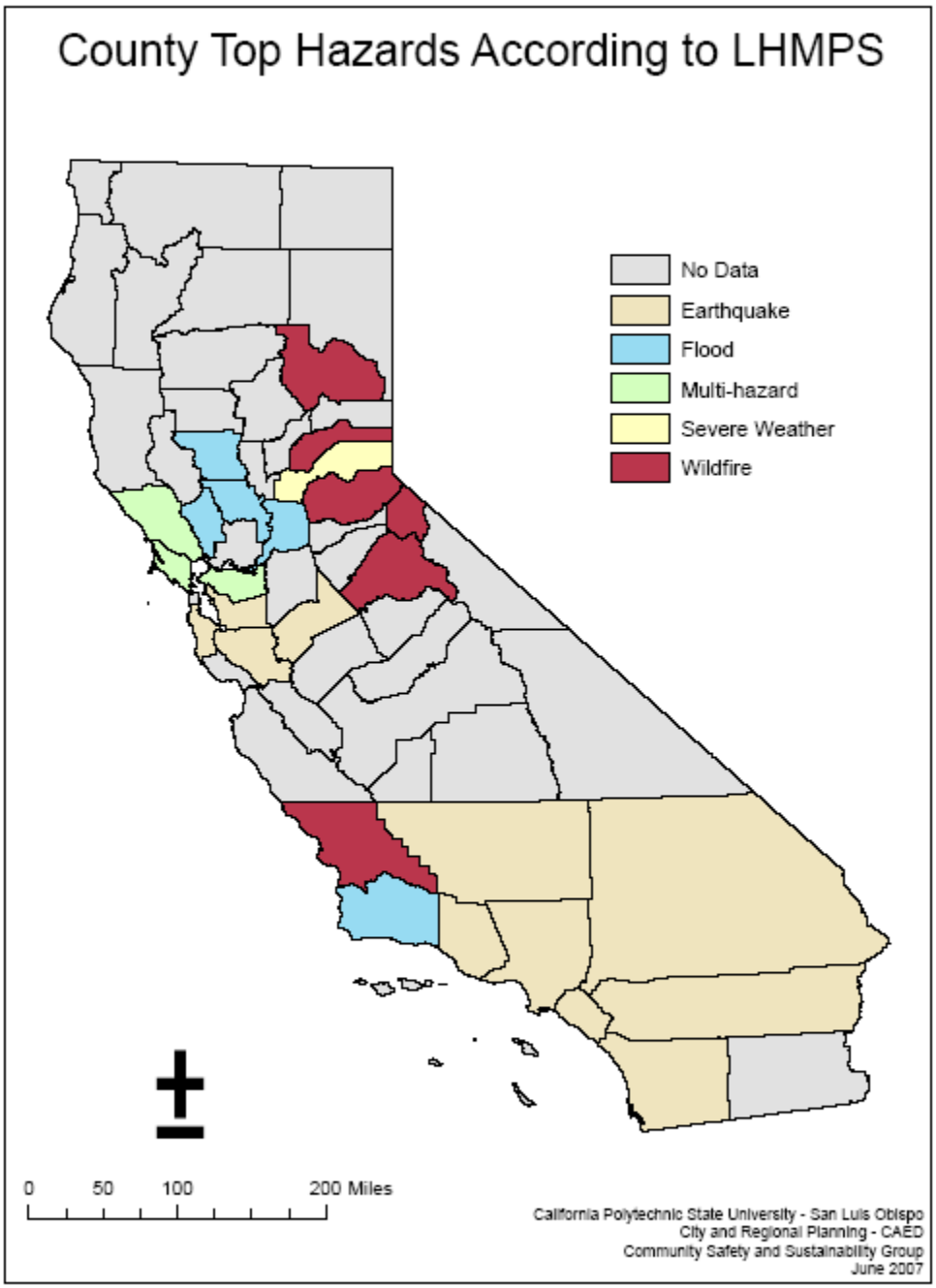
The LHMPs identify the hazards that have or may affect the jurisdiction. The most commonly identified hazards are earthquake/seismic, wildfire, and flood. Including these three hazards, the plans identified a total of 57 distinct hazards (see Table 6.2.4A on the following page).

The spatial distribution of these hazards, summarized at the county level, is shown in Map 6.2.4A. Counties with no data either do not have an approved LHMP or the data was missing/problematic from the LHMP.

Table 6.2.4A Hazards Identified in LHMPs

Agriculture	Insect Hazards
Arson/Commercial Fire	Landslides
Avalanche	Large Venue Fires
Biological/Health Emergency	Liquefaction
Blackout	Mass Casualty
Civil Unrest	Mine Safety
Coastal Erosion	Multi-Hazard
Coastal Storm	Nuclear Power Plant Accident
Dam/Levee Failure	Propane Distribution Facilities
Data Telecommunications	Radiological Incident/Accident
Drought	Severe Weather
Earth Movement	Sinkholes/Subsidence
Earthquake	Soil Hazards
Economic Disruption	Snow Storm
Energy Emergency	Special Events
Explosions	Substations
Explosive Manufacturing & Storage	Technological Failure
Extreme Heat	Terrorism
Fire	Tornados
Flooding	Toxic Pollution
Fuel Release	Transportation Incident (incl. Train & Airplane)
Geologic Hazard	Tsunami
Groundshaking	Unexplained Munitions
Groundwater Contamination	Utility Loss
HAZMAT	Volcanoes
High/Straight Line Winds	Water/Wastewater Disruption
Human Caused	Wildfire
Infrastructure (Pipeline, Aqueduct)	Windstorms
Jail/Prisons Event	

Map 6.2.4A Top Hazard Map

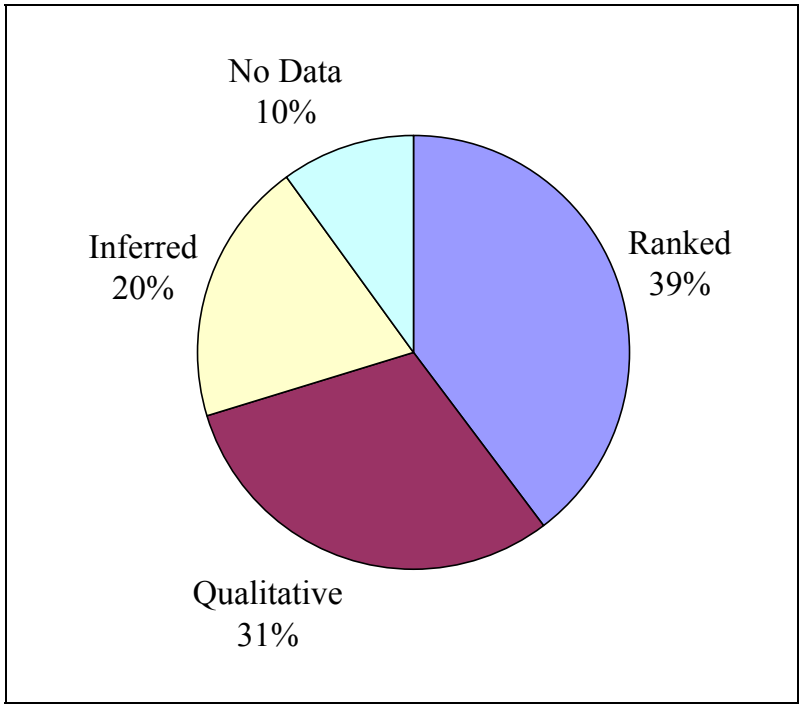


Map **6.2.**4A shows the most frequently identified hazard cited by local jurisdictions with LHMPs. "No data" indicates that data were insufficient to discern a primary hazard.

In 43% of the jurisdictions, human-caused hazards are identified despite the fact that the Rule makes this optional. Although GIS mapping is not required, 65% of jurisdictions used this technology to map the spatial extent of their hazards.

In 39% of the jurisdictions, hazards are numerically ranked (e.g., 1,2,3,…) and in 31% of the jurisdictions hazards are qualitatively ranked (e.g., highest/lowest, significant/insignificant, etc.) (see Chart 6.2.4A). Of concern are the 30% of jurisdictions that had no explicit ranking of hazards despite the requirement in the FEMA Guidelines.

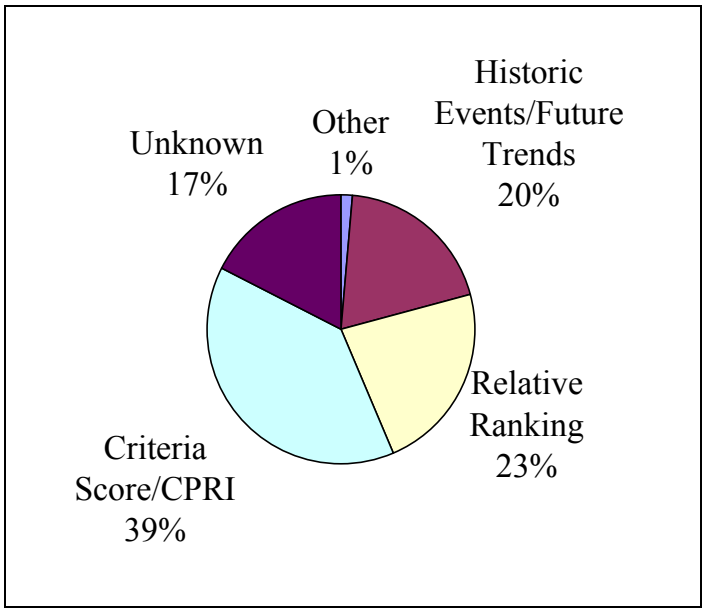
Chart 6.2.4A Hazard Ranking Type



Approaches to Hazard Ranking

Local jurisdictions used a variety of approaches to rank the hazards they identified. The most common method (30% of plans) was to assign scores to the hazards based on a set of criteria (see Chart 6.2.4B). Some of these jurisdictions specifically used the Calculated Priority Risk Index (see below). The second most common method (23% of plans) was to describe the nature and extent of the hazards and then compare these descriptions to assign relative rankings. This is an informed, but subjective process that does not permit comparison of hazard rankings to other jurisdictions or aggregation to regional or state levels. The third most common method (20% of plans) was to assess the historic occurrence of hazards and use this to extrapolate future hazard likelihood. This method does permit greater comparison with other jurisdictions but suffers from the fact that past trends are not always good future predictors.

Chart 6.2.4B Criteria Used to Assign Hazards



Calculated Priority Risk Index (CPRI)

An interesting innovation in hazard ranking is the Calculated Priority Risk Index (CPRI). The CPRI was developed in the Arizona Division of Emergency Management, Model Local Hazard Mitigation Plan (2003, November 1). The CPRI is a quantitative scoring system used to evaluate and rank hazards. The CPRI value is obtained by assigning varying degrees of risk to four categories for each hazard, and then calculating an index value based on a weighting scheme.

The four categories are: Probability, Magnitude/Severity, Warning Time, and Duration. The Model Plan cautions that "there is a high degree of subjectivity in the assigning of various levels of severity to each CPRI category for a given hazard. The user is reminded that the CPRI is only one of several "tools" that should be used to help a community understand what hazards pose the largest threat" (p. 4-7).

Risk Assessment and Loss Estimation

Local jurisdictions used a variety of approaches to conduct local risk assessments. The most common method (80% of plans) was based on the FEMA's "How-To" Guides and/or HAZUS method (59% indicated some use of HAZUS). This indicates the usefulness of technical support by FEMA in standardizing LHMP methods.

Vulnerable Critical Facilities and Structures

The results of the risk assessment described in the plans shows 84% of jurisdictions identified that they had vulnerable critical facilities and 66% of jurisdictions identified specific critical facilities. Also, 82% identified that they had vulnerable existing structures in their jurisdiction. There were many concerns about this situation described in the plans, with the potential monetary impacts being the most common. Of concern is

that almost 1/3 of jurisdictions did not address the implications of having vulnerable existing structures.

The LHMPs had a wide variety of detail and formats in reporting information on critical facilities and structures making it impossible to summarize in total or compare from one jurisdiction to the next. Given that the DMA 2000 guidance for SHMPs requires that states summarize this information, the lack of standard reporting is of concern.

Future Land Use and Development Trends

Although LHMP guidance from DMA 2000 requires that jurisdictions identify future land use and development trends and how they affect hazard and risk assessment, 83% of plans contained no such analysis. This is of concern because land use planning and regulation is a significant component of hazard mitigation. Without this analysis these tools may not be effectively employed.

Comment On: Chapter 6 Section 2.5

6.2.5 Planning and Mitigation Trends

This section identifies trends related to linkage to other planning efforts and the development of mitigation measures.

All jurisdictions identified mitigation measures per the federal requirement. Table 6.2.5A shows the percentage of plans that identified mitigation measures in the specified categories. These categories are based on OES's grants management database categories for comparison. There are several notable observations from these data.

First, 67% of plans identified actions/projects that are not mitigation measures and are more appropriately characterized as response and recovery measures in most cases.

Second, 62% of plans identified "Planning & Mapping" mitigation measures. Moreover, 57% of plans contained policies that addressed the spatial dimension of risk through land use control.

Third, few plans identified retrofit or elevation as priority mitigation measures. In addition, jurisdictions indicated that only 33% of these mitigation measures are new measures prompted by DMA 2000 and preparation of the LHMPs.

Table 6.2.5A Percentage of Plans Identifying Specified Mitigation Measures

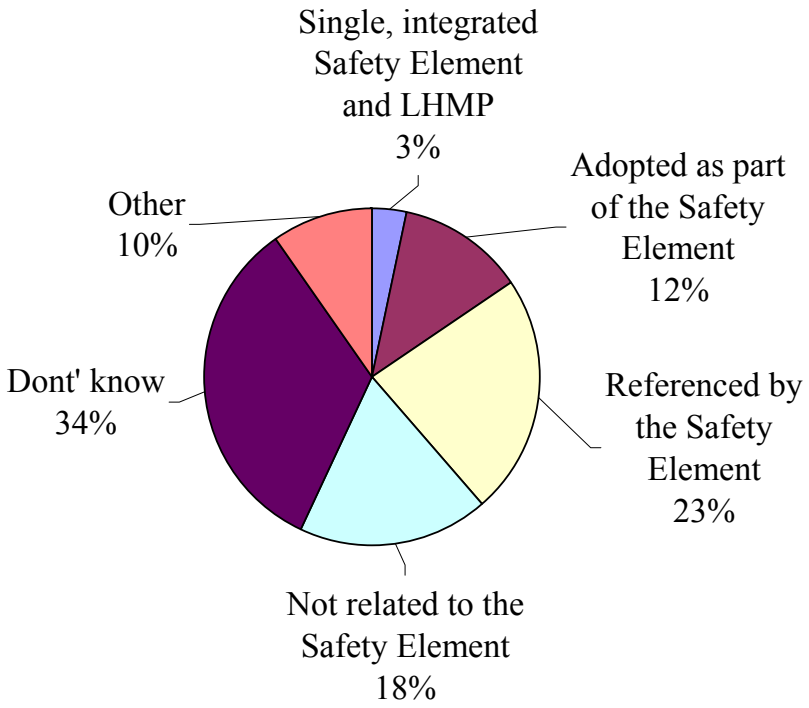
Acquisition	1%
Education/Information	56%
Elevation	1%
Equipment	7%
Erosion Control	1%
Flood Control	19%
Management Costs	3%
Non-Mitigation	67%
Non-structural Retrofit	4%
Other	13%
Planning/Mapping	62%
Relocation	2%
Structural Retrofit	20%
Supporting Measures	3%
Technology Development	11%
Vegetation Management	8%
Warning System	8%

Only 61% of LHMPs prioritized the identified mitigation measures. The most common method (34% of plans) for prioritizing mitigation measures was the STAPLE/E method specified in the FEMA "How-to" Guides; this is consistent with the use of these Guides observed for hazard and risk assessment trends. Of concern is the observation that 17% of plans contained no explicit description of the method used to prioritize the mitigation measures. Of additional concern is that only 68% of the plans clearly linked choices about mitigations to the risk assessment. The risk is that the mitigation measures may not adequately address the specific hazards and vulnerabilities of the jurisdiction.

Linkages to the Local Safety Element

California AB 2140, authorizes a city or county to adopt a LHMP with the Safety Element of its general plan, and creates incentives for local governments to do so. Specifically, they would become eligible for additional financial assistance in the event of a federally declared disaster. Based on the survey, only 15% of jurisdictions have chosen to adopt a LHMP with the Safety Element (see Chart 6.2.5A).

Chart 6.2.5A Integration of LHMP with the Safety Element



Linkages to the SHMP and Other State, & Federal Plans

Only 10% of the LHMPs had any linkage to the SHMP, but many of them where adopted or in preparation prior to adoption of the SHMP. Table 6.2.5B shows a variety of other state and federal plans, programs, and agencies and the percentage of LHMPs that had a link to them. Most LHMPs had no external links; specifically, 77% of LHMPs had no links to the state level.

Table 6.2.5B Integration of LHMP with the Safety Element

State	
CDF	21%
DWR	12%
FireWise	15%
State Building Code	16%
Federal	
Disaster Resistant Communities Initiative	0%
FEMA/NFIP/CRS/FIRM	41%
National Incident Management System (NIMS)	0%
USFS Forest Management Plans	0%

Implementation Constraints

Of concern is that 47% of jurisdictions do not know how they will fund their identified mitigation measures (a majority will rely on general funds) and very few can even estimate how much money they will spend over the next five years. Over 80% cited insufficient funds and staff as constraints on implementation. In addition, 25% cited lack of technical expertise as a constraint. The findings suggest that a focus on LHMP preparation is not enough to ensure hazard mitigation occurs at the local level.

Comment On: Chapter 6 Section 3

6.3 Local Mitigation Planning Assistance

This section describes the state's local hazard mitigation planning support efforts as required by 44 CFR 201.

Editor's Note – To Be Developed

Comment On: Chapter 6 Section 3.1

6.3.1 Planning and Technical Assistance

The table below describes the four parts of the technical assistance program the state has developed to assist local governments in preparing LHMPs (see Table 6.3.1A).

Table 6.3.1A Outline of State Technical Assistance for Local Governments

Part	Function
1	Identify and communicate with local governments to promote local hazard evaluation and mitigation planning and to assist in developing local hazard mitigation plans.
2	Provide technical assistance, guidance, resources, and tools to local governments for all aspects of local hazard mitigation planning.
3	Provide specialized training and exercises to state agency staff and local governments concerning local hazard mitigation planning and the LHMP Program.
4	Maintain an ongoing project tracking system to track the hazard mitigation actions, plans, and projects of local governments.

Based on the survey, only 10% of jurisdictions were not satisfied with OES's support and training assistance, but 15% did not consult OES.

Comment On: Chapter 6 Section 3.2

6.3.2 Funding Assistance

Editor's Note – To Be Added

Comment On: Chapter 6 Section 4

6.4 Integration of Local and State Mitigation Efforts

Based on the LHMP analysis and OESs experience with administerisng the LHMP program, there are potential objectives for improving LHMP performance and consistency with state needs and objectives.

1. The state should establish consistent definitions for common concepts, such as critical facilities, loss estimate, and risk assessment.

2. The state should establish consistent definitions and categories for hazards types.

3. The state should ensure that all LHMPs contain a numerical hazard ranking. The Calculated Priority Risk Index (CPRI) method is a potential common method that could be required.

4. The state should establish consistent reporting requirements for type and number of critical facilities and structures at risk.

5. The process of preparing and updating LHMPs should seek to incorporate members of the general public

6. Local jurisdictions should be encouraged to take advantage of the financial benefits of AB2140 by either creating integrated LHMP-Safety Elements or by adopting their LHMP as an annex to their Safety Element.

7. Local jurisdictions should also be encouraged to consider participating in multi-jurisdiction planning efforts. Multi-jurisdictional plans should reflect regional integration and cooperation while also ensuring the individual jurisdictions address their unique hazards and vulnerabilities and their unique opportunities and constraints.

8. The state should clarify mitigation measures from response and recovery measures and ensure that LHMPs are focused on mitigation measures.

9. The state should require that each identified mitigation measure be assigned to a standard category—possibly based on OES's grants management database categories—so that the state can effectively determine the needs of the state as a whole. In addition, each mitigation measure should have an estimated cost.

10. State agencies should prepare guidance on how LHMPs can be developed to ensure consistency and coordination of other state hazard plans.

The state should address implementation of LHMPs, especially by providing assistance to local jurisdictions on how to finance their mitigation measures beyond dependency on federal grant (e.g., HMGP, PDM)..

Comment On: Chapter 7

Chapter 7 - Funding Sources and Capability

Chapter Organization

7.0 Chapter Summary
7.1 Federal Funding Sources
7.2 State Funding Sources
  7.2.1 Earthquake Hazard Mitigation Funding
  7.2.2 Flood Hazard Mitigation Funding
  7.2.3 Wildfire Hazard Mitigation Funding
  7.2.4 Other State Hazard Mitigation Funding
7.3 Local Funding Sources
7.4 Alternative Funding Sources

Comment On: Chapter 7 Section 0

7.0 Chapter Summary

Introduction

Three primary sources fund California's hazard mitigation efforts: the federal programs; the combined state general fund and bond funds; and local funding. Federal funding sources are presented in Section 7.1; State Funding Capacity in Section 7.2, Local Capacity in Section 7.3; and Alternative Funding Sources in Section 7.4. On a dollar-for-dollar basis, the State of California provides the majority of funds through its general fund and voter approved bond issues that are directed to mitigation of specific types of hazards. State agencies also partner with federal agencies for funds to conduct mitigation-related projects. California demonstrates financial capacity through voter approved bond issues to reduce risks and state general funds. Local governments have invested over $50 million since 2000 in providing 25% local matching funds to federal and state mitigation project grant funds. Private support also exists through local companies, utility groups and foundations, but on a smaller basis than that of federal or state efforts.

Comment On: Chapter 7 Section 1

7.1 Federal Funding Sources

Federal assistance for mitigation efforts is available through many programs and agencies. These include: FEMA, EPA, NOAA, U.S. Army Corps of Engineers, HUD, the Bureau of Land Management, U.S. Department of Agriculture and various other health, economic and research agencies. California utilizes many of these programs as part of its comprehensive mitigation efforts. The following tables (7.1A – 7.1J) provide a brief description of Federal mitigation funding sources and technical assistance programs that are currently available through each agency. For further contact information and projected expenditures visit the website listed for the particular program of interest.

Federal Emergency Management Agency (FEMA)

FEMA provides a multiplicity of funding opportunities for mitigation, disaster relief, education and training. Primary federal FEMA funding sources include Pre-Disaster Mitigation (PDM) grants, Hazard Mitigation Grant Program (HMGP) grants, and Flood

Mitigation Assistance (FMA) grants, as described in Chapter 2. Together such grants have totaled over $82 million since 2004. Table 7.1A below identifies the extent of each of these FEMA mitigation support programs from 2004-2006.

Table 7.1A Major FEMA Fund Groups for California, 2004-2006

OES Obligated FEMA Mitigation Program Funds, 2000-2006

Program	Obligated Funds
PDM	$64,692,885
HMGP	$14,921,814
FMA	$2,949,617
Total	$82,564,316

Primary FEMA hazard mitigation programs are outlined in Table 7.1B below. Additonal details on other FEMA program resources can be found in the Appendix Table 7.1K.

Table 7.1B Major FEMA Mitigation Funding Sources

Program	Details	Criteria
Flood Mitigation Assistance Program (FMA)	Provides funding to implement measures to reduce or eliminate the long-term risk of flood damage. http://www.fema.gov/government/grant/fma/index.shtm	States and localities
Hazard Mitigation Grant Program (HMGP)	Provides grants to implement long-term hazard mitigation measures after a major disaster declaration. http://www.fema.gov/government/grant/hmgp/index.shtm	Open
National Flood Insurance Program (NFIP)	Enables property owners to purchase insurance as a protection against flood losses in exchange for State and community floodplain management regulations that reduce future flood damages. http://www.fema.gov/business/nfip/	States, localities, and individuals
Pre-Disaster Mitigation Program (PDM)	Provides funds for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event. http://www.fema.gov/government/grant/pdm/index.shtm	States, localities and tribal governments
Fire Management Assistance Grant Program	Assistance for the mitigation, management, and control of fires on publicly or privately owned forests or grasslands. http://www.fema.gov/government/grant/fmagp/index.shtm	States, local and tribal governments

Environmental Protection Agency

The EPA makes available funds for water management and wetlands protection programs that help mitigate against future costs associated with hazard damage.

Table 7.1C EPA Mitigation Funding Sources

Program	Details	Criteria
Clean Water Act Section 319 Grants	Grants for water source management programs including technical assistance, financial assistance, education, training, technology transfer, demonstration projects, and regulation. http://www.epa.gov/OWOW/NPS/cwact.html	Funds are provided only to designated state and tribal agencies
Clean Water State Revolving Funds	State grants to capitalize loan funds. States make loans to communities, individuals, and others for high-priority water-quality activities. http://www.epa.gov/owow/wetlands/initiative/srf.html	States and Puerto Rico
Wetland Program Development Grants	Funds for projects that promote research, investigations, experiments, training, demonstrations, surveys, and studies relating to the causes, effects, extent, prevention, reduction, and elimination of water pollution. http://www.epa.gov/owow/wetlands/initiative/#financial	Open

National Oceanic and Atmosphere Administration (NOAA)

NOAA is the major source for mitigation funding related to coastal zone management and other coastal protection projects.

Table 7.1D NOAA Mitigation Funding Sources

Program	Details	Criteria
Coastal Services Center Cooperative Agreements	Funds for coastal wetlands management and protection, natural hazards management, public access improvement, reduction of marine debris, special area management planning, and ocean resource planning. http://www.csc.noaa.gov/funding/	May only be used to implement and enhance the states' approved Coastal Zone Management programs
Coastal Services Center Grant Opportunities	Formula and program enhancement grants for implementing and enhancing Coastal Zone Management programs that have been approved by the Secretary of Commerce. http://www.csc.noaa.gov/funding/	Formula grants require non-federal match
Coastal Zone Management Program	The Office of Ocean and Coastal Resource Management (OCRM) provides federal funding and technical assistance to better manage our coastal resources. http://coastalmanagement.noaa.gov/funding/welcome.html	Funding is reserved for the nation's 34 state and territory Coastal Zone Management Programs

U.S. Army Corps of Engineers (USACE) and U.S. Fish and Wildlife Service

USACE and the U.S. Fish and Wildlife Service offer funding and technical support for programs designed to protect floodplains, wetlands and watersheds.

Table 7.1E Funding and Technical Assistance for Wetlands and Floodplains

Agency	Program	Details	Criteria
USACE	Planning Assistance to States (PAS)	Fund plans for the development and conservation of water resources; dam safety, flood damage reduction, and floodplain management. http://www.usace.army.mil/cw/cecw-cp/library/pas.pdf	50 percent non-federal match
USACE	Flood Plain Managemen t Services (FPMS)	Technical support for effective floodplain management. http://www.usace.army.mil/cw/cecw-cp/library/fpms.pdf	Open
USACE	USACE Environmen tal Laboratory	Guidance for implementing environmental programs such as ecosystem restoration and reuse of dredged materials. http://el.erdc.usace.army.mil/index.cfm	Open
U.S. Fish & Wildlife Service	Coastal Wetlands Conservatio n Grant Program	Matching grants to States for acquisition, restoration, management or enhancement of coastal wetlands. http://ecos.fws.gov/coastal_grants/viewContent.do?viewPage=home	States only. Federal share is 50 percent
U.S. Fish & Wildlife Service	Partners for Fish and Wildlife Program	Program that provides financial and technical assistance to private landowners interested in restoring degraded wildlife habitat. http://ecos.fws.gov/partners/viewContent.do?viewPage=home	Funding for volunteer-based programs

Housing and Urban Development

The Community Development Block Grants (CDBG) administered by HUD can be used to fund hazard mitigation projects.

Table 7.1F HUD Mitigation Funding Sources

Program	Details	Criteria
Community Development Block Grants (CDBG)	Grants to develop viable communities, principally for low and moderate income persons. CDBG funds available through Disaster Recovery Initiative. http://www.hud.gov/offices/cpd/communitydevelopment/programs/	Disaster funds contingent upon Presidential disaster declaration
Disaster Recovery Assistance	Disaster relief and recovery assistance in the form of special mortgage financing for rehabilitation of impacted homes. http://www.hud.gov/offices/cpd/communitydevelopment/programs/dri/assistance.cfm	Individuals

Bureau of Land Management

The Bureau of Land Management (BLM) has two technical assistance programs focused on fire mitigation strategies at the community level.

Table 7.1G Bureau of Land Management Mitigation Funding Sources

Program	Details	Criteria
Community Assistance and Protection Program	Focuses on mitigation/prevention, education, and outreach. National Fire Prevention and Education teams are sent to areas across the country at-risk for wildland fire to work with local residents. http://www.blm.gov/nifc/st/en/prog/fire/community_assistance.html	Open
Firewise Communities Program	Effort to involve homeowners, community leaders, planners, developers, and others in the effort to protect people, property, and natural resources from the risk of wildland fire before a fire starts. http://www.firewise.org/	Open

U.S. Department of Agriculture

There are multiple mitigation funding and technical assistance opportunities available from the USDA and its various sub-agencies: the Farm Service Agency, Forest Service, and Natural Resources Conservation Service.

Table 7.1H U.S. Department of Agriculture Mitigation Funding Sources

Agency	Program	Details	Criteria
USDA	Smith-Lever Special Needs Funding	Grants to State Extension Services at 1862 Land-Grant Institutions to support education-based approaches to addressing emergency preparedness and disasters. http://www.csrees.usda.gov/funding/rfas/smith_lever.html	Population under 20,000
USDA	Community Facilities Guaranteed Loan Program	This program provides an incentive for commercial lending that will develop essential community facilities, such as fire stations, police stations, and other public buildings. http://www.rurdev.usda.gov/rhs/cf/cp.htm	Population under 20,000
USDA	Community Facilities Direct Loans	Loans for essential community facilities. http://www.rurdev.usda.gov/rhs/cf/cp.htm	Population of less than 20,000
USDA	Community Facilities Direct Grants	Grants to develop essential community facilities. http://www.rurdev.usda.gov/rhs/cf/cp.htm	Population of less than 20,000
USDA Farm Service Agency	Farm Service Agency Disaster Assistance Programs	Emergency funding and technical assistance for farmers and ranchers to rehabilitate farmland and livestock damaged by natural disasters. http://www.fsa.usda.gov/	Farmers and ranchers
USDA Forest Service	National Fire Plan	Funding for organizing, training, and equipping fire districts through Volunteer, State and Rural Fire Assistance programs. Technical assistance for fire related mitigation. http://www.fireplan.gov/	Program specific

USDA Forest Service	Economic Action Program	Funds for preparation of Firesafe plans to reduce fire hazards and utilize byproducts of fuels management activities in a value added fashion. http://www.fs.fed.us/spf/coop/programs/eap/	80% of total cost of project may be covered
USDA Natural Resources Conservation Service	Emergency Watershed Protection Support Services	Funds for implementing emergency measures in watersheds in order to relieve imminent hazards to life and property created by a natural disaster. http://www.nrcs.usda.gov/programs/ewp/	Open
USDA Natural Resources Conservation Service	Watershed Protection and Flood Prevention	Funds for soil conservation; flood prevention; conservation, development, utilization and disposal of water; and conservation and proper utilization of land. http://www.nrcs.usda.gov/programs/watershed/index.html	Open

Health and Economic Agencies

Alternative mitigation programs can be found through health and economic agencies that provide loans and grants aimed primarily at disaster relief.

Table 7.1I Federal Loans and Grants for Disaster Relief

Agency	Program	Details	Criteria
Department of Health & Human Services	Disaster Assistance for State Units on Aging (SUAs)	Provide disaster relief funds to those SUAs and tribal organizations who are currently receiving a grant under Title VI of the Older Americans Act. http://www.aoa.gov/doingbus/fundopp/fundopp.asp	Areas designated in a Disaster Declaration issued by the President.
Economic Development Administratio n (EDA)	Economic Development Administration Investment Programs	Grants that support public works, economic adjustment assistance and planning. Certain funds allocated for locations recently hit by major disasters. http://www.eda.gov/AboutEDA/Programs.xml	The maximum investment rate shall not exceed 50 percent of the project cost.
U.S. Small Business Administratio n	Small Business Administration Loan Program	Low-interest, fixed rate loans to small businesses for the purpose of implementing mitigation measures. Also available for disaster damaged property. http://www.sba.gov/services/financialassistance/index.html	Must meet SBA approved credit rating.

Research Agencies

The United States Geological Survey (USGS) and the National Science Foundation (NSF) provide grant money for hazard mitigation-related research efforts.

Table 7.1J Hazard Mitigation Research Grants

Agency	Program	Details	Criteria
National Science Foundation (NSF)	Decision, Risk and Management Sciences Program (DRMS)	Grants for small-scale, exploratory, high-risk research having a severe urgency with regard to natural or anthropogenic disasters and similar unanticipated events. http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5423&org=SES	Open
U.S. Geological Survey (USGS)	National Earthquake Hazards Reduction Program	The purpose of NEHRP is to provide products for earthquake loss reduction to the public and private sectors by carrying out research on earthquake occurrence and effects. http://www.usgs.gov/contracts/nehrp/	Community with a population under 20,000.

In addition, it is highly recommended that all funding sources listed in this chapter be evaluated in conjunction with those listed in The Catalog of Federal Domestic Assistance (CFDA) at www.cfda.org, under the sub-category "Disaster Prevention and Relief."

7.2 State Funding

California is fortunate that its legislature and citizens recognize the need for safer and more disaster-resilient communities. Projects that support the Multi-Hazard Plan goals and objectives are embedded in the budget and programs of many departments. In 2006 the California Budget Act included $214 million for preparedness and emergency measures. A sizeable portion of these funds are mitigation-directed or mitigation related. The following is a brief summary of each of these programs sorted by primary impact hazard type.

7.2.1 Earthquake Hazard Mitigation Funding

Seismic mitigation is addressed by a series of state agencies and commissions. Some agencies focus on structural measures (such as Caltrans) while others focus on nonstructural measures (such as the Seismic Safety Commission).

California Department of Transportation (Caltrans)

Since the 1971 San Fernando earthquake struck the Los Angeles area, Caltrans has been seismically retrofitting bridges throughout the state. A total of 1,235 city- and county-owned bridges have been identified as candidates for seismic retrofit. Caltrans is the lead agency and operates the Seismic Local Bridge Retrofit Program. Seven hundred of the 1,235 bridges have been retrofitted and the remaining 535 are scheduled for work through 2013. A total of $1.2 billion dollars has been spent thus far and an estimated $625 million will be spent on the remainder.

Between 2005-2007 Caltrans allocated $64.8 million for retrofit (from the Retrofit Bond Fund of 1996). The local match funding for these retrofits will be provided through the

Highway Safety, Traffic Reduction, Air Quality, and Port Security Bond of 2006 (Proposition 1B bond) funds.

In 2006 $10 million was allocated to the Environmental Enhancement and Mitigation Program Fund. The Toll Bridge and Motor Vehicle Fuel Tax programs provide funds for state toll bridge retrofits. These amounts vary annually.

The toll bridge seismic retrofit program consists of six state-owned retrofits and one replacement span (east span of the Oakland Bay Bridge) at a cost of $8.7 billion. The majority of these funds are generated though increased bridge tolls authorized by the state legislature.

Table 7.2.1A summarizes some of Caltrans future mitigation funding commitments through 2030.

Table 7.2.1A Seismic Retrofit for Transportation Infrastructure 2007-2030

Program or Project	Amount
State-owned Toll Bridge Retrofit/Replacements	$4,513,000,000
State-owned Non-Toll Bridge Retrofit/Replacements	613,000,000
Local Bridge Seismic Retrofit	616,000,000
Local-owned Toll Bridge	$60,000,000
Bart Retrofit Program	$1,307,000,000

Source: Caltrans

California Seismic Safety Commission

The Alfred E. Alquist Seismic Safety Commission is funded by fees paid by insurance companies that sell policies in California. It has an annual budget of approximately 41.1 million with 20 volunteer Commissioners and 6 staff members. It manages programs for public education, preparedness, mitigation, and research to improve earthquake safety. Its efforts are also funded in party by a $6.7 million insurance claim settlement resulting from the Northridge Earthquake.

California Department of Insurance (CDI)

CDI administers the $2.9 million Earthquake Grants and Loans Program, which provides money to retrofit homes against potential earthquake damage. The sunset date of the program has been extended from December 1, 2004 to July 1, 2007.

Comment On: Chapter 7 Section 2.2

7.2.2 Flood Hazard Mitigation Funding

California is making significant and continue investments in mitigating flood risks. Funding for this comes from the state general fund and from large bond issues voted on by the citizens of the state.

General Fund

In general, state flood management programs are funded from the General Fund and voter approved bonds. Since 2000, annual state funding for flood management has varied from

about $60 million (2002–03) to about $270 million (2000–01). In addition, local governments, including flood control districts and other public water agencies, operate their own flood management programs and projects. Funding for these local programs comes from various sources, including property assessments and state financial assistance.

Proposition 1E

In addition to the General Fund, bonds are an important source of state funding for flood hazard mitigation projects. Among the largest is the voter approved $4.09 billion Proposition 1E (the Disaster Preparedness and Flood Prevention Bond Act of 2006), to fund flood management projects, including repairs and improvements to levees, weirs, bypasses, and other flood control facilities throughout the state. Proposition 1E allocates $3 billion to repair and improve state-federal facilities that are part of the *State Plan of Flood Control for the Central Valley* and to reduce the risks of levee failure in the Sacramento-San Joaquin Delta.

Of these funds, a minimum of $1 billion will be allocated to high level flood protection for urban areas protected by state-federal project levees, $300 million to design flood level protection to non-urban areas protected by state-federal project levees, and a minimum of $500 million to reduce the risks of levee failure in the Sacramento-San Joaquin Delta. Also allocated is $500 million for State Flood Control Subventions and $300 million in Stormwater Flood Management Grants. Table 7.2.2A summarizes the purpose of allocated Proposition 1E dollars.

Table 7.2.2A Proposition 1E Uses of Bond Funds

Bond Project Allocation	Amount
State Central Valley flood control system repairs and improvements; Delta levee repairs and maintenance.	$3,000,000,000
Flood control subventions (local projects outside the Central Valley).	$500,000,000
Stormwater flood management (grants for projects outside the Central Valley).	$300,000,000
Flood protection corridors and bypasses; floodplain mapping.	$290,000,000
Total	$4,090,000,000

Source: California Legislative Analyst's Office

Proposition 84

The voter approved $5.4 billion Proposition 84 (the Safe Water Quality, Supply, Flood Control, River and Coastal Protection Act of 2006) will allocate about $1.2 billion in additional funding beyond Proposition 1E for flood control projects including the Delta Levee Program, the State Flood Control Subventions Program, and Floodplain evaluation and delineations (Table 7.2.2B). Local agencies have already proposed mitigation and levee strengthening projects in the amount of $204 million related to funds from Propositions 1E and 84.

Table 7.2.2B Proposition 84 Uses of Bond Funds Related to Mitigation

Bond Project Allocation	Amount
State flood control projects - evaluation, system improvements, flood corridor program	$315,000,000
Flood control projects in the Delta	$275,000,000
Local flood control subventions (outside the Central Valley flood control system).	$180,000,000
Floodplain mapping and assistance for local land use planning.	$30,000,000
Protection of various coastal areas and watersheds.	$360,000,000
Total	$1,160,000,000

Source: California Legislative Analyst's Office

Federal Flood Subventions Participation

The State of California has provided funds directing state agencies to match funds provided under federal programs in order not to lose such opportunities. For example, the California Budget Act of 2006 included $100,000,000 for local agency assistance with the provision that The Department of Water Resources would give priority to processing $10,000,000 in claims from the Napa County Flood Control and Water Conservation District to avoid delays that could lead to the loss of federal funds or create otherwise avoidable flood risks along the Napa River. This priority will apply during the 2006-07 fiscal year in recognition of the extensive 2006 flood damage.

Proposition 40

The voter-approved $2.6 billion Proposition 40, (the California Clean Water, Clean Air, Safe Neighborhood Parks, and Coastal Protection Act of 2002) was passed to protect natural resources in California. $1.5 billion was allocated to support the CALFED Bay-Delta Program, which protects coastal zones and funds flood mitigation efforts.

Proposition 50

Proposition 50, also known as the Water Security, Clean Drinking Water, Coastal and Beach Protection Act of 2002, provided $825 million of bond funds for a variety of water projects including development of river parkways and improved security for state, local, and regional water systems. Eligible applicants have included local agencies, educational institutions, non-profit organizations, and Native American tribal governments, together with state and federal agencies.

California Water Resources Control Board

The Water Resources Control Board has three programs for funding hazard mitigation projects: the Watershed Protection Program, the Southern California Integrated Watershed Program, and the Lake Elsinore and San Jacinto Watershed Program.

1. Watershed Protection Program. This program provides grants to municipalities, local agencies, or non-profit organizations to develop local watershed management plans and/or implement projects consistent with watershed plans. Sixty percent of the funds

are allocated to projects in Los Angeles, Orange, Riverside, Ventura, San Bernardino, and San Diego Counties. Forty percent of the funds are allocated to projects in the remaining counties. A total of $90 million is allocated for the program, $35 million of which is set aside for grants to small communities.

2. Southern California Integrated Watershed Program. This program provides local assistance to the Santa Ana Watershed Project Authority for projects in the Santa Ana watershed such as: basin water banking; contaminant and salt removal; removal of non-native plants; the creation of wetlands; water conservation efficiency; storm water management; and planning and implementation of a flood control program to protect agricultural operations and adjacent property and to assist in abating the effects of waste discharges into the water supply.

3. Lake Elsinore and San Jacinto Watershed Program. This program provides $15 million in local funding for watershed management and flood control projects consistent with the Lake Elsinore Management Plan that preserve agricultural land, protect wildlife habitat, protect and enhance recreation resources, and improve lake water quality.

Department of Water Resources (DWR)

DWR has eight programs that provide funding for hazard mitigation projects. These programs include the following:

1. Urban Streams Restoration Program. This is a competitive grant program to promote effective low-cost flood control projects, including stream clearance and flood mitigation and clean-up activities. Funds are available to public agencies, nonprofit organizations, and local community groups. All public agencies must have a partnership with a non-profit citizens group to receive funding. Individual projects are limited to a maximum of $1 million.

2. Flood Protection Corridor Program. This is a competitive grant program for flood protection projects, including the acquisition of real property and the acquisition of easements from willing sellers. Funds are available to public agencies, non-profit organizations, and DWR.

3. Yuba-Feather Flood Protection Program. This program provides competitive grants for flood protection projects along the Yuba and Feather Rivers and their tributaries and along the Colusa Drain and its tributaries. Grants are available to public agencies. A total of $90 million was authorized for the program.

4. Bay-Delta Multipurpose Water Management Program. DWR provides competitive grants and funding for specific projects aimed at achieving Café's goal of achieving long-term solutions to fish and wildlife, water supply reliability, flood control, and water quality problems in the Bay-Delta. Funding is available to federal, state, and local public agencies.

5. Infrastructure Rehabilitation Program. DWR provides competitive grants for feasibility studies and cost-effective construction projects for the replacement of water distribution and storage infrastructure as well as construction grants to economically disadvantaged public agencies and mutual water companies. Applicants must demonstrate water losses or that the system is in imminent danger of failure. Funds from this program have been used to replace elevated water tanks that do not meet seismic standards.

6. Capital Area Flood Protection Program. This project pays for the state's share of the non-federal costs of flood management projects that improve flood protection in the Sacramento region.

7. Floodplain Mapping Program. DWR committed $120 million for a continuing mapping program to assist local land use planning efforts in order to avoid or reduce future flood risks and damage.

8. Flood Control Subventions Program. The DWR Division of Flood Management provides financial assistance to local agencies cooperating in the construction of federal flood control projects. For more information, see url: www.fcpsubventions.water.ca.gov

Comment On: Chapter 7 Section 2.3

7.2.3 Wildfire Hazard Mitigation Funding

CAL FIRE

Within CAL FIRE, the California Department of Forestry and Fire Protection (CDF) has begun implementation of a new fuels reduction program funded by Proposition 40, (the California Clean Water, Clean Air, Safe Neighborhood Parks, and Coastal Protection Act of 2002). Proposition 40 provides CDF with $39 million from Proposition 40 funding to reduce hazardous fuel build up in the Sierra Nevada range over the next five years.

The goal of the Fuels Reduction Program is to reduce wildland fuel loadings that pose a threat to watershed resources and water quality. CDF is implementing the Fuels Reduction Program through three existing mitigation programs: the Watershed and Fuels Community Assistance Grants Program, Vegetation Management Program, and the California Forest Improvement Program.

Watershed and Fuels Community Assistance Grants Program

This program funds projects via Community Assistance Grants (CAG) that reduce wildland vegetation in the central Sierras. These projects are limited to State Responsibility Areas (SRA) for fire protection.

Vegetation Management Program

The Vegetation Management Program (VMP) provides $4 million in funds for removal of fuel beds and public benefit efforts. Cities and counties can apply for these funds that are provided annually in the general fund budget.

California Forest Improvement Program

Funding is available for fuels reduction projects conducted under the California Forest Improvement Program (CFIP). Eligible forest landowners can be reimbursed up to 90% of their expenses for fuels reduction projects conducted under CFIP.

California Fire Safe Councils

An additional fire mitigation program is operated through the California Fire Safe Councils. These are local councils made up of cross-sections of the community and can apply for grant funding from federal and private entities (such as PG&E) for fuel hazard reduction and education programs. Table 7.2.3A summarizes the total value of projects selected for federal funding through California Fire Safe grant programs.

Table 7.2.3A Total Value of Mitigation Projects Funded by California Fire Safe Councils

Program	Total Value of Projects	
	2005 - 2006	2006 - 2007
Bureau of Land Management (BLM) Community Assistance	$1,500,000	$3,100,000
USDA Forest Service Community Protection (CP)	$2,500,000	$1,200,000
USDA Forest Service State Fire Assistance (SFA)	$890,000	$4,200,000
National Park Service (NPS) Community Assistance/WUI	$250,000	$150,000
Total	$5,140,000	$8,650,000

Source: The Fire Safe Council

Air Pollution Control Districts

The air pollution control districts can provide funds to support chipping projects that reduce air pollution and lower fuel levels. At times forest health is a factor in chipping, which is an alternative to controlled fires. In 2003 Proposition 40 provided funds to address the fire hazard related to bark beetle infestation in the San Bernardino and Riverside Counties mountain areas.

Comment On: Chapter 7 Section 2.4

7.2.4 Other State Hazard Mitigation Funding

Commerce and Economic Development Program

The Commerce and Economic Development Department administers two programs that may provide funding for hazard mitigation projects: the Infrastructure State Revolving Fund Program, and the Rural Economic Development Infrastructure Program.

1. The Infrastructure State Revolving Fund (ISRF) Program provides low-cost financing to public agencies for a wide variety of infrastructure projects. Loans are available in amounts ranging from $250,000 to $10,000,000 with loan terms of up to 30 years. Eligible applicants include any subdivision of a local government, including cities,

counties, redevelopment agencies, special districts, assessment districts, joint powers authorities and non-profit corporations formed on behalf of a local government. Flood control is an eligible project type.

2. The Rural Economic Development Infrastructure Program (REDIP) provides loans to eligible public entities for water treatment and supply facilities and flood control projects. There is a limit of $2 million per project.

Housing and Community Development Department

The Community Development Block Grant (CDBG) Program; administered by Housing and Community Development, funds housing, economic development, public works, community facilities, and public service activities for lower-income people in small, typically rural, communities. State regulations dictate the method of fund distribution to eligible jurisdictions, including ratings and rankings for most of the funds.

State regulations allow the amendment of an existing grant to fund an otherwise CDBG-eligible replacement project or activity in an area proclaimed by the Governor as either a "state of emergency" or a "local emergency" as defined in Government Code §8558.

HCDs Codes and Standards Program purpose is to protect the public's health, safety, and general welfare in buildings and structures designed for human occupancy or the enforcement of the relevant provisions of the California Health and Safety Code, including the State Housing Law, Employee Housing Act, Mobilehome Parks Act, California Factory-Built Housing Law, and the Mobilehome-Manufactured Housing Act of 1980 as well as by enforcement of federal and state standards for the construction and safety of manufactured homes.

Comment On: Chapter 7 Section 3

7.3 Local Funding Sources

Local funding occurs in various forms. California's local governments and special districts have made considerable commitments to funding mitigations measures. For example, Historical examples include Berkeley Retrofit Rebate Program (for retrofitting and upgrading), where over $8 million dollars has been spent funded through fee waivers and transfer tax rebates, and the San Francisco City Hall Restoration ($300 million bond).

Since passage of DMA 2000, FEMA funds in the amount $148,094,435 have been applied to the HMGP, PDM and FMA program efforts of the 2000-2006 period. Local governments must provide a local match of 25% for such funds. Using this requirement to determine the approximate level of local government match, it can be reasonably estimated that cities, counties, special districts have provided a minimum (as some projects contain more than the minimum local match) of $49,364,812 as their 25% local match for federal funds obligated totaling $148,094,435. It is reasonable to conclude that the California local government effort can be estimated to be well over $50 million over this six-year period. Table 7.3A shows these estimated expenditures by type of federal program.

Table 7.3A Estimated Local Match by FEMA Program Type, 2000-2006

Disaster Type	FEMA	Local Match
Earthquake	$88,487,992	$29,495,997
Flood	$31,263,422	$10,421,141
Fire	$2,443,340	$814,447
Landslide	$2,144,615	$714,872
Multi-Hazard	$23,406,449	$7,802,150
Economic	$136,179	$45,393
Mudslide	$112,438	$37,479
Other	$100,000	$33,333
Total	$148,094,435	$49,364,812

Source: OES database file 2007

Comment On: Chapter 7 Section 4

7.4 Alternative Funding Sources

Combined Funding Approaches

Projects in California are commonly carried out by combining funding from one or more state agencies, state and local agencies, federal and state agencies, or a combination of all three. These approaches have been both informal and formal.

California Financing Coordinating Committee (CFCC)

The California Financing Coordinating Committee (CFCC), (http://www.cfcc.ca.gov) created in 1998, consists of state and federal agencies and departments that work together to offer coordinated and streamlined access to subsidized infrastructure financing for California's local communities. The CFCC members provide potential borrowers and grant recipients with an efficient and effective infrastructure funding mechanism. Funds for flood control projects are made available through the California Infrastructure and Economic Development Bank (I-Bank).

Non-Profit Government Partnerships

Land purchases in California have been carried out in cooperation with non-profit agencies. The Trust for Public Land, The Nature Conservancy, and the Conservation Fund are all helping communities throughout the country to develop local and regional plans for systems of open space. The California Council of Land Trust (CCLT) is the statewide voice for more than 150 land trusts that conserve land and waters in local communities throughout California. http://www.calandtrust.org

Utility Companies

California's public and private utilities play an essential role in keeping critical facilities up and running. Mitigation is an essential part of core infrastructure planning for them. The California Emergency Utilities Association (CUEA) http://www.cueainc.com is the organization that is integrated into state's overall mitigation effort. CUEA consists of 280 Full members and 74 Associate Members, and provides training programs for members and associate members in mitigation and response protocols. Its annual base budget of

$340,000 is member paid, and members also contribute equipment and staffing for response events in the average annual amount of $10 million per year.

CUEA major programmatic efforts are directed at building public/private partnership in the areas of utilities and transportation, as called for under the Governors Directive S-04-06. Joint training workshops are provided by OES to CUEA members on a quarterly basis.

Major private utility companies, such as Pacific Gas and Electric (P G & E) and Southern California Edison, as well as small local water companies, are continuously programming capital investments which provide strengthening of their companies' overall capacities to withstand various natural and human-caused disasters. Many of these investments represent incremental improvements in the resilience against natural and human-caused hazards within their plant and facilities.

Mitigation investments then become the object of careful planning over time of the balance which must be reached between adequate reinvestment in antiquated systems and maintenance of reasonable rates.

Comment On: Chapter 8

Chapter 8 - Enhanced Plan Criteria Achievements Program

Chapter Organization

8.0 Chapter Summary
8.1 Integration with Other Planning Initiatives
8.2 Project Implementation Capability
  8.2.1 Hazard Mitigation Grant Program (HMGP)
  8.2.2 Pre-Disaster Mitigation Grants (PDM)
  8.2.3 Flood Mitigation Assistance Grants (FMA)
  8.2.4 Determining Cost Effectiveness
8.3 Program Management Capability
8.4 Assessment of Mitigation Actions
8.5 Effective Use of Available Mitigation Funding
8.6 Commitment to a Comprehensive Mitigation Program
8.7 Monitoring, Evaluating, and Updating the Plan

Comment On: Chapter 8 Section 0

8.0 Chapter Summary

Under FEMA guidance for Enhanced Plans, a state must detail how its plan is specifically integrated into other state, regional, and FEMA initiatives providing primary guidance for mitigation-related activities. Integration of plans, as manifested in day-to-day action, has various dimensions. Legislative and policy integration has taken place incrementally over time as issues emerged in response to specific disasters. Formal institutional coordination at the state level has been solidified through the work of the State Hazard Mitigation Team (SHMT), and through outreach to local governments, tribal governments, and the private sector. The SHMT has been involved at every significant step of 2007 SHMP preparation.

Funding for mitigation planning and projects in California comes from a variety of sources. For example, FEMA mitigation grant funds provided support for over 90 LHMP plans. Major seismic bridge retrofit, levee improvement, and flood programs are bond supported. Educational programs of the California Seismic Safety Commission are funded through fees on insurance policies and an insurance settlement derived from the Northridge Earthquake. Special funds and the state general fund provide support for various other legislatively mandated programs.

The Enhanced Plan must document the State's project implementation capability, identifying and demonstrating the ability to implement the plan including establishing eligibility criteria for multi-hazard mitigation measures and a system to determine the cost effectiveness of mitigation measures. Before forwarding applications to FEMA, OES determines that an activity meets the federal eligibility criteria. Each disaster has particular characteristics related to specific hazards that influence the mitigation priority determination. To maximize the effectiveness of the competitive mitigation grants, OES has established criteria for ranking proposed activities.

The Enhanced Plan must also demonstrate that the State has the capability to effectively manage all mitigation grant programs and complete all mitigation grant activities within established performance periods, including financial reconciliation. California has a successful record of meeting all mitigation grant application timeframes and submitting complete, technically feasible, and eligible proposed activities applications with appropriate supporting documentation. OES ensures that all applicants have provided all required environmental information and benefit-cost analyses. OES submits complete and accurate quarterly progress and financial reports on time. Quarterly reports are generated by the subgrantee and reported to OES. OES compiles the reports and assesses the programmatic and financial components before sending them to FEMA.

The Enhanced Plan must document the system and strategy by which the state conducts an assessment of completed mitigation actions and includes a record of the effectiveness (actual cost avoidance) of each mitigation action (DMA 2000, §201.5(b)(2)(iv). The state must describe how effectiveness of each completed mitigation action is assessed, what agency or agencies are involved in the assessment, and indicate the timeframe for carrying out this assessment.

California must also describe how it tracks potential losses avoided for each action taken. OES maintains an extensive project database that contains over 800 projects. OES is transitioning to the State Mitigation Assessment Review Team (SMART) system to assess the outcome of previously funded mitigation projects in a disaster area by: 1) ascertaining loss avoidance performance at a given level of intensity of an event, and 2) identifying effective mitigation best practices. The SMART system approach will provide statewide coverage to OES and the support of trained non-OES personnel through a partnership with the California State University system (CSU) and other cooperating organizations.

The Enhanced Plan must demonstrate that the state effectively uses existing mitigation programs to achieve its mitigation goals. The state must document that it has fully and effectively made use of FEMA and other funding already at its disposal to fund mitigation actions. FEMA mitigation funds allocated are closely linked to the plan goals. California has approved large sums well beyond the magnitude of funds available for FEMA mitigation grants to mitigate earthquake and flooding hazards. For example, over $5.5 billion in bond funds were committed through an election in 2006 for levee and flood hazard mitigation projects, and $6 billion dollars have been committed from the state general fund and increased bridge tolls for seismic retrofits of freeway bridges.

Under FEMA guidance for Enhanced Plans, a state must also detail how its plan reflects a commitment to a comprehensive mitigation program. California's commitment to a comprehensive mitigation program is manifested through active implementation of programmatic efforts by all major state agencies that operate in concert with California's built environment.

Finally, California must monitor, evaluate, and update its plan on a regular basis. Upon adoption of the 2007 SHMP, the SHMT will be restructures as the SEMS Mitigation

Specialist Committee and will meet on an ongoing basis to carry out these functions. Establishment of the restructured SHMT as a permanent part of the SEMS structure will assure: 1) continuing and active participation of key state agencies in SHMP monitoring, evaluation, and updating; 2) integration of mitigation with preparedness, response, and recovery related aspects of OES and other state agency functions.

Comment On: Chapter 8 Section 1

8.1 Integration with Other Planning Initiatives

Under FEMA guidance for Enhanced Plans (DMA 2000, §201.5(b)(1), a state must detail how its plan is specifically integrated into other state, regional, and FEMA initiatives providing primary guidance for mitigation-related activities. Examples include integration of hazard mitigation actions and priorities with those of other state plans, passage of laws and regulations mandating such integration, and/or working with regional planning authorities and councils of government.

Chapter 2 of the 2007 SHMP administrative draft identifies a legal, institutional, and policy framework facilitating advances in integrating mitigation practice in California. Table 2.3.3A of Chapter 2 identifies emergency management and hazard mitigation responsibilities of over 40 state agencies, most of which are involved with the State Hazard Mitigation Team (SHMT) , as identified in Table 1.3.2A of Chapter 1. It also provides examples of best practices in hazard mitigation resulting from state-mandated local planning and state mapping.

Chapter 3 presents state mitigation goals, objectives, and strategies emphasizing both horizontal coordination between state agencies and vertical coordination between state and local agencies.

Integration Dimensions and Examples

Chapter 8 directly addresses the issue of integration by providing information on various dimensions of integration with other planning initiatives—legislative, policy, institutional, substantive, functional, and financial—and offering examples of how these dimensions are being manifested in day-to-day action.

Legislative and Policy Integration

As noted previously in Chapters 2 and 3, a substantial body of state law dealing with hazards has grown over the past several decades. Crafted over several decades in response to a succession of disasters (see Chapter 5, Part 1), legislation has been largely incremental, addressing specific issues perceived as problems in response to disasters. This body of law is being knit together into an integrated structure through annual legislative review and action. Incremental adjustment is the general process used by the California legislative and executive branches to address state issues. Mitigation planning and policy therefore follow state practice.

This process has been enhanced by disaster events taking place elsewhere. For example, the Southeast Asia tsunamis led to increased attention to tsunami run-up mapping in California, and Hurricane Katrina raised the visibility of potential levee failure in the San

Francisco-San Joaquin-Sacramento Area Delta region stimulating action by the voters on flood control and levee strengthening bonds in November 2006.

This movement toward greater integration of mitigation planning has taken a major step forward in the past three years at the state and local level with parallel development and FEMA approval of the 2004 SHMP and over 400 LHMPs. The 2004 SHMP for the first time integrated statewide incorporated and integrated content from previously adopted hazard-specific state plans for earthquakes, floods, and fires.

Examples of legislative and executive level integration of mitigation have included state-local and public-private sector integration initiatives. For example, Assembly 2140 passed by the California Legislature in 2006 integrates evolving mitigation policy at the state and local level by providing financial incentives for cities and counties to adopt Local Hazard Mitigation Plans (LHMPs) as part of local general plans.

Also in 2006, Governor Schwarzenegger issued Executive Order S-04-06 directing state agencies to develop stronger public private partnerships for disaster mitigation, preparedness and emergency services. This is another tool for an integrated state strategy.

Institutional Integration

Parallel to this movement toward formal integration of policy and plans was the formal institution of coordination at the state level through formation of the State Hazard Mitigation Team (SHMT) with the original dozen and one-half member agencies. With revision of the Plan, the SHMT has grown to over 40 agencies, plus representatives of cities, counties, and special districts associations. Table 2.2.3B in the 2007 SHMP Appendix includes a comprehensive profile of general functions, emergency management and hazard mitigation responsibilities, and enabling laws for nearly 50 state agencies.

An example of progress in horizontal coordination is the significant role played by the SHMT in preparation of the 2007 SHMP. The SHMT has been involved at every significant step, including provision of update information and review of the goals and objectives of the state mitigation strategy. Materials contributed by member agencies have been included in the 2007 Plan to a substantial extent.

Integration of state efforts is an ongoing process in California. In 1991 then Governor Wilson strengthened that integration by issuing Governor's Executive Order W-9-91, mentioned in Chapter 1, which authorized the Director of OES to assign specific emergency functions to state agencies through standing administrative orders. These orders were subsequently updated to require agencies to establish hazard mitigation as an integral element in program delivery.

For example, the Department of Water Resources Agency 2006 FloodSAFE initiative has three goals: 1) reduce flood risk to Californians, their homes and properties; 2) develop a sustainable flood management system; and 3) reduce the consequences of floods when they do occur.

Augmenting this horizontal integration are various agency programs and actions demonstrating vertical integration. Each agency on the SHMT represents a potential link between state and local government. Most agencies have long-established relationships with first responders, city managers, county administrative officers, and other local government entities and officers.

Examples of multiple instances of vertical coordination include: 1) CAL FIRE administration of the vegetation management program which involves private property owner participation and volunteer Fire Safe Council support; and 2) Department of Water Resources administration of Flood Mitigation Assistance activities. Both mitigation program examples are coordinated through OES local hazard mitigation planning.

Substantive and Functional Integration

Progress has been made toward integrating the substance of mitigating planning during SHMP revision. This substantially reinforces the preceding history of policy and institutional integration.

Chapter 3 provides substantial revisions to mitigation planning objectives, underscoring and strengthening vertical integration. Chapter 5 of the 2007 SHMP for the first time includes an integrated risk assessment which examines historical, current, and future hazards, vulnerability, and risks in California from a multi-hazard perspective. The GIS-based maps in Chapter 5 provides a valuable tool for reexamination of mitigation strategies and priorities in the future, opening the door of technology to 21st century mitigation planning in California and, for the first time examining the regional interrelationships between the primary impact hazards of earthquakes, floods, and fires.

The 2007 SHMP, also for the first time, includes editorial attention to the multiple links between mitigation and emergency preparedness planning. For example, in Chapter 2, the relationship of the SHMP to emergency management planning is discussed under Section 2.3.2. Additionally, the Chapter 5 GIS-based risk assessment will be incorporated by reference in the California Emergency Management Plan, presently under revision, and includes language drawn from the Emergency Management Strategic Plan.

The examination of over 500 LHMPs in Chapter 6 points out that nearly 40% of local mitigation plans used FEMA guidance (vertical integration), and link mitigation planning to local general plans and emergency plans (horizontal integration).

Financial Integration

Funding for mitigation planning and projects in California comes from a variety of sources. No one source provides it all. The following are examples of the scope and variety of funding that does occur at the state level.

The FEMA HMGP grant program provided support for over 90 LHMP plans (single and multiple agency plans). The major bridge retrofit (seismic safety) and levee improvement (seismic and flood) programs are bond supported. Educational programs of the California Seismic Safety Commission are funded through fees on insurance policies and

an insurance settlement derived from the Northridge Earthquake. Special funds and the state general fund provide support for various other legislatively mandated programs. The California Earthquake Authority is funded through insurance policy rates. The work of the California Utilities Emergency Association (CUEA) is membership supported.

An important example of financial integration of mitigation planning was passage of Assembly Bill 2140, mentioned previously This bill provides incentives for LHMP preparation by authorizing cities and counties to adopt an LHMP as part of their general plan safety element, authorizes the California legislature to provide to such cities and counties a state share of costs exceeding 75% of total state-eligible post-disaster costs under the Stafford Act. It also requires OES to give future priority to assistance to local jurisdictions without an LHMP to prepare and adopt one.

Comment On: Chapter 8 Section 2

8.2 Project Implementation Capability

The Enhanced Plan must document the State's project implementation capability, identifying and demonstrating the ability to implement the plan (DMA 2000, §201.5(b)(2)(i) and (ii), including:

- Established eligibility criteria for multi-hazard mitigation measures;
- A system to determine the cost effectiveness of mitigation measures, consistent with OMB Circular A-94, Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs, and to rank the measures according to the State's eligibility criteria.

The OES Hazard Mitigation Branch administers the following federal hazard mitigation grant programs, each of which are addressed in this section:

- Hazard Mitigation Grant Program (HMGP);
- Pre-Disaster Mitigation Grants (PDM);
- Flood Mitigation Assistance Grants (FMA).

Each of these programs require applications for proposed activities (usually planning and project activities) and are reviewed for the following:

1. Consistency with federal and state eligibility criteria
2. Consistency with state mitigation priorities
3. Rank based on state ranking criteria

Comment On: Chapter 8 Section 2.1

8.2.1 Hazard Mitigation Grant Program (HMGP)

Consistency with Federal and State Eligibility Criteria

All proposed activities submitted to OES must meet the federal eligibility criteria described in CFR 44, Section 206.434 (Hazard Mitigation Grant Program Eligibility). Before forwarding applications to FEMA, OES determines that an activity meets the federal eligibility criteria as well as the state established application criteria (see Table 8.2.1A as an example set of the state established criteria from DR-1628/DR-1646).

Table 8.2.1A Example of HMGP State Criteria Severe Storms and Flooding Disasters (DR-1628/DR-1646) , December 2005 – January 2006 and March – April 2006

OES-Approved Notice of Intent (NOI): Each application must match with an OES-approved NOI. If you did not receive notification from OES that the activity described in an NOI submitted by the subgrant applicant was approved, do not submit an application for the activity.

Matching Funds: Funds are provided on a 75/25 cost share basis: 75 percent federal and 25 percent non-federal. Matching funds must be identified and secured in the application when submitted.

Local Hazard Mitigation Plan (LHMP) Requirement: A FEMA-approved LHMP is required to receive federal funds for any project application activity.

Performance Period: OES will not accept applications for activities with performance periods exceeding 36 months.

Federal Requested Share: OES will not accept applications for activities with a requested federal share that exceeds $3 million for project activities and $200,000 for planning activities.

Other Important Eligibility Considerations: The following are also important considerations in determining the eligibility of activities.

- Completed activities and activities under construction are not eligible for funding.
- Project activity applications with benefit/cost ratios of less than 1.0 will not be considered.
- Applications that are incomplete, do not conform to pre-established priorities, or are not consistent with state and federal HMGP regulations will not be considered.
- HMGP funds cannot be used as a substitute or replacement to fund activities or programs that are available under other federal authorities.
- HMGP funds cannot be used as matching funds for other federal funds.

Consistency with State Mitigation Priorities

The state also establishes mitigation priorities (see Table 8.2.1B as an example set of the state mitigation priorities from DR-1628/DR-1646). This prioritization will be part of the initial program guidance to potential applicants. Information to be considered in establishing priority categories may include the evaluation of natural hazards in the disaster area, state of the art knowledge and practices relative to hazard reduction, existing state mandates or legislation, existing state or local programs, and long-term mitigation goals and objectives at the state, local, and community level.

Moreover, each disaster has particular characteristics that influence the mitigation priority determination. Flooding can occur at very frequent intervals; flooding in one year does not preclude a flood from occurring the following year, or the following month, and

repairing flood damage does not protect a structure from future damage. Therefore, flood mitigation priorities address the protection of structures that have flooded repeatedly.

Fire has a different set of considerations. When an area has been burned, one major factor of the hazard in the immediate area – fuel load – has been reduced. The immediate mitigation concerns are then to avoid further damage from mudslides and flooding (especially in steeply sloped areas). The long-term concern is to reduce hazards and/or vulnerabilities to fire in areas that have not burned and contain heavy fuel loads.

Earthquake hazards also differ from those that affect much of the rest of the nation. When structures are damaged or destroyed by an earthquake, they are generally repaired or rebuilt to current local codes and standards. However, there may be inconsistencies between how various jurisdictions address repairs for structures that are only partially damaged due to factors including the desire to rebuild quickly and difficulties in determining whether a structure has met the threshold of damage and repair required to trigger a code upgrade. In spring 2007, the California Building Officials recommended adoption of a uniform "Repair and Reconstruction Model Ordinance" based on applicable portions of the international Existing Building Code to correct this policy deficiency (www.calbo.org/build_dept/emergency/Emergency.aspx).

Table 8.2.1B Example of HMGP State Mitigation Priorities Severe Storms and Flooding Disasters (DR-1628/DR-1646), December 2005 – January 2006 and March – April 2006

The current funding estimate for DR-1628/DR-1646 is approximately $10 million. The state has established the following specific priorities:
Project Activities:

- Flood mitigation projects. Specifically flood barriers, culverts, and basins.
- Fire mitigation projects. Specifically shaded fuel breaks, defensible space, fire resistant materials, and vegetation management projects that do not impact environmentally sensitive areas.
- Elevation or acquisition of repetitively damaged structures or structures in high flood hazard areas.
- Structural and Non-structural seismic retrofits of critical facilities. Critical Facility is defined as Emergency Operation Centers, Power Facilities, Water Facilities, Sewer and Wastewater Treatment Facilities, Communication Facilities, Emergency Medical Care Facilities, Fire Protection Facilities and Police Facilities.
- Project applications from sub-grant applicants located in declared counties.
- Sub-grant applicants with a FEMA approved LHMP by the application submission deadline of November 3, 2006. Project activities must be in conformance with this LHMP.
- Federal Share may not exceed $3 million. Performance Period may not exceed 3 years.

Planning Activities:

- Multi-jurisdictional local multi-hazard mitigation plans developed in accordance with Section 322 of the Stafford Act.

- Local multi-hazard mitigation plans developed in accordance with Section 322 of the Stafford Act.
- A comprehensive review and update of an existing local hazard mitigation plan to meet the five year requirement under 44 CFR Part 201.
- Federal Share may not exceed $200,000. Performance Period may not exceed 3 years.

Rank Based on State Ranking Criteria

To maximize the effectiveness of the competitive HMGP, OES has established criteria for ranking proposed activities (see Table 8.2.1C as an example set of criteria from DR-1628/DR-1646). The Governor's Appointed Representative, working in conjunction with the State Hazard Mitigation Officer and, if appropriate, committees and task forces established for the purpose, will identify priority proposed activities types.

Table 8.2.1C Example of HMGP Ranking Criteria Severe Storms and Flooding Disasters (DR-1628/DR-1646), December 2005 – January 2006 and March – April 2006

State Ranking Factors for DR-1628/DR-1646 HMGP

The factors listed below will be used to rank applications:

Project Activities:

- The cost benefit of the project. The subgrant applicant must submit a Benefit/Cost Analysis (BCA) with their project application. The BCA must be prepared in accordance with the FEMA Mitigation BCA Toolkit Version 2.0. OES will review the BCA and supporting documentation.
- The time needed to implement the project. Projects that can be completed in the least amount of time will receive the highest ranking. Factors will include the project schedule, the complexity of the environmental review and the state of project planning.
- The capability of the applicant to complete the project as requested. Applicants that have the best history of completing HMGP projects on time and within budget will be given additional consideration.
- Number of Community Mitigating Factors, e.g. Community Ratings System participant, Fire Wise Community, adoption and enforcement of codes/ordinances that promote mitigation.

Planning Activities:

- Population at risk. Applications for plans that address the largest population will rank higher.
- Number of Community Mitigation Factors, e.g. Community Rating System participant, Fire Wise Community, adoption and enforcement of codes/ordinances that promote mitigation.
- Multiple Jurisdictions. Plans that include the most jurisdictions will rank higher.

Funding Availability

The October 1997 Statewide Section 404 revisions to the Stafford Act made all counties in a state eligible for HMGP funding following a disaster. The state's funding priorities is dependent on the amount of funding available following a disaster. Although the HMGP regulations do not require that proposed activities be located in the declared county(ies),

it would be politically impractical to fund proposed activities outside of the declared area when funding is very limited. Also, the state may cap the per application federal share based on the amount of funds available. DR-1008 funded proposed activities for as much as $64,000,000, but the state imposed a $3,000,000 limit on per- proposed activities funding for the 1577/85 HMGPs, which have only approximately $19 million available.

Special Circumstance Proposed Activities

A five percent set-aside policy has been established by FEMA for special circumstance proposed activities. These proposed activities are often difficult to evaluate for cost effectiveness and eligibility. The proposed activities to be submitted under the 5% set-aside initiative shall be identified and selected at the discretion of the OES Director.

Comment On: Chapter 8 Section 2.2

8.2.2 Pre-Disaster Mitigation Grants (PDM)

All proposed activities submitted to OES must meet the federal eligibility criteria described in FEMA's Pre-Disaster Mitigation Program Guidance. The Hazard Mitigation Branch uses these criteria to evaluate and rank proposed activities.

The Hazard Mitigation Branch provides notice of interests when PDM funds are available, establishes deadlines, and invites eligible entities to apply as sub-applicants under the state. In addition, the Hazard Mitigation Branch conducts application workshops for sub-applicants.

Each year, OES establishes focused priorities for grant funding based on the State Multi-Hazard Mitigation Plan. These priorities, in conjunction with FEMA criteria, are used to evaluate proposed activities. Finally, all proposed activities must be cost-effective per OMB Circular A-94 Guidelines as described above. After evaluation and ranking, OES submits applications to FEMA. The Hazard Mitigation Branch submits more applications that can be funded with available funds in case additional funding becomes available. Also, because FEMA's PDM Guidance is issued annually each year, OES incorporates FEMA's priorities into the states ranking process so that California's applications will rank high in the national competition.

Comment On: Chapter 8 Section 2.3

8.2.3 Flood Mitigation Assistance Grants (FMA)

All proposed activities submitted to OES must meet the federal eligibility criteria described in FEMA's Flood Mitigation Assistance Program Guidance and otherwise is very similar to the PDM Program, except that it only funds flood mitigation activities, the development of flood mitigation plans (or the flood component of an LHMP) and cost effective flood mitigation projects.

Comment On: Chapter 8 Section 2.4

8.2.4 Determining Cost Effectiveness

All proposed activities grants must be cost-effective. FEMA-funded proposed activities must meet the criteria described in OMB Circular A-94 Guidelines. OES uses the January 2006 FEMA Mitigation Benefit Cost Analysis (BCA) Toolkit Version 3.0, which incorporates the discount rate and present day value in the B/C ratio calculations. In the past, OES performed benefit-cost analyses with the information provided by the applicant. Currently OES provides benefit cost training to potential applicants as part of

the application workshops, which allows the applicants to perform their own analysis. OES staff reviews the analyses for the credibility of data used to determine the benefit-cost ratio.

Comment On: Chapter 8 Section 3

8.3 Program Management Capability

The Enhanced Plan must demonstrate that the State has the capability to effectively manage all mitigation grant programs, and provide a record of the following (DMA 2000, §201.5(b)(2)(iii A-D):

- Meeting all mitigation grant application timeframes and submitting complete, technically feasible, and eligible proposed activities applications with appropriate supporting documentation;
- Preparing and submitting accurate environmental information and benefit-cost analyses;
- Submitting complete and accurate quarterly progress and financial reports on time; and
- Completing all mitigation grant activities within established performance periods, including financial reconciliation.

Administration

All FEMA funded pre and post-disaster mitigation grant programs are administered by the OES Hazard Mitigation Branch (HMB). Chart 8.3.1 shows the organization and program areas for the HMB.

The State of California has a successful record of meeting all mitigation grant application timeframes and submitting complete, technically feasible, and eligible proposed activities applications with appropriate supporting documentation. The Hazard Mitigation Branch handles the application process once notice of hazard mitigation grant funding becomes available. Initially, notices of interest (NOI) are solicited from potential applicants; eligible organizations submitting NOIs are provided with full applications to complete.

As soon as possible following notice from FEMA, the state distributes to potential eligible applicants a notice of funding availability (NOFA), state established priorities, ranking criteria, application deadlines, and other pertinent information. Additionally, information typically is provided through Public Assistance Program applicant briefings, separate hazard mitigation grant applicant briefings, press releases, and via the Hazard Mitigation Web Portal.

The Hazard Mitigation Branch has established an application and review process to insure timely and adequate implementation of the various mitigation grant programs (see Chart 8.3A).

OES is tracking mitigation grant projects geographically by geocoding each location for ease of reference. Appendix Map 8.3A shows the distribution of hazard mitigation grant projects by County, DR-845 through 1585 (1989-Present). Shown on accompanying Appendix Map 8.3B is the percent of these projects which have been geocoded to date.

Chart 8.3A OES Hazard Mitigation Branch Organization

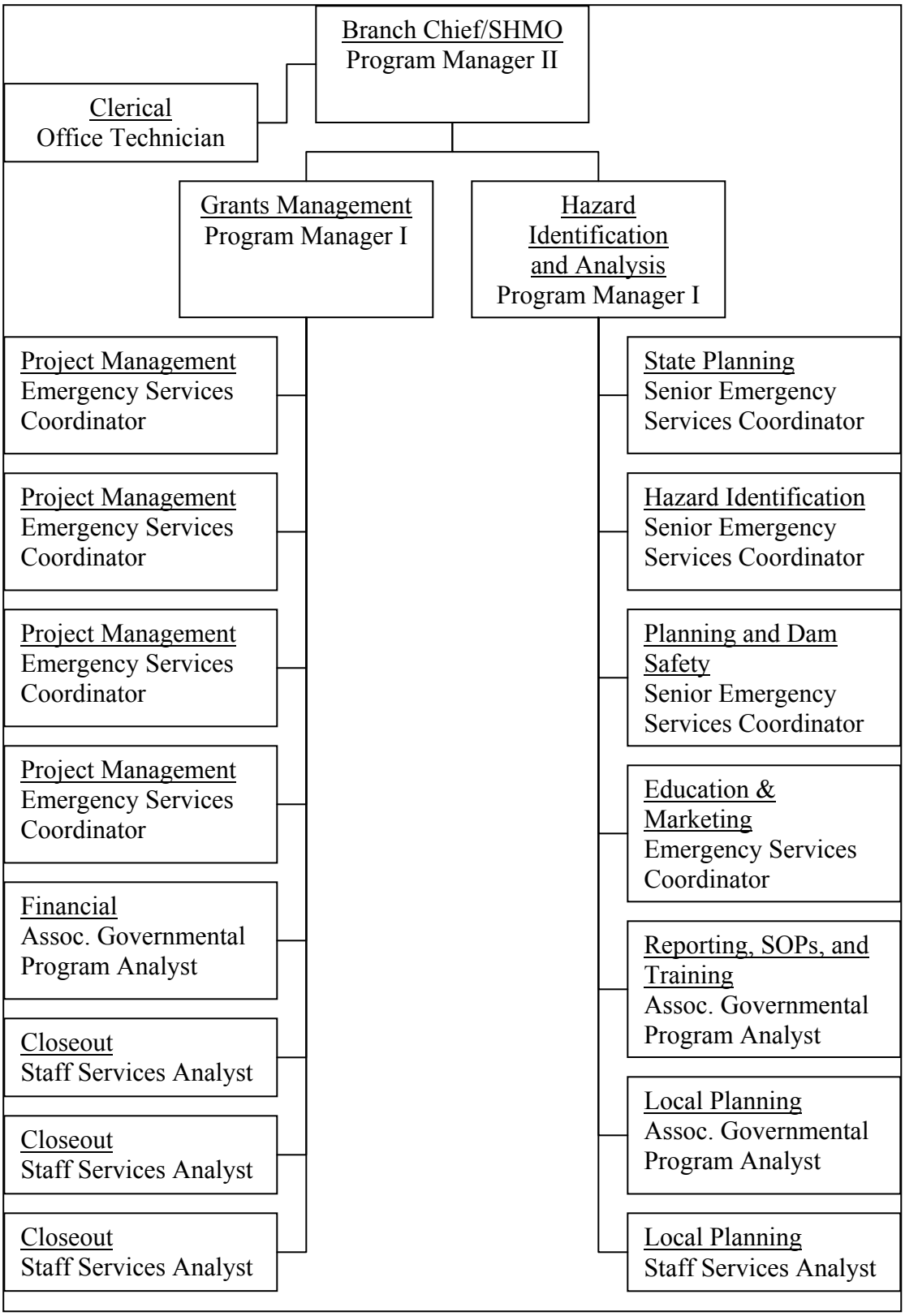
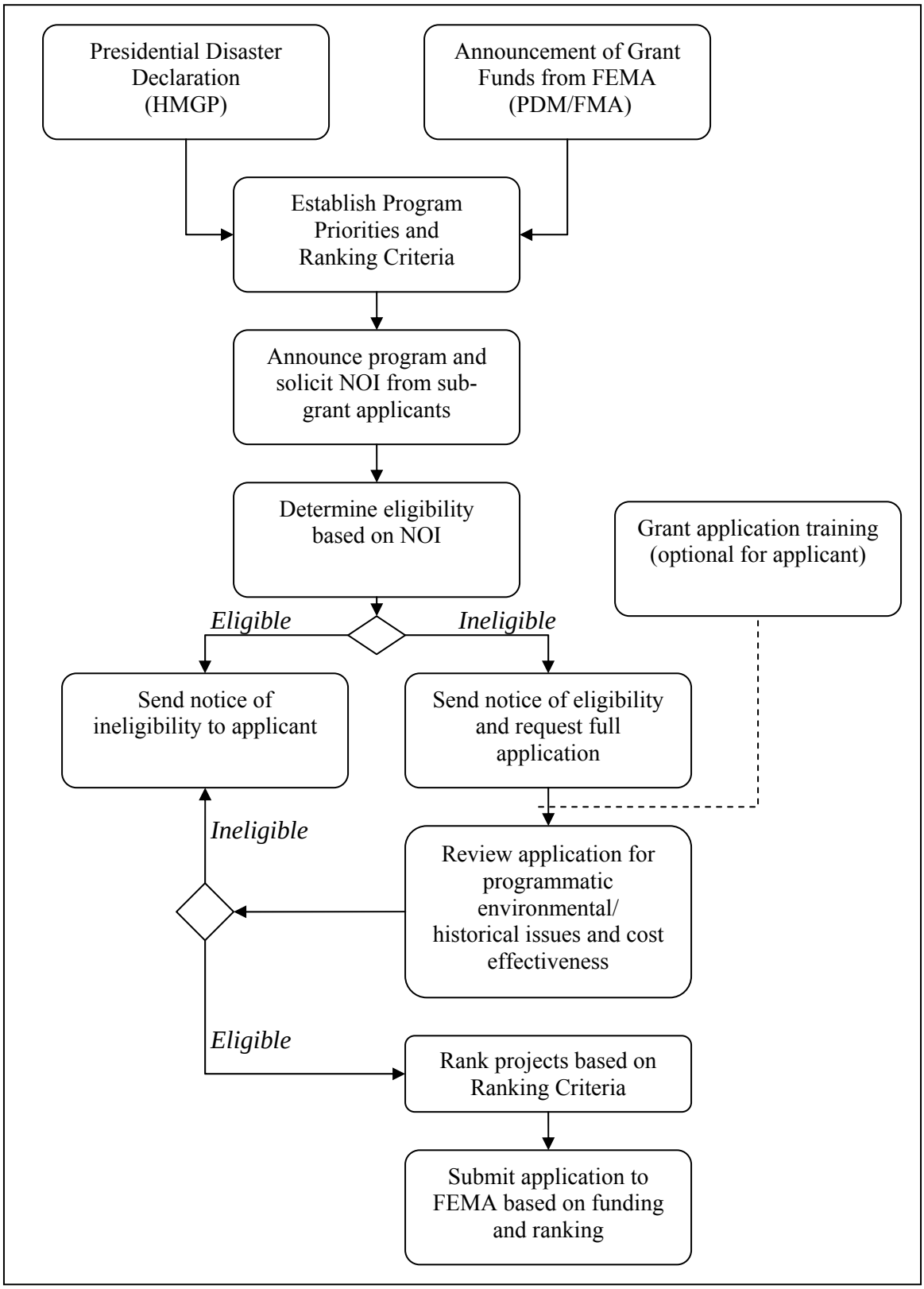


Chart 8.3B State of California Mitigation Activities Review Process



Once received, NOIs are reviewed, and eligible organizations are provided with a full application. Depending upon the program, organizations will have 60 to 90 days to complete their applications.

All grant information is managed by the Mitigation Grants Management System (MGMS), Lotus Notes database. The MGMS includes the following information for all grants:

- Executive Summary
- Applicant Information
- Project Information
- Application Review
- Project Monitoring
- Financial
- Closeout Information.

Editor's Note: For this section information is needed showing throughput statistics: how many applications were submitted; how many were recommended by OES; how many were approved by FEMA; how many were processed on time; how many were rejected due to technical/feasibility deficiencies. In addition, OES needs to declare any problems in meeting FEMA deadlines or requirements and what has been done to correct those.

Environmental Review and Benefit-Cost Analyses

The State of California ensures that all applicants have provided all required environmental information and benefit-cost analyses. This information is recorded in the MGMS and used in the tracking, monitoring, and closeout of mitigation activities.

OES relies on the staff of Federal Emergency Management Agency Region IX to conduct environmental reviews for construction projects seeking hazard mitigation grant funding from the Hazard Mitigation Grant Program, Pre-Disaster Mitigation Program, or the Flood Mitigation Assistance Program. Before FEMA approval of a hazard mitigation grant, the proposed activities must comply with all applicable federal, state, and local codes and standards including the California Environmental Quality Act and the National Environmental Policy Act (PL 91-190, as amended) and all federal laws covered within the act, and for securing the necessary permits and approvals.

OES ensures that applicants have provided proper documentation of benefit-cost analyses including documentation of all data sources and through description of calculations and assumptions.

Quarterly Progress Reporting

The State of California submits complete and accurate quarterly progress and financial reports on time. Quarterly reports are generated by he subgrantee and reported to OES. OES compiles the reports and assesses the programmatic and financial components before sending them to FEMA. The reports include:

- Percentage completion of the project;
- Progress on milestones identified in the original schedule;
- Overall assessment of the schedule; and,
- Adherence to budget (incl. over-under reporting).

If subgrantees do not submit timely and accurate quarterly reports or the reports indicate problems associated with the above components, OES will suspend payment processing.

Prior to the last quarter of 2006, OES had submitted quarterly reports that lacked information on the local match. This deficiency was due to a problem with the OES financial ledger system. This deficiency was corrected and OES now includes all required information in the quarterly reports.

Mitigation Activities Completion and Close-out

The State of California completes all mitigation grant activities within established performance periods, including financial reconciliation. This information is tracked and managed in the Mitigation Grant Monitoring System (MGMS) and OES financial ledger systems (ALS). Sub-applicants are required to submit "Accomplishment Reports" that describe the proposed activities completion and expenditures per the budget. OES reviews these for accuracy and completeness as part of the close out process.

Editor's Note: Information to be provided on how OES closes out projects and conducts financial reconciliation. In addition, statistics on how many projects are completed and how many projects are completed on time.

Comment On: Chapter 8 Section 4

8.4 Assessment of Mitigation Actions

The Enhanced Plan must document the system and strategy by which the state conducts an assessment of completed mitigation actions and includes a record of the effectiveness (actual cost avoidance) of each mitigation action (DMA 2000, §201.5(b)(2)(iv). The state must describe how effectiveness of each completed mitigation action is assessed, what agency or agencies are involved in the assessment, and indicate the timeframe for carrying out this assessment. The state must also describe how it tracks potential losses avoided for each action taken.

Tracking System and Strategy

OES maintains an extensive project database (Lotus Notes) that contains all HMPG, FMA, and PDM project work-ups, from initial funding through project completion. This database contains over 800 projects. From 2000 through 2006 some 244 projects were added to the database. This database provides information on the scope of the projects, geo-coded location (60% of the projects), and local contacts. Digital imaging is beginning to be added to recent projects. The database provides detailed tracking information which is reviewed on a regular basis by OES Hazard Mitigation Branch staff to assess status and completion of mitigation projects. The database is also the beginning point of assessments linked to loss avoidance.

Current Assessment in Place (AIP)

When an event occurs, OES staff checks its database to determine if a mitigation project has been funded in the immediate area. Existing project files include locations, project particulars, and local contact people. Local contact is made by OES staff to request a field report on the effectiveness of the mitigation project, with local participants making a determination of cost-avoidance. This process is as good as the quality of information provided from the local level. Also when an event occurs field-gathered information is used in development of a state emergency proclamation and in requesting a federal disaster declaration.

Emerging SMART System

OES is transitioning from the AIP approach for identifying loss avoidance to the State Mitigation Assessment Review Team (SMART) system, modeled after the in-place OES Safety Assessment Program (SAP) system which provides preliminary damage estimates after disasters.

SMART system objectives are to assess the outcome of previously funded mitigation projects in a disaster area by: 1) ascertaining loss avoidance performance at a given level of intensity of an event, and 2) identifying effectiveness of mitigation practices. This is to be done by on-site review and documentation of loss avoidance based on the project Benefit Cost Analysis (BCA). The SMART system will also have value in assisting OES to prepare new Governor's proclamations and request federal declarations by including loss avoidance data as part of those processes.

The SMART system approach will provide statewide coverage to OES and the support of trained non-OES personnel through partnerships with cooperating organizations. When an event occurs, OES staff will retrieve files on funded mitigation projects in the immediate area. All OES funded mitigation projects will have geo-codes to provide location coordinates and digital images of the projects. This information along with assessment forms for the type of event (earthquake, flood, wildfire, etc.) and a summary of the project background will be placed on the OES Web Portal. The SMART team will go to the disaster location(s), contact appropriate local agencies, and conduct assessments of previously funded mitigation projects with a primary focus on estimating loss avoidance. Each team will utilize current regionally adjusted construction data and other pertinent data to estimate physical loss avoidance.

Once an assessment is completed, the SMART report will be sent back to the OES portal where OES mitigation branch staff will analyze it against the project database in terms of its BCA and other factors such as avoidance of injury, loss of life, or environmental degradation. For example, if the funded project was a real property acquisition in a floodplain and a flood event occurs, then the loss avoidance would be calculated as non-payment of damages based on current replacement costs.

Spatial Coverage

Given the enormous physical size of California (nearly 160,000 square miles of land area, 1,100 miles of coastline), providing coverage for the state is a challenge.

For this reason, OES has approached the California State University system (CSU), as one of several potential partners. The CSU system could have campus-based SMART team locations throughout the state. CSU has 23 locations throughout California and a well-spring of expertise for conducting loss avoidance estimation. SMART teams from CSU campuses would be able to reach 90% of California's population areas within 4-6 hours of surface travel.

At different campuses SMART teams with expertise in different types of disaster events could be in place and available to go to a location with short notice. Moreover, the CSU system has a central office of Risk Management that could serve a networking role for coordination of this effort. In addition to faculty members with wide-ranging expertise, each CSU campus has three groups that can assist with coordination of SMART team deployment, including the Risk Management Office, the Emergency Management Coordinators (often in the campus police department), and the Facilities Group.

Executive order W-9-91 provides the OES with the administrative capacity to utilize CSU and other state employees after a disaster event. Training for SMART potential team members will be provided by OES and other state agencies having specialized knowledge by disaster type. For example, the Department of Water Resources could assist with training and assessment documentation related to floods. OES staff will provide base forms for use by SMART team members similar to those used with preparing preliminary damage assessments.

The recently completed "Loss Avoidance Study: Southern California Flood control Mitigation," HMTAP Task Order 393 (April 2007) provides some guidance on assessment practices, depth of information in HMGP files, and data needs. Sources such as this study will be used in designing special field assessment protocols for specific use in the SMART program.

Moderate vs. Catastrophic Disasters

It should be noted that the SMART team system is designed to build a record of successful mitigation project outcomes for the entire State of California, both in evaluating mitigation investments and documenting best practices. The SMART system will meet these objectives after small- and moderate-sized disasters which do not significantly stretch the resources of the CSU system or that of any cooperating organizations. It is recognized that larger disasters, such as the Northridge Earthquake or repeats of the 1906 San Francisco Earthquake or the 1857 Fort Tejon Earthquake, may require cooperating organizations to direct expert resources to wholly internal response recovery issues, substantially postponing post-disaster loss avoidance tracking under such circumstances.

Pilot Program

Pending mutual aid agreements with the CSU and other interested state organizations, the SMART system will take three years to fully implement throughout California. OES intends to pilot this concept through California Polytechnic State University, San Luis

Obispo, where a SMART team is available and training for coverage of flood, seismic, and fire events can take place during the course of present work concluding the SHMP.

Interagency Service Agreements
Steps for program implementation with CSU and other interested state cooperating organizations are as follows. OES will meet with the staff of the cooperating organization, and an interagency service agreement will be established for the assignment of staff to the SMART program. State employees are allowed to be assigned to disaster-related activities, so no direct personnel costs are incurred. Costs of travel will be paid by OES though a master travel reimbursement agreement with the cooperating organization. Costs of SMART training for staff and faculty will be provided by OES and program funding will become part of the OES annual operation costs.

Comment On: Chapter 8 Section 5

8.5 Effective Use of Available Mitigation Funding

The Enhanced Plan must demonstrate that the state effectively uses existing mitigation programs to achieve its mitigation goals (DMA 2000, §201.5(b)(3)). The state must document that it has fully and effectively made use of FEMA and other funding already at its disposal, such as taking full advantage of FEMA programs, FMA, HMGP, and PDM to fund mitigation actions, and has used other FEMA and non-FEMA funding to support mitigation.

The State uses many funds and programs to mitigate against injury, loss of life and damage to property. Over the 2000-2006 period, 158 FEMA funded projects have been undertaken. The investments in mitigation follow the major disaster risk areas of California in the GIS modeling maps (see Chapter 5, Part 2). FEMA mitigation funds allocated are closely linked to the plan goals as is shown in Table 8.5A below. Prevention or significant reduction of loss of life and injuries is the State's primary goal and the number of earthquake (seismic) projects reflects the commitment to life safety.

The criteria used by OES to solicit, select and rank projects is clear and linked to maximizing project impact that support the state plan goals and objectives. While the OES objective is to expend all funds in each cycle, delays based on revised cost estimates and local capacity are real constraints to meeting this objective standard. OES attempts to maximize local opportunities for receiving federal mitigation funding by establishing a project waiting list of HMGP applicants from previous rounds.

A large number of HMGP projects under the Multi-Hazard category (see Table 8.5B) fund multi-hazard planning at the local or multi-jurisdictional level. This supports one of the main goals of *Statewide Emergency Management Strategic Plan 2005-2010* that "California will institutionalize hazard identification, risk assessment, and hazard mitigation planning to reduce vulnerability and provide parameters for planning and preparedness."

Table 8.5A Goals Investment Matrix 2000-2006

Multi-Hazard Plan Goals	Projects Obligated
Significantly reduce loss of life and injuries	76 Earthquake projects
Avoid damage to structures and property	64 Flood/Landslide/Mudslide Projects
Protect the environment	11 Wildfire projects
Promote hazard mitigation as an integrated public policy	91 Multi-Hazard Projects

Table 8.5B Distribution of All FEMA Project Grants 2000-2006

Disaster/Grant Type	Number of Projects
Multi-Hazard	92
Earthquake	76
Flood	59
Fire	11
Landslide	3
Mudslide	2
Economic	1

Source: OES Database 2007

In addition to the FEMA support funding as shown in Table 8.5.C, California integrates its own mitigation investment funds with those provided through many sources. For example, the California Seismic Commission is developing a $7 million funding program related to education, preparedness and loss reduction for implementation in 2007 through 2010. The California Earthquake Authority has funded mitigation booklets "Putting Down Roots in Earthquake Country" including one for northern California and one for southern California (in English and Spanish) for use in colleges and high schools. These funds come from an insurance company settlement. The Department of Water Resources has nine programs that address hazard mitigation throughout the state. The voters of California approved over 5.5 billion dollars in bond funds in 2006 for Hazard Mitigation projects. The state transportation agency (Caltrans) for example has committed over $6 billion dollars to retrofit and replace major bridges in the state with funds coming from the state general fund and increased bridge tolls.

Table 8.5C Distribution of Major FEMA Support Grant Programs 2000-2006

FEMA Grant Program	Obligated $	Number of Projects	Number of Counties Served
FMA	$ 8,257,142	43	18
HMGP	$73,845,013	102	19+
PDM	$65,992,280	99	27

Source: OES Database 2007

Comment On: Chapter 8 Section 6

8.6 Commitment to a Comprehensive Mitigation Program

Under FEMA guidance for Enhanced Plans (DMA 2000, §201.5(b)(4)(i-vi), a state must detail how its plan reflects a commitment to a comprehensive mitigation program. California's commitment to a comprehensive mitigation program is manifested through active implementation of programmatic efforts by all major state agencies that operate in concert with California's built environment.

1. Support for local mitigation planning. Commitment to support of mitigation planning by providing training workshops and coordinated development of local agency capability is represented by the ongoing program operated by the California Specialized Training Institute (CSTI), San Luis Obispo, an outreach operation of OES. CSTI has been providing training in mitigation planning to local agencies long before the Disaster Mitigation Act was passed by Congress in 2000. Various state agencies have provided workshops with mitigation content, including OES for FEMA grants applicants and the Disaster Resistant California Program; the California Seismic Safety Commission; Department of Water Resources; Caltrans; CAL FIRE through the Fire Wise program; and, CUEA (for its member and associate members).

2. Statewide program of hazard mitigation. Chapters 2, 3 and 5 as well as Section 8.1.1 of Chapter 8 have illustrated various facets of California's statewide hazard mitigation program including legislative initiatives, mitigation councils, formation of public/private partnerships, and executive actions that promote hazard mitigation. Another statewide effort comes from CAL FIRE which is remapping fire hazard severity zones for lands for which the state has fiscal responsibility for wildland fire protection (State Responsibility Area). CAL FIRE is also preparing Very High Fire Hazard Severity recommendations for local responsibility areas.

3. State provision of a portion of the non-Federal match for mitigation projects. Assembly Bill 2140, passed by the state legislature in 2006, provides a portion of the non-Federal match for HMGP and/or other mitigation projects, as described further in Chapter 2 and in Section 8.1.1 of Chapter 8. Moreover, AB 2140, together with new objectives in Chapter 3 of the 2007 SHMP, encourages linkage of state-mandated local general plan safety elements with LHMPs through joint adoption. In addition, $500 million of Proposition E bond funds were approved by the voters in 2006 for State Flood Control subventions.

4. Promotion of nationally applicable model building codes. California has led the nation in requiring and encouraging local governments to adopt current versions of nationally applicable model building codes and standards addressing natural hazards, not only for design and construction of state-sponsored mitigation projects, but also for all private construction. For example, there is new emphasis within CAL FIRE for upgrading codes related to the Wildland Urban Interface challenge. The Office of the State Fire Marshal (SFM), along with other state agencies, is in the process of developing and proposing a new Building and Fire Code for California using the 2006 International Building Code (IBC) and the International Fire Code (IFC) as the base documents. The California Building Commission adopted the Wildland-Urban

Interface codes in late 2005 with an effective date of January 2008. These new codes include provisions for ignition resistant construction standards in the wildland urban interface.

An additional example is the linking of Department of Water Resources flood management programs to the city and county statutory General Plan process. As noted in Chapter 2 and elsewhere, state planning law mandates local commitment to comprehensive mitigation action through state-mandated general plan safety elements and mandatory consistency of local development actions with those elements.

5. Post-disaster mitigation of building risks. Additionally, through the California Seismic Safety Commission and California Fire Safe Council, the state has sponsored comprehensive, multi-year efforts to mitigate risks posed to existing buildings identified as necessary for post-disaster response and recovery operations. For example, after the December 23, 2003 San Simeon Earthquake, the Seismic Safety Commission assessed the need for accelerated local mitigation of unreinforced masonry buildings, stimulating the legislature to pass new occupant disclosure requirements for URM buildings not yet retrofitted.

6. Integration of mitigation into its post-disaster recovery. Chapters 7 and 8 have provided numerous examples of how California integrates mitigation into its post-disaster recovery operations through HMGP and FMA project grants.

The 2007 SHMP knits together these horizontally and vertically integrated examples of California comprehensive mitigation program initiatives within a coordinated planning and implementation framework for further development and refinement.

8.7 Monitoring, Evaluating, and Updating the Plan

The SHMP is a living document that reflects the state's ongoing hazard mitigation commitment, planning, and implementation actions. Therefore the process of monitoring, evaluating, and updating is critically important to effectiveness of hazard mitigation in California.

Monitoring the Plan

Under 44 CFR 201.2, the State Hazard Mitigation Officer (SHMO) is the state's primary point of contact with FEMA, other federal agencies, and local governments for mitigation planning and implementation activities required under the Stafford Act and the Flood Insurance Act. Currently, the SHMO is the OES Hazard Mitigation Section (HMS) chief.

The HMS administers hazard mitigation grant programs authorized under the Stafford Act—HMGP, PDM, and FMA—and other grant programs as directed. The section also oversees state and local hazard mitigation planning programs undertaken to meet the requirements of the Stafford Act.

The SHMO has the responsibility for monitoring, maintaining, evaluating, and updating the Plan. OES staff supports the SHMO in a wide range of state and local hazard-specific

implementation plans and projects which involve continuous monitoring and updating of the Plan. Such activities consist of the submittal of periodic reports by agencies involved in implementing projects or actions, site visits, phone calls, and meetings conducted by the person responsible for overseeing the plan, and ongoing meetings of the State Hazard Mitigation (SHMT), described at length in Chapters 1 and 2 as well as early in Chapter 8. OES staff review of plan progress has been largely incremental. A new system of quarterly reports is being instituted to make the monitoring, evaluation, and update process more continuous and systematic. The quarterly reports examine progress toward achieving goals and evaluate implementation activities.

Evaluating the Plan

Evaluation of the SHMP is a function of multiple stakeholders, including the SHMO and OES mitigation staff, together with member agencies in the SHMT, local governments, and the public. During revision of the 2004 SHMP a major plan evaluation effort has been undertaken through the SHMT, as described in Chapters 1 and 2. SHMT deliberations have included consideration of such matters as:

1. Changes in the nature and magnitude of hazard problems and/or development;
2. Resources available committed to implementing the Plan;
3. Technical, policy, legal, and coordination challenges to effective implementation;
4. Positive and negative outcomes of mitigations actions;
5. Extent of desired agency participation as initially expected.

Monitoring Hazard Mitigation Projects

OES staff is monitoring the implementation of hazard mitigation projects, programs, and initiatives. Staff is reporting to the SHMO and the SHMT on the progress made towards plan goals and objectives and will track the following specific events:

- Hazard events, including federally declared disasters;
- FEMA approval of local hazard mitigation plans;
- Advances in knowledge or understanding of hazards;
- Changes in federal, state, and local legislation;
- Performance of mitigation projects during hazard events.

Systematic Plan Revision

The Plan is being systematically updated every three years, in accordance with FEMA requirements and good planning practice. The SHMO reviews and recommends for approval any plan updates proposed by the SHMT. During the 2007 SHMP update, the SHMT has played an influential role in providing input, direction, and guidance to the revision process. Recommendation for Plan revisions have been based on factors such as:

- New technologies such as use of the OES Portal to disseminate plan concepts and to collect information and comments;
- New information forthcoming from agencies with scientific and/or regulatory responsibilities for primary impact hazards, for example, additional California

Geologist Survey seismic mapping, CAL FIRE periodic wildfire risk map updates, and Department of Water Resources' new flood maps;

- Adjustments to changes in federal or state laws, regulations, or policies.

New Role of the SHMT

Using the lessons from the 2007 SHMP revision as a foundation, OES is devising a new role for the SHMT in Plan monitoring, evaluating, and updating. Upon adoption of the 2007 SHMP, the SHMT will be reorganized as the SEMS Mitigation Specialist Committee of the SEMS Technical Group reporting to the SEMS Advisory Board. Meeting at least quarterly, SHMT as the SEMS Mitigation Specialist Committee will be formally charged with the responsibility of monitoring, evaluating, and updating the 2007 SHMP.

Establishment of the restructured SHMT as a permanent, continuing part of the SEMS structure will assure: 1) continuing and active participation of key state agencies in SHMP monitoring, evaluation, and updating; 2) integration of mitigation with preparedness, response, and recovery related aspects of OES and other state agency functions. Regular ongoing meetings will provide an opportunity to begin the 2010 SHMP updating process as new disaster circumstances, societal conditions, and technology arise, providing a more continuous feedback loop between planning and implementation.

(This Page Intentionally Left Blank)

2007 SHMP Appendix

Introduction

The following appendix includes separate technical documents, charts, maps, tables, and other materials which supplement or elaborate on those included in the preceding eight chapters of the draft 2007 SHMP. These materials are identified by type (e.g., document, chart, map, or table) and listed in order of appearance of cross-references in each chapter. Each item bears a specific section or subsection in the body of the text number plus a letter indicating its sequence by type of material.

For example, Document 1.3.2A consists of a set of minutes of the State Hazard Mitigation Team from October 2006 through June 2007. Its first three numbers refer to the chapter, section, and subsection number in the text and its letter indicates its place in the sequence of items related to the same text. The following is an table of contents for each chart, document, map, or table listed by chapter, section, or subsection. The following is a list of technical materials by Chapter.

Appendix Index

Chapter	Identifier and Content
Chapter 1:	Document 1.3.2A SHMT Minutes, October 2006 – June 2007
Chapter 2:	Table 2.3.3B State Agency Functions – Agency Responsibility Matrix
	Table 2.3.4B Earthquake Hazard Mitigation Legislation, 1933 to 2006
	Table 2.3.4C Flood Hazard Mitigation Legislation, 1933 to 2006
	Table 2.3.4D Wildfire Hazard Mitigation Legislation, 1933 to 2006
Chapter 5:	Table 5.1.1C California Disaster History
	Table 5.4.1A GIS Risk Exposure Analysis
	Chart 5.4.1B GIS Modeling
	Table 5.5.4.1G Draft Overall Progress Toward Earthquake Mitigation and Key Building Inventories in California (two versions to be merged into one for Public Comment Draft)
	Map 5.5.4.1B State Owned & Leased Structures, Northern California, Earthquake Faults (to be added for Public Comment Draft)
	Map 5.5.4.1C State Owned & Leased Structures, Central California, Earthquake Faults (to be added for Public Comment Draft)
	Map 5.5.4.1D State Owned & Leased Structures, Southern California, Earthquake Faults (to be added for Public Comment Draft)
	Map 5.6.3B State Owned & Leased Structures, Northern California – 100-Year Flood Plain (to be added for Public Comment Draft)
	Map 5.6.3C State Owned & Leased Structures, Central California – 100-Year Flood Plain Earthquake Faults (to be added for Public Comment Draft)
	Map 5.6.3D State Owned & Leased Structures, Southern California– 100-Year Flood Plain (to be added for Public Comment Draft)

Chapter	Identifier and Content
Chapter 5:	Chart 5.7.1B Dollar Damage on State Responsibility Area (SRA) Since 2000
	Chart 5.7.1C Structures Burned in State Responsibility Area Since 2000
	Table 5.7.1D Wildfire Events (check)
	Map 5.8.2B General Areas Susceptible to Landslides
	Map 5.8.2C Landslide Declared Disasters Since 1950
	Document 5.11A Additional Hazards
Chapter 7:	Table 7.1K Additional FEMA Mitigation Funding and Technical Assistance Sources
Chapter 8:	Map 8.3A Hazard Mitigation Grant Projects by County, DR-845 through 1585 (1989-Present)
	Map 8.3B Hazard Mitigation Grant Projects Percent Geocoded by County, DR-845 through 1585 (1989-Present)

Document 1.3.2A SHMT Meeting Minutes

State Agency Hazard Mitigation Team (SHMT)
State Multi-Hazard Mitigation Plan Update and Enhancement

October 26, 2006 Meeting Minutes

Welcome

Purpose of This Meeting
To introduce California state agencies to the 2007 update and enhancement process of the State Multi-Hazard Mitigation Plan process and to solicit input and assistance from the agencies.
Welcome

Grace Koch welcomed the assembly. The goal of the State of California Multi-Hazard Mitigation Plan (SHMP) process is to leverage the work in preparedness to benefit California as a whole. It is hoped that the planning and preparedness work the state agencies have done will contribute to these goals.

Overview of the SHMP

DMA 2000 and the 2004 SHMP (Ken Worman)
The goal of Hazard Mitigation planning is to trigger cost-beneficial mitigation project development to reduce or eliminate risks from hazards in California communities. Federal mandates require that the SHMP be updated every three years. The first update is due October 8, 2007. If this deadline is not met, the state will not be eligible for public assistance funding.

SHMP Revision Project Overview (Ken Worman)
OES has a lot of existing material but needs to add new information and fill in the gaps since the original SHMP of 2004. OES has contracted with Cal Poly to assist with the research and development of the updated SHMP.

OES is also preparing to enhance the SHMP, which will make California eligible for up to 20% in federal funding.

In the packets distributed to the agencies today, there are two handouts:

- "What is Mitigation?" - Provides a definition of hazard mitigation and steps for planning.
- "Multi-Hazard Mitigation Plan Overview" - Provides an overview of what the SHMP is and what it is intended to do.

SHMP 2007

Department/Agency Role in Drafting the SHMP Update(Ken Topping)

OES and Cal Poly want to help agencies determine where they fit into the SHMP update process. Cal Poly developed a questionnaire for the agencies to fill out. This questionnaire was distributed at today's meeting. Cal Poly needs the following:

- Any new hazards, risk, and/or mitigation actions that are not currently in the 2004 SHMP. Example of new hot issues:
  - → Levee problems
  - → Avian flu
  - → West Nile Virus
  - → Urban heat
  - → Tsunamis
- Anything in the 2004 SHMP that needs to be expanded upon.
- Strategies that have been developed.
- Mitigation actions that can improve or ensure long-term safety.
- How any new legislation may affect the agency's planning efforts.

Two new topics to be included in the update are vulnerable populations and pets (evacuation).

FEMA wants to make sure that California understands what hazards and vulnerabilities it has, and wants to know what we are doing about them.

Paula Schulz, a pre-and post disaster planning and management consultant, will be available to assist agencies with the questionnaire. Charles Eadie will conduct outreach to local governments and the private sector.

Cal Poly will modify the structure of the plan to reflect new priorities in hazards. They will develop a model linking mitigation and preparedness with response.

The deadline for agencies to submit information is December 15, 2006. Cal Poly will only have three months, until March 2007, to prepare the revised draft Mitigation Plan, and three months for further state agency comment before submittal to FEMA for approval in June 2007.

Enhanced Plan Requirements (Bill Simbieda)

The Enhanced SHMP, which includes an update of the Standard SHMP, will be written according to current requirements in the FEMA crosswalks. The Enhanced SHMP will be integrated within the Standard SHMP as it expands on areas required within the Standard SHMP. Updates of the Standard SHMP Guidance and crosswalk are due to be available November 2006. Updates of the Enhanced Plan Guidance and crosswalk are due to be available in early 2007.

While FEMA Region IX reviews the Standard SHMP, FEMA will assign a six-person special team outside of Region IX to review the Enhanced SHMP component. Therefore, FEMA Region IX will be enlisted to act as mentor to OES and Cal Poly for the enhanced plan.

Standard SHMP updates are due every three years, whereas the initial development of an Enhanced SHMP does not have a deadline. Once a state has achieved Enhanced SHMP status, it will then require updates every three years.

The state agencies will not need to be involved in the development of the enhanced portion requirements of the planning process, as this is primarily OES / Cal Poly responsibilities. We anticipate having the circulation draft out for review in March 2007.

Web Portal (Johanna Fenton) and GIS (Paul Veisze)
The web portal is in the prototype stage and is not accessible by the public yet. The target for release is mid-November. Any agencies interested in beta-testing the web portal, may link to it at: http://test.hazardmitigation.ceres.ca.gov

The purpose of the web portal is two-fold:

- To eventually act as the SHMP
- To provide "all things mitigation" to state and local agencies, educators, students, and the public. It links to the SHMP but also links to flood mitigation plans, non-oes sites, maps and GIS data, other state SHMPs, LHMPs, forms, calendar of events, etc.

The web portal will be valuable for public awareness of the SHMP and to educate the public on the importance of mitigation, as well as what the state is doing to protect them from hazards. The goal is to make the web portal a paperless source for information, documents, forms, and other media.

Web Portal Tools –
- It will be a powerful content management system where forms can be filled out on line.
- It will have an on-line approval process.
- It will have a geographic search function so if you someone types in a city, all the documents for that city will be accessible (lat and long).

Use of GIS in the SHMP – Space will be used as an indexing tool for the plan.

State agencies can contact OES GIS to obtain help in mapping. Other sources include:

- California GIS Council
- California Mapping Coordinators Committee
- Federal Geographic Coordinators Committee of California

Hazard Vulnerability Assessment System (HVAS) – A PowerPoint presentation was given at today's meeting.

Local Hazard Mitigation Plans (LHMP)

Integrating LHMPs into the SHMP - Mike Boswell
Cal Poly has four graduate students who are currently reviewing the approximately 300 approved LHMPs.

Cal Poly's game plan is as follows:

- Compare collective local risk assessments to the state perspective. To do this, they will develop a database to sort the LHMP information, and will create a report.

- Determine how state and local agencies can better work together to plan for mitigation projects.
- Develop a case study of interesting plans.
- For the Enhanced SHMP, they want to show that all California agencies, both state and local, are on the same page and are working together to reduce risks.
- Document where locals received their information (maps, etc.) to include in their plans. How dependent are they on various departments for this information?

If agencies have any additional ideas of what Cal Poly should look for – areas that would be "good to know" as they review these plans, please contact Julie Malm.

Questions and Answers

Q: How does mitigation funding benefit state agencies?
A: It makes state agencies eligible for federal reimbursement of costs to perform mitigation projects and activities.

Q: Examples of mitigation projects for state agencies?
A: Structural and non-structural strengthening of state buildings, CDF fuel breaks, awareness programs, and DWR technologies.

Q: Who determines what projects are eligible for mitigation funds?
A: State OES Hazard Mitigation Branch evaluates the applications to determine eligibility of the applicant and the project, and determines whether the project is cost beneficial and meets current priorities. The applications are then forwarded to FEMA for final evaluation and approval.

Q: How do agencies determine what kinds of mitigation projects to plan for?
A: Contact the OES Hazard Mitigation Branch at (916) 845-8150.

Q: Where can agencies get eligibility information?
A: Currently you can call OES Hazard Mitigation staff, and it will be available on the web portal.

Q: How would each agency determine where they would fit into the SHMP?
A: If you don't deal directly with the big three (flood, fire, earthquake), go to Chapters 7 – Other Hazards, and 8 – Less Significant Hazards, of the SHMP. For additional assistance, contact the SHMP Coordinator, Julie Malm.

Q: Will there be a crosswalk to the SHMP?
A: Yes, FEMA has a crosswalk for both the standard and enhanced SHMPs.

Q: Will Cal Poly include Local Hazard Mitigation Plan (LHMP) information in the SHMP?

A: Yes. Mike Boswell discusses what Cal Poly is doing with the LHMPs in Agenda Item IV above. It is a requirement to incorporate LHMPs into the SHMP.

Q: A security issue – How do we protect confidentiality?
A: The SHMP and LHMPs are all public documents. Agencies need to inform Cal Poly on what must not be public information. And if there is anything that must be included in the SHMP but also must be confidential, discuss it in a general way.

Next Meeting
CHANGE IN DATE: January 25, 2007 from 1:30-3:30 p.m.
Location: OES Headquarters. Room: MPR2

State Hazard Mitigation Plan Team Roster

Agency	Name	Phone	E-Mail
Building Standards	Debra Brown	(916) 274-5872	debra.brown@dgs.ca.gov
California Conservation Corps	Kim Bushard	(916) 341-3180	kim.bushard@ccc.ca.gov
California Energy Commission	Sherry Stoner	(916) 654-5005	sstoner@energy.state.ca.us
California Geological Survey	Chuck Real	(916) 323-8550	creal@conservation.ca.gov
	John Parrish	(916) 445-1923	john.parrish@conservation.ca.gov
California Highway Patrol	Steve Lerwill	(916) 657-4098	slerwill@chp.ca.gov
	L.D. Maple	(916) 227-6388	ldmaple@chp.ca.gov
Cal Poly San Luis Obispo	Ken Topping	(805) 756-1315 (805) 927-7773	ktopping@calpoly.edu kentopping@aol.com
	Bill Siembieda	(805) 756-1315	wsiembie@calpoly.edu
	Mike Boswell	(805) 756-2496	mboswell@calpoly.edu
	Charles Eadie	(831) 459-9992	us-charlie@pacbell.net
	Paula Schulz	(707) 939-8963	schulzpa@aol.com
City of Roseville	Julia Burrows	(916) 774-5361	jburrows@roseville.ca.us
Contra Costa County Delta Protection Commission	Roberta Goulart	(925) 335-1226	rgoul@cd.cccounty.us
Department of Corrections & Rehabilitation	Bob Caputi	(916) 323-2305	robert.caputi@cdcr.ca.gov
	Jim Fernandes	(209(915-9584	Jim.fernades@cdcr.ca.gov
Department of Food and Agriculture	Rita Witucla	(916) 651-6517	rwitucki@cdfa.ca.gov
Department of Forestry & Fire Protection	Curt Karlin	(916) 324-1637	curt.karlin@fire.ca.gov
	Robert Chew	(916) 657-0470	robert.chew@fire.ca.gov
Department of Fish and Game	Larry Kirsch	(925) 945-6732	lkirsch@ospr.dfg.ca.gov
Department of General Services	Kim Hunt	(916) 376-5271	kim.hunt@dgs.ca.gov
	Ted Park	(916) 375-4700	ted.park@dgs.ca.gov

Agency	Name	Phone	E-Mail
Dept. of Resources	David Harris	(916) 653-8092	David.Harris@resources.ca.gov
Department of Social Services	Milt Yee	(916) 657-1901	milton.yee@dss.ca.gov
Department of Transportation	Sri Balasubramanian	(916) 208-2348	balasubramanian@dot.ca.gov
Department of Water Resources	Maria Lorenzo-Lee	(916) 574-0639	mlorenzo@water.ca.gov
Division of State Architect	Dan Levernier	(916) 323-3013	Dan.levernier@dgs.ca.gov
Environmental Protection Agency	Steven Monk	(9160 323-2634	smonk@cdpr.ca.gov
Housing and Community Development	Chris Anderson	(916) 445-9471	canderson@hcd.ca.gov
	Elliott Mandell	(916) 327-2625	emandell@hcd.ca.gov
Office of Homeland Security	Brian Keith	(916) 322-1556	brian.keith@ohs.ca.gov
Seismic Safety Commission	Robert Anderson	(916) 263-5526	anderson@stateseismic.com
Stanislaus Co. CSAC	Gary Hinshaw	(209) 602-0252	ghinshaw@stanoes.com
State and Consumer Services	Kathleen Webb	(916) 657-5022	kwebb@scsa.ca.gov
State Lands	Kevin Mercier	(502) 499-6312	mercier@s.c.ca.gov
University of Calif. Office of the President	Bob Charbonneau	(510) 987-9594	robert.charbonneau@ucop.edu
OES	Becky Wagoner	(916) 845-8151	Rebecca_Wagoner@oes.ca.gov
	Chris Lowrie	(916) 845-8162	chris.lowrie@oes.ca.gov
	Grace Koch	(916) 845-8534	Grace_Koch@oes.ca.gov
	Julie Malm	(916) 845-8160	Julie_Malm@oes.ca.gov
	Johanna Fenton	(916) 845-8157	Johanna_Fenton@oes.ca.gov
	Karen McCready	(916) 845-8177	Karen_McCready@oes.ca.gov
	Karma Hackney	(916) 845-8141	Karma_Hackney@oes.ca.gov
	Ken Leep	(916) 845-8272	Kenneth_Leep@oes.ca.gov
	Ken Worman	(916) 845-8154	Ken_Worman@oes.ca.gov
	Nancy Sutton	(916) 845-8276	Nancy_Sutton@oes.ca.gov
	Paul Veisze	(916) 845-8542	Paul_Veisze@oes.ca.gov
	Robert Mead	(916) 845-8174	Robert_Mead@oes.ca.gov
	Scott Marotte	(916) 845-8785	Scott_Marotte@oes.ca.gov

State Agency Hazard Mitigation Team (SHMT)
State Multi-Hazard Mitigation Plan Update and Enhancement

January 25, 2007 Meeting Minutes

Purpose of This Meeting

To provide California state agencies stakeholders an update on the progress of the 2007 State Multi-Hazard Mitigation Plan process and to solicit input and assistance from the agencies.

Welcome

Ken Worman welcomed the assembly.

OES is required to produce a State of California Multi-Hazard Mitigation Plan (SHMP) every three years to stay eligible for federal hazard mitigation funding. The first plan was approved in 2004. The current plan must be updated by October 2007.

The goal of the SHMP process is to leverage the work in preparedness to benefit California as a whole. It is hoped that the planning and preparedness work the state agencies have done will contribute to these goals.

Update on Homework Questionnaires

During the previous meeting on October 26, 2006, the state agency stakeholders were given questionnaires to fill out listing hazards and risks to their communities, and resources they have available. The challenge for the core writing team is to condense the plan.

Status Report

Ken Topping of Cal Poly provided a written Progress Report Summary and gave an update to the SHMT.

Approximately 46 agencies were involved in the update.

Cal Poly is currently in the process of reviewing all the information received from the state agency questionnaires to look for the most important information to include in the plan. Additionally, Cal Poly is determining if the information provided is sufficient.

The last page of the Progress Report Summary contains a recommended outline of the new plan.

This Spring, the core writing team will provide a draft SHMP to the state agencies to review.

This Summer, the public comment period will take place.

The goal – FEMA approval as an enhanced plan by October 2007.

State Agency Questionnaire (Part 1)

Paula Schulz

If anyone has not completed the questionnaire, please submit it to Julie Malm as soon as possible. Cal Poly needs input from all the state agency stakeholders.

Results of the questionnaire to date:

- 27 responses.
- Awaiting at least six critical agencies to respond.
- Hazards listed:

Fire	Flood	Earthquake
Tsunami	Environmental	Pandemic Illness
Landslide	Delta Levees	Climate Related
Drought	Freeze	Health Safety
Pests	Terrorism	Naturally-Occurring Asbestos

- Impacts listed:
  - Risks to special needs populations
  - Risks to utilities and transportation
  - Risks to the energy supply
- New regulations:
  - AB 2140 – Adopting the LHMP as part of General Plan, Safety Element
  - ASCE 41-06, New publication covering retrofit standards for public schools and state buildings
  - Marine Oil Terminal Engineering & Maintenance Standards, completed in February 2006 as part of the California Building Code
- Mitigation Strategies
  - Single hazard
  - Multiple hazards

Triggering (one causes another, which causes another, etc.)

Charles Eadie

Outreach efforts:

- Focusing on umbrella, non-governmental, and professional organizations, and the private sector.
- Explaining to those groups about the SHMP and why it is important to them.
- Looking for "nuggets of wisdom" from organizations and agencies with experiences we can learn from for the SHMP.
- Using the web portal to gather input.
  - What organizations are doing in mitigation
  - How the state can help to fund local mitigation projects
  - Do they want to be involved in updates?

Web Portal

The new web portal is located at www.oes.ca.gov. Once you are in the OES website, click on "Hazard Mitigation" in the menu at the left side of the screen. Then click "Hazard Mitigation Web Portal."

LHMP Study Initial Results

Mike Boswell

Mike Boswell gave a PowerPoint presentation of the LHMP study. It provided summaries of the following:

- Basic plan information
  - Total plans reviewed 424+
  - 80% were multi-jurisdictional plans
  - 40% of counties have LHMPs in place.
  - Majority are in the southern, central, and bay areas
  - 50% of the plans are prepared by the agency themselves
- Plan preparation
  - Approximately 1/3 did not include public involvement
- Hazards included in the plans
  - Over 50 types of hazards were identified
  - Approximately 64% used GIS mapping
- Risk assessments
  - Majority (43%) used FEMA How-To Guides. These are available on the web portal.
  - 16% used DMA 2000 Guidance
  - 22% used HAZUS
- Mitigation
  - Ranking methods:
    - 41 % used STAPLEE
    - Qualitative
    - Other
- None – This is a concern to us
- Other observations
  - Important concepts were inconsistently defined
  - Hazards were inconsistently defined/categorized
  - Hazard ranking schemes varied
  - Methods were insufficiently documented
- Next steps
  - Continue analysis
  - Survey local governments and LHMP preparation and implementation
  - Develop final LHMP study report
  - Develop recommendations for updates

- Determine why some communities produce good plans and why others produce poor plans. Biggest predictor is amount of financial resources.
- Find out why some locals don't create plans

Part of the enhanced plan is to determine how much money locals have saved from real-life disasters due to mitigation efforts.

SHMP Goals and Objectives

Ken Topping gave a short PowerPoint presentation of the goals and objectives currently listed in the approved 2004 SHMP.

In review of the current SHMP goals and objectives, the core writing team is identifying gaps, conflicting goals, and seeking to clarify terms used previously. The SHMT was directed to review the current goals and objectives and provide input identifying suggested changes needed for the updated SHMP.

Please send written comments and suggestions on the current SHMP goals and objectives to Julie Malm by Thursday, February 15.

Miscellaneous

Paul Veisze, Manager of OES GIS Branch is looking for GIS resources from the state agency stakeholders. Please contact him at (916) 845-8542.

Next Meeting

Next State Agency Meeting – February 22, 2007, 9:00 am to 11:00 am

First revision of the Draft Administrative SHMP will be distributed to the SHMT for review at the March 29, 2007 meeting.

State Agency Hazard Mitigation Team Roster

Agency	Name	Phone	E-Mail
California Coastal Commission	Lesley Ewing	(415) 904-5291	lewing@coastal.ca.gov
California Department of Food and Agriculture	Lisa Quiroz	(9160 651-0032	Lquiroz@cdfa.ca.gov
California Earthquake Authority	Nancy Kincaid	(916) 325-3827	nkincaid@calquake.com
California Energy Commission	Sherry Stoner	(916) 654-5005	sstoner@energy.state.ca.us
California Geological Survey	Chuck Real	(916) 323-8550	creal@conservation.ca.gov
California Highway Patrol	Steve Lerwill	(916) 657-4098	slerwill@chp.ca.gov
Cal Poly San Luis Obispo	Ken Topping	(805) 756-1315 (805) 927-7773	ktopping@calpoly.edu kentopping@aol.com
	Bill Siembieda	(805) 756-1315	wsiembie@calpoly.edu
	Mike Boswell	(805) 756-2496	mboswell@calpoly.edu
	Charles Eadie	(831) 459-9992	us-charlie@pacbell.net
	Paula Schulz	(707) 939-8963	schulzpa@aol.com
California State University	Charlene Minnick	(562) 951-4580	cminnick@calstate.edu
City of Roseville	Julia Burrows	(916) 774-5361	jburrows@roseville.ca.us
Department of Fish and Game	Larry Kirsch	(925) 945-6732	lkirsch@ospr.dfg.ca.gov
Department of General Services	Kim Hunt	(916) 376-5271	kim.hunt@dgs.ca.gov
	Susan George	(916) 375-5992	Susan.george@dgs.ca.gov
Department of Insurance	Bruce Patton	(9160 492-3560	pattonb@insurance.ca.gov
Department of Social Services	Milt Yee	(916) 657-1901	milton.yee@dss.ca.gov
Department of Technological Services	Pam Wagner	(916) 464-4527	pamela.wagner@dts.ca.gov
Department of Water Resources	Ricardo Pineda	(916) 579-6611	rpineda@water.ca.gov
Division of State Architect	Dan Levernier	(916) 323-3013	dan.levernier@dgs.ca.gov
Delta Protection Commission	Linda Friack	(916) 776-2292	lindadpc@citlink.net
Environmental Protection Agency	Steven Monk	(9160 323-2634	smonk@cdpr.ca.gov

Agency	Name	Phone	E-Mail
Housing and Community Development	Elliott Mandell	(916) 327-2625	emandell@hcd.ca.gov
Office of Homeland Security	Drew Hammond	(916) 324-6120	drew.hammond@ohs.ca.gov
	Jessica Cummins	(916) 324-8908	jessica.cummins@ohs.ca.gov
Office of Planning and Research	Scott Morgan	(916) 322-2960	scott.morgan@opr.ca.gov
Seismic Safety Commission	Fred Turner	(916) 263-5506	turner@stateseismic.com
SOS – Archives	Laren Metzer	(916) 653-3834	lmetzer@ss.ca.gov
Stanislaus Co. CSAC	Gary Hinshaw	(209) 602-0252	ghinshaw@stanoes.com
State Lands	Kevin Mercier	(502) 499-6312	mercier@s.c.ca.gov
OES	Becky Wagoner	(916) 845-8151	Rebecca_Wagoner@oes.ca.gov
	Chris Lowrie	(916) 845-8162	chris.lowrie@oes.ca.gov
	Julie Malm	(916) 845-8160	Julie_Malm@oes.ca.gov
	Johanna Fenton	(916) 845-8157	Johanna_Fenton@oes.ca.gov
	Karen McCready	(916) 845-8177	Karen_McCready@oes.ca.gov
	Ken Worman	(916) 845-8154	Ken_Worman@oes.ca.gov
	Nancy Sutton	(916) 845-8276	Nancy_Sutton@oes.ca.gov
	Paul Veisze	(916) 845-8542	Paul_Veisze@oes.ca.gov
	Robert Mead	(916) 845-8174	Robert_Mead@oes.ca.gov
	Scott Marotte	(916) 845-8785	Scott_Marotte@oes.ca.gov

State Agency Hazard Mitigation Team (SHMT)
State Multi-Hazard Mitigation Plan Update and Enhancement

February 22, 2007 Meeting Minutes

Purpose of This Meeting

To discuss the Gap Analysis for the Enhanced State Multi- Hazard Mitigation Plan (SHMP).

2004 SHMT Gap Analysis

Ken Topping of Cal Poly discussed this document using a PowerPoint presentation. Johanna Fenton will put this PowerPoint presentation on the web portal. The gap analysis document was made available at the meeting.

Federal law requires that all states have a state multi-hazard mitigation plan in place to be eligible for federal disaster assistance. It also requires that local agencies have a plan in place to receive certain federal mitigation funding.

Mr. Topping gave a discussion on what an enhanced SHMP is:

- Makes the state eligible for up to 20% of federal post-disaster mitigation funding for total eligible Stafford Act assistance.
- A standard SHMP makes the state eligible for up to 15% of total eligible Stafford Act assistance, depending upon the size of the disaster, as of passage of the 2007 Department of Homeland Security Appropriations Act (HR 5441) on October 4, 2006. With a standard plan, California would only be qualified to receive Hazard Mitigation Grant Project funds equaling the following proportions of total eligible Stafford Act assistance:
  - 15% for amounts not more than $2 billion;
  - 10% for amounts more than $2 and not more than $10 billion;
  - 7½% for amounts more than $10 billion and not more than $35 billion.
- Previously, a standard plan only qualified the state to receive up to 7½ % for all size disasters.

<u>In either case, the difference to the state with a catastrophic disaster in California between an Enhanced Plan (20%) and a Standard Plan (7½% for amounts over $10 billion) would be significant.</u>

Requires all elements of the standard SHMP, plus the following:

- Integration with other planning initiatives
- Project implementation capability
- Program management capability
- Assessment of mitigation actions
- Effective use of available mitigation funding
- Commitment to a comprehensive mitigation program

New material and institution needed:

- Evidence of ongoing mitigation planning process for California. We need to track additional projects throughout the state which are not funded by FEMA.
- State Hazard Mitigation Team should become a permanent interagency coordination team.
  - Becky Wagoner announced the SEMS Mitigation Specialist Committee, which will work to integrate mitigation and the SHMP into SEMS. This committee is on hold until release of the Draft SHMP.
  - SEMS is not just a response system, but also for recovery and mitigation.
  - Ms. Wagoner is looking for volunteers to join this effort.

Emerging Issues:

- Recent Catastrophic disasters elsewhere have highlighted hazards previously given minimal attention in the California SHMP:
  - Tsunamis
  - Levee failure
  - Climate related issues
  - CO_2 emissions
  - Coastal erosion
  - Pandemics
  - Extreme heat
- Recommendation – New sections addressing hazards gaining attention since 2004.

What are the Gaps?

- Routine updates
- What hasn't been included
- How we look at emerging issues

Currently working on:

- Chapter 4 – Earthquake Hazards
- Chapter 5 – Wildfire Hazards
- Chapter 6 – Flood Hazards
- Chapters 4, 5, and 6 – GIS Hazards Assessment Model
- Appendices 1 through 14 – Need data sources from OES

Mr. Topping requested that the State Hazard Mitigation Team members determine how the SHMP can be useful to their agencies – This is to be a state-level plan.

Ideally, the plan would also include causes and effects - for example, how fires can be connected to landslides.

What is Still Needed From the State Agencies

Paula Schulz followed up on the questionnaire distributed to the state agency representatives at the October 2006 meeting.

Approximately 75% of the questionnaires have been returned. Cal Poly is still awaiting about 10 questionnaires.

"Other state efforts" is lacking. We need more information from SHMT agencies about your mitigation programs. Cal Poly does not know what each of you do on a day to day basis to support hazard mitigation activities at the state and local level. We rely on you to provide that information.

Example of helpful information to submit – Annual budgets or funding sources your agency has available for planning, projects, workshops, conferences, etc. Identify all funding sources. Document all that you do in relation to hazard mitigation activities.

Much of the data Cal Poly has received provides some consensus and language updates. That information is very helpful. Additionally, responses that highlighted gaps will need some follow-up, and we will be contacting you individually for that information. This is particularly important for the emerging hazards or hazards that were not adequately addressed in the 2004 Plan. However, don't wait for our call to get started on collecting data.

What Cal Poly needs for each hazard:

- Identify the hazard
- Profile the hazard – what causes it, how often, etc.
- Assess state vulnerability and potential losses, including dollar losses (DGS has maps of the locations of all state-owned facilities).
- Current mitigation activities- what is going on in the state and what does your agency want to see happen in the future?
- Area of Responsibility: Include private property damages and vulnerability.

Ms. Schulz asks that each state agency read the sections of the current SHMP that they think may apply to their agency, and give Cal Poly information that needs to be added or updated. Please include tables, charts, maps, and any other ways to present data. When presenting data, remember to identify the source of the data and the date it was created.

Idea presented: To determine the overall state-wide funds spent for mitigation activities, have agencies give annual dollars spent, broken down by hazard type.

The Web Portal

Johanna Fenton announced the official launch of the Hazard Mitigation Web Portal.

The new web portal is located at www.oes.ca.gov. Once in the OES website, click on "Hazard Mitigation" in the menu at the left side of the screen. Then click "Hazard Mitigation Web Portal."

Ms. Fenton specifically discussed the SHMP section of the web portal. Under either "Programs" or "Quick Links" you can

- Make comments on the 2007 SHMP update
- Get information about and comment on the 2004 SHMP, in its entirety or by chapter
- Request a CD of the 2004 SHMP

- Review related guidance and regulations
- Review other approved SHMPs – The states of Washington, Oregon, and Virginia have enhanced SHMPs in place
- Review frequently asked questions (FAQs).

OES will add a list of approved local hazard mitigation plans and the FEMA SHMP crosswalk on the web portal for state agency use.

Mitigation Success Stories can be found under the "Resources and Education" portion of the web portal.

Goals and Objectives

Ken Topping provided a PowerPoint presentation of recommended language changes. The group discussed the language in the presentation.

Goals of this process:
- Check for gaps
- Respond to comments provided by state agency representatives
- Simplify, promote consistency, and reach general consensus.

Goals of the Enhanced SHMP:
- Goal 1: Reduce risk to lives and reduce injuries – there were concerns by the state agency representatives that the language claims to "save lives," "ensure all development…" etc. However, there are no guarantees for this since mitigation reduces, not eliminates risks.
- Goal 2: Avoid damage to property. Success stories are initially based on benefit cost analyses.
- Goal 3: Protect the environment.
  - Federally-funded projects are already put through environmental review.
  - We need to define the difference between "risk" and "hazard."
- Goal 4: Promote hazard mitigation as an integrated policy.

Next Meeting

The March 29, 2007 meeting has been CANCELLED to allow the SHMT time to review the first Draft Administrative SHMP, which will be distributed by e-mail to the SHMT at the end of March.

The next SHMT meeting is scheduled for April 26, 2007 from 9:00-12:00 AM.

State Agency Hazard Mitigation Team Roster

Agency	Name	Phone	E-Mail
California Earthquake Authority	Nancy Kincaid	(916) 325-3827	nkincaid@calquake.com
California Geological Survey	Chuck Real	(916) 323-8550	creal@conservation.ca.gov
California Highway Patrol	L.D. Maples	(916) 227-6388	ldmaples@chp.ca.gov
Cal Poly San Luis Obispo	Ken Topping	(805) 756-1315 (805) 927-7773	ktopping@calpoly.edu kentopping@aol.com
	Bill Siembieda	(805) 756-1315	wsiembie@calpoly.edu
	Paula Schulz	(707) 939-8963	schulzpa@aol.com
California State University	Michelle Schlack	(562) 951-4568	mschlack@calstate.edu
Department of Fish and Game	Larry Kirsch	(925) 945-6732	lkirsch@ospr.dfg.ca.gov
Department of Forestry	Robert Chew	(916) 651-0470	robert.chew@fire.ca.gov
Department of General Services	Susan George	(916) 375-5992	Susan.george@dgs.ca.gov
	Kristine French	(916) 376-5313	kristine.french@dgs.ca.gov
Department of Insurance	Bruce Patton	(916) 492-3560	pattonb@insurance.ca.gov
Department of Resources	David Harris	(916) 653-8092	david.harris@resources.ca.gov
Department of Technological Services	Pam Wagner	(916) 464-4527	pamela.wagner@dts.ca.gov
Department of Transportation	Sri Balasubramanian	(916) 208-2348	balasubramanian@dot.ca.gov
Department of Water Resources	Maria Lorenzo-Lee	(916) 574-0639	mlorenzo@water.ca.gov
Housing and Community Development	Elliott Mandell	(916) 327-2625	emandell@hcd.ca.gov
Office of Homeland Security	Patrick Koeneren	(916) 323-7440	patrick.koeneren@ohs.ca.gov
Seismic Safety Commission	Fred Turner	(916) 263-5506	turner@stateseismic.com
State Lands	Kevin Mercier	(502) 499-6312	merciek@slc.ca.gov
OES	Becky Wagoner	(916) 845-8151	Rebecca_Wagoner@oes.ca.gov
	Julie Malm	(916) 845-8160	Julie_Malm@oes.ca.gov
	Johanna Fenton	(916) 845-8157	Johanna_Fenton@oes.ca.gov
	Karen McCready	(916) 845-8177	Karen_McCready@oes.ca.gov
	Ken Leep	(916) 845-8272	Kenneth_Leep@oes.ca.go
	Ken Worman	(916) 845-8154	Ken_Worman@oes.ca.gov
	Nancy Sutton	(916) 845-8276	Nancy_Sutton@oes.ca.gov
	Robert Mead	(916) 845-8174	Robert_Mead@oes.ca.gov
	Scott Marotte	(916) 845-8785	Scott_Marotte@oes.ca.gov

State Agency Hazard Mitigation Team (SHMT)
State Multi-Hazard Mitigation Plan Update and Enhancement

May 10, 2007 Meeting Minutes

Purpose of This Meeting

To discuss the agency review of the Draft 2007 SHMP.

What's In It? What's New?

Ken Topping of Cal Poly gave a PowerPoint presentation to give a summary of updates and changes to the SHMP for the 2007 draft plan.

Overview

Draft 2007 SHMP Review

- What's new?
- What are the key themes?
- What refinements are anticipated?
- How can the Plan promote creation of a comprehensive mitigation program for California?
- How can your agency benefit?
- What would you like to see this Plan accomplish?
- How can this document be made most useful?

Current Status 2007 SHMP

- Administrative draft 2007 SHMP has now been prepared by Cal Poly
- Now under review by the State Hazard Mitigation Team (SHMT)
- Editorial process leading to preparation of public release draft to be circulated July-August 2007
- 2007 SHMP structured to qualify for FEMA approval as an Enhanced Plan

Benefits of Enhanced Plan Approval

- FEMA Enhanced Plan approval would qualify California for HMGP funding up to 20% of a federally declared disaster authorization
- Present Standard Plan status qualifies the state for:
  - 15% for amounts not more than $2 billion;
  - 10% for amounts more than $2 and not more than $10 billion;
  - 7½% for amounts more than $10 billion and not more than $35 billion
- Most disasters in California since 1950 have cost below $2 billion, yet a few have exceeded $10 billion
- Main value of FEMA-approved Enhanced SHMP is for potential for catastrophic events such as a major earthquake on the San Andreas or Hayward faults

FEMA Enhanced Plan Criteria

- General: 2007 SHMP must convincingly show that California is a proactive leader in implementing a comprehensive statewide mitigation program

- Integration with Other Planning Initiatives: Is the Plan integrated to the extent practicable with other State/regional planning initiatives?
- Project implementation capability: Does it identify and demonstrate ability to implement the SHMP?
- Program management capability: Does it show state capability to effectively manage HMGP, FMA, PDM, other mitigation grants?
- Assessment of mitigation actions: Does it document a system and strategy by which the State conducts assessments and includes a record of effectiveness (actual cost avoidance) for each completed project?
- Effective use of available mitigation funding: Does it demonstrate that the State effectively uses existing mitigation programs to achieve its mitigation goals?
- Commitment to a comprehensive mitigation program: Does it demonstrate commitment to a comprehensive state mitigation program?

SHMP Key Findings – Toward a Comprehensive Mitigation Program

- General Summary: Incremental federal and state legislation has created framework state mitigation responsibilities covering wide range of hazards, vulnerabilities, and risks
- Further attention is needed to basic FEMA Enhanced Plan criteria
- California needs to articulate a comprehensive mitigation program, including a consistent system for prioritizing short-term and long-term risks at state and local levels
- In doing this California should explore opportunities for developing all six dimensions of integration identified in 2007 SHMP Ch. 8—legislative, policy, institutional, substantive, functional, and financial

<u>Chapter 1, The Planning Process</u>

Content:

- Updates 2004 SHMP Chs. 1-2
- Covers 2007 SHMP planning process, public involvement, adoption by the state
- Describes revision procedure, role of SHMT, Web-based outreach process

Key themes:

- Comprehensive statewide mitigation framework
- Benefits of integrated mitigation planning
- Importance of stakeholder engagement

Anticipated Refinements:

- Add more emphasis on revision in Ch. 1 and in director's letter
- Add brief overview of evolution of mitigation planning in California
- Update outreach program
- Check overlap with Ch. 8 re integration with other planning efforts
- Consider moving plan monitoring, evaluation, etc. from Ch. 8

<u>Chapter 2, Legal, Institutional and Policy Framework (New)</u>

Content:

- Reviews federal and state hazard mitigation laws

- Designed to help general and specialized readers understand how various parts of government at multiple levels carry out their hazard mitigation responsibilities.
- Tracks legislative, institutional and policy progress
- Profiles mitigation responsibilities of 40+ agencies
- Figure 2-2, a comprehensive chart profiles hazard mitigation responsibilities for over 40 state agencies participating in the State Hazard Mitigation Team (SHMT)
- Provides examples of local hazard mitigation best practices fostered by state legislation

Key theme:
- Piecemeal legislation at federal and state levels has moved state toward comprehensive hazard mitigation framework

Anticipated Refinements:
- Clean up Figure 2-2

<u>Chapter 3, State Mitigation Strategy</u>
Content:
- Updates 2004 SHMP Ch. 9
- Constitutes the core of the Plan
- Presents revised mission, vision, goals, objectives
- Provides overview of mitigation priorities
- Assesses state and local capabilities to conduct effective mitigation (elaborated in new Chapter 8)

Key theme:
- Mitigation priorities reflect state's hazards experiences

Refinements:
- Needs clarification and strengthening of priorities
- Preparing chart documenting mitigation legislation by hazard type as part of comprehensive program

<u>Chapter 4, Profile of State Assets</u>
Content:
- Updates 2004 SHMP Ch. 3
- Characteristics seen as valued assets state has sought to protect: people, rivers and watersheds, climate, geology, economy, natural resources
- Provides context for more detailed analyses of a hazards, risk, and vulnerability in Chapter 5

Key themes:
- Asset protection as context for risk assessment
- Size and diversity of California assets

Needed Refinements:
- Adding county population statistics

- Adding California geography map, plus inset showing comparative state size through overlay of smaller states

<u>Chapter 5, Assessing Hazards, Vulnerability, and Risk</u>
Content:
- Consolidates, partially updates 2004 SHMP Chs. 4 – 9
- Adds basic terminology and definitions discussion
- Adds statistical summary of disasters since 1950
- Adds GIS-based multi-hazard threat modeling
- Adds new discussion of climate change implications
- Classifies hazards into a hierarchy:
  - Primary impact – earthquakes, flood, wildfires
  - Secondary impact - vulnerable levees, landslides, and tsunamis
  - Climate-related – drought, heat, severe storms, etc.
  - Other - dam failure, hazardous materials release, terrorism, etc.
- Links hazards to revised SHMP goals, objectives, priorities in Chapter 3
- Leads into local planning, funding, and implementation details in Chapters 6 – 8.

Chapter 5 Goal:
Create an even level of analysis, further reducing details and emphasizing "big picture" to avoid readers "getting lost in the weeds"

Disaster History Findings, 1950-present
- Earthquakes have caused greatest combined losses (deaths, injuries, and damage costs), though a less frequent source of declared disasters
- Fires have been most frequent source of declared disasters, accounting for the second highest combined losses (deaths, injuries, and damage costs)
- Floods have been second most frequent source of disasters, accounting for third highest combined losses among the three primary impact hazards
- Fires accounted for the second highest damage costs, but earthquake damage costs exceeded fire costs by more than 10 times

Multi-Hazard Threat Analysis GIS Modeling – Mitigation Decision Support Index
- Total Population vs. Vulnerable Populations
- Factors in Social Vulnerability Index per S. Cutter
- Earthquake Shaking Potential with Combined Total and Vulnerable Populations
- FEMA 100-year Flood Zone Threat with Combined Total and Vulnerable Populations
- Fire Threat with Combined Total and Vulnerable Populations

Needed Refinements:
- SHMT members to provide additional updates, as needed
- OES to complete data in 2004 SHMP Table 2:
  - Add all deaths, injuries, and disaster costs, 2000 – present
  - Clarify terminology, e.g., "multi-hazard" (includes severe storm, flooding, mudslide, landslides) and "miscellaneous" (includes two plane crashes + other)

- Include complete series of disaster declaration maps for primary and secondary impact hazards
- Conduct expert Delphi review of GIS modeling
- Define catastrophic event and discuss potential threat

Chapter 6, Local Hazard Mitigation Planning (New)

Content:

- Analysis of 400+ Local Hazard Mitigation Plans (LHMPs) prepared by cities, counties, special districts (as of January 1, 2007)
- Updates local mitigation planning assistance information from Chapter 11 of the 2004 SHMP
- Identifies linkages between LHMPs, California General Plan Safety Element, and Hazard Mitigation Grant Program (HMGP) requirements.
- Will identify recommendations for integration of local and state hazard mitigation

Analytic Objectives:

- Describe contents of LHMPs based on standards from the FEMA guidance and issues of concern to update of 2004 SHMP
- Identify areas of systematic deficiency in LHMP content and quality as well as areas of systematic inconsistency with state plans and goals so new state polices and programs can be developed to address these issues
- Assess determinants of plan quality so OES and FEMA can address the broader policy framework of the LHMP program

Key Findings:

- Important concepts are inconsistently defined and used in LHMPs from jurisdiction to jurisdiction, e.g.,
  - critical facilities
  - loss estimates
  - risk assessment
- Hazards are inconsistently defined or categorized, e.g. landslides, tsunami
- Hazard ranking schemes vary and make cross-jurisdiction comparison difficult
- Methods are insufficiently documented

Anticipated Refinements:

- Questionnaire analyses of cities and counties with and without approved plans under way
- Probing for motivation, citizen participation, other issues
- Seeking to identify existing linkages between LHMPs and General Plan Safety Elements, hazard mitigation projects, and emergency preparedness
- Completed Chapter 6 will provide recommendations for integration of LHMP process with SHMP
- Check for overlap with Chapter 3 local hazard mitigation planning program statements

Chapter 7, Funding Sources and Financial Considerations

Content:

- Updates 2004 SHMP Ch. 10
- Covers federal, state, and local mitigation funding sources

- Also identifies alternative mitigation funding from a variety of sources including private sector

Key Findings:

- Substantial state funding commitments to mitigation evident
- Commitments identified are only part of the whole story

Anticipated Refinements:

- Need information on mitigation funding commitments

Chapter 8, Enhanced Plan Criteria, Achievements, Program (New)

Content:

- Addresses FEMA criteria for qualifying the 2007 SHMP as an Enhanced Plan.
- Identifies six dimensions of plan integration—legislative, policy, institutional, substantive, functional, and financial
- Describes mitigation program management capabilities
- Assesses mitigation actions and effective use of funds
- Ties projects to comprehensive mitigation program
- Discusses system-strategy for monitoring, evaluating, and updating SHMP

Key points:

- California demonstrates effective management and tracking of mitigation projects (HMGP, FMA, and PDM)
- Actions are part of comprehensive mitigation program

Anticipated Refinements:

- Need program management clarification from OES and SHMT
- Develop SMART system for post-disaster loss avoidance tracking

Chapter 9, 2007 SHMP Appendix

Appendix Organization:

- Figures (tables, maps) from 2007 SHMP Chapters
- Other documents, including
  - GIS Methods: Mitigation Decision Support Index
  - GIS Maps
  - GIS Metadata
  - Historical Developments in Earthquake Mitigation (moved from 2004 SHMP text)

Refinements:

- Tables, maps, and charts from 2004 SHMP to be added after vetting
- Requesting SHMT review and correction of Figure 2-2, State Agency Mitigation Responsibility Chart

What's in it For Your Agency – Round Robin

The meeting attendees made the following contributions. NOTE: Due to time limitations, not all ideas will be included in the 2007 SHMP, but rather, some will be further explored for the 2010 SHMP.

Laren Mitzer, State Archives:
Vital records planning – need clear strong statement about the importance to mitigation and preparedness and recovery. CALRIM(?) offers vital records training.

Bob Anderson, Seismic Safety Commission:
GIS products are over and above hazard maps. They are enhanced and do not necessarily match the text. Need to integrate concepts into text and need to have the actual reflection of hazard. Need an electronic linkage to progress from last plan.

Bruce Patton, Department of Insurance:
Issue of hazard maps – does not help with decisions of where the actual risk is. (OES comment: OES working on specific hazard maps to go on portal for general public as part of First Lady initiative)

Fred Turner, Seismic Safety Commission:
CEA has maps of regions of California where certain types of mitigation are cost effective. Statewide cost effectiveness maps could be created. Build on what others are doing with repositories (i.e., climate change). Create a place where public and private input could be entered. Compile existing registries.

Kathy Webb, State Consumer Services Agency:
Need to see overarching efforts so can get away from silos. Need to talk about how we are breaking them down. Examples are GEOC and the Public/Private partnership initiative.

Nancy Sutton, OES Planning:
Need better description of successful FEMA funded projects.
There is an inconsistency in reporting costs – need to discuss what that means. Public vs. private costs, societal costs, environmental costs, etc. If you look at only "reimbursable costs", you don't see the whole picture.

Scott Morgan, Office of Planning & Research:
Need to include regional planning efforts.

Michelle Schlack, California State University System:
How is California integrated into national effort. Plan lists grant sources – need to document how being used and how effective.
Need to include a consumer education component.

Kathy Webb, State Consumer Services Agency:
Direct vs. indirect costs – need to be factored in and can be reduced by consumer activities.

Nancy Sutton, OES Planning:
Document partnerships and what is being done about public education in the state. What are the state strategies? Create a "new chapter".

Steve Patton, Department of Insurance:
SHMP should help agencies be able to help the public make choices to be less vulnerable.

Fred Turner, Seismic Safety Commission:
Measurable objectives should be developed and a system set up to document. Start the metric now. Need to make the transition from liking mitigation to counting mitigation. Current objectives in 2007 plan are not really objectives because they are not measurable.

Chuck Real, California Geologic Survey:
The United Nations Prevention Program Strategy includes measurable objectives that could be used as a reference.

Steve Monk, Cal EPA:
When we started process we were unclear about how we fit in. Now at least we are in the plan, but still don't know what else to contribute since we consider everything we do as mitigation. The plan does not include issues like livestock loss and disposal from extreme heat and what about air and water pollution?

Julie Malm-Norris, OES Mitigation:
Incorporate Cal Fire Strategic Plan

Ken Leep, OES Mitigation
Need acknowledgement that comments were received on web portal

Tiffani Harter, California Volunteers:
How about a common space on the web portal so we can all see each other's comments.

Ken Leep, OES Mitigation:
Source documents that were in the 2004 plan need to be included in the 2007 plan (i.e. FEAT)

Bob Anderson, Seismic Safety Commission:
Create a hyperlink with a password for a secure link. Need to answer the question, what would I get out of the plan as and individual, a family, government level, business or community. This is how state makes decisions, this is the framework.

Becky Wagoner, OES Mitigation:
Hazards are identified in the mitigation plan. This needs to be tied to SEMS and the National Response Plan. What we can't mitigation, we need to prepare to respond to and recover from. The after action reports should feed back into what needs to be included in overall mitigation strategy.

Kathy Webb, State Consumer Services Agency:
Turn strategy into public education and outreach tool. Need for public shared responsibility.

Chuck Real, California Geologic Survey:
Plan does a good job of talking about seismic zonation program. Need tighter integration and link with local plans and action part of local plans and how locals can support the seismic zonation program.

Robert Chew, Cal Fire:
New Fire Severity Zone Map is scheduled for release in January 2008.

Michelle Schlack, California State University System:
Interoperability and communication issues need to be referenced in the plan.

Kathy Webb, State Consumer Services Agency:
Department of Technology Services and issue of operability regarding technology, including blackberries, etc, and warning center technology.

Becky Wagoner, OES Mitigation:
Preparing guidance to local governments on updating plans should be a result of this process. OES is working to tie mitigation to all other planning and through SEMS. We have specialist committees for SEMS, mitigation, and recovery. It all starts with identifying the hazards. Also, the statewide strategic plan is on the OES website. After-actions need to be carefully looked at – the goal is to come up with overall strategies.

Bob Anderson, Seismic Safety Commission:
Make web portal access to categories of update for input from state or local agencies to support OES and so state agencies can get access to summaries from other agencies.

Chuck Real, California Geologic Survey:
Chapter 3 – anything that can be done to clarify the vision would be beneficial so all can work toward a common goal.

Diane Earl, Federal Emergency Management Agency:
Using local plans as criteria for grant review. Mitigation best practices is best way to reach the public. Need to document successes. Find them at FEMA.gov/recovery. Include MultiHazard Mitigation Council study on cost effectiveness of mitigation.

Fred Turner, Seismic Safety Commission:
Goals and objectives are inconsistent with state law and federal government policies. Refinements in wording are needed to bring them into line.

Next Meeting
June 19, 2007 1:30-4:00 at OES Headquarters

The focus of the meeting will be on policy, goals, vision, and programmatic direction.

State Agency Hazard Mitigation Team Roster

Agency	Name	Phone	E-Mail
California Earthquake Authority	Nancy Kincaid	(916) 325-3827	nkincaid@calquake.com
California Energy Commission	Sherry Stoner	(916) 654-5005	sstoner@energy.ca.gov
California Geological Survey	Chuck Real	(916) 323-8550	creal@conservation.ca.gov
California Highway Patrol	Lidia Mosley	(916) 227-6388	
Cal Poly San Luis Obispo	Ken Topping	(805) 756-1315 (805) 927-7773	ktopping@calpoly.edu kentopping@aol.com
	Bill Siembieda	(805) 756-1315	wsiembie@calpoly.edu
	Charles Eadie	(831)459-9992	Hs-charlie@pacbell.net
	Paula Schulz	(707) 939-8963	schulzpa@aol.com
California State University	Michelle Schlack	(562) 951-4568	mschlack@calstate.edu
California Volunteers	Tiffani Harter	(916) 261-2268	Tiffany.harter@cv.ca.gov
Delta	Sheila Singleton	(916) 776-2290	dpc@citilink.net
Department of Fish and Game	Larry Kirsch	(925) 945-6732	lkirsch@ospr.dfg.ca.gov
Department of Forestry	Robert Chew	(916) 651-0470	robert.chew@fire.ca.gov
Department of Insurance	Bruce Patton	(916) 492-3560	pattonb@insurance.ca.gov
Department of Resources	David Harris	(916) 653-8092	david.harris@resources.ca.gov
Department of Technological Services	Pamela Wagner	(916) 464-4527	Pamela.wagner@dts.ca.gov
	Paul Duer	(916) 464-1589	Paul.duer@dts.ca.gov
	Trina Rosa-Robinson	(916) 464-3658	Trina.rosa-robinson@dts.ca.gov
Department of Transportation	Sri Balasubramanian	(916) 208-2348	balasubramanian@dot.ca.gov
Environmental Protection Agency	Steven Monk	(916) 825-8081	smonk@cdpr.ca.gov
FEMA	Diane Earl	(510) 627-7193	Diane.earl@dhs.gov

Agency	Name	Phone	E-Mail
Housing and Community Development	Chris Anderson	(916) 445-9471	canderson@hcd.ca.gov
Office of Homeland Security	Patrick Koeneren	(916) 323-7440	patrick.koeneren@ohs.ca.gov
Office of Planning and Research	Scott Morgan	(916) 322-2960	Scott.morgan@opr.ca.gov
Office of State Archives	Laren Mitzer	(916) 653-3834	lmetzer@sos.ca.gov
Seismic Safety Commission	Fred Turner	(916) 263-5506	turner@stateseismic.com
	Robert Anderson	(916) 263-5506	Anderson@stateseismic.com
U.C.O.P	Bob Charbonneau	(510) 987-9594	Robert.charbonneau@ucop.
OES	Becky Wagoner	(916) 845-8151	Rebecca_Wagoner@oes.ca.gov
	Frank Hauck	(916) 845-8795	Frank_Hauck@oes.ca.gov
	Jami Childress-Byers	(916) 845-8161	Jami_childress-byers@oes.ca.gov
	Julie Malm-Norris	(916) 845-8160	Julie_Malm@oes.ca.gov
	Karen McCready	(916) 845-8177	Karen_McCready@oes.ca.gov
	Ken Leep	(916) 845-8272	Kenneth_Leep@oes.ca.go
	Ken Worman	(916) 845-8154	Ken_Worman@oes.ca.gov
	Nancy Sutton	(916) 845-8276	Nancy_Sutton@oes.ca.gov
	Robert Mead	(916) 845-8174	Robert_Mead@oes.ca.gov
	Scott Marotte	(916) 845-8785	Scott_Marotte@oes.ca.gov

State Agency Hazard Mitigation Team (SHMT)
State Multi-Hazard Mitigation Plan Update and Enhancement

June 19, 2007 Meeting Minutes

Purpose of This Meeting

Topics of this meeting include

- Discussion of the draft changes including response to SHMT comments
- Making Implementation Work
- Follow-Through
- September Meeting Date

General Information – Ken Topping

Public Comment Phase – due for release in July. The SHMT Team will have a week to reply back with any final comments before posting on web.

Chapters 3 and 5 are not complete yet. For Chapter 3, we need clarification on goal statements. We will send out the final Draft once these chapters are complete next week for SHMT comment.

Once the Public Comment draft is ready:

- Draft will be posted on the OES Web Portal approx. 45 days for public comment
- OPR State Clearing House will review the draft simultaneously

General Draft Changes – Ken Topping

- Adding an Executive Summary
- Adding Chapter Summaries
- Adding illustrative photos
- Providing common map, chart, table numbering system
- Reducing redundancies and length, where possible
- Increasing emphasis on local and private sector mitigation efforts, public-private partnerships.

Changes to the Chapters – Ken Topping

Chapter	Content
1	Planning process and state adoption
2	Legal, institutional, and policy framework
3	State mitigation strategy – changing Goal 1 statement from "save lives and reduce injuries" to "significantly reduce life loss and injuries; adding target setting discussion."
4	Profile of state assets
5	Assessment of hazards, vulnerability, and risk
6	Local hazard Mitigation planning (Mike Boswell)
7	Funding sources and financial considerations
8	Enhanced plan criteria, achievement program

Chapter 6 – Local Hazard Mitigation Planning – Mike Boswell

- 534 LHMPs reviewed – compared against FEMA and OES criteria.
- Surveyed cities and counties that had LHMPs in place – 180 of 317 responded.
- Approximately 60% of the state's population is covered by an approved LHMP and an additional 11% is in progress.
- Identified approximately 75 distinct hazards
- Identified top hazards for each county.
- Analyzed the top three hazards – Fire, flood, and earthquake, and mapped them by county. Maps will be in Chapter 5.

Identified current linkages – references to other plans and programs. Only about 11% of the LHMPs provided information regarding linkages.

Currently, about 15% of the LHMPs are linked to the General Plan Safety Element. However, new legislation should increase this amount.

Discussed implementation constraints to jurisdictions.

Recommendations – The state should
- Establish consistent definitions for common concepts/terms.
- Establish consistent definitions and categories for hazard types.
- Establish consistent reporting requirements.
- Clarify mitigation measures versus response and recovery measures.
- Require each identified mitigation measure to be assigned to a standard category.
- Prepare guidance on how LHMPs can be developed to ensure consistency and coordination with other state plans.
- Address implementation of LHMPs by providing assistance to jurisdictions on how to finance their mitigation measures beyond federal grants.

Next Steps:
- Statistical analysis of LHMP and survey data for quality indicators
- Compilation of survey "open-ended" responses
- Preparation of stand-alone report

Charles Eadie discussed the system of outreach outlined in Chapter 1 of the SHMP
- Public/Private Sector activities will be useful and inter-active and continue throughout the summer of 07'.
- Outreach efforts will establish groundwork for ongoing conversations to help make the SHMP more useful to the public/private sector.

After the SHMP is Approved by FEMA – Next Steps – Ken Worman

SEMS Mitigation Advisory Group

- Kickoff will be Nov/Dec 2007
- Group will meet quarterly to continue SHMT efforts
- Group will record, track and measure advances in mitigation activities
- Group will identify new goals/targets/priorities for the 2010 SHMP.

Is your Agency Information Missing from the SHMP?

Call or e-mail Ken Topping and Julie (Malm) Norris

Ken Topping	Julie (Malm) Norris
Cal Poly	Office of Emergency Services
On Campus (805) 756-5083	Office (916) 845-8160
Off Campus (805) 927-7773	Pager (916) 594-1051
Cell (805) 305-8710	Julie.Malm@oes.ca.gov

Upcoming Dates

Public Comment – Tentatively starts July 9, 2007

Next Meeting – To be determined – September/October 2007

SEMS Mitigation Advisory Group Kickoff – To be determined – Nov/Dec 07

State Agency Hazard Mitigation Team Roster

Agency	Name	Phone	E-Mail
California Highway Patrol	Lidia Narvaez-Mosley	(916) 227-6388	LNarvaez-Mosley@chp.ca.gov
California Energy Commission	Sherry Stoner	(916) 654-5005	sstoner@energy.ca.gov
Cal Poly San Luis Obispo	Ken Topping	(805) 756-1315 (805) 927-7773	ktopping@calpoly.edu kentopping@aol.com
	Bill Siembieda	(805) 756-1315	wsiembie@calpoly.edu
	Charles Eadie	(831)459-9992	Hs-charlie@pacbell.net
	Paula Schulz	(707) 939-8963	schulzpa@aol.com
California State Parks	Jim Fitzpatrick	(916) 653-1007	jfitzpatrick@parks.ca.gov
California State University	Michelle Schlack	(562) 951-4568	mschlack@calstate.edu
California Volunteers	Mike Staley	(916) 445-6687	Mike.Staley@cv.ca.gov
City of Roseville	Julie Burrows	(916) 774-5361	jburrows@roseville.ca.us

Agency	Name	Phone	E-Mail
Department of Fish and Game	Larry Kirsch	(925) 945-6732	lkirsch@ospr.dfg.ca.gov
Department of Forestry & Fire Protection	Wayne Mitchell	(916) 712-7642	Wayne.mitchell@fire.ca.gov
Department of General Services	Kristine French	(916) 376-1928	Kristine.French@dgs.ca.gov
Department of Housing & Community Develop	Elliott Mandell	(916) 445-4775	emandell@hcd.ca.gov
Department of Insurance	Bruce Patton	(916) 492-3560	pattonb@insurance.ca.gov
Department of Transportation	Sri Balasubramanian	(916) 208-2348	balasubramanian@dot.ca.gov
Department of Water Resources	Kevin Elcock	(916) 653-7447	kelcock@water.ca.gov
	Maria Lorenzo-Lee	(916) 574-0639	mlorenzo@water.ca.gov
Office of Planning and Research	Scott Morgan	(916) 322-2960	Scott.morgan@opr.ca.gov
Seismic Safety Commission	Robert Anderson	(916) 263-5506	Anderson@stateseismic.com
State Lands Commission	Kevin Mercier	(562) 499-6312	merciek@slc.ca.gov
OES	Julie Malm-Norris	(916) 845-8160	Julie_Malm@oes.ca.gov
	Karen McCready	(916) 845-8177	Karen_McCready@oes.ca.gov
	Ken Worman	(916) 845-8154	Ken_Worman@oes.ca.gov
	Nancy Sutton	(916) 845-8276	Nancy_Sutton@oes.ca.gov
	Robert Mead	(916) 845-8174	Robert_Mead@oes.ca.gov

Table 2.3.3B State Agency Functions – Agency Responsibility Matrix

Agency	Agency Function	Emergency Management and Mitigation Responsibilities	Legislation
Business, Transportation & Housing Agency (BTHA) www.bth.ca.gov	Umbrella agency that oversees statewide transportation system, promotes job growth and economic development, increases affordable housing and regulates building codes and sales.		
California Highway Patrol (CHP) www.chp.ca.gov	Serves and protects the public and prevents the loss of life, injuries, and property damage.	Responsible for protection of state employees and property	GC §14685
Department of Housing & Community Development (HCD) www.hcd.ca.gov	Provides policy and program leadership to expand and preserve safe and affordable housing opportunities and promotes strong communities for all Californians.	Requires mobile home earthquake bracing devices: test devices and issue certifications	SB 360 (1981)
		Manufactured Housing Program: mobile home inspection	Mobile Homes-Manufactured Housing Act of 1980, HSC, Div. 13, Pt. 2, §18000, et seq.; 25 CCR, Div. 1, Ch. 3, subchapter 2, §4000, et seq.
		Factory-Built Housing Program	HSC, Div. 13, Pt. 6, §19960, et seq.; 25 CCR, Div. 1, Ch. 3, subchapter 1, §3000, et seq.

Agency	Agency Function	Emergency Management and Mitigation Responsibilities	Legislation
Department of Housing & Community Development (HCD) (cont.)	Provides policy and program leadership to expand and preserve safe and affordable housing opportunities and promotes strong communities for all Californians.	Office of Migrant Services: contracts with local governments to procure or construct housing and provide services for migrant agricultural workers	HSC, Div. 31, Pt. 2, Ch. 8.5, §§50710-50715
		Special Housing Programs for the Developmentally Disabled, Mentally Disordered, and Physically Disabled	HSC, Div. 31., Pt. 2, Ch. 7, §§50680-50689.5
		Residential Hotel Rehabilitation	HSC, Div. 13, Pt. 2, Ch. 3.3, §§50519-50522
		Multifamily Housing Program	HSC, Div. 13, Pt. 2, Ch. 6.7, §§50675-50675.14
		Assure protection of health, safety, welfare of all mobilehome and special occupancy park residents and user	Mobilehome Park Act (HSC Div. 13, Park 2.1) & Special Occupancy Park Act (HSC Div. 13, Part 2.3)
		Uniformity in building standards	HSC, Div. 13, Pt. 1.5, Ch. 4, §17958, et seq.
		Accessibility requirements	24 CCR, Pt. 2 (CA Building Code)
		Propose the adoption, amendment, or repeal of building standards to CA Building Standards Commission	HSC, Div. 13, Pt. 2.5, Ch. 4, §18935, et seq.
		State Housing Law authority	State Housing Law: Part 2.5, Chapter 4, commencing with §18935

Agency	Agency Function	Emergency Management and Mitigation Responsibilities	Legislation
Department of Transportation (DOT) www.dot.ca.gov	Oversees the planning, design, construction, maintenance of the State Highway System and related highway facilities.	Administers bond addressing emissions reduction, air quality improvement, transit system security, port security and disaster response	SB 1266 (2006)
		Prepares inventory of state-owned bridges that require strengthening to meet seismic safety standards	SB 2104 (1990)
		Seismic hazards consideration in design of highway infrastructure	
California Earthquake Authority (CEA) www.earthquakeauthority.com	Provides residential earthquake insurance, responds post-event to Local Area Assistance Centers to assist in claim filing and handling, and coordinates services with state responders.	Provides reduced-coverage residential property earthquake insurance designed to restore habitability of residential structure	SB 1993 & AB 2086 (1996)

Agency	Agency Function	Emergency Management and Mitigation Responsibilities	Legislation
California Environmental Protection Agency (CalEPA) www.calepa.ca.gov	Umbrella agency that protects California's environment and public health	Establish minimum standard protocols for responding to pesticide drift emergencies	SB 391 (2004); HSC §25501
Air Resources Board (ARB) www.arb.ca.gov	Promotes and protects public health, welfare and ecological resources through the effective and efficient reduction of air pollutants.	Climate Action Team	Global Warming Solutions Act of 2006 (AB 32), Executive Order S-3-05
		Toxic Air Contaminants Identification Program	Toxic Air Contaminants Identification & Control Act (AB 1807; HSC §39600, et seq.)
		Air Toxic Hot Spots Program	Air Toxics "Hot Spots" Information & Assessment Act (AB 2588; HSC §44300, et seq.)
Department of Pesticide Regulation (DPR) www.cdpr.ca.gov	Regulates pesticide sales and use; fosters reduced-risk pest management.	California Schools Integrated Pest Management Program	Healthy Schools Act of 2000 (AB 2260)
		Regulates the proper, safe, and efficient use of pesticides essential for production of food and fiber and for protection of public health and safety	Food and Agricultural Code §11501
		Fosters reduced-risk pest management	Food and Agricultural Code §11501
		Assures agricultural and pest control workers of safe working conditions where pesticides present	Food and Agricultural Code §11501
		Encourages development and implementation of pest management systems	Food and Agricultural Code §11501

Agency	Agency Function	Emergency Management and Mitigation Responsibilities	Legislation
Department of Toxic Substances Control (DTSC) www.dtsc.ca.gov	Oversees statewide regulation of the generation, transport, treatment, storage and disposal of hazardous waste; oversees the cleanup of sites contaminated with hazardous wastes and hazardous substances.	Hazardous substance release prevention, containment and mitigation; hazardous waste transportation; hazardous waste transfer, treatment and disposal facilities	Resource Conservation and Recovery Act (1976)
		Hazardous waste source reduction compliance	Hazardous Waste Source Reduction and Management Review Act of 1989 (SB 14)
		Brownfields cleanup and reuse program	California Land and Environmental Restoration and Reuse Act (SB 32)
		Biomonitoring Program: monitors toxic chemicals in bodies of Californians to target chemicals of concern	SB 1379; HSC §105440, et seq.
		Green Chemistry: promotes design of chemical products and processes that reduce or eliminate use and generation of hazardous substances	California Safer Chemical Substitutes Act of 2005 (AB 990)
Integrated Waste Management Board (CIWMB) www.ciwmb.ca.gov	Manages generated waste, promotes waste reduction, regulates the handling, processing and disposal of solid waste.	Fosters partnerships with local agencies for integrated waste management planning, education and enforcement.	Integrated Waste Management Act (AB 939, 1989); 14 CCR, Chs. 3 through 5
		Operation and maintenance of solid waste facilities and waste tire hauling and storage, promote recycling of lubricating oil, and require recycled-content in paper products	PRC, Div. 30 - Waste Management; 14 CCR - California Waste Management Board (Chs. 3 through 5)
		Disaster Plan and Disaster Debris Management Plan	AB 2920 (1992); PRC §43035

Agency	Agency Function	Emergency Management and Mitigation Responsibilities	Legislation
Office of Environmental Health Hazard Assessment (OEHHA) www.oehha.ca.gov	Develop and provide risk managers in state and local government agencies with toxicological and medical information relevant to decisions involving public health.†	Environmental Protection Indicators for California (EPIC)	
		California Accidental Release Prevention (CalARP) Program: Prevents accidental release of regulated toxic and flammable substances	Risk Management Program; HSC §§25531-25543.3
		Assessing Exposures and Health Risks at Existing and Proposed School Sites	HSC §901
		OEHHA Ecotoxicology Program	HSC §901
		PBDE Health Risks	HSC §108920, et seq.
		Toxic Air Contaminants Identification Program	Toxic Air Contaminants Identification & Control Act (AB 1807; HSC §39600, et seq.)
		Air Toxic Hot Spots Program	Air Toxics "Hot Spots" Information & Assessment Act (AB 2588, HSC §44300, et seq.)
		Safe Drinking Water and Toxic Enforcement Act of 1986, Prop 65	Safe Drinking Water and Toxic Enforcement Act of 1986 (Prop 65)
		Green Chemistry and Inherently Safer Technologies	California Safer Chemical Substitutes Act of 2005 (AB 990)
State Water Resources Control Board (SWRCB) www.waterboards.ca.gov	Preserve, enhance and restore the quality of California's water resources, and ensure proper allocation and efficient use.	Underground Storage Tank Cleanup	Barry-Keene Underground Storage Tank Cleanup Fund Act of 1989
		Santa Monica Bay Restoration Commission	through National Estuary Program (Clean Water Act §320)
		Prohibits discharge of substances from oceangoing ships under NPDES	Clean Water Act of 2005 (SB 771)

Agency	Agency Function	Emergency Management and Mitigation Responsibilities	Legislation
California Health & Human Services Agency (CHHS) www.chhs.ca.gov	Umbrella agency that administers state and federal programs for health care, social services, public assistance and rehabilitation.		
Department of Health Services (DHS) www.dhs.ca.gov	Administers range of public and clinical health programs that provide services to Californians. †	Drinking Water Standards (maximum contaminant levels - MCLs)	22 CCR
		Authority to impose terms and conditions on permits for public drinking water systems to assure sufficient water is available	Water Code §350, et seq.
		Water Security, Clean Drinking Water, Coastal and Beach Protection	Water Security, Clean Drinking Water, Coastal & Beach Protection Act of 2002; WC §79500, et seq.
		Pandemic Flu Plan	HSC §§120125-120140
Office of Statewide Health Planning & Development (OSHPD) www.oshpd.ca.gov	Promotes equitable healthcare accessibility for California. †	Develop and regulate seismic performance standards for hospitals	Alquist Hospital Seismic Safety Act of 1983 (SB 1953), HSC §§130000-130070
		Institutes plan review and field inspection of hospital buildings under construction	SB 961 (1982)
		Hospital Building Safety Board	SB 519
California Public Utilities Commission (CPUC) www.cpuc.ca.gov	Regulates privately owned electric, telecommunications, natural gas, water and transportation companies.	Encourages solar energy infrastructure in existing homes and businesses (joint program with CEC)	California Solar Initiative; SB 1 (2006)
		Addresses seismic design of Liquid Natural Gas (LNG) facilities	SB 1081 (1977)

Agency	Agency Function	Emergency Management and Mitigation Responsibilities	Legislation
California State Archives (CSA) www.ss.ca.gov/archives	Collects, catalogs, preserves, and provides access to the historic records of state government and some local governments. †	Preservation of state historical records	
California State Military Reserve (CSMR) www.calguard.ca.gov/casmr/	Assists in training the California National Guard; provides rapid response in the preparation, prevention, defense, and mitigation of natural and man-made threats to California.	Responds to natural disasters in California, such as earthquake damage assessment	
California State University System (CSU) www.calstate.edu	Provides high-quality, accessible, student-focused higher education at 23 campuses throughout state. †	Adopt retrofit guidelines for state buildings owned by CSU	AB 3313 (1990)
CaliforniaVolunteers (California Service Corps - CSC) www.californiavolunteers.org	Administers statewide volunteer programs, and guides policy development to support the non-profit and service fields. †	Provides volunteers for disaster relief organizations	Executive Order W-77-94; (administers Americorps in CA)

Agency	Agency Function	Emergency Management and Mitigation Responsibilities	Legislation
Department of Corrections & Rehabilitation (CDCR) www.cdcr.ca.gov	Maintains efficient and cohesive correctional policy. †	Provides labor for vegetation management	
Department of Education (CDE) www.cde.ca.gov	Provides leadership, assistance, oversight, and resources for education of students at primary and secondary levels.	California Schools Integrated Pest Management Program	Healthy Schools Act of 2000 (AB 2260)
		Nonstructural Earthquake Hazards in CA Schools	SB 1122; GC §8587.7
		Guides schools in planning for earthquakes and other emergencies	Katz Act; Education Code §§35295-35297
		Guides school districts in preparation to respond to emergencies using Standardized Emergency Management System (SEMS)	Petris Bill; GC § 8607
Department of Food & Agriculture (CDFA) www.cdfa.ca.gov	Administers food safety oversight and inspection, responses to invasive animal and plant disease, and ensures an equitable and orderly marketplace for agricultural products.	Animal Health and Food Safety Services: mitigate risks to CA's livestock and poultry industries. Animal Health Branch, Meat and Poultry Inspection Program, Milk and Dairy Food Safety Branch	3 CCR, Div. 2, et seq.
		California Animal Health and Food Safety Laboratory System	3 CCR, Div. 1, Ch. 3, §520, et seq.
		Meat and Poultry Inspection Services	3 CCR, Div. 9, Ch. 4, §18650, et seq.
		Makes state-owned fairgrounds available for emergency management preparedness, response, recovery and mitigation activities	

Agency	Agency Function	Emergency Management and Mitigation Responsibilities	Legislation
Department of Food & Agriculture (CDFA) (cont.)	Administers food safety oversight and inspection, responses to invasive animal and plant disease, and ensures an equitable and orderly marketplace for agricultural products.	Inspection Services: mitigate the introduction of toxins and contaminants to the food chain	3 CCR, Div. 4, et seq.; 3 CCR, Div. 5, et seq.
		Integrated Pest Control ("Integrated Pest Prevention System" not found on CDFA website)	
		Plant Health and Pest Prevention Services and Disease Control Program: Administers statewide exterior exclusion program, interior exclusion quarantine programs, weed eradication and biological control programs	
		Pierce's Disease Control Program	3 CCR, Div. 4, Ch. 9, Art. 8, §6045, et seq.
Department of Insurance (CDI) www.insurance.ca.gov	Enforces many of the insurance-related laws of the state; regulates insurance industry's practices. †	Enforces statutory mandatory compliance with "mini" residential earthquake insurance policy	AB 1366; California Insurance Code §10089
Department of Social Services (DSS) (Disaster and Client Services Bureau) www.dss.cahwnet.gov	Administers programs that provide a variety of social services to assist needy and vulnerable children and adults.	Mass Care and Shelter: Build shelter capacity	Admin. Order by OES, Executive Order W-9-91
		Maintain shelter facility database	
		Volunteer Emergency Services Team (VEST) Recruiting: Recruiting and training state employee volunteers to increase disaster response capacity to assist in mass care and shelter operations	Admin. Order by OES, Executive Order W-9-91

Agency	Agency Function	Emergency Management and Mitigation Responsibilities	Legislation
Department of Social Services (DSS) (Disaster and Client Services Bureau) (cont.)	Administers programs that provide a variety of social services to assist needy and vulnerable children and adults.	California Grant Assistance for Individuals and Families: Assist OES with outreach to victims seeking recovery assistance	Admin. Order by OES, Executive Order W-9-91
		Individuals and Households Program (IHP)	Admin. Order by OES, Executive Order W-9-91
		State Supplemental Grant Program (SSGP)	Admin. Order by OES, Executive Order W-9-91
		Disaster and Mass Casualty Plan	HSC §§1530, 1568, 1569, 1596, 1597, and 13131, et seq.
Emergency Medical Services Authority (EMSA) www.emsa.ca.gov	Provides leadership in developing and implementing EMS systems throughout the state	Provides medical resources to local governments in support of their disaster response; promotes disaster medical preparedness	HSC §§1797.150-151
Governor's Office of Emergency Services (OES) www.oes.ca.gov	Protects the public and the state from natural and man-made disasters through coordination and support for emergency managers, hazard mitigation, disaster assistance and other programs.	Nonstructural Earthquake Hazards in CA Schools	SB 1122; GC §8587.7
		Flood Mitigation Assistance	44 CFR 78.5
		Hazard Mitigation Grant Program	44 CFR 206 and 13
		Local Hazard Mitigation Planning Program	DMA 2000, Section 322; Interim Final Rule of 2002; 44 CFR 201, as amended
		Pre-Disaster Mitigation Program	DMA 2000
		State Multi-Hazard Mitigation Plan	44 CFR 201

Agency	Agency Function	Emergency Management and Mitigation Responsibilities	Legislation
Governor's Office of Emergency Services (OES) (cont.)	Protects the public and the state from natural and man-made disasters through coordination and support for emergency managers, hazard mitigation, disaster assistance and other programs.	Provides reimbursements for disaster-related costs including emergency response, emergency protective measures, and restoration of public infrastructure.	California Disaster Assistance Act; 19 CCR Div. 2, Ch. 6
		Natural Disaster Assistance Act	GC Title 2, Div. 1, Ch. 7.5
		Emergency Services Act created Office of Emergency Services (originally established in 1950)	Emergency Services Act (1970); GC §8550, et seq.
		California State Warning Center	
		California Accidental Release Prevention (CalARP) Program: Prevents accidental release of regulated toxic and flammable substances	Risk Management Program; HSC §§25531-25543.3
		Establish Steering Committee (for Tsunamis) and establishes Statewide Tsunami Hazard Mitigation Program	Tsunami Hazard Mitigation and Preparedness (AB 319)*
Governor's Office of Homeland Security (OHS) www.homeland.ca.gov	Gathers and disseminates information critical to the protection of the state; creates state's comprehensive security strategy; and designs and implements critical state, regional and local programs.	Establishes CA Governor's Office of Homeland Security	The Homeland Security Act of 2002, Executive Order (2003)
		Critical Infrastructure Protection: Identify and assure protection of critical infrastructure; provide timely warning of specific, imminent threat.	Homeland Security Presidential Directive Number 7 (2003)

Agency	Agency Function	Emergency Management and Mitigation Responsibilities	Legislation
Governor's Office of Homeland Security (OHS) (cont.)	Gathers and disseminates information critical to the protection of the state; creates state's comprehensive security strategy; and designs and implements critical state, regional and local programs.	Protected Critical Infrastructure Information (PCII): Encourages private industry to voluntarily share sensitive and proprietary business information with Federal Government	Homeland Security Presidential Directive Number 7 (2003)
		Buffer Zone Protection Plan (BZPP) Program: Facilitates reduction of vulnerabilities at critical infrastructure/key resources (CI/KR) sites by protecting area around site	Homeland Security Presidential Directive Number 7 (2003)
		California Homeland Security Exercise and Evaluation Program (CA-HSEEP): provides financial and direct support to state and local agencies with development and implementation of an exercise and evaluation program to enhance and assess domestic preparedness	
		State Terrorism Threat Assessment Centers (STTACs): provides statewide analysis products, information tracking, pattern analysis and other statewide intelligence products	

Agency	Agency Function	Emergency Management and Mitigation Responsibilities	Legislation
Governor's Office of Homeland Security (OHS) (cont.)	Gathers and disseminates information critical to the protection of the state; creates state's comprehensive security strategy; and designs and implements critical state, regional and local programs.	Regional Terrorism Threat Assessment Centers (RTTACs): maintains regional threat assessment, facilitates coordination with FBI Field offices, facilitates inter-agency information sharing	
		Terrorism Liason Officers: local agency point of contact for all terrorism-related alerts, requests for information, warnings and other notifications from regional, state or federal homeland security agencies	
Governor's Office of Planning & Research (OPR) www.opr.ca.gov	Provides legislative and policy research support for Governor's office; also assists in issues pertaining to land-use planning. †	Provides technical advisory to cities and counties on developing general plan, including Safety Element	AB 890; GC §65300, et seq.
		Provides technical advisory series that includes publication "Fire Hazard Mitigation and the General Plan"	GC §65300, et seq.
Office of Historic Preservation (OHP) www.ohp.parks.ca.gov	Administers federal and state mandated historic preservation programs in California	Seismic upgrading issues in historical buildings, as governed by California Historical Building Code	California Historical Building Code; PRC §2621.7; HSC §18953; and 24 CCR, Part 8

Agency	Agency Function	Emergency Management and Mitigation Responsibilities	Legislation
Resources Agency (CRA) www.resources.ca.gov	Umbrella agency for departments, boards and commissions and conservancies with shared goals to protect and conserve natural and human public resources of the state.		
California Conservation Corps (CCC) www.ccc.ca.gov	Improves the ecology of California's lands and rivers and contributes to the state's public safety while providing workforce development for young men and women. †	Provides critical front-line and logistical support for natural and manmade hazards	Public Resources Code §§14000-14406, Division 12.
California Coastal Commission (CCC) www.coastal.ca.gov	Administers the California Coastal Act, manages the conservation and development of coastal resources.	Minimizes impact of new development on coastal erosion or instability within Coastal Act boundary	Coastal Act §30253
California Energy Commission (CEC) www.energy.ca.gov	Administers statewide energy policy and planning	Energy Emergency Response Plan - plan for possible electrical energy or fuel supply shortage	Public Resource Code §§25216.5(b) and 25700
		Green Building Initiative - reduce energy use in state-owned buildings by 20%, encourage private sector to reduce energy use	Executive Order S-20-04

Agency	Agency Function	Emergency Management and Mitigation Responsibilities	Legislation
California Energy Commission (CEC) (cont.)	Administers statewide energy policy and planning	Reduce wasteful peak load energy consumption in residential and nonresidential buildings	AB 549
		California Solar Initiative - encourage solar energy infrastructure in new homes (joint program with CPUC)	SB 1 (2006)
		Reduce Wildlife Impacts from Wind Energy Development (joint program with DFG)	PRC §§25210, 25213, 25218(e)
California State Lands Commission (CSLC) www.slc.ca.gov	Manages and protects important natural and cultural resources on public lands within the state, and the public's right to access such lands	Oil Transfer & Transportation Emission and Risk Reduction (OTTER)	Oil Transfer & Transportation Emission & Risk Reduction Act of 2002
		Ballast Water Program: prevents non-indigenous species into California's water by way of oceangoing ships	Ballast Water Management for Control of Non-Indigenous Species Act (AB 703, as amended); 2 CCR, Division 3, Chapter 1, §2280
		Spill Prevention and Response responsibilities	Lempert-Keene-Seastrand Oil Spill Prevention & Response Act; GC §§8574 and 8670
		Marine Terminal Physical Security	2 CCR, Division 3, Chapter 1, Article 5.1, §2430, et seq.
Delta Protection Commission (DPC) www.delta.ca.gov	Implements the Land Use and Resource Management Plan for the Primary Zone of the Delta.	Mandates designation of Primary and Secondary Zones within Delta region; creation of DPC; completion of Land Use and Resource Management Plan for Primary Zone	Delta Protection Act (SB 1866, 1992, as amended); PRC §297000, et seq.

Agency	Agency Function	Emergency Management and Mitigation Responsibilities	Legislation
Delta Protection Commission (DPC) (cont.)	Implements the Land Use and Resource Management Plan for the Primary Zone of the Delta.	Makes policy recommendations for subsidence control	Delta Protection Act
		Makes policy recommendations for monitoring, maintenance, rehabilitation, and upgrading of levee system	Delta Protection Act
Department of Boating and Waterways (DBW) www.dbw.ca.gov	Develops convenient public access to the waterways and promotes on-the-water safety. †	Control of water hyacinth and Egeria densa in Sacramento-San Joaquin Delta	Harbors and Navigation Code § 64
Department of Conservation www.consrv.ca.gov	Provides services and information that promote environmental health, economic vitality, informed land use decisions and sound management of our state's natural resources.†	State Mining & Geological Board: represents state interest in development of seismological and geological information pertaining to earthquake and other geological hazards	PRC §§660-678 (specifically §672)
-- California Geological Survey (CGS) www.consrv.ca.gov/cgs	Provides data, information, expert technical services and advice on seismic hazards, earthquake engineering, geology, mineral hazards and mineral resources.	Strong Motion Instrumentation Program (SMIP): installation of monitoring devices to measure earthquake shaking	SB 1374 (1972)
		Alquist-Priolo Earthquake Fault Zoning Act: prevents construction of buildings used for human occupancy on surface trace of active faults	Alquist-Priolo Earthquake Fault Zoning Act, Alquist-Priolo Special Studies Zone Act (SB 520, 1972); PRC §§2621-2630

Agency	Agency Function	Emergency Management and Mitigation Responsibilities	Legislation
-- California Geological Survey (CGS) (cont.)	Provides data, information, expert technical services and advice on seismic hazards, earthquake engineering, geology, mineral hazards and mineral resources.	Seismic Hazard Zonation Program (SHZP): establishes regulatory zones and issues appropriate seismic maps for non-surface fault rupture earthquake hazards; addresses liquefaction and seismically induced landslides	Seismic Hazards Mapping Act (SB 3897, 1990); PRC §2690, et seq.
Department of Fish & Game (DFG) www.dfg.ca.gov	Maintains native fish, wildlife, plant species and natural communities for their intrinsic and ecological value and their benefits to people.	Habitat protection, Natural Communities Conservation Planning	Natural Communities Conservation Planning Act; Fish and Game Code §200, et seq.
		Establish networks of marine protected areas in California waters	Marine Life Protection Act
		wildlife disease control	
		pollution control	
		fire control	
		flood control	
		vector control	
		conservation and mitigation banking, flood control	Sacramento-San Joaquin Wetlands Mitigation Bank Act of 1993; Fish & Game Code §1775, et seq.
		Comprehensive Environmental Response, Cleanup, and Liability Act (CERCLA) support	Comprehensive Environmental Response, Cleanup, and Liability Act (CERCLA, 1980)
		Natural Resource Damage Assessment (NRDA) and Restoration	CERCLA, Clean Water Act (1972/1977), Oil Pollution Act (1990)

Agency	Agency Function	Emergency Management and Mitigation Responsibilities	Legislation
Department of Fish & Game (DFG) (cont.)	Maintains native fish, wildlife, plant species and natural communities for their intrinsic and ecological value and their benefits to people.	Military Base Realignment and Closure/Installation Restoration Services (BRAC/IR)	Ballast Water Management Act of 1999 (Marine Invasive Species Monitoring Program)
		"Keep Me Wild" campaign	
		Pike Eradication Proposal	
-- Office of Spill Prevention & Response (OSPR) www.dfg.ca.gov/ospr	Protects California's natural resources by preventing, preparing for, and responding to spills of oil and other deleterious materials.	Marine Invasive Species Monitoring Program	Lempert-Keene-Seastrand Oil Spill Prevention & Response Act; GC §§8574 and 8670, et seq.; PRC §8750, et seq.
		Oil spill prevention and response responsibilities	
Department of Forestry & Fire Protection (CAL FIRE/CDF) www.fire.ca.gov	Protects the people of California from fires, responds to emergencies, and protects and enhances forest, range and watershed values. †	Sudden Oak Death Syndrome Task Force	Plant Quarantine Manual (State Miscellaneous Ruling 3700), AB 2251
		Southern California Bark Beetle Infestation	Governor's Declaration of State Emergency (March 7th, 2003)
		Pitch Canker Task Force	SB 1712 (Sept. 21, 1998)
		Local Community Wildland Protection Plan Programs	Healthy Forests Restoration Act (HFRA)
		Fire Hazard Severity Zone (FHSZ) mapping	PRC §§4201-4204; 14 CCR, §1280
		Vegetation Management Plan (VMP)	SB 1704
		California Forest Improvement Program (CFIP)	California Forest Improvement Act of 1978; PRC §§4790-4799.05 or 14 CAC, Div. 1.5, Ch. 9.5, Articles 1-8

Agency	Agency Function	Emergency Management and Mitigation Responsibilities	Legislation
Department of Forestry & Fire Protection (CAL FIRE/CDF) (cont.)	Protects the people of California from fires, responds to emergencies, and protects and enhances forest, range and watershed values. †	Prop 40 Fuels Reduction Programs	Proposition 40, California Clean Water, Clean Air, Safe Neighborhood Parks and Coastal Protection Act of 2002; PRC §5096.659(g)
		Reforestation	SB 251
		Designate Hazardous Fire Areas	SB 1972 (1979); PRC §§4254, 4255, 4258, 4259, 4260, 4296.5
		Firework regulation in State Area of Responsibility (SRA) fire Hazard Zones	AB 799; PRC §§4258-4260
		Forest Stewardship Program	Cooperative Forestry Assistance Act of 1978, as amended; first enacted with 1990 Farm Bill
		Urban forestry health	California Urban Forestry Act of 1978; PRC §§4799.06-4799.12
		Firefighter training and standards	AB 669
		Defensible Space (100' reduction zone)	PRC §4291, et seq.
		Natural Hazard Disclosure for wildfire in SRA	AB 1812 (1989); PRC §4291, et seq.
		Minimum fire safety regulation in SRA	SB 1075 (1991); PRC §4290
		Very High Fire Hazard Severity Zones; Fire Hazard Zoning in Local Area of Responsibility (LRA)	AB 337 (1992); GC §§ 51178-51188; HSC §13108.5
		Class A roof and Model Ordinance for defensibility of space and structures	AB 3819 (1995); GC §§51178.5, 51189; HSC §§13108.5, 13132.7; PRC §42205
		Class A, B, C roof and shingle testing timeline	HSC §13132.7
		LE-38 Program	

Agency	Agency Function	Emergency Management and Mitigation Responsibilities	Legislation
Department of Forestry & Fire Protection (CAL FIRE/CDF) (cont.)	Protects the people of California from fires, responds to emergencies, and protects and enhances forest, range and watershed values. †	WUI Building Standards	24 CCR, Part 2, California Building Code (Phase I, Phase II); 24 CCR, Part 9, California Fire Code; 24 CCR, Part 2, California Reference Standards Codes
		FireWise	Cooperative Forestry Assistance Act of 1978, as amended
		Natural Hazard Disclosure for wildfire in LRA and Very High Fire Hazard Severity Zones	AB 6X and 1195 (1998); Civil Code §1103, et seq.
		California Fire Alliance	National Fire Plan (2000) (??)
-- Office of the State Fire Marshal (CAL FIRE/OSFM) www.osfm.fire.ca.gov	Protects life and property through development and application of fire prevention engineering, education and enforcement. †	Expand fire safety building standards in areas with high fire risk to various components (not listed)	AB 1216 (2002); PRC §4291, GC §51189
		Proposes fire protection building standards for roofs, exterior walls, structure projections and structure openings	HSC §13108.5
		Lists wood roofing materials that have passed at least five years of the ten-year weather test; insurance companies honor replacement cost coverage for increased cost of fire retardant roofing materials	AB 423 (1999); HSC §13132.7
		Ensures fire safety of hospital buildings under construction	SB 961 (1982)
		Arson Task Force	AB 2336, as amended

Agency	Agency Function	Emergency Management and Mitigation Responsibilities	Legislation
Department of Parks & Recreation (CA State Parks) www.parks.ca.gov	Protects natural and coastal resources, the state's biodiversity; provides quality recreational experiences.	Charged with stewardship and protection of the lands, facilities and the public within the State Park System, to include all-hazard preparedness and mitigation	Public Resources Code 5003, 5008
Department of Water Resources (DWR) www.water.ca.gov	Operates and maintains the State Water Project; provides dam safety and flood control services, assists local water districts in water management and conservation activities, promotes recreational opportunities, and plans for future statewide water needs.	Disaster Preparedness and Flood Prevention - rebuilds and repairs California's most vulnerable flood control structures	Disaster Preparedness and Flood Prevention Bond Act of 2006 (Proposition 1E)
		Flood Protection Corridor Program: funds nonstructural flood management protects	Safe Drinking Water, Watershed Protection and Flood Protection Act (Proposition 13)
		Stormwater Flood Control Grants	Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006 (Prop 84)
		National Dam Safety Program: provides training, technical assistance, research and support to states through incentive grant awards that encourage states to improve their programs	Dam Safety Act (1928), most recent reauthorization is Dam Safety and Security Act of 2002
		FloodSafe California Initiative	
		Delta Risk Management Strategy: evaluates potential impacts on water supplies from Delta based on projections for impacts from natural and man-made hazards	AB 1200; Water Code §139.2, et seq.

Agency	Agency Function	Emergency Management and Mitigation Responsibilities	Legislation
Department of Water Resources (DWR) (cont.)	Operates and maintains the State Water Project; provides dam safety and flood control services, assists local water districts in water management and conservation activities, promotes recreational opportunities, and plans for future statewide water needs.	Delta Vision Process	Proposition 84
		Drought Action Team	Admin. Order by OES, Executive Order W-9-91
		Governor's Proclamation of State of Emergency	Emergency Services Act (Government Code §8550, et seq.)
		State Water Plan; Water Quality Monitoring	
		Southern District (Division of Planning and Local Assistance) - Water Quality Evaluations	Water Code §229
		Authorize public and private water purveyors to declare water shortage emergency	Water Code §§350-358
		Provides financial assistance to local agencies for the development, control and conservation of water resources	Davis-Grunsky Act of 1960
		Urban Water Management Planning: Assesses water supply availability	Urban Water Management Planning Act (SB 610/SB 221, 2001, as amended); Water Code §§10610-10656
		California Bay-Delta Program (CALFED): Provides ecosystem protection for the Bay-Delta Estuary, improves quality and reliability of water supplies	California Bay-Delta Act of 2003
		Urban Streams Restoration Program	Proposition 84
		Floodplain Management Task Force	AB 1147 (2000)

Agency	Agency Function	Emergency Management and Mitigation Responsibilities	Legislation
Department of Water Resources (DWR) (cont.)		Flood Emergency Action Team formation	Executive Order (1997)
		San Joaquin Valley Drainage Implementation Program: Drainage management plan in SJ Valley	Memorandum of Understanding (1991)
State & Consumer Services Agency (SCSA) www.scsa.ca.gov	Umbrella agency responsible for civil rights enforcement, consumer protection and professional licensure. †		
Building Standards Commission (BSC) www.bsc.ca.gov	Administers the processes related to adoption, approval, and implementation of state's building codes. †	Reviews and approves building standards proposed and adopted by state agencies	California Building Standards Law (1953); 24 CCR: "California Building Standards Code"
		Develop and adopt building retrofit guidelines for state buildings	AB 3313 (1990)
Seismic Safety Commission (SSC) www.seismic.ca.gov	Provides decision makers and the general public with cost effective recommendations to reduce earthquake losses and speed recovery.	Commission established to advise Governor, Legislature, state and local governments on reduction of earthquake risk	Seismic Safety Commission Act (1975)
		Nonstructural Earthquake Hazards in CA Schools	SB 1122; GC §8587.7
		Prepare and administer Earthquake Loss Reduction Plan	California Earthquake Hazards Reduction Act; GC §8871, et seq.
		Compile update on status of local governments' compliance with Unreinforced Masonry Building Law	Unreinforced Masonry Building Law (1986); GC §8875
		Develop and adopt building retrofit guidelines for state buildings	AB 3313 (1990)

Agency	Agency Function	Emergency Management and Mitigation Responsibilities	Legislation
Department of General Services (DGS) www.dgs.ca.gov	Oversees services supporting state government normal operation, including the management of state properties and telecommunications. †	Field Act implementation	Field Act (1933), Education Code §17281
		ASCE 41-06: Seismic Rehabilitation of Existing Buildings	
		Statewide Property Inventory	GC §§11011.15-18
-- Division of the State Architect (DSA) www.dsa.dgs.ca.gov	Provides policy, design and construction oversight, for K-12 schools and community colleges	Field Act implementation	Field Act (1933), Education Code §17281
		Nonstructural Earthquake Hazards in CA Schools	SB 1122; GC §8587.7
	Provides policy leadership and design and construction oversight, for K-12 schools and community colleges	Ensures essential buildings are designed and constructed to minimize fire, seismic and wind hazards	Essential Services Building Act of 1986; HSC §16000, et seq.
		Ensures essential buildings comply with State Building Standards Code	SB 122 (1990)
		Develop and adopt building retrofit guidelines for state buildings	AB 3313 (1990)
-- Office of Public School Construction (OPSC) www.opsc.dgs.ca.gov	Administers the School Facility Program and other programs of the State Allocation Board	Good Repair Standards: Interim Evaluation Instrument and Facilities Inspection System	SB 550 & AB 607
Department of Technology Services (DTS) www.dts.ca.gov	Provides IT services to state, county, federal and local government entities; technology center for the state.	Operational Recovery: recover critical applications within 72 hours in event of disaster	State Administrative Manual §§4842.21 & 4843

Agency	Agency Function	Emergency Management and Mitigation Responsibilities	Legislation
The Reclamation Board (RB) www.recbd.ca.gov	Controls flooding along the Sacramento and San Joaquin Rivers and their tributaries; maintains flood control infrastructure. †	Authority to designate floodways in Central Valley	23 CCR, Art. 5, §107
University of California (UC) www.universityofcalifornia.edu	Conduct research, teaching, and public service activities at ten campuses through out the state. Provide healthcare and conduct teaching and research at five associated medical centers.	Adopt retrofit guidelines for state buildings owned by UC	AB 3313 (1990)
		California Animal Health and Food Safety Laboratory System	3 CCR, Div. 1, Ch. 3, §520, et seq.
		University of California Center for Pest Research	3 CCR, Div. 1, Ch. 3, §576, et seq.
		Establishes center for earthquake engineering and research (PEER)	SB 1864 (1996)
		Seismic retrofit or replacement of hospital facilities.	Alquist Act (1983) SB 1953

† Description of agency function derived from agency website in lieu of survey response.
* Pending legislation

Table 2.3.4B Earthquake Hazard Mitigation Legislation, 1933 to 2006

Legislation	Adoption Date	Subject	Type of Legislation	General Provisions	Citation
Field Act [AB 2342]	1933	School seismic safety	Regulation	Requires all new school building construction to be designed based on high level building standards adopted by the state; plans and specifications prepared by state-registered designers	Education Code §17281, et seq.
Riley Act [AB 2391]	1933	General building safety	Institution / Regulation	Requires local governments to have building departments that issue permits for new construction and alterations to existing structures and conduct inspections; set minimum seismic safety requirements	AB 2391
Garrison Act	1939	School seismic safety	Regulation	Requires school boards to assess building safety of pre-Field Act schools; ordered modernization of non-Field Act compliant structures	
Strong Motion Instrumentation Act [SB 1374]	1972	Earthquake monitoring	Program	Establishes statewide network of earthquake data-gathering instruments in essential structures; required Division of Mines and Geology to monitor instruments	PRC §§2700-2709.1

Legislation	Adoption Date	Subject	Type of Legislation	General Provisions	Citation
Seismic Safety General Plan Element [SB 519]	1972	Seismic safety policy	Policy	Requires city and county general plans to include a seismic safety element	GC §65302
Alquist-Priolo Earthquake Fault Zoning Act [SB 520]	1972	Seismic zone mapping	Program / Regulation	Requires the state geologist to prepare maps of major fault traces and zones; prohibited construction of new buildings used for human occupancy on the surface trace of active faults; required geologic investitgation prior to issuance of building permit	PRC §§2621-2630
State Capitol Seismic Evaluation [SCR 84]	1972	Seismic evaluation			
Alquist Hospital Facilities Seismic Safety Act of 1973 [SB 352, SB 519]	1973	Essential building seismic safety	Regulation / Institution	Regulates the design, construction, and alteration of hospitals; set seismic safety standards for new hospitals; created an advisory Hospital Building Safety Board	HSC §129675, et seq.
Seismic Safety Commission Act	1975	Seismic safety policy	Institution	Establishes independent commission to advise Governor, Legislature, state and local governments on reduction of earthquake risk	Business and Professions Code §1014

Legislation	Adoption Date	Subject	Type of Legislation	General Provisions	Citation
Highway Emergency Fund [AB 387]	1975	Infrastructure repair	Program	Establishes Highway Emergency Fund to provide assistance to local jurisdictions for repair or replacement of highways damaged by earthquakes	
Seismic design of LNG facility [SB 1081]	1975	Essential facility seismic safety	Regulation	Requires seismic design of a liquefied natural gas terminal be addressed by PUC	
Earthquake hazard reduction program [SB 1279]	1978	Seismic hazard mitigation	Policy	Directs CSSC to assess policy and program implications of earthquake prediction and to develop seismic safety program and financing plan for the state.	
Mobile home bracing devices [SB 360]	1980	Seismic hazard mitigation	Regulation / Program	Requires mobilehome bracing devices; required HCD to administer program, test devices, issue certifications	
Hospital inspections [SB 961]	1980	Seismic evaluation	Program		
Earthquake insurance [AB 2865]	1983	Earthquake insurance	Regulation / Policy	Requires insurance companies to offer earthquake insurance; [repealed concurrent causation theory for earthquake damage]	Insurance Code §§100-124.5; Insurance Code §§1063.50-1063.68

Legislation	Adoption Date	Subject	Type of Legislation	General Provisions	Citation
Alquist Hospital Facilities Seismic Safety Act of 1983 [SB 1953]	1983	Essential building seismic safety	Policy / Regulation	Requires design and construction standards for hospitals; requires that after Jan. 1, 2008 any general acute care hospital building determined to be at potential risk of collapse or poses a risk of significant loss of life be used only for nonacute care	HSC §§130000-130070
Earthquake Education Act [SB 1893]	1983	Education and preparedness	Program		PRC §2805, et seq.
Earthquake preparedness [AB 2662]	1983	Education and preparedness	Program		
California Earthquake Hazard Reduction Act [SB 548]	1985	Seismic hazard mitigation	Program	Authorizes CSSC to develop a statewide plan to reduce earthquake hazards	GC §8870, et seq.
Unreinforced Masonry Building Act	1986	General building seismic safety	Program	Requires local governments within Seismic Zone 4 to identify all potentially hazardous buildings; establish mitigation programs; report progress to CSSC	GC §§8875-8875.10
Essential Services Building Seismic Safety Act of 1986 [SB 122]	1986	Essential building seismic safety	Regulation	Sets seismic safety design and review standards for critical facilities such as police and fire stations and emergency operations facilities; enforced by DSA	HSC §16000, et seq.

Legislation	Adoption Date	Subject	Type of Legislation	General Provisions	Citation
Katz Act	1987	School seismic safety	Regulation	Requires all private schools to develop disaster plans and en earthquake emergency procedure system	Education Code §§35295-35297
SB 920	1989	Government building seismic safety	Policy	Requires CSSC to develop a state policy on acceptable levels of earthquake risk for new and existing state-owned buildings by January 1, 1991	Revenue and Taxation Code §74.5
Bridge Seismic Retrofit Program [SB 2104]	1990	Essential facility seismic safety	Program	Requires CalTrans to prepare an inventory of all state-owned bridges which require strengthening or replacement to meet seismic-safety standards, and prepare plan and schedule for completion	
Earthquake Safety and Public Buildings Rehabilitation Bond Act of 1990 [Prop 122]	1990	Essential building seismic safety	Program / Institution	Issues general obligation bonds for the seismic retrofit of state and local government buildings	GC §§8878.50-8878.52

Legislation	Adoption Date	Subject	Type of Legislation	General Provisions	Citation
Seismic Hazards Mapping Act	1990	Seismic hazard mapping	Program	Directs Department of Conservation to identify and map areas prone to liquefaction, earthquake-induced landslides, and amplified ground shaking; required geotechnical investigations to identify hazards and formulate mitigation measures before issuance of building permit within mapped Zones of Required Investigation	PRC §§2690-2699.6
	1990	Essential building seismic safety	Policy	Establishes seismic safety standards for ambulatory surgical centers; requires fixed medical equipment (floor, roof or wall mounted) to be installed using services of licensed architect or structural engineer; and requires inspection every five years	HSC §1226.5
Private Schools Act	1990	School seismic safety	Enhancement	Extends Field Act to new private schools	
AB 631	1990	Manufactured/ Mobile home bracing devices	Enhancement	Requires HCD to adopt regulations governing the installation of earthquake-resistant bracing systems on manufactured homes or mobilehomes	HSC §18613.5, et seq.
AB 1890	1990	Water heater bracing devices	Regulation	Requires new and replacement water heaters to be braced and anchored	HSC §§19210-19214

Legislation	Adoption Date	Subject	Type of Legislation	General Provisions	Citation
AB 3313	1990	Seismic retrofit guidelines	Regulation	Requires DSA and Building Standards Commission to develop and adopt seismic retrofit guidelines for state buildings, including those owned by CSU and UC	
Executive Order D-86-90	1990	Executive Order	Program	Requires CalTrans to prepare plan to review and retrofit transportation structures; requests UC and requires CSU to give priority consideration to seismic safety in allocation of funds for construction projects	
Charter Schools Act	1992	School seismic safety	Retraction	Makes Field Act provisions optional for charter schools	
Hospital Seismic Retrofit and Replacement Program [SB 1953]	1994	Essential building seismic safety	Enhancement	Establishes timeline and guidelines for hospitals to achieve full compliance with Alquist Hospital Seismic Safety Act by 2030	SB 1953
Marine Oil Terminal Program	1994	Essential facilities seismic safety	Program	Authorizes State Lands Commission to develop standards for the evaluation, retrofit, and maintenance of new and existing marine oil terminals	
California Earthquake Authority [AB 13, SB 1993]	1996	Earthquake insurance	Institution	Creates the California Earthquake Authority; authorized CEA to issue policies of basic residential earthquake insurance	Insurance Code §§10089.5-10089.54

Legislation	Adoption Date	Subject	Type of Legislation	General Provisions	Citation
AB 425	1997	School seismic safety	Retraction	Authorizes community college district to acquire for use any offsite facility constructed prior to Jan. 1, 1998 that meets structural requirements of the 1976 UBC, but does not meet requirements of Education Code §81130 if it has gone through an inspection by a structural engineer whose report is reviewed by DGS.	Education Code §§81149, 81530.5
AB 865	1997	School seismic safety	Retraction	Authorizes school district to lease a commercial building prior to Jan. 1, 2003 that does not meet the requirements of the Field Act provided that the building was constructed in accordance with seismic safety standards for commercial buildings within earthquake zones	Education Code §17285
AB 300	1999	School seismic safety	Program	Requires DGS to conduct inventory of public school buildings that are concrete tilt-up or have nonwood frame walls that do not meet requirements of 1976 UBC by Dec. 31, 2001	Education Code §17317

Legislation	Adoption Date	Subject	Type of Legislation	General Provisions	Citation
SB 1122	1999	School seismic safety	Program	Requires OES, in cooperation with State Department of Education, DGS and SSC to develop an educational pamphlet for use by K-14 personnel to identify and mitigate risks posed by nonstructural earthquake hazards	GC §8587.7
AB 80*	1999	School seismic safety	Retraction	Repeals provision of the Field Act that govern community college facilities	Education Code §8093
AB 2791	2000	School and essential facility seismic safety	Policy / Regulation	Authorizes DGS to issue a stop work order when construction on a public school, community college, or essential services facility is not being performed in compliance with Field Act	Education Code §§17307.5, 81133.5; HSC §16017.5
SB 1729	2000	School seismic safety	Policy / Regulation	Requires geological and soil engineering studies by competent personnel if prospective school site is located within boundaries of special studies zone or within an area designated as geologically hazardous in safety element	Education Code §17212, et seq.

Legislation	Adoption Date	Subject	Type of Legislation	General Provisions	Citation
AB 656	2001	Essential building seismic safety	Regulation	Authorizes, for county-owned general acute care hospital buildings, a 1-year extension of Jan. 1, 2002 deadline for Non-structural performance Category-2 requirements until if hospital is removed from general acute care service and completion of specified replacement by Jan. 1, 2003.	HSC §§130063.1-2
SB 1898	2003	Seismic gas valve shut-off device	Policy / Regulation	Authorizes local governments to adopt ordinances requiring installation of earthquake sensitive gas shutoff devices in buildings due to motion caused by an earthquake; allows DSA to establish a certification procedure for installation	HSC §§19180-83; HSC §§19200-05
AB 3032	2003	URM building retrofit	Policy	Exempts owners of retrofitted URM buildings from compliance with posted entry-area earthquake warning signs	GC §§8875.8, 8875.9
AB 3033	2003	URM building retrofit	Policy	Prohibits a city or county from imposing additional non-seismic building improvements to retrofit of URM building if building or site conditions unrelated to the improvements	AB 3033

Legislation	Adoption Date	Subject	Type of Legislation	General Provisions	Citation
SB 1014*	2003			Retracts provisions of the Alquist Hospital Facilities Seismic Safety Act of 1983 relating to seismic retrofitting and hospital facilities upgrade requirements as of Jan. 1, 2004	HSC §130026, §130071
AB 216	2005	Essential facility seismic safety	Program	Allocates $143 million for BART Tube Seismic Strengthening	Streets & Highways Code §30914(c)(21)
AB 144	2005	Toll-bridge retrofit	Program	Authorizes retrofit of state-owned toll bridges using seismic toll surcharge	Streets & Highways Code §188.4
SB 167	2005	Essential facility seismic safety	Policy	Exempts hospitals subject to state seismic standards for hospitals from 2008 deadline if governing body agrees to comply with 2030 standards by 2020.	HSC §130030, §130070
SB 491*	2005	Essential facility seismic safety	Program	Authorizes bond to finance a seismic safety program for nonprofit and public general acute care hospitals	GC §15465, HSC §130060
Highway Safety, Traffic Reduction, Air Quality, and Port Security Bond Act of 2006 [Proposition 1B]	2006	Essential facility seismic safety	Program	Provides $125 million funding for seismic retrofit work on local bridges, ramps, and overpasses; establishes Local Bridge Seismic Retrofit Account	GC §8879.23(i)

Legislation	Adoption Date	Subject	Type of Legislation	General Provisions	Citation
SB 1279*	2006	School seismic safety	Program	DGS conducts an inventory of public school buildings to identify those that do not meet performance standards of Field Act	Education Code §17280.4
AB 1934*	2006	School seismic safety	Program / Regulation	Establishes grant program for seismic safety upgrades for school facilities that are in close proximity to active faults	Education Code §17074.60, et seq.
SCA 28*	2006	Reappraisal exemption after seismic retrofit	Policy	Exempts existing structure that has seismic retrofit to be reappraised for property tax purposes	CA Constitution Article XIII, Section 2
SCA 32*	2006	Preservation of historic facility	Policy	Directs the preservation of 21 California missions, which could include seismic retrofitting	CA Constitution Article XVI, Section 5

**Legislation is in either of the two houses and has not been (or was not) adopted and codified*

Table 2.3.4C Flood Hazard Mitigation Legislation, 1933 to 2006

Legislation	Adoption Date	Subject	Type of Legislation	General Provisions	Citation
Flood Control Law of 1946	1946	Flood control infrastructure cost sharing	Policy	Establishes state interest in and cooperation with the federal government in construction of flood control projects	Water Code §12800, et seq.
Cobey-Alquist Flood Plain Management Act	1965	Floodplain management	Program / Regulation	Authorizes review of floodplain management plans, establishes floodplain regulations, and regulates designated floodway use and reimbursement costs for federal flood control projects	Water Code §§8400-8415, §8401(c)
California Emergency Services Act	1970	Property disclosure	Regulation	Establishes disclosure obligations of seller or agent of seller of property in special flood hazard area, or in area of potential flooding	GC §§8589.3, 8589.4
Executive Order B-30-77	1977	Essential building flood safety	Program	Floodplain management for state buildings	Exec. Order B-30-77
Flood Emergency Action Team	1997			Creates Flood Emergency Action Team	Exec. Order

Legislation	Adoption Date	Subject	Type of Legislation	General Provisions	Citation
California Watershed Protection and Flood Prevention Law [AB 793]	1999				Water Code §12850
Floodplain Management Task Force [AB 1147]	2000	Floodplain management strategy	Institution	Recommends creation of the Flood Emergency Action Team to recommend floodplain management strategies designed to reduce flood losses and maximize the benefits of floodplains	AB 1147
Safe Drinking Water, Watershed Protection and Flood Protection Act [Proposition 13, AB 1584]	2000	Local flood control projects	Program	Provides funding to local agencies for locally sponsored, federally authorized flood control projects; provides funding for Flood Protection Corridor Program and flood control mapping	Proposition 13
Water Code §128		Flood disaster response	Policy	Enables DWR to respond to flood damage to property of general or state interest	Water Code §128
Flood Control Law		Flood control infrastructure construction	Policy	Allows any city to incur indebtness to finance the construction of flood control infrastructure	Water Code §8000
Water Security, Clean Drinking Water, Coastal and Beach Protection Act of 2002 [Proposition 50]	2002	Flood control infrastructure improvement	Program	Allocates funding available for grants for planning and implementation of multipurpose flood control programs; eligibility for funding dependent on project being designed to improve flood management	Water Code §79651(h)

Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006 [Proposition 84]	2006	Critical flood control infrastructure evaluation	Program	Allocates $275 million in funding for levee inspection and evaluation; map floodplains including rural areas with potential for urbanization and high density urban areas; improve effectiveness of emergency response; provides funding for critical immediate flood control needs throughout state; provides funding for assistance to local land-use planning	PRC §75030, et seq.
Disaster Preparedness and Flood Prevention Bond Act of 2006 [Proposition 1E, AB 140]	2006	Flood control infrastructure improvement	Program	Allocates $3.0 billion in funding for evaluation, repair, reconstruction, or replacement of flood control infrastructure; improve or add flood control facilities; reduce risk of levee failure in Delta; develop flood hazard maps	PRC §5096.8, et seq.
				FloodSafe California Initiative	

Table 2.3.4D Wildfire Hazard Mitigation Legislation, 1933-2006

Legislation	Adoption Date	Subject	Type of Legislation	General Provisions	Citation
Organic Act	1887			Set aside National Forest Reserves	
State Fire Responsibility Act	1965	State Areas of Responsibility	Policy	Requires State Board of Forestry to classify all lands in state in which financial responsibility of preventing and suppressing fires is primarily the responsibility of the state; defines SRA land	PRC §4125
Z'berg Nejedly Forest Practice Act	1973	Forest resource improvement	Policy	Restores, enhances, and maintains productivity of timberlands while giving consideration to their varied public benefits; exempts certain vegetation management practices related to fuel reduction and establishing fuel breaks	PRC §4511, et seq., 4584(j)
California Forest Improvement Act of 1978	1978	Forest resource improvement	Program	Allows (DFW) to enter into agreements with eligible landowners to undertake forest resource improvement work; establishes practices that will improve long-term quality of forested lands in terms of timber productivity, retention of soil cover and value for wildfire	PRC §§4790-4799.05

Legislation	Adoption Date	Subject	Type of Legislation	General Provisions	Citation
Designate Hazardous Fire Areas [SB 1972 - Campbell)]	1979	Fire hazard zone designation	Policy / Regulation	Designates hazardous fire areas, regulates the use of fireworks and other hazardous materials within these designated areas; fire prevention reduction standards on railroad right of way	PRC §§4254, 4255, 4258, 4259, 4260, 4296.5
SB 78 - Ayala	1981	Fire hazard classification; building regulations	Policy / Regulation	Establishes State Area of Responsibility (SRA) fire hazard classification and zoning, roof and attic openings, and HCD roofing regulations	PRC §4291.5; HSC §13108.5
SB 799 - Mello	1981	Firework regulation	Regulation	Bans the use of fireworks in SRA Fire Hazard Zones	PRC §§4254-4255, 4258-4260
	1989	Safety element review	Policy / Regulation	Requires State Board of Forestry to review the safety element of counties which contain state responsibility areas and make appropriate recommendations	PRC §4128.5
Natural Hazard Disclosure requirements [AB 1812 - Cortese]	1989	Natural hazard disclosure	Policy / Regulation	Requires Natural Hazard Disclosure for wildfire in SRA	PRC §4291, et seq.
Minimum fire safety regulation in SRA [SB 1075 - Rogers)]	1991	Minimum fire safety	Policy / Regulation	Sets minimum fire safety regulation in SRA	PRC §4290
Very High Fire Hazard Severity Zones; Fire Hazard Zoning in Local Area of Responsibility (LRA) [AB 337 - Bates]	1992	Fire hazard zone designation	Policy / Regulation	Establishes designation of Fire Hazard Zoning in Local Area of Responsibility (LRA)	GC §§51178-51188; HSC §13108.5

AB 3819 - Brown	1995	Fire hazard building safety	Policy / Regulation	Class A roof and Model Ordinance for defensibility of space and structures	GC §§51178.5, 51189; HSC §§13108.5, 13132.7; PRC §42205
AB 747 - Brown	1995	Fire hazard building safety	Policy / Regulation	Sets timeline for testing of Class A, B, C roof and shingles	HSC §13132.7
AB 1195 - Torlakson	1997	Fire hazard zone designation	Institution	Requires local agencies to designate Very High Fire Hazard Severity Zones upon recommendation from CDF; creates the Emergency Response Training Advisory Committee	Civil Code §§2079.11, 1102.6c, GC §§8589.3-8589.5, 51179, 51183.5, PRC §§2621.9, 2694, 2696, 4125, 4136
Natural Hazard Disclosure for wildfire in LRA and Very High Fire Hazard Severity Zones [AB 6X, AB 1195]	1998	Natural hazard disclosure	Regulation	Establishes disclosure obligations of seller or agent of seller of property in LRA and Very High Fire Hazard Severity Zones; facilitated by Natural Hazard Disclosure Statement	Civil Code §1103, et seq.; GC §51183.5
AB 423	1999	Fire hazard building safety	Policy	Lists wood roofing materials that have passed at least five years of the ten-year weather test; insurance companies honor replacement cost coverage for increased cost of fire retardant roofing materials	HSC §13132.7
California Clean Water, Clean Air, Safe Neighborhood Parks and Coastal Protection Act of 2002 [Proposition 40, AB 1602]	2002	Fuel reduction program	Program	Establishes program with goal to reduce wildland fuel loadings that pose threat to watershed resources and water quality	PRC §5096.3

Legislation	Adoption Date	Subject	Type of Legislation	General Provisions	Citation
AB 1216	2002	Fire hazard building safety		Expand fire safety building standards in areas with high fire risk to various components (not listed)	PRC §4291, GC §51189
Governor's Blue Ribbon Fire Commission	2003	Review of fire response	Program	Review firefighting effort of Southern California wildfires; present recommendations to policy makers that will promote fire safe environment in WUI	
Defensible Space regulations [SB 1369]	2004	Fire hazard building safety	Regulation	Requires persons in SRA to maintain additional firebreak by removing all brush, flammable vegetation or combustible growth located 30 to 100 feet from building or structure or to property line	PRC §4291(b)

Document 2.3.4A Earthquake Hazard Mitigation Legislative History – Historical Development

Editor's Note: The following material was moved from the 2004 SHMP text to help begin the process of trimming which will continue through the edit process preceding circulation of the public release draft. Additional materials may be moved to this location because of its historical informative.

Dam Safety Act

After the 1928 collapse of the Saint Francis Dam in Ventura County killed more than 450 people, in 1929 California passed the Dam Safety Act to regulate the construction and maintenance of all non-federal dams. Following 1963 collapse of the Baldwin Hills Dam in Southern California, the state expanded its jurisdiction to both new and existing off-stream storage facilities. DWR's Division of Safety of Dams administers the Dam Safety Act and periodically inspects dams to ensure their safety. Fees paid by dam owners fund the Division's work.

Field Act

In 1933, one month after the Long Beach Earthquake destroyed 70 schools, seriously damaged 120 others, and caused minor damaged to 300 more, California passed the Field Act to ensure seismic safety in new public schools. The Act establishes regulations for the design and construction of K-12 and community college buildings. The Division of the State Architect within DGS enforces the Field Act.

Riley Act

Following the 1933 Long Beach Earthquake, the state also passed the Riley Act, which requires local governments to have building departments that issue permits for new construction and alterations to existing structures and conduct inspections. Permit fees paid by building owners generally fund the work of local building departments. The Act also set minimum seismic safety requirements that have since been incorporated into all building codes.

Hospital Safety Act

The loss of emergency functions and hospital collapses due to the 1971 San Fernando Earthquake prompted passage of the Hospital Seismic Safety Act of 1973. This Act regulates the design, construction, and alteration of hospitals for the protection of life and property and so that they will remain functional after disasters. OSHPD enforces this Act.

Strong Motion Instrument Act

The state passed the Strong Motion Instrumentation Act in 1972 in response to the extensive damage to buildings and bridges caused by the 1971 San Fernando Earthquake. The earthquake highlighted the need for more data on strong ground shaking during earthquakes and on the response of structures to the shaking. The Act established a statewide network of strong motion instruments to gather vital earthquake data for the engineering and scientific communities. Data obtained from the strong motion instruments is used to recommend changes to building codes, assist local governments in the development of their general plans, and help emergency response personnel in the event of a disaster.

Alquist-Priolo Earthquake Fault Zoning Act

The state passed the Alquist-Priolo Earthquake Fault Zoning Act in 1972 to mitigate the hazard of surface faulting to structures built for human occupancy. The law was another response to the 1971 San Fernando Earthquake, which produced extensive surface fault ruptures that damaged numerous homes, commercial buildings, and other structures. The Act's main purpose is to prevent the construction of buildings used for human occupancy on the surface trace of active faults. Before issuing building permits, cities and counties must require a geologic investigation to ensure that proposed buildings will not be constructed across active faults. Proposed building sites must be evaluated by a licensed geologist. If an active fault is found, a structure for human occupancy cannot be placed over the trace of the fault.

Seismic Safety Commission Act

The 1971 San Fernando Earthquake highlighted weaknesses in California's earthquake risk management policies. To address these weaknesses, in 1975 the state legislature created the independent California Seismic Safety Commission (CSSC) to provide a consistent earthquake policy framework for the state. The mission of CSSC is "to provide decision makers and the general public with cost-effective recommendations to reduce earthquake losses and expedite recovery from damaging earthquakes." The commission is also responsible for implementing the California Earthquake Hazards Reduction Act, which requires CSSC to "prepare and administer a program setting forth priorities, funding sources, amounts, schedules, and other resources needed to reduce statewide earthquake hazards."

California Earthquake Hazards Reduction Act

After the 1985 Mexico City Earthquake, in 1986 California passed the Earthquake Hazards Reduction Act, which called for a coordinated state program to implement new and expanded activities to significantly reduce earthquake threat. The program is coordinated by CSSC, which is required to specify priorities, funding sources and amounts, schedules, and other resources. Although historically funded by the state general fund, since the 2003-2004 fiscal year, the program was funded by fees imposed on property insurance companies.

Un-reinforced Masonry Building Law

In response to the 1983 Coalinga Earthquake, in 1986 the state legislature enacted the Un-reinforced Masonry Building Law, which requires local governments in high seismic regions of California to inventory un-reinforced masonry buildings, establish mitigation programs, and report progress to the CSSC. As of 2003, 251 local governments have established programs and 16,761 buildings have either been retrofitted or demolished.
Cities and counties rely on a variety of funding sources, including building permit fees, to pay for these programs. Some local programs offer financial, planning, and zoning incentives to building owners for retrofit.

The CSSC periodically reports on the progress made by local programs in a publication entitled Status of the Un-reinforced Masonry Building Law, most recently in 2003.

Essential Services Building Seismic Safety Act

Also in response to the 1985 Mexico City earthquake, in 1986 the state passed the Essential Services Building Seismic Safety Act to require enhanced regulatory oversight by local

governments during the design and construction of new essential service facilities, such as fire and police stations and emergency communications and operations facilities. The Division of the State Architect within DGS enforces this Act.

Bridge Seismic Retrofit Program

Since the 1971 San Fernando Earthquake, CalTrans has been authorized to seismically retrofit vulnerable state and local bridges. Phase 1 consisted of retrofitting 1,039 state-owned single- and multiple-column bridges at a cost of $815 million. Phase 2 consisted of retrofitting the remaining 1,364 multiple-column state bridges at a cost of approximately $2 billion. Approximately $1.5 billion is being spent to replace major non-toll bridges and $4.6 billion for major toll bridge retrofits and replacements. Replacement costs include significant non-seismic upgrades. Costs for retrofitting 1,212 locally owned bridges are expected to be approximately $1 billion. Funds come from the State Transportation Improvement Fund, the State Highway Account, FEMA public assistance, sales tax increments, and gasoline taxes.

Earthquake Safety and Public Buildings Rehabilitation Bond Act of 1990 (Prop 122)

Proposition 122 was passed by voters in June 1990 after the 1989 Loma Prieta earthquake revealed vulnerabilities to state-owned and essential services buildings. The bond measure authorized the state to issue $300 million in general obligation bonds for the seismic retrofit of state and local government buildings ($250 million for state-owned buildings and $50 million for partial financing of local government essential services facilities). The Seismic and Special Programs Section of DGS' Real Estate Services Division administers Proposition 122 grant programs.

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act, passed in 1990, directs the Department of Conservation to identify and map areas prone to liquefaction, earthquake-induced landslides, and amplified ground shaking. The purpose of the Act is to reduce the threat to public safety and to minimize the loss of life and property by identifying and mitigating these seismic hazards. The Act requires geotechnical investigations to identify hazards and formulate mitigation measures before permitting most developments within mapped Zones of Required Investigation.

Hospital Seismic Retrofit and Replacement Program

The state legislature passed Senate Bill 1953 after the 1994 Northridge earthquake revealed vulnerabilities in older hospitals. The law requires hospitals to undertake nonstructural retrofits of emergency and surgical rooms by 2002, collapse-avoidance retrofits by 2008, and achieve full compliance with the Alquist Hospital Seismic Safety Act by 2030. OSHPD enforces this Act.

Marine Oil Terminal Program

After the 1994 Northridge Earthquake, the State Lands Commission received a hazard mitigation grant from FEMA to develop standards for the evaluation, retrofit, and maintenance of new and existing marine oil terminals. In 2003, the Commission issued its proposed regulations and plans to hold hearings prior to their consideration for adoption. The proposed regulations would help limit the potential and size of oil releases after earthquakes and tsunamis by requiring upgrades of older terminals. Fees to be paid by marine oil terminal owners would fund the state's oversight of this program.

Early History of California's Earthquake Loss Reduction Programs

CSSC issued its first comprehensive earthquake hazard mitigation plan, *Guiding Action: Goals and Policies to Strengthen Earthquake Safety in California,* in 1979. The commission prepared a strategic seismic safety program and financing plan in 1982, *Earthquake Hazards Management: An Action Plan for California*. After the passage of the California Earthquake Hazard Reduction Act of 1986, CSSC prepared *California at Risk,* a series of comprehensive five-year programs for earthquake mitigation.

Table 5.1.1C California Disaster History: State Proclamations, Federal Declarations, and Selected Events (1950 – May 2007)

Disaster Name	Disaster Type	Disaster Cause	Disaster #	Year	Counties and Cities Declared	State Proclamation	Federal Declaration	Deaths	Injuries	Cost of Damage ($)
Island Fire (Catalina)	Fire	Fire	FM-2694	2007	Los Angeles		5/10/07			
Griffith Park Brush Fire	Fire	Fire	FM-2691	2007	Los Angeles		5/8/07			
241 Fire	Fire	Fire	FM-2683	2007	Orange		3/11/07			
2007 Severe Freeze	Freeze	Freeze	DR-1689	2007	Fresno, Imperial, Kern, Los Angeles, Monterey, Riverside, San Bernardino, San Diego, San Luis Obispo, Santa Barbara, Tulare, Ventura		3/13/07			
Shekell Fire Complex	Fire	Fire	2006-13	2006	Ventura	12/4/06				
Esperanza Fire	Fire	Fire	2006-09	2006	Riverside	10/26/06		5		1,791,036
Day Fire	Fire	Fire	2006-08	2006	Ventura	9/24/06				6,324
Orchard Fire	Fire	Fire	FM-2676	2006	Riverside	9/19/06	9/16/06			
Junction Fire	Fire	Fire	FM-2662 / DC 2006-07	2006	Trinity		7/29/06			142,373
Major Levee Erosion	Flood	Levee break	DC 2006-06	2006	Trinity	9/19/06				210,411
Horse Fire	Fire	Fire	FM-2656	2006	San Diego		7/24/06			136,308
Lake Tahoe Sewage Spill	HazMat	Sewage spill	SBA-10224	2006	El Dorado					
Sawtooth Fire Complex	Fire	Fire	2006-05	2006	San Bernardino	7/13/06				255,155
Corcoran Water Well Failure	Facility	Water Well Failure	2006-04	2006	City of Corcoran (Kings County)	6/23/06				398,288
Ferguson Rockslide	Landslide	Landslide	SBA-10535	2006	Mariposa (Merced River)					

2006 June Storms	Flood	Storms	DR-1646	2006	Alameda, Amador, Calaveras, El Dorado, Lake, Madera, Marin, Merced, Napa, Nevada, Placer, San Joaquin, San Mateo, Santa Cruz, Sonoma, Stanislaus, Tuolumne, Statewide (HM)		6/5/06			28,946,125
2006 April Storms	Flood	Storms	2006-03	2006	Fresno, Kings, Mariposa, Tulare	04/10/06 04/13/06				4,149,847
Levee Erosion	Flood	Levee break	DC 2006-02	2006	City of East Palo Alto (San Mateo)	3/28/06				251,161
Sierra Fire	Fire	Fire	FM-2630	2006	Orange, Riverside		2/6/06			161,790
2005/06 Winter Storms	Flood	Storms	DR-1628	2005, 2006	Alameda,Alpine,Amador,Butte,Colusa,Contra Costa,Del Norte,El Dorado,Humboldt,Lake,Lassen, Marin,Mendo.,Napa,Nevada,Placer,Plumas,Sac.,San Joaquin,San Luis Obispo,San Mateo,Santa Cruz,Sierra,Siskiyou,Solano,Sonoma,Sutter,Trinity,Yolo,Yuba, +statewide HM		2/3/06			128,964,501
2005-06 Winter Storms	Flood	Storms	2006-01	2005 2006	Fresno, Kings, Shasta, Tulare	1/12/06				1,275,237
Hurricane Katrina Evacuations	Economic	Hurricane	EM-3248	2005	All 58 counties		9/13/05			763,576
Extreme Rainfall	Flood	Storms	DC 2005-06	2005	Sierra	11/7/05				504,323
School Fire	Fire	Fire	FM-2586	2005	Ventura		11/18/05			4,468,439
Border #50 Fire	Fire	Fire	FM-2585	2005	San Diego		10/6/05			3,406,702
Woodhouse Fire	Fire	Fire	FM-2584	2005	Riverside		10/5/05			1,040,087
Severe Thunderstorms & Flash Flooding	Flood	Storms	DC 2005-06	2005	California City (Kern), City of Needles & Town of Yucca Valley (San Bernardino)	9/26/05				759,591
Topanga Fire	Fire	Fire	FM-2583	2005	Los Angeles, Ventura		9/28/05			19,787,415
Sundevil Fire	Fire	Fire	FM-2582	2005	San Diego		9/5/05			233,530
Manton Fire	Fire	Fire	FM-2580	2005	Tehama, Shasta		8/26/05			3,961,454
Quartz Fire	Fire	Fire	FM-2571	2005	Madera		7/25/05			1,428,429
Rain and Flooding (Modoc)	Flood	Storms	GP 2005-04	2005	Modoc	5/1/05				495,824

March Storms & Landslide (San Mateo)	Flood	Storms	GP 2005-05	2005	San Mateo	3/1/05					307,846
2005 March Flooding (Mariposa)	Flood	Flood	GP 2005-03	2005	Mariposa	3/1/05					2,123,164
2005 Floods Excluded from DR-1585	Flood	Storms	GP 2005-02	2005	Kern, San Bernardino, San Diego, Santa Barbara	2/1/05					
2005 February Storms	Flood	Storms	DR-1585	2005	Kern, Los Angeles, Orange, Riverside, San Bernardino, San Diego, Ventura	3/16/05	4/14/05				76,128,144
2005 January Winter Storms	Flood	Storms	DR-1577, GP2005-01	2005	Los Angeles, Orange, Riverside, San Bernardino, San Diego, Santa Barbara, Ventura, Kern (HM only)	01/12/05 01/15/05	2/4/05				291,368,772
Death Valley Flood	Flood	Flood	DC 2004-08	2004	Inyo	11/1/04					186,052
Old Hwy Fire	Fire	Fire	FM-2555	2004	Mariposa		9/13/04				2,691,934
Geysers Fire	Fire	Fire	FM-2554	2004	Sonoma		9/4/04				10,617,205
Pattison Fire	Fire	Fire	FM-2553	2004	Calaveras		9/4/04				3,625,196
Bear Fire (Mariposa)	Fire	Fire	FM-2552	2004	Mariposa		9/3/04				1,118,783
Lake Fire	Fire	Fire	FM-2548	2004	Shasta	8/23/04	8/14/04				204,470
French Fire	Fire	Fire	FM-2547	2004	Shasta	8/23/04	8/14/04				14,608,538
Oregon Fire	Fire	Fire	FM-2545	2004	Butte		8/11/04				2,327,464
Bear Fire (Shasta)	Fire	Fire	FM-2544	2004	Shasta	8/23/04	8/11/04				8,890,997
Stevens Fire	Fire	Fire	FM-2541	2004	Placer		8/8/04				3,469,004
Calaveras Complex	Fire	Fire	FM-2540	2004	Calaveras		8/8/04				4,656,887
Deep Fire	Fire	Fire	DC 2004-06	2004	Tulare	8/1/04					
Crown Fire	Fire	Fire	FM-2535	2004	Los Angeles		7/21/04				2,604,924
Foothill Fire	Fire	Fire	FM-2534	2004	Los Angeles		7/18/04				4,319,501
Melton Fire	Fire	Fire	FM-2533	2004	Riverside		7/17/04				2,715,200
Hollow Fire	Fire	Fire	FM-2532	2004	El Dorado		7/14/04				179,440
Lakeview Fire	Fire	Fire	FM-2530	2004	Riverside		7/14/04				74,349
Mataguay Fire	Fire	Fire	FM-2529	2004	San Diego		7/14/04				2,084,052
Pine Fire	Fire	Fire	FM-2528	2004	Los Angeles		7/14/04				9,028,675
Gaviota Fire	Fire	Fire	FM-2519	2004	Santa Barbara		6/5/04				6,143,627

San Joaquin Levee Break	Flood	Levee break	DR-1529	2004	San Joaquin	6/4/04	6/30/04				27,214,428
Cerritos Fire	Fire	Fire	FM-2517	2004	Riverside		5/4/04				5,816,297
Eagle Fire	Fire	Fire	FM-2516	2004	Riverside		5/4/04				6,257,005
Pleasure Fire	Fire	Fire	FM-2515	2004	Riverside		4/26/04				
Daly City Flooding	Flood	Flood	DC 2004-02	2004	San Mateo	2/1/04					337,614
Snowstorm (Trinity)	Snow	Storms	DC 2004-01	2004	Trinity	1/1/04					1,122,549
San Simeon Earthquake	Earthquake	Earthquake	DR-1505	2003	San Luis Obispo, Santa Barbara	12/23/2003 12/31/03	1/13/04				38,538,733
Flash flooding	Flood	Storms	GP 2003-04	2003	Los Angeles	11/14/03					903,275
Whitmore Fire	Fire	Fire	FM-2508	2003	Shasta		10/28/03				1,999,031
California Wildfires	Fire	Fire	DR-1498 (see * fires above)	2003	Ventura, Los Angeles, San Bernardino, Riverside, San Diego	10/26/03	10/27/03				147,110,958
Mountain Fire	Fire	Fire	FM-2507*	2003	Riverside		10/26/03				
Paradise Fire	Fire	Fire	FM-2506*	2003	San Diego		10/26/03				
Cedar Fire	Fire	Fire	FM-2505*	2003	San Diego		10/26/03				
Simi Fire	Fire	Fire	FM-2504*	2003	Ventura		10/26/03				
Old Fire	Fire	Fire	FM-2503*	2003	San Bernardino		10/25/03				
Verdale Fire	Fire	Fire	FM-2502*	2003	Los Angeles, Ventura		10/25/03				
Grand Prix Fire	Fire	Fire	FM-2501*	2003	San Bernardino		10/23/03				
Pass Fire	Fire	Fire	FM-2500*	2003	Riverside		10/21/03				
Bridge Fire	Fire	Fire	FM-2497	2003	San Bernardino		9/5/03				784,529
Locust Fire	Fire	Fire	FM-2491	2003	Riverside		8/19/03				1,319,887
2003 August Storms	Flood	Storms	DC 2003-02	2003	Imperial, Inyo, San Bernardino		8/1/03				4,126,902
Canyon Fire	Fire	Fire	FM-2487	2003	Riverside		7/25/03				3,681,947
Railroad Fire	Fire	Fire	FM-2475	2003	Riverside		7/3/03				276,200
Tejon Fire	Fire	Fire	FM-2474	2003	Kern		6/29/03				1,323,296
Sawmill Fire	Fire	Fire	FM-2473	2003	Kern		6/27/03				946,806
Bark Beetle Infestation	Economic	Insect pest	GP 2003	2003	San Bernardino, San Diego, Riverside	3/7/03					
Pacific Fire	Fire	Fire	FM-2466	2003	Los Angeles		1/7/03				2,017,043

State Road Damage	Road damage	Flood	GP 2003	2003	Alameda, Colusa, Contra Costa, Del Norte, Humboldt, Lake, Marin, Mendocino, Napa, San Mateo, Santa Clara, Santa Cruz, Solano, Sonoma, Trinity	1/1/03				
Exotic Newcastle Disease Epidemic	Agricultural	Disease	GP 2003	2003	Los Angeles, Orange, Riverside, San Bernardino, San Diego, Ventura	1/3/07				
Late Storm '02	Flood	Storms	DC 2003-01	2003	Humboldt, Mendocino, Trinity	1/1/03				5,875,940
Mexican Fruit Fly (San Diego)	Agricultural	Insect pest	GP 2002	2002	San Diego	12/1/02				
Croy Fire	Fire	Fire	FM-2465	2002	Santa Clara		9/25/02			8,700,329
Williams Fire	Fire	Fire	FM-2464	2002	Los Angeles		9/23/02			6,028,991
Sierra Fire	Fire	Fire	FM-2463	2002	Placer		9/19/02			720,595
Leona Fire	Fire	Fire	FM-2462	2002	Los Angeles		9/3/02			2,410,655
Squirrel Fire	Fire	Fire	FM-2461	2002	Shasta		9/3/02			2,931,942
Pines Fire	Fire	Fire	FM-2456	2002	San Diego		7/30/02			26,820,605
Deer Fire	Fire	Fire	FM-2450	2002	Kern		7/21/02			926,099
Louisiana	Fire	Fire	FM-2433	2002	San Bernardino		6/27/02			1,445,999
BlueCut Fire	Fire	Fire	FM-2425	2002	San Bernardino		6/17/02			1,256,818
Copper Fire	Fire	Fire	FM-2417	2002	Los Angeles		6/6/02			2,927,981
Antonio Fire	Fire	Fire	FM-2405	2002	Orange		5/13/02			467,678
Gavilan Fire	Fire	Fire	FM-2396	2002	San Diego		2/11/02			3,035,562
Trinity Wildfire	Fire	Fire	DC 2001-05	2001	Trinity	9/1/01				242,935
Calaveras Wildfire	Fire	Fire	GP 2001-04	2001	Calaveras	9/10/01				6,693,498
Modoc/Siskiyou Drought	Drought	Drought	GP 2001-03	2001	Modoc, Siskiyou	5/4/01				14,858,480
Rio Dell Water Shortage	Economic	Drought	GP 2001-02	2001	City of Rio Dell (Humboldt County)	3/16/01				2,523,425
2001 March Storms	Flood	Storms	DC 2001-01	2001	Los Angeles, San Luis Obispo, Santa Barbara	3/1/01				9,353,703
Energy Emergency	Economic	Greed	GP 2001	2001	All 58 counties	1/1/01				
Napa Earthquake	Earthquake	Earthquake	DR-1342	2000	Napa	9/6/00	9/14/00			17,700,867
Windstorms	Wind	Storms	DC 2000-02	2000	Los Angeles	4/1/00				78,081
Millbrae Landslide	Landslide	Landslide	DC 2000-01	2000	San Mateo	2/1/00				8,206,349
Mudslides (San Bernardino)	Landslide	Landslide	DC 99-04	1999	San Bernardino	7/26/99				67,272,822

1999 August Fires	Fire	Fire	EM-3140	1999	Butte, Humboldt, Napa, Plumas, San Bernardino, Shasta, Tehama, Trinity, Tuolumne, Yuba	8/26/99	9/1/99			1,154,573
Sonoma Road Failure	Road damage	Flood	GP 99-03	1999	Sonoma	3/29/99				396,521
Beaumont Wind Storms	Wind	Storms	DC 99-02	1999	San Bernardino	2/1/99				4,019
Avenal Water Pipeline Failure	Facility	Pipeline rupture	DC 99-01	1999	City of Avenal (Kings County)	2/1/99				256,609
1998 Freeze	Freeze	Freeze	GP 98-02, DR-1267	1998	Fresno, Kern, Kings, Madera, Merced, Monterey, Riverside, Tulare, Ventura	12/29/98	2/9/99			17,481,385
1998 Winter Storms	Flood	Storms	GP 98-01	1998	Siskiyou, Shasta, Kings, Madera	2/26/1998, 4/16/1998, 5/15/1998				
1998 El Nino Floods	Flood	Storms	DR-1203	1998	Alameda, Amador, Butte, Calaveras, Colusa, Contra Costa, Fresno, Glenn, Humboldt, Kern, Kings, Lake, Los Angeles, Marin, Mendocino, Merced, Monterey, Napa, Orange, Riverside, Sacramento, San Benito, San Bernardino, San Diego, San Francisco, San Joaquin, San Luis Obispo, San Mateo, Santa Barbara, Santa Clara, Santa Cruz, Siskiyou, Solano, Sonoma, Stanislaus, Sutter, Tehama, Trinity, Tulare, Ventura, Yolo, Yuba, Del Norte	Proclaimed	2/9/98	17		385,141,192
Floods (Orange)	Flood	Flood	97-04	1997	Orange	12/10/97				
Fires (Yuba)	Fire	Fire	97-02	1997	Yuba	10/1/97				

1997 January Floods	Flood	Storms	DR-1155	1997	Alpine, Amador, Butte, Colusa, Del Norte, El Dorado, Glenn, Humboldt, Lake, Lassen, Modoc, Napa, Nevada, Plumas, Sacramento, San Joaquin, Sierra, Siskiyou, Solano, Sonoma, Sutter, Tehama, Trinity, Yuba, Calaveras, Madera, Mono, Monterey, Placer, San Benito, San Luis Obispo, San Mateo, Santa Cruz, Shasta, Stanislaus, Tuolumne, Yolo, Contra Costa, Fresno, Marin, Tulare, Mariposa, Merced, Santa Clara, Alameda, San Francisco, Kings, Mendocino	1/2/97 - 1/31/97	1/4/97	8		194,352,509
1996 Southern California Firestorms	Fire	Fire	EM-3120	1996	Los Angeles, Orange, San Diego, Ventura	10/1/96	Emergency Dec only 10/23/96		5	12,589,808
1996 Severe Fires	Fire	Fire	96-04	1996	Los Angeles, Orange, San Diego, City of San Buenaventura (Ventura)	10/22/96				
Lake County Fire	Fire	Fire	DC 96-03	1996	Lake	8/1/96				
Torrential Winds and Rain	Flood	Storms	GP 96-01	1996	Humboldt, Mendocino, Plumas, Sacramento, San Francisco, San Mateo, Santa Cruz, Shasta	1/2/96				
Humboldt County Flooding	Flood	Flood	GP 96-02	1995	Humboldt	12/1995				
Vision Fire (Marin)	Fire	Fire	DC 95-05	1995	Marin	10/1995				
1995 Late Winter Storms	Flood	Storms	DR-1046	1995	All counties except Del Norte	Proclaimed	1/10/1995 3/12/95	17		132,040,111

1995 Severe Winter Storms	Flood	Storms	DR-1044	1995	Los Angeles, Orange, Humboldt, Lake, Sonoma, Butte, Colusa, Contra Costa, Del Norte, Glenn, Kern, Lassen, Mendocino, Modoc, Monterey, Napa, Placer, Plumas, San Luis Obispo, Santa Barbara, Santa Clara, Santa Cruz, Tehama, Ventura, Yolo, Yuba, Alpine, Amador, Nevada, Riverside, Sacramento, San Bernardino, San Mateo, Shasta, Sutter, Trinity, San Diego, Alameda, Marin, Fresno, Kings, El Dorado, Madera, Solano, Siskiyou *Not on j	1/6/95 - 3/14/95	1/13/1995 1/10/05	11		221,948,347
1994 Humboldt Earthquake	Earthquake	Earthquake	GP 94-03	1994	Humboldt	12/29/94	Not declared			1,300,000
Mediterranean Fruit Fly (Ventura)	Agricultural	Insect pest		1994	Ventura	10/7/94	Not declared			
San Luis Obispo Fire - Hwy 41	Fire	Fire	GP 94-02	1994	San Luis Obispo	8/24/94	Not declared		12	6,382,235
Salmon fisheries	Economic	Unknown	DR-1038	1994	Del Norte, Humboldt, Mendocino, Sonoma *Blue only on o	5/20/94	9/20/1994 9/13/94			30,300,000
Northridge Earthquake	Earthquake	Earthquake	DR-1008	1994	Los Angeles, Ventura, Orange	1/17/94, 1/24/94	1/17/94	57	11,846	6,115,103,071
Mediterranean Fruit Fly (Riverside)	Agricultural	Insect pest		1993	Riverside	12/1993	Not declared			
1993 Southern California Firestorms	Fire	Fire	DR-1005	1993	Los Angeles, Ventura, San Diego, Orange, Riverside, San Bernardino	10/27/93, 10/28/93	10/28/93	4	162	83,032,567
Klamath Earthquake	Earthquake	Earthquake	DC 93-03	1993	Modoc	10/1993				
New River Pollution	HazMat	Sewage spill	DC	1993	Imperial	10/6/93	Not declared			
Tornado	Tornado	Tornado	DC 93-02	1993	Imperial	9/10/93	Not declared			
Tijuana River Pollution	HazMat	Sewage spill	DC	1993	San Diego	9/10/93	Not declared			
Flash flooding	Flood	Flood	DC 92-06 - 92-09	1993	San Bernardino	01/1993				

1992 Late Winter Storms	Flood	Storms	DR-979	1992	Alpine, Los Angeles, Humboldt, Napa, Santa Barbara, Culver City (Los Angeles County), City of Los Angeles (Los Angeles County), Contra Costa, Mendocino, Sonoma, Fresno, Imperial, Madera, Monterey, San Bernardino, Sierra, Tehama, Trinity, Tulare, Modoc, Orange, Riverside, Lassen, Siskiyou, Plumas, San Diego	1/7/93 - 2/19/93	1/15/1993 2/3/93	20	10	226,018,111
Fountain Fire	Fire	Fire	DR-958	1992	Calaveras, Shasta	8/21/92	8/29/92		8	38,152,133
Landers/Big Bear Earthquake	Earthquake	Earthquake	DR-947	1992	Riverside, San Bernardino, Los Angeles	6/28/92	6/28/1992 7/2/92	1	402	15,579,530
1992 Humboldt Earthquake	Earthquake	Earthquake	DR-943	1992	Humboldt	4/25/92	5/5/1992 5/4/92		356	17,829,642
Los Angeles Civil Unrest	Civil Unrest	Civil Unrest	DR-942	1992	Los Angeles	4/29/92	5/22/1992 5/25/92	53	2,383	122,431,732
Point Loma Sewage Spill	HazMat	Sewage spill	GP	1992	San Diego, City of Chula Vista, City of Coronado, San Diego	2/6/92, 2/7/92	Not declared			
1992 Winter Storms	Flood	Storms	DR-935	1992	Los Angeles, Ventura, City of Los Angeles, Kern, Orange, San Bernardino	2/12/92, 2/19/92	2/25/92	5		53,897,542
Sweet potato Whitefly	Agricultural	Insect pest		1991	Imperial, Riverside		Not declared			12,700,000
East Bay Hills Fire	Fire	Fire	DR-919	1991	Alameda County	10/20/91	10/22/91	25	150	56,996,503
Sierra Madre Earthquake	Earthquake	Earthquake	GP 91-04	1991	Los Angeles	7/5/91	Not declared	1	30	33,500,000
1991 Heavy Rains	Flood	Storms	GP 91-01 - 91-03	1991	San Bernardino, San Diego	4/1/91				
1990 Freeze	Freeze	Freeze	DR-894	1990	Santa Cruz, Fresno, Glenn, Imperial, Kern, Mendocino, Monterey, Riverside, San Benito, San Bernardino, San Diego, San Mateo, Santa Barbara, Santa Clara, Solano, Sonoma, Tulare, Ventura, Alameda, Butte, Colusa, Los Angeles, Madera, Marin, Merced, Napa, San Joaquin, San Luis Obispo, Sutter, Yolo, Yuba, Stanislaus, Tehama	12/19/90-1/18/91	2/11/91			856,329,675

Santa Barbara Drought	Drought		GP 1990	1990	Santa Barbara	11/13/90	Not declared			
Finley Fire/ Yosemite Fire	Fire	Fire	GP 90-01, GP 90-02	1990	Mariposa, Kern, Tehama	8/13/90, 8/14/90	Not declared	1	84	548,000,000
1990 Drought	Drought	Drought		1990	City of Santa Barbara (Santa Barbara County)	7/17/90	Not declared			
Santa Barbara Fires	Fire	Fire	DR-872	1990	Los Angeles, Santa Barbara, Riverside, San Bernardino	6/28/90, 6/29/90	6/30/90	3	89	4,061,861
Mexican Fruit Fly	Agricultural	Insect pest	GP 1990	1990	Los Angeles, San Diego	5/14/90	Not declared			
Mediterranean Fruit Fly (Riverside)	Agricultural	Insect pest	GP 1990	1990	Riverside	4/18/90	Not declared			
Upland Earthquake	Earthquake	Earthquake	GP 89-07	1990	Los Angeles, San Bernardino	3/9/90, 3/13/90	Not declared		38	12,034,150
1990 Severe Storms	Flood	Storms	GP 989-06	1990	Butte, Nevada	2/22/90	Not declared	1	17	11,500,000
Mediterranean Fruit Fly	Agricultural	Insect pest	GP 1989	1989	Orange, Mariposa	11/20/89	Not declared			
Loma Prieta Earthquake	Earthquake	Earthquake	DR-845	1989	Alameda, Monterey, San Benito, San Mateo, Santa Clara, Santa Cruz, San Francisco, Contra Costa, Marin, City of Isleton (Sacramento County), City of Tracy (San Joaquin County), Solano	10/18/89 - 10/30/89	10/18/89	63	3,757	888,662,382
Mediterranean Fruit Fly (San Bernardino)	Agricultural	Insect pest	GP 1989	1989	San Bernardino	10/3/89	Not declared			
Mediterranean Fruit Fly (Santa Clara)	Agricultural	Insect pest	GP 1989	1989	Santa Clara	9/6/89	Not declared			
Mediterranean Fruit Fly (Los Angeles)	Agricultural	Insect pest	GP 1989	1989	Los Angeles	8/9/89	Not declared			
Fires (Los Angeles)	Fire	Fire	GP 88-03	1988	Los Angeles	12/9/88	Not declared		2	12,400,000
Forty-Niner Fire	Fire	Fire	FM-2071	1988	Nevada		9/13/88			
Fires (Forty-Niner, Miller, Fern)	Fire	Fire	DR-815	1988	Shasta, Solano, Yuba, Nevada	9/11/88-9/20/88	9/13/1988 Check this - only 49er listed in j list and no DR-815			

Wildland Fires (Calaveras)	Fire	Fire	GP 88-01	1988	Calaveras	7/21/88	Not declared			
Mediterranean Fruit Fly	Agricultural	Insect pest	GP 1988	1988	Los Angeles	7/21/88	Not declared			
Fire and Wind Driven Waves	Fire	Fire		1988	City of Redondo Beach (Los Angeles County)	6/15/88	Not declared			25,000,000
1988 Fires	Fire	Fire	GP 87-07	1988	Los Angeles	5/1988				
1988 Storms	Flood	Storms	GP 87-06	1988	Santa Barbara, City of San Buenaventura (Ventura County)	1/26/88	Not declared			49,416,200
Coastal Storms	Flood	Storms	DR-812	1988	Los Angeles, Orange, San Diego, San Bernardino, Ventura	1/21/88	2/5/88			
Imperial County Earthquake	Earthquake	Earthquake	GP 87-03	1987	Imperial	11/23/87	Not declared		94	2,638,833
Wildfires/ Flooding/ Mud Slides	Fire	Fire	GP 87-01	1987	San Diego	11/19/87	Not declared			5,371,150
Whittier Earthquake	Earthquake	Earthquake	DR-799	1987	Monterey park (Los Angeles County), City of Whittier (Los Angeles County), Los Angeles, Orange	10/2/87 - 10/5/87	10/7/87	9	200+	358,052,144
Stanislaus Fire Complex	Fire	Fire	FM-2065	1987	Mariposa		9/2/87			
1987 Wildland Fires	Fire	Fire	GP	1987	Colusa, Del Norte, Butte, Fresno, Humboldt, Inyo, Kern, Lake, Lassen, Mariposa, Mendocino, Modoc, Mono, Nevada, Placer, Plumas, Riverside, San Bernardino, Shasta, Sierra, Siskiyou, Trinity, Tulare, Tuolumne	9/10/87, 9/3/87	Not declared	3	76	18,000,000
Acorn Fire	Fire	Fire	GP	1987	Alpine	8/3/87	Not declared		3	8,500,000
Mediterranean Fruit Fly	Agricultural	Insect pest	GP	1987	Los Angeles	8/25/87	Not declared			
Del Monte Fire	Fire	Fire	GP	1987	Monterey	5/1/87	Not declared		8	15,000,000
Earthquake (Riverside)	Earthquake	Earthquake	GP 86-02	1986	Riverside	10/1986				
Plane Crash	Air Disaster	Manmade		1986	City of Cerritos (Los Angeles County)	8/31/86	Not declared	82	2	
Heavy Rains	Flood	Storms		1986	Monterey, Siskyou	3/26/86	Not declared			400,000

1986 Storms	Flood	Storms	DR-758	1986	Humboldt, Napa, Sonoma, Glenn, Lake, Marin, Modoc, Sacramento, Santa Clara, Santa Cruz, Solano, Yuba, Alpine, Amador, Butte, Calaveras, Colusa, El Dorado, Lassen, Mendocino, Nevada, Placer, Plumas, San Joaquin, Sierra, Sutter, Tehama, Tuolumne, Yolo, Fresno, Madera, San Mateo, Alameda, Contra Costa, Del Norte, Trinity, Mono, San Benito, Shasta *Green not in j database - Tehama may be correct but entered as 106 between 101 and 105 in j database	2/18-86 - 3/12/86	2/18/1986 2/21/86	13	67	407,538,904
Wheeler Fire	Fire	Fire		1985	Ventura	10/14/85	Not declared	1	2	
Hydrilla Infestation	Invasive Species	Aquatic Plant Pest		1985	Shasta	9/13/85	Not declared			
Hidden Valley Lake Fire	Fire	Fire	FM-2055	1985	Lake		7/11/85			
Lexington Fire	Fire	Fire	FM-2054	1985	Santa Clara		7/11/85			
1985 Statewide Fires	Fire	Fire	DR-739	1985	San Diego, City of Lost Angeles (Los Angeles County), San Luis Obispo, Monterey, Santa Clara, Santa Cruz, Ventura	7/1/85 - 7/11/85	7/18/85	3	470	64,845,864
1984 Floods	Flood	Flood	GP 84-02, GP 84-03	1984	Inyo, Mono		9/1/84			
1984 Storms (Kern)	Flood	Storms	GP 84-01	1984	Kern		Not declared			1,600,000
Morgan Hill Earthquake	Earthquake	Earthquake	EM-4043	1984	Santa Clara		4/25/84		27	7,265,000
High Tides / Storms	Flood	Storms	GP 83-06	1984	Contra Costa	1/1/84				
Bradford Levee Failure	Flood	Levee break	GP 83-05	1983	Contra Costa, Alameda	12/9/83, 1/18/84	Not declared			10,909,785
Mexican Fruit Fly	Agricultural	Insect pest		1983	Los Angeles	11/4/83	Not declared			
San Bernardino Flooding	Flood	Flood	84-01	1983	San Bernardino	11/1983				
1983 Summer Storms	Flood	Storms	DR-690	1983	Inyo, Riverside, San Bernardino	8/29/83	8/29/1983 9/22/83	3		34,689,155

Colorado River Flooding	Flood	Flood	DR-687	1983	Riverside, San Bernardino, Imperial	6/23/83, 6/28/83	7/1/83			4,640,315
Coalinga Earthquake	Earthquake	Earthquake	DR-682	1983	Fresno	5/2/83	5/3/1983 5/5/83		47	31,076,300
River Junction Storms	Flood	Storms	83-02	1983	San Joaquin	03/1983				
High Winds	Wind	Storms	83-01	1983	Yuba, Los Angeles	03/1983				
1983 Floods	Flood	Flood	82-19	1983	Los Angeles	03/1983				
Winter Storms	Flood	Flood	DR-677	1982	Contra Costa, San Joaquin, Sacramento, Marin, San Mateo, Los Angeles, San Diego, Alameda, Orange, San Benito, Santa Barbara, Santa Clara, Santa Cruz, Shasta, Sonoma, Ventura, Trinity, Colusa, Lake, Mendocino, Monterey, San Luis Obispo, Solano, Yolo, Butte, Glenn, Kern, Kings, San Bernardino, Sutter, Tehama, Merced, Del Norte, Fresno, Madera, Napa, Placer, Riverside, Stanislaus, Tulare, Humboldt, Mariposa, Nevada, Yuba	12/8/82-3/21/83	2/9/83			523,617,032
High Tides and Rains	Flood	Storms		1982	Contra Costa, Sacramento, San Joaquin	12/8/82	Not declared			6,964,998
Rain and Flooding (Imperial)	Flood	Storms	DC 82-17	1982	Imperial	12/1982				
Rains Causing Agricultural Losses	Agricultural	Storms	GP	1982	Fresno, Madera, Merced, Monterey, Kern, Tulare, Sacramento, San Joaquin, Solano, Stanislaus, Yolo	10/26/82	Not declared			345,195,974
Dayton Hills Fire	Fire	Fire	GP	1982	Los Angeles, Orange, Ventura	10/10/82	Not declared			19,277,102
1982 Heavy Rains	Flood	Storms	GP 82-16	1982	Inyo	9/27/82	Not declared			6,161,320
McDonald Island Levee Break	Flood	Levee break	DR-669	1982	McDonald Island (San Joaquin County)	8/24/82	8/24/82			11,561,870
Orange Fire	Fire	Fire	DR-657	1982	Orange	4/21/82	4/21/1982 4/24/82			50,877,040
Heavy Rains and Flooding	Flood	Storms	DC 82-03	1982	Amador, Calaveras, Madera, Mono, Sacramento, Santa Clara, Santa Cruz, Sierra, Yuba	4/1/82				

1982 Winter Storms	Flood	Storms	DR-651	1982	Alameda, Santa Clara, Solano, San Joaquin, Contra Costa, Humboldt, Marin, San Mateo, Santa Cruz, Sonoma	1/5/82 - 1/9/82	1/7/82	33	481	273,850,000
Strong Winds & Fire	Fire	Fire	82-01	1981	Humboldt	10/1981				
1981 Mediterranean Fruit Fly Infestation	Agricultural	Insect pest		1981	Contra Costa, Los Angeles, San Benito, Stanislaus, Santa Cruz, San Mateo	8/8/81 - 9/25/81	Not declared			22,000,000
Atlas Peak Fire	Fire	Fire		1981	Napa	6/24/81	Not declared			31,000,000
Major Brush Fire	Fire	Fire	GP	1981	Napa	6/1/81				
Imperial County Earthquake	Earthquake	Earthquake	DC 81-02	1981	Imperial	4/1/81				
Wave Action & High Tides	Flood	High Tides	DC 81-01	1981	San Mateo	03/1981				
1980 Mediterranean Fruit Fly Infestation	Agricultural	Insect pest	GP-1980 Medfly	1980	Alameda, Santa Clara	12/1/80				
1980 Southern California Fires	Fire	Fire	DR-635	1980	San Bernardino, Los Angeles, Orange, Riverside	11/18/1980, 11/25/80	11/18/1980 11/27/80			64,795,200
Jones Tract Levee Break	Flood	Levee break	DR-633	1980	San Joaquin	9/30/80	9/30/1980 10/02/80			21,510,956
Owens Valley Earthquake	Earthquake	Earthquake		1980	Mono	5/28/80	Not declared		9	2,000,000
1980 April Storms	Flood		80-01 - 80-25	1980	Alpine, Amador, El Dorado, Inyo, Lake, Marin, Monterey, Placer, Plumas, San Mateo, Santa Cruz, Sierra, Solano, Stanislaus, Tuolumne, Calaveras	4/1/80				
1980 March Storms	Flood	Storms		1980	Stanislaus, Monterey, Solano, Santa Cruz	3/5/80	Not declared			
1980 Winter Storms	Flood	Flood	DR-615	1980	Santa Barbara, Los Angeles, Orange, Riverside, Ventura, San Bernardino, San Diego	2/21/80, 2/7/80, 2/19/80	2/21/80			
Delta Levee Break	Flood	Levee break	EM-3078	1980	Contra Costa, Sacramento, San Joaquin	1/23/80	1/23/80			17,388,013
Gasoline Shortage	Economic	OPEC		1979	Alameda, Contra Costa, Los Angeles, Marin, Monterey, Orange, Riverside, San Francisco, San Diego, Santa Clara, Santa Cruz, San Mateo, Ventura, San Bernardino, Sonoma	5/8/79 - 11/13/79	Not declared			
Imperial Earthquake	Earthquake	Earthquake	DR-609	1979	Imperial	10/16/79	10/16/79		91	21,197,250

1979 Fires	Fire	Fire		1979	Santa Barbara, Ventura, Los Angeles, El Dorado	9/28/79, 9/21/79, 9/20/79	Not declared			9,970,119
1979 Severe Storms (Riverside)	Flood	Storms	DR-594	1979	Riverside	7/26/1980???	7/27/79			25,867,100
Excessive Rains	Flood	Storms		1979	Riverside					
1979 Storms and Floods (San Diego)	Flood	Storms	DC 79-01	1979	San Diego	2/1/79				
1978 Los Angeles Fire	Fire	Fire	EM-3067	1978	Los Angeles	10/24/78	10/29/78	1		61,279,374
Laguna Landslide	Landslide	Landslide	DR-566	1978	City of Laguna Beach (Orange County)	10/5/78	10/9/78			16,595,000
PSA Air Crash	Air Disaster	Manmade		1978	City of San Diego (San Diego County)	1/15/79	Not declared	150		
Inyo County Flooding	Flood	Flood	GP 78-13	1978	Inyo	9/1/78				
Santa Barbara Earthquake	Earthquake	Earthquake		1978	Santa Barbara	8/15/78	Not declared		65	12,987,000
1978 Winter Storms	Flood	Storms	DR-547	1978	Inyo, Mono, San Diego, San Luis Obispo, Kings, Monterey, Kern, Los Angeles, Orange, Riverside, San Bernardino, Santa Barbara, Tulare, Ventura	3/9/78, 2/27,78, 2/13/78	2/15/78	14	21	117,802,785
Heavy rains excluded	Flood	Storms	DC 78-06-11	1978	Santa Clara, Solano, Sonoma, Tuolumne, Colusa	2/13/78				
1978 Storms	Flood	Storms	GP 78-03/04	1978	Humboldt, Mendocino, Santa Cruz	1/27/78, 1/20/78	Not declared			6,126,409
Heavy Rains (Marin)	Flood	Storms	DC 78-02	1978	Marin	1/1/78				
1978 Storms and Flooding	Flood	Storms	GP 78-01/03	1978	Riverside, San Diego	1/26/78				
1977 Storms	Flood	Storms	GP 77-05	1977	San Diego, Kern, Humboldt, City of Arvin (Kern County)	1/10/78, 12/23/77, 1/22/77???, 12/21/77	Not declared			38,009,035
Heavy Rainstorms	Flood	Storms	DC 77-03/04	1977	Imperial, Mendocino, Riverside	10/1/77				
Threat of Floods	Flood	Fire	GP	1977	Monterey, Riverside	9/8/77	Not declared			6,110,000

Imperial County Flooding	Flood	Storms	GP 77-02	1977	Imperial	8/23/77	Not declared				28,498,469
Desert Hot Springs Heavy Rains	Flood	Storms	DC 77-01	1977	Imperial	8/31/77					
Scarface Fire	Fire	Fire	FS-2028	1977	Modoc		8/1/77				
Sycamore Fire	Fire	Fire		1977	Santa Barbara	7/27/77	Not declared				25,540,755
1977 Heavy Rains and Windstorms	Flood	Storms	DC 76-03/04	1977	San Bernardino	1/1/77					
1976 High Winds and Flooding	Flood	Storms	DR-521	1976	Imperial, Riverside, San Bernardino, San Diego	9/13/76, 9/22/76	9/21/76				120,132,771
1976 Heavy Rains and Windstorms	Flood	Storms	DC 76-02	1976	San Diego	9/1/76					
1976 Drought	Drought	Drought		1976	Alpine, Calaveras, Colusa, Fresno, Glenn, Madera, Merced, San Diego, San Joaquin, Solano, Stanislaus, Sutter, Tuolumne, Alameda, Butte, Contra Costa, Kings, Los Angeles, Riverside, San Luis Obispo, Tulare, Yolo, Amador, Monterey, Napa, Nevada, San Benito, San Bernardino, Tehama, San Mateo, Marin	2/9/76, 2/13,76, 2/24/76, 3/26/76, 7/6/76	Not declared				2,664,000,000
1975 Fires	Fire	Fire		1975	Los Angeles	11/24/75	Not declared				19,486,960
Heavy Rain and Snow (Kern)	Flood	Storms	DC 75-04	1975	Kern	11/1/75					
Butte Earthquake	Earthquake	Earthquake	DC 75-03	1975	Butte		8/1/75				
Heavy Rain and Snow (El Dorado)	Flood	Storms	DC 75-01	1975	El Dorado	2/1/75					
1974 Storms	Flood	Storms	DR-432	1974	Mendocino	4/23/74	5/7/74				4,475,900
Gasoline Shortage	Economic	OPEC		1974	Alameda, Contra Costa, Los Angeles, Orange, Riverside, San Mateo, Solano, Santa Clara, Ventura	2/28/74, 3/4/74, 3/10/74	Not declared				
Storms (Santa Cruz)	Flood	Storms		1974	Santa Cruz	2/28/74	Not declared				763,267
1974 Storms	Flood	Storms	DR-412	1974	Humboldt, Shasta, Siskiyou, Trinity, Glenn, Mendocino, Tehama	1/17/74, 1/18/74	1/25/74				35,192,500
Boulder Fire	Fire	Fire		1973	San Diego	12/12/73	Not declared				215,700
1973 Fires	Fire	Fire		1973	Los Angeles	7/16/73	Not declared				1,300,000

Eucalyptus Tree Freeze	Freeze	Freeze	DR - 373	1973	Alameda, Contra Costa	4/4/73	5/25/73			
Southern Pacific Railroad Fires and Explosions (Roseville)	Fire	Explosion		1973	Sacramento, Placer	4/30/73	Not declared		37	2,925,000
Storms and Floods (San Mateo)	Flood	Storms		1973	City of Pacifica (San Mateo County)	4/11/73	Not declared			700,000
Storms and Floods (Mendocino)	Flood	Storms		1973	Mendocino	3/15/73	Not declared			1,523,200
1973 Freeze	Freeze	Freeze		1973	Butte	2/28/73	Not declared			300,000
1973 Storms and Floods	Flood	Storms		1973	Colusa, Glenn, Napa, Placer, Sutter, Yuba	2/28/73	Not declared			1,864,000
1973 High Tides	Flood	High Tides		1973	Ventura	2/1/73	Not declared			1,027,000
Coastal Flooding	Flood	Storms	DR-364	1973	Marin, San Luis Obispo, City of South San Francisco (San Mateo County), Santa Barbara, Solano, Ventura	1/23/73, 1/30/73, 2/8/73, 2/28/73	2/3/73			17,998,250
1972 Heavy Rains and Mud Slides	Flood	Storms		1972	Monterey	10/24/72	Not declared			720,000
1972 Severe Weather	Flood	Storms		1972	Sutter	9/3/72	Not declared			2,004,300
1972 Freeze (Lake)	Freeze	Freeze		1972	Lake	7/13/72	Not declared			357,000
1972 Drought	Drought	Drought		1972	Glenn, San Benito, Santa Clara	7/3/72	Not declared			8,000,000
Andrus island Levee Break	Flood	Levee break	DR-342	1972	Sacramento	6/21/72	6/27/72			23,681,630
1972 Freeze	Freeze	Freeze		1972	Fresno, Kings, Tulare, Merced, Kern, Madera, San Benito, Stanislaus, El Dorado, Tehama, Placer, Nevada, San Joaquin, Colusa, Siskiyou, Modoc, Santa Clara	4/17/72, 5/22/72, 5/31/72	Not declared			111,517,260
Exotic Newcastle Disease Epidemic	Agricultural	Disease		1972	Los Angeles, Orange, Riverside, San Bernardino, San Diego, Ventura, Santa Barbara	4/10/72, 5/22/72	Not declared			10,000,000
1972 Continuing Storms	Flood	Storms	DR-329	1972	Del Norte, Humboldt	2/28/1972, 3/28/72	4/5/72			6,817,618
1972 Storms	Flood	Storms	DR-316	1972	Santa Barbara	1/3/72	2/11/72			2,660,000

1971 Fires	Fire	Fire		1971	Santa Barbara	10/13/71	Not declared	4		9,000,000
1972 High Tides	Flood	High Tides		1971	Ventura	5/19/71	Not declared			250,000
San Fernando Earthquake	Earthquake	Earthquake	DR-299	1971	Los Angeles	2/9/71	2/9/71	58	2,000	483,957,000
Fires (Riverside)	Fire	Fire		1970	Riverside	12/22/70	Not declared			3,200,000
1970 Fires	Fire	Fire	DR-295	1970	City of Oakland (Alameda County), Los Angeles, Ventura, San Diego, Kern, San Bernardino, Monterey, Riverside	9/24/70, 9/28/70, 10/1/70, 10/2/70, 10/20/70, 11/14/70	9/29/70	19		223,611,000
1970 Storms and Floods	Flood	Storms		1970	Contra Costa	4/10/70	Not declared			
1970 Freeze	Freeze	Freeze		1970	Napa, Sonoma, Mendocino, San Joaquin, Lake	5/1/70, 5/19/70, 6/8/70, 6/10/70, 7/24/70	Not declared			19,749,200
1970 Landslide (Los Angeles)	Landslide	Storms		1970	City of Los Angeles (Los Angeles County)	3/10/70	Not declared			8,500,000
1970 Riots	Civil Unrest	Civil Unrest		1970	Santa Barbara	2/26/70	Not declared		12+	300,000
Fire (Tuolumne)	Fire	Fire		1970	City of Sonora (Tuolumne County), Tuolumne	2/26/70	Not declared			2,300,000
1970 Landslide (Oakland)	Landslide	Storms		1970	City of Oakland (Alameda County)	2/10/70	Not declared			11,500,000
1970 Northern California Flooding	Flood	Flood	DR-283	1970	Butte, Colusa, Glenn, Lake, Lassen, Marin, Modoc, Plumas, Shasta, Siskiyou, Tehama, Trinity, Sutter, Yuba, Del Norte, Alameda, El Dorado, Mendocino	1/27/1970, 2/3/1970, 2/10/1970, 3/2/1970	2/16/70			27,657,478
Berkeley Riots	Civil Unrest	Civil Unrest		1969	City of Berkeley (Alameda County)	2/5/69	Not declared		20	
Santa Barbara Oil Spill	HazMat	Offshore Oil Platform spill		1969	Coastal Areas of Southern California (Santa Barbara Channel)		Not declared			
1969 Freeze	Freeze	Freeze		1969	San Diego	2/5/69	Not declared			10,000,000

1969 Storms	Flood	Storms	DR-253	1969	Los Angeles, San Luis Obispo, Fresno, Inyo, Riverside, San Bernardino, Santa Barbara, Tulare, Ventura, Amador, El Dorado, Kern, Kings, Madera, Modoc, Mono, Monterey, Orange, Placer, Sacramento, San Joaquin, Shasta, Solano, Stanislaus, Tuolumne, Mariposa, Merced, Calaveras, San Benito, Sierra, Contra Costa, Humboldt, Mendocino, Sonoma, Plumas, Tehama, Yuba, Butte, Marin, Yolo	1/23/69, 1/25,69, 1/28/69, 1/29/69, 2/8/69, 2/10/69, 2/16/69, 3/12/69	1/26/69	47	161	300,000,000
Heavy Snow Runoff	Flood	Snow melt	DR-227	1969	Kings	1/28/96	8/15/69			2,812,500
1968 Riots	Civil Unrest	Civil Unrest		1968	City of Richmond (Contra Costa County)	8/2/68	Not declared			
Woodson Fire	Fire	Fire		1967	Los Angeles, Orange, San Diego, Ventura	1/7/67	Not declared			11,345,000
1966 Landslides	Landslide	Landslide		1966	Redwood City	12/16/66	Not declared			100,000
1966 Winter Storms	Flood	Storms	DR-223	1966	Kern, Riverside, Tulare, San Bernardino, San Luis Obispo, Monterey, City of Escondido (San Diego County), Inyo	12/9/66, 12/13/66, 12/16/66, 12/23/66	1/2/67			28,761,041
1966 Riots	Civil Unrest	Civil Unrest		1966	San Francisco	9/27/66	Not declared		42	
1966 Rains	Flood	Storms	DR-212	1966	Humboldt	1/14/66	1/22/66			6,918,000
1965 Heavy Rainfall	Flood	Storms	DR-211	1965	Riverside, San Bernardino, Ventura, San Diego	11/24/65, 11/26/65, 12/23/65	12/7/1965, 1/3/1966			21,843,739
1965 Fires	Fire	Fire		1965	Marin, Napa, Placer, Solano, Sonoma	9/18/65	Not declared			
1965 Riots	Civil Unrest	Civil Unrest		1965	Los Angeles	8/14/65	Not declared	32	874	44,991,000
1965 Landslide	Landslide	Landslide		1965	City of Los Angeles (Pacific Palisades area), Los Angeles County	6/21/65	Not declared			6,488,600
Flooding and Landslides	Flood	Storms		1965	City of Burbank, Los Angeles	1/5/65	Not declared			
1964 Late Winter Storms	Flood	Storms	DR-183	1964	Del Norte, Humboldt, Shasta, Mendocino, Colusa, Glenn, Lassen, Plumas, Sierra, Siskiyou, Sonoma, Sutter, Tehama, Trinity, Amador, Butte, El Dorado, Modoc, Nevada, Placer, Yuba, Alpine, Lake, Sacramento, Yolo, Marin	12/22/64, 12/23/64, 12/28/64, 1/5/65, & 1/14/65	12/29/64			213,149,000

1964 Tsunami (Marin)	Tsunami	Earthquake		1964	Marin	9/15/64	Not declared			
Fires and High Winds	Fire	Fire		1964	Napa, Sonoma, Santa Barbara	9/22/64, 9/23/64, & 9/25/64	Not declared			16,500,000
1964 Storms	Flood	Storms		1964	Los Angeles	4/3/64	Not declared			1,610,300
1964 Tsunami (Del Norte)	Tsunami	Earthquake	Unknown	1964	Del Norte	3/28/64	4/1/64	12		10,000,000
Weldon Fire	Fire	Fire		1964	Los Angeles	3/16/64	Not declared			2,000,000
1964 Heavy Rains	Flood	Storms		1964	Humboldt	2/10/64	Not declared			1,407,000
Baldwin Hills Dam Failure	Flood	Dam Failure	DR-161	1963	Los Angeles	12/16/63	12/21/63			5,233,203
High Tides and Heavy Surf	Flood	High Tides		1963	Orange, City of Redondo Beach		Not declared	5		500,000
1963 Floods and Rains	Flood	Storms	Unknown	1963	Alpine, Nevada, Placer, Plumas, Sierra, Amador, Colusa, El Dorado, Glenn, Lake, Lassen, Tehama, Santa Clara, Santa Cruz, Siskiyou, Yolo, Tulare, Mono, Trinity, Yuba	2/7/63, 2/26/63, 2/29/63, & 4/22/63	145 (2/25/63)			
1963 Floods	Flood	Storms		1963	Northern California (boundaries of San Luis Obispo, Ventura, Los Angeles, and San Bernardino counties to the Oregon State Line (list actual counties?)	2/14/64	Not declared			
1962 Floods and Rains	Flood	Storms		1962	Alameda, Butte, Contra Costa, Modoc, Napa San Mateo, Sierra, Sutter, Yuba, Placer, Trinity, Lassen	10/17/62, 10/25/62, 10/30/62, & 11/4/62	10/24/62			4,000,000
Fires and Explosions	Fire	Fire		1962	Alameda	9/14/62	Not declared	1	12	500,000
Flood and Rainstorm	Flood	Storms	DR-122	1962	Los Angeles, Ventura	2/16/62 & 2/23/62	3/6/62			
Bel Air Fires	Fire	Fire	DR-119	1961	Los Angeles (Bel Air area)		11/16/61		103	
1961 Widespread Fires	Fire	Fire		1961	Amador, Butte, El Dorado, Napa, Nevada, Placer, San Diego, Sonoma, Tehama	9/8/61	Not declared			5,696,813
1961 Widespread Fires (Madera)	Fire	Fire		1961	Madera		Not declared	2		

High Tides and Waves	Flood	Storms		1961	Ventura	1/16/61	Not declared			
1960 Widespread Fires	Fire	Fire		1960	Lassen Plumas, Shasta, Sierra, Tehama	8/16/60	Not declared			3,075,000
1960 Major Fires	Fire	Fire		1960	Los Angeles, San Bernardino	7/21-22/60	Not declared		12	10,000,000
1959 Heavy rains	Flood	Storms		1959	Tokay grape producing areas of Northern California (more specific?)	9/17/59	Not declared	2		100,000
Potential Flood Damage and Landsides as a Result of Fires	Flood	Fire	CDO 59-01	1959	Los Angeles	1/8/59	Not declared			
1958 April Storms & Floods	Flood	Storms		1958	Statewide	4/2/58	4/4/58	13	several	24,000,000
1958 February Storms & Floods	Flood	Storms	CDO 58-03	1958	Northern California (Southern boundaries of Santa Cruz, Santa Clara, Stanislaus, Tuolumne, Alpine counties to the Oregon border) List actual counties	2/26/58	Not declared			
High Tides	Flood	High Tides	CDO 58-02	1958	City of Imperial Beach, San Diego County	1/31/58	Not declared			
Newton Fires (Monrovia Fires)	Fire	Fire	CDO 58-01	1958	Los Angeles	1/3/58	Not declared	1	23	
Heavy Rainsl	Flood	Storms		1957	Cherry producing areas of Northern California	Not Proclaimed	Not declared		2	6,000,000
1956 Fires	Fire	Fire	DR-65	1956	Los Angeles (Malibu area), Ventura		12/29/56	1	Several hundred	70,000,000
1955 Floods	Flood	Flood	DR-47	1955	Statewide	12/22/55	12/23/55	74		200,000,000
Fire, Flood, and Erosion	Flood	Flood	DR-28	1954	Los Angeles, San Bernardino	Not Proclaimed	Federal funds made available			
1950 Floods	Flood	Flood	OCD 50-01	1950	Statewide	11/21/50	Not declared	9		32,183,000

Document 5.4.1A GIS Risk Exposure Analysis Methodology

Summary

This section summarizes the methodology for compilation of the GIS Risk Exposure Analysis. An overview of the purposes and approach underlying the GIS risk exposure modeling procedure can be found in Chapter 5, Part 2, Section 5.4.1.

The primary intent of the GIS modeling analysis was to identify and compare variations between counties of risk exposure to the primary hazards of earthquakes, floods, and wildfires. The GIS risk exposure modeling produced a series of maps allowing comparison between counties of the relative presence of each hazard and multiple hazards in relation to total population and vulnerable population.

As pointed out in Chapter 5, two types of source maps were used either singly or in combination to identify the relative presence of each hazard: a) the proportion of each county subject to the potential level of hazard severity (ranked low, medium, and high); b) the combined number of Governor's emergency proclamations and federal disaster declarations for each county depicting the recurrence frequency of disasters generated by a hazard. Sources for the three hazards and disaster frequencies included:

- Earthquake shaking potential from California Geological Survey mapping;
- Fire threat from CAL FIRE mapping;
- 100-year flood zones from FEMA mapping;
- Wildfire and flooding disaster proclamations and declarations from OES mapping.

Each of these five factors is compared between counties by the application of a simple ranking of low, medium, or high. Expert judgment of subject matter specialists was used in a consensus review to evaluate and adjust the procedure.

The general concepts and procedures guiding development of the maps included:

- Use of existing, available input data
- Input data must be consistent for the entire state
- Reduction and reclassification of data
- Simple relative ranking modeling techniques for High, Medium and Low
- All data was normalized to the county level (county is the land class unit)
- Modular model structure (changing one module wont change the others)
- ArcGIS 9.1, ESRI
- Identify subjective valuations used in the model for further review through a modified Delphi consensus expert review process.

Map and Sources

The GIS risk exposure modeling consists of a series of 11 maps, divided into three categories:

- Demographic data
- Hazard data
- Hazard/ demographic data.

Table 5.4.1A below provides a list of all GIS maps prepared for this analysis.

Table 5.4.1A GIS Maps and Sources

Subject	Category
Map 5.4.1A Total County Population, 2005 (Dept. of Finance) Map 5.4.1B Social Vulnerability Index, 2000 (Cutter) Map 5.4.1C Total/Vulnerable Population	Demographics
Map 5.4.1H Earthquake Hazard Source maps: • Earthquake shaking potential (California Geological Survey) Map 5.4.1I Fire Hazard Source maps: • Fire threat (CAL FIRE) • Wildfire disaster declarations since 1950 (OES) Map 5.4.1J Flood Hazard Source maps: • 100-Year flood zones (FEMA) • Flood disaster declarations since 1950 (OES). Map 5.4.1K Combined Hazard	Hazard
Map 5.4.1D. Earthquake Hazard Risk and Total/Vulnerable Population Map 5.4.1F Fire Hazard and Combined Total/Vulnerable Population Map 5.4.1E Flood Hazard and Total/Vulnerable Population Map 5.4.1G Combined Hazard and Total/Vulnerable Population	Combined Hazards/ Demographics

Method

This section summarizes methods used to create the maps. The methods used in the GIS modeling include geographic information system spatial and attribute modeling, statistical classification and subjective (weighted) classification.

A series of diagrams at the end of this document highlights the sources, sequencing, and weighting methods used for construction of each GIS map in the series described in preceding Table 5.4.1A GIS.

It should be noted that only maps which combined demographic data combined with hazard data were used in the Chapter 5 analysis since the purpose of this analysis was to compare relative risk exposure to populations, including vulnerable groups.

Additional Source Metadata

- Fire Threat Source URL
- Shaking Potential Source URL
- FEMA Q3 Flood Zones Metadata URL
- CA County 100K, Metadata
- Jenks Natural Breaks, Reference

Title: Fire Threat

http://frap.cdf.ca.gov/data/frapgismaps/select.asp
April 30, 2007

Title: Shaking Potential / The Revised 2002 California Probabilistic Seismic Hazard Maps June 2003

http://www.seismic.ca.gov/sscpub.htm.
April 30, 2007

Title: FEMA Q3 Flood Data

http://msc.fema.gov/webapp/wcs/stores/mapstore/docs/nuser_gd.pdf
April 30, 2007
http://msc.fema.gov/webapp/wcs/stores/mapstore/docs/q3spec.pdf
April 30, 2007

Title: CA County 100K

Identification Information:
Citation:
Citation Information:

Originator:	U.S. Geological Survey
Originator:	Teale Data Center GIS Solutions Group
Originator:	California Department of Fish and Game
Publication Date:	2006-11

Title: County Boundaries (100K)

Geospatial Data Presentation Form: vector digital data
Online Linkage:
\\Molib01\GIS_Library\geopolitical\counties_states_nations\county100k
Description:
Abstract: State of California county boundaries. Feature types available in the coverage-format version of the dataset include regions (one feature per county), polygons (may include multiple features per county), label points, and lines. The Teale Data Center GIS Solutions Group originally assembled the dataset from 1:100,000-scale (100K) Purpose: General reference and cartography.

Supplemental Information:
Converted to California Teale Albers NAD83 by the California Department of Fish and Game

Title: Jenks Natural Breaks

http://www.ESRI.com
April 30, 2007

Question: What is the Jenks optimization method?

Answer: Some ESRI products use the Jenks optimization method to classify features using natural breaks in data values. The Jenks optimization method is also known as the goodness of variance fit (GVF). It is used to minimize the squared deviations of the class means. Optimization is achieved when the quantity GVF is maximized:

1. Calculate the sum of squared deviations between classes (SDBC).
   GVF = ----------

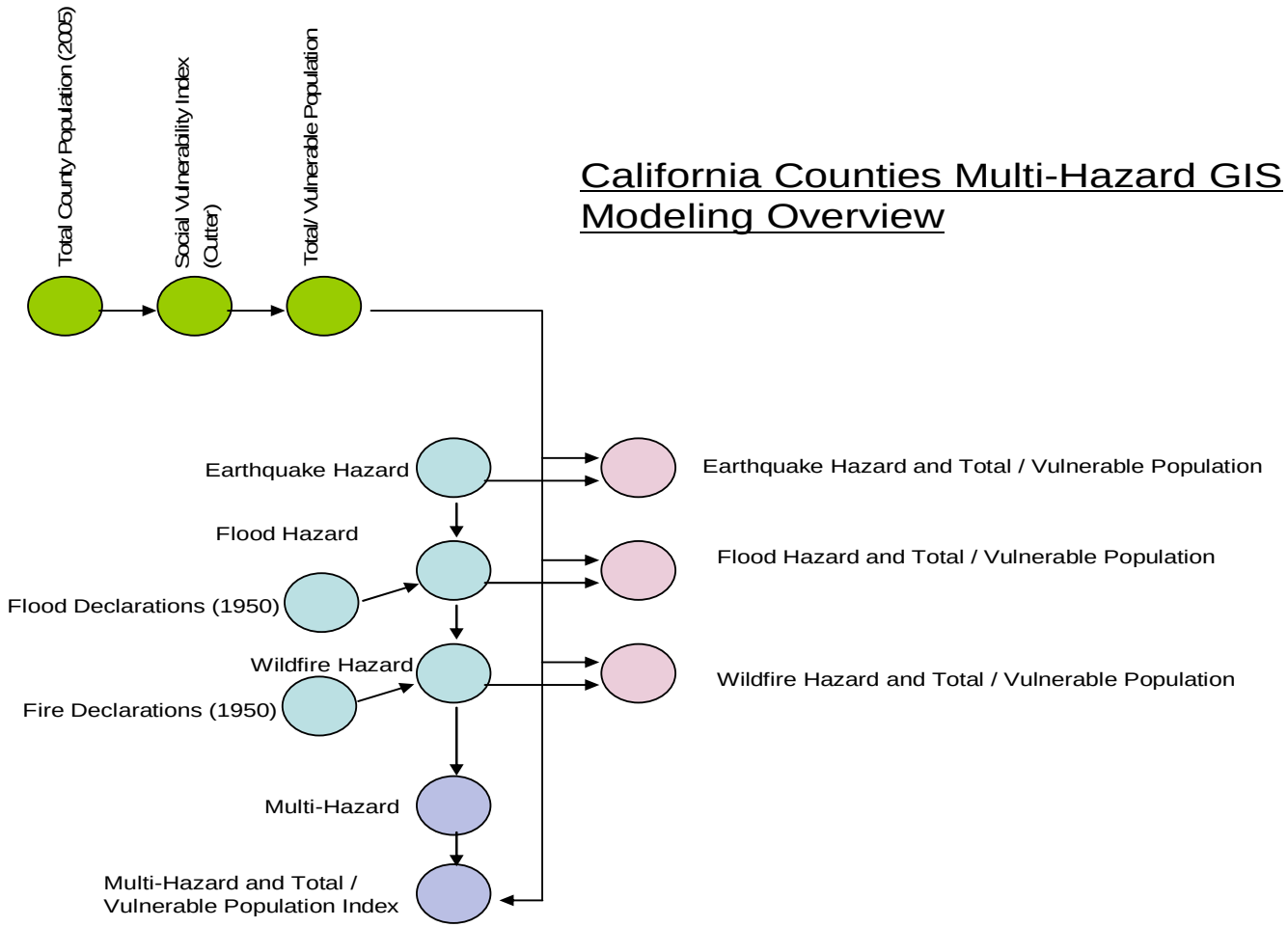
2. Calculate the sum of squared deviations from the array mean (SDAM).

3. Subtract the SDBC from the SDAM (SDAM-SDBC). This equals the sum of the squared deviations from the class means (SDCM).

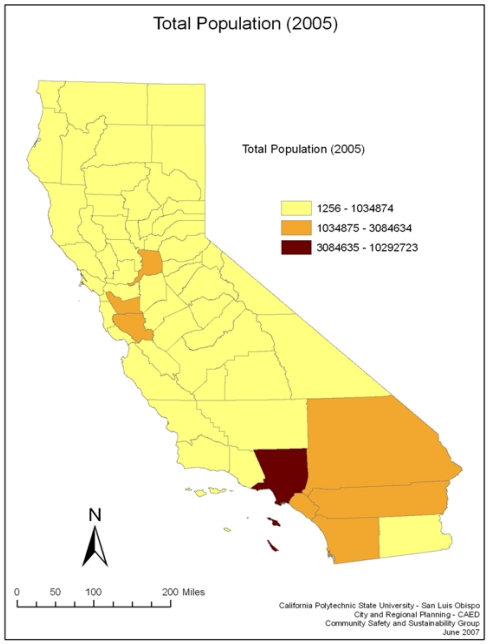
The method first specifies an arbitary grouping of the numeric data. SDAM is a constant and does not change unless the data changes. The mean of each class is computed and the SDCM is calculated. Observations are then moved from one class to another in an effort to reduce the sum of SDCM and therefore increase the GVF statistic. This process continues until the GVF value can no longer be increased.

Further Reading: Jenks, George F. 1967. "The Data Model Concept in Statistical Mapping", International Yearbook of Cartography 7: 186-190.

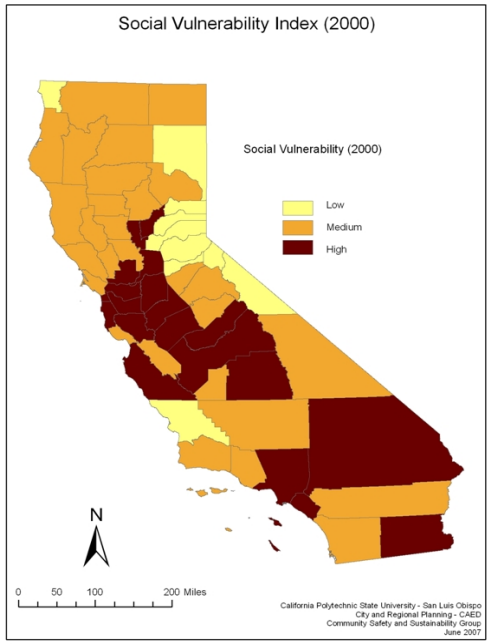
Chart 5.4.1B. GIS Modeling



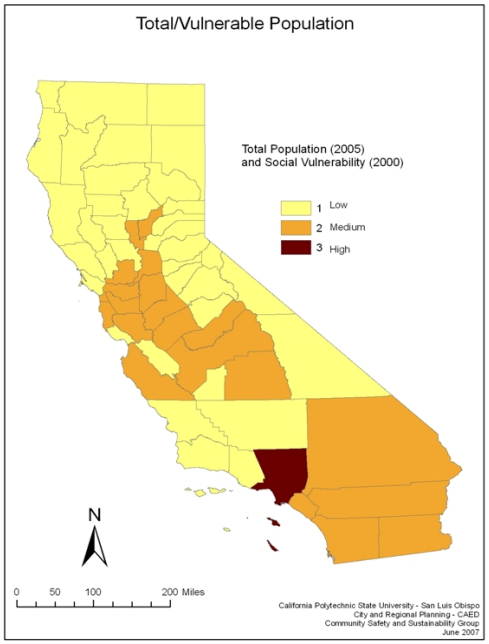
Map 5.4.1A. Total County Population, 2005



Map 5.4.1B. Social Vulnerability Index, 2000



Map 5.4.1C. Total/Vulnerable Population

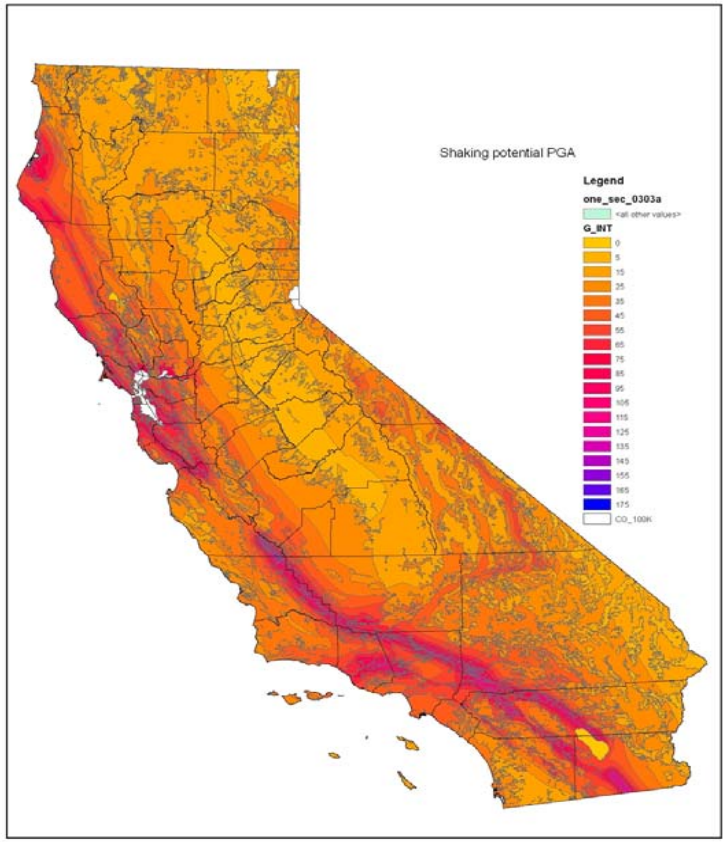


Weighted combination		SOVI 33%		
		1	2	3
Population 66%	1	1	1	2
	2	2	2	2
	3	2	3	3

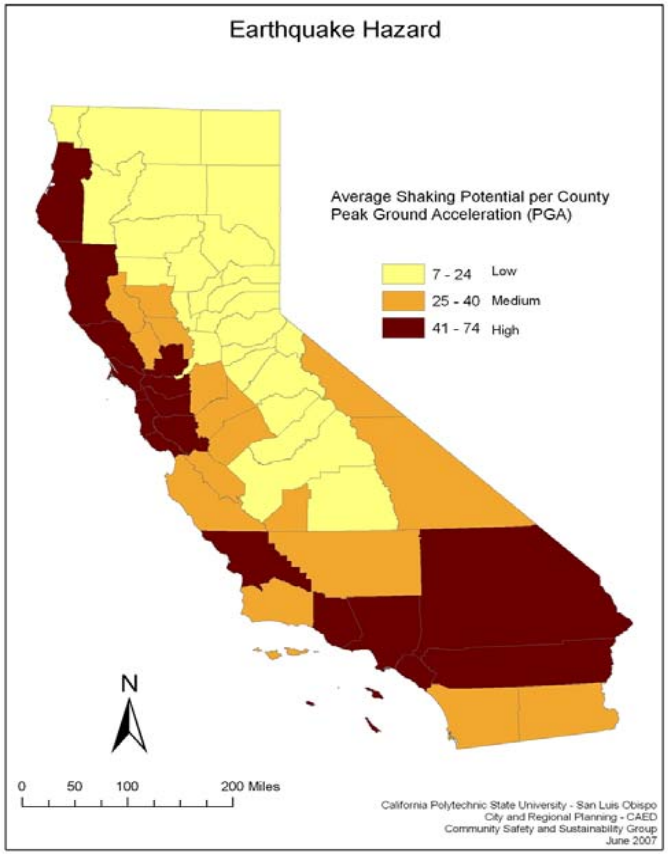
(Pop*66%)+(Vuln*33%)=score

Score is rounded to the nearest whole number

Earthquake shaking potential
(California Geological Survey)

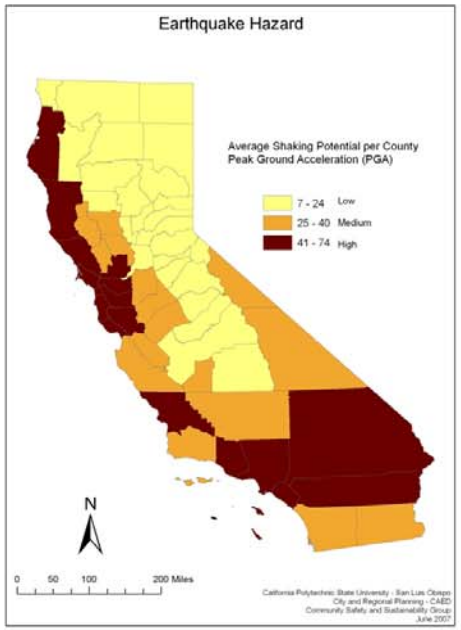


Map 5.4.1H. Earthquake Hazard

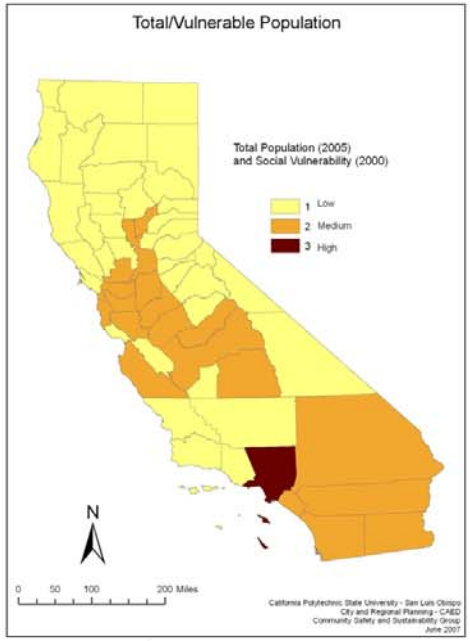


Average Raster value score for
Shaking Potential PGA

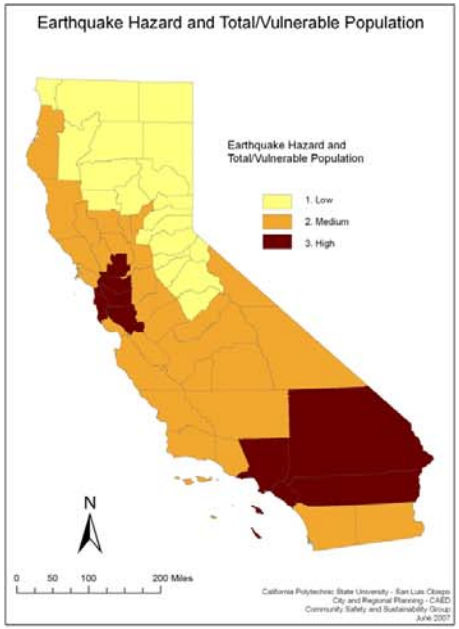
Map 5.4.1H. Earthquake Hazard



Map 5.4.1C. Total/Vulnerable Population

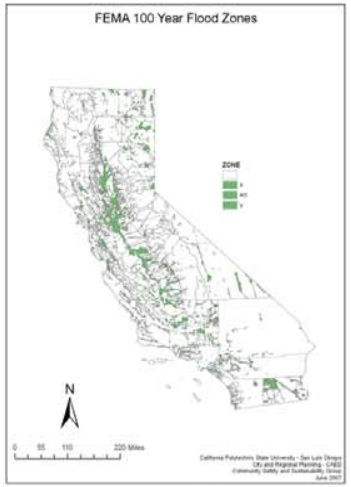


Map 5.4.1D. Earthquake Hazard and Total/Vulnerable Population



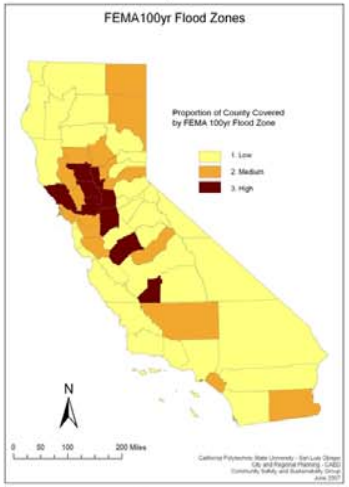
Weighted combination		EQ Haz 50%		
		1	2	3
Vuln Pop 50%	1	1	2	2
	2	2	2	3
	3	2	3	3

100-Year flood zones (source: FEMA)

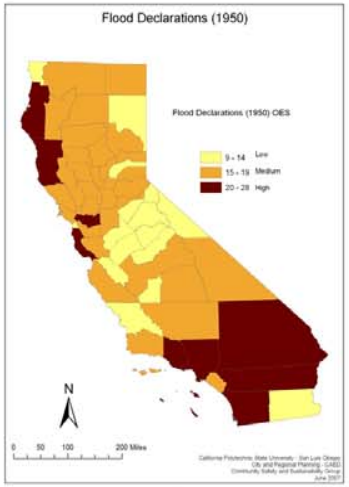


Flood Threat score by County
Percentage of a county surface area covered by 100yr flood zone

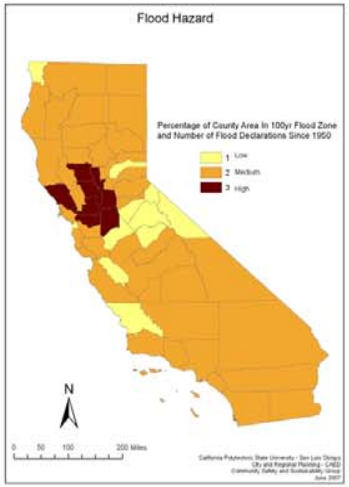
0-5-5% = low-yellow
5.6-15.7% = medium-orange
15.8%-36.7% = high-brown



Flood disaster declarations since 1950 (source: OES)



Map 5.4.1J. Flood Hazard

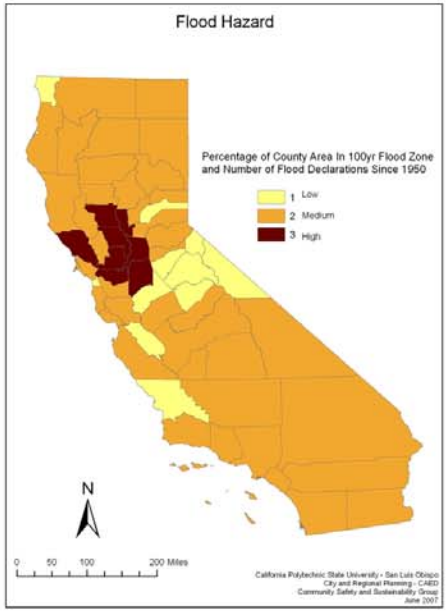


Weighted combination		FEMA 100yr 50%		
		1	2	3
Flood declaration 66%	1	1	1	2
	2	2	2	2
	3	2	3	3

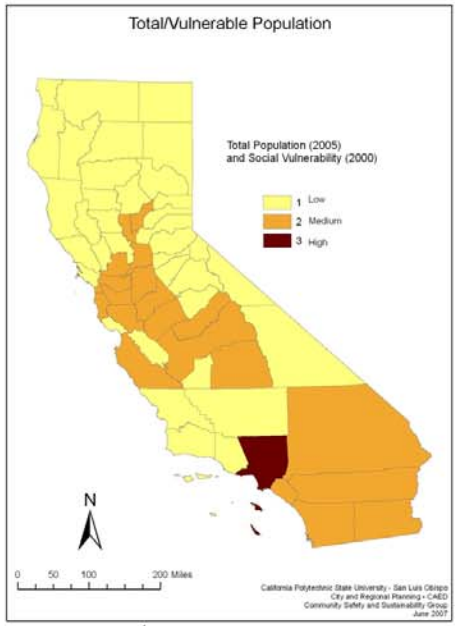
(Decl*66%)+(Flood*33%)=score

Score is rounded to the nearest whole number

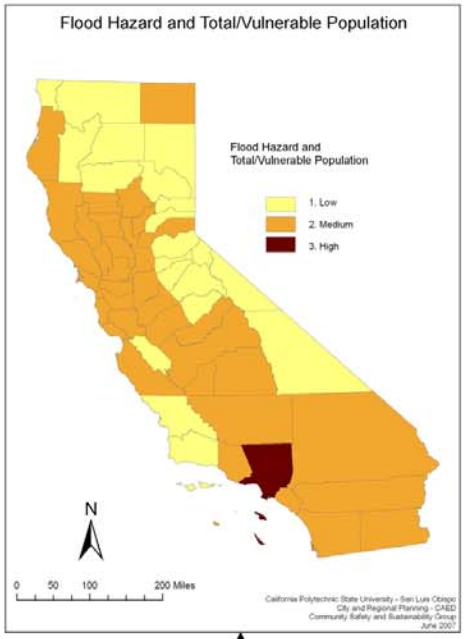
Map 5.4.1J. Flood Hazard



Map 5.4.1C. Total/Vulnerable Population



Map 5.4.1E. Flood Hazard and Total/Vulnerable Population



Weighted combination		flood Haz 50%		
		1	2	3
Vuln Pop 50%	1	1	2	2
	2	2	2	3
	3	2	3	3

Wildfire threat (CAL Fire)

1. Low
2. Moderate
3. High
4. Very high
5. Extreme

Wildfire threat score

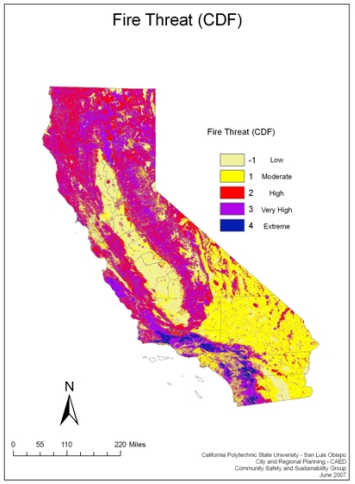
Average raster cell value per county
1.28-2.09 = Low-yellow
2.10-2.76 = Medium-orange
2.77-3.44 = High-brown

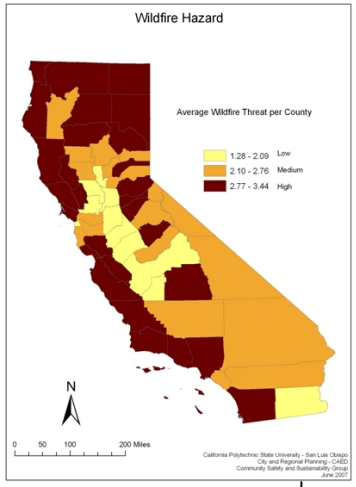
Wildfire disaster declarations since 1950 (source: OES

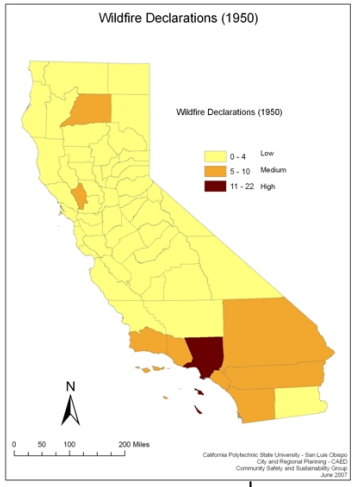
Fire declaration score

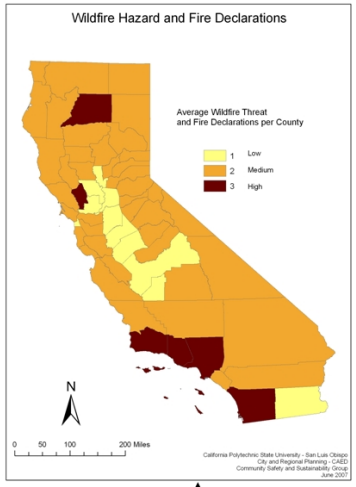
Total Declaration by county
0-4 = Low-yellow
5-10 = Medium-orange
11-22 = High-brown

Map 5.4.1I. Wildfire Hazard







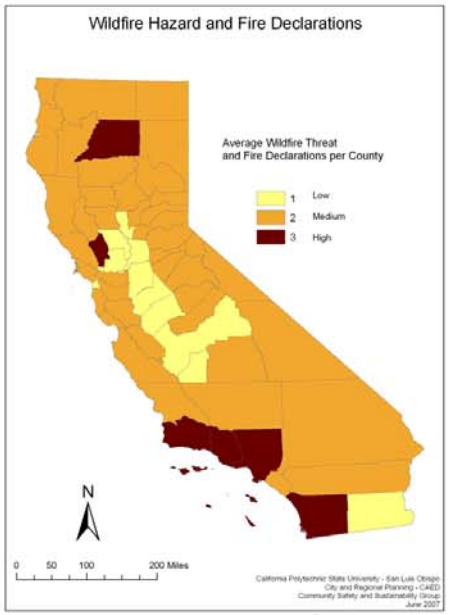


Weighted combination		Fire threat 50%		
		1	2	3
Fire declaration 50%	1	1	2	2
	2	2	2	3
	3	2	3	3

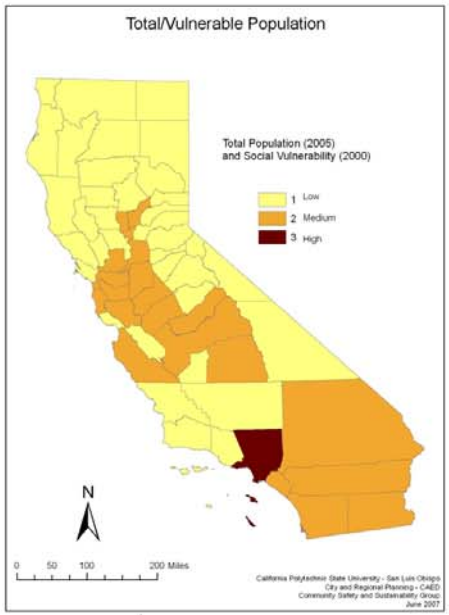
(Decl*50%)+(threat*50%)=score

Score is rounded up to the nearest whole number

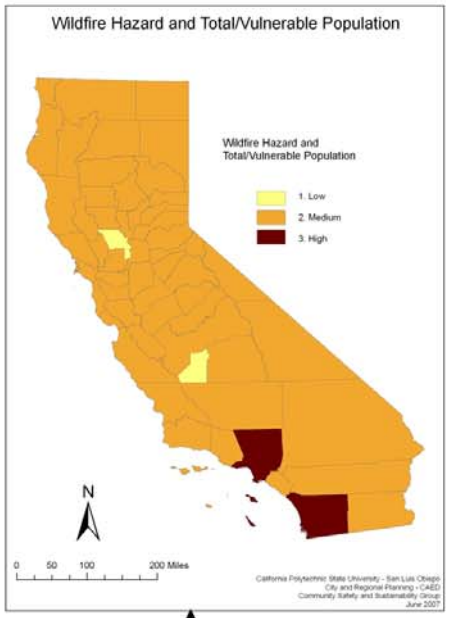
Map 5.4.1I. Fire Hazard



Map 5.4.1C. Total/Vulnerable Population

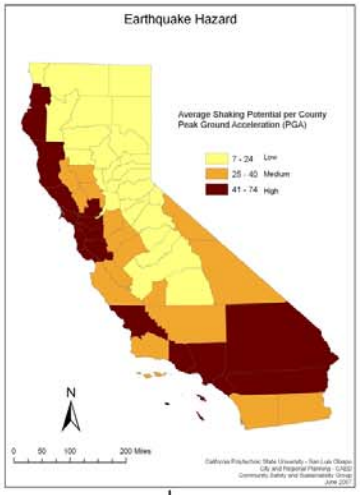


Map 5.4.1F. Fire Hazard and Total/Vulnerable Population

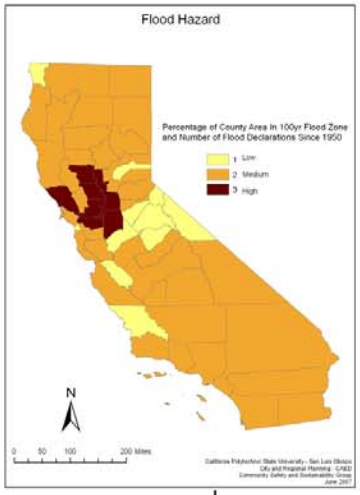


Weighted combination		Fire Haz 50%		
		1	2	3
Vuln Pop 50%	1	1	2	2
	2	2	2	3
	3	2	3	3

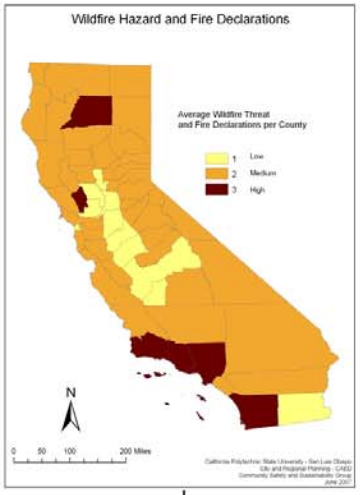
Map 5.4.1H. Earthquake Hazard



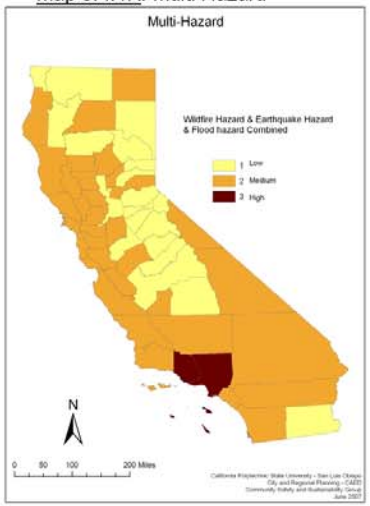
Map 5.4.1J. Flood Hazard



Map 5.4.1I. Wildfire Hazard



Map 5.4.1K. Multi Hazard

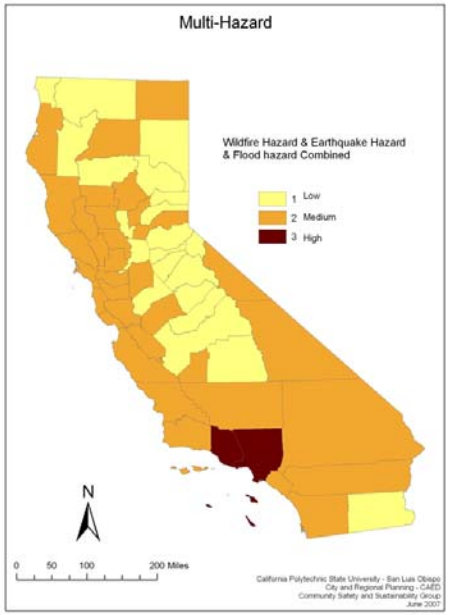


Sample

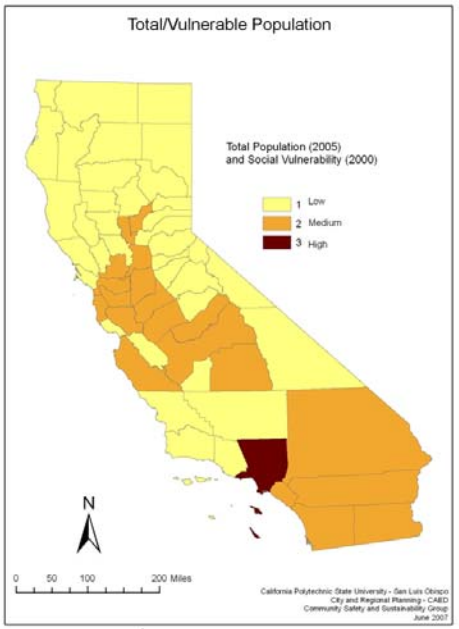
haz 1	haz 2	haz 3	composite
1	1	1	1.00
1	1	2	1.33
1	1	3	1.67
2	2	1	1.67
2	2	2	2.00
2	2	3	2.33
3	3	1	2.33
3	3	2	2.67
3	3	3	3.00

(Eq*33%)+(Flood*33%)+(fire*33%)=combined score
rounded up to the nearest whole number

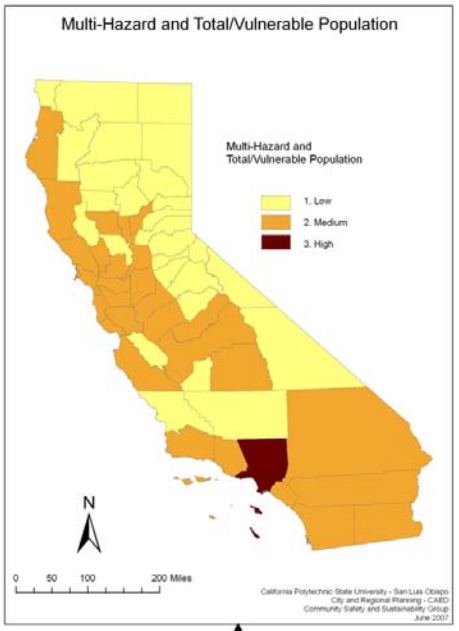
Map 5.4.1K. Multi-Hazard



Map 5.4.1C. Total/Vulnerable Population

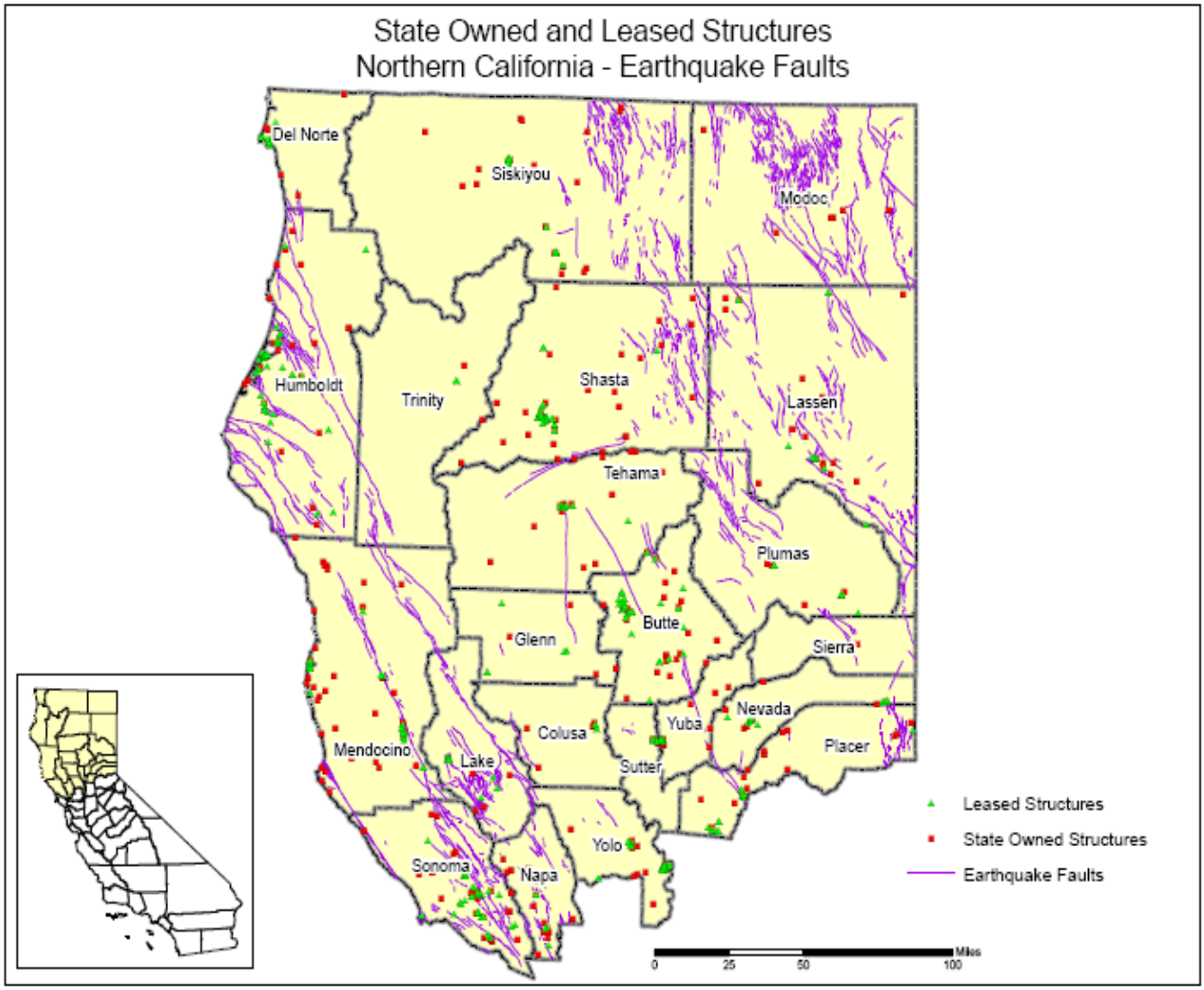


Map 5.4.1G. Multi-Hazard and Total/Vulnerable Population

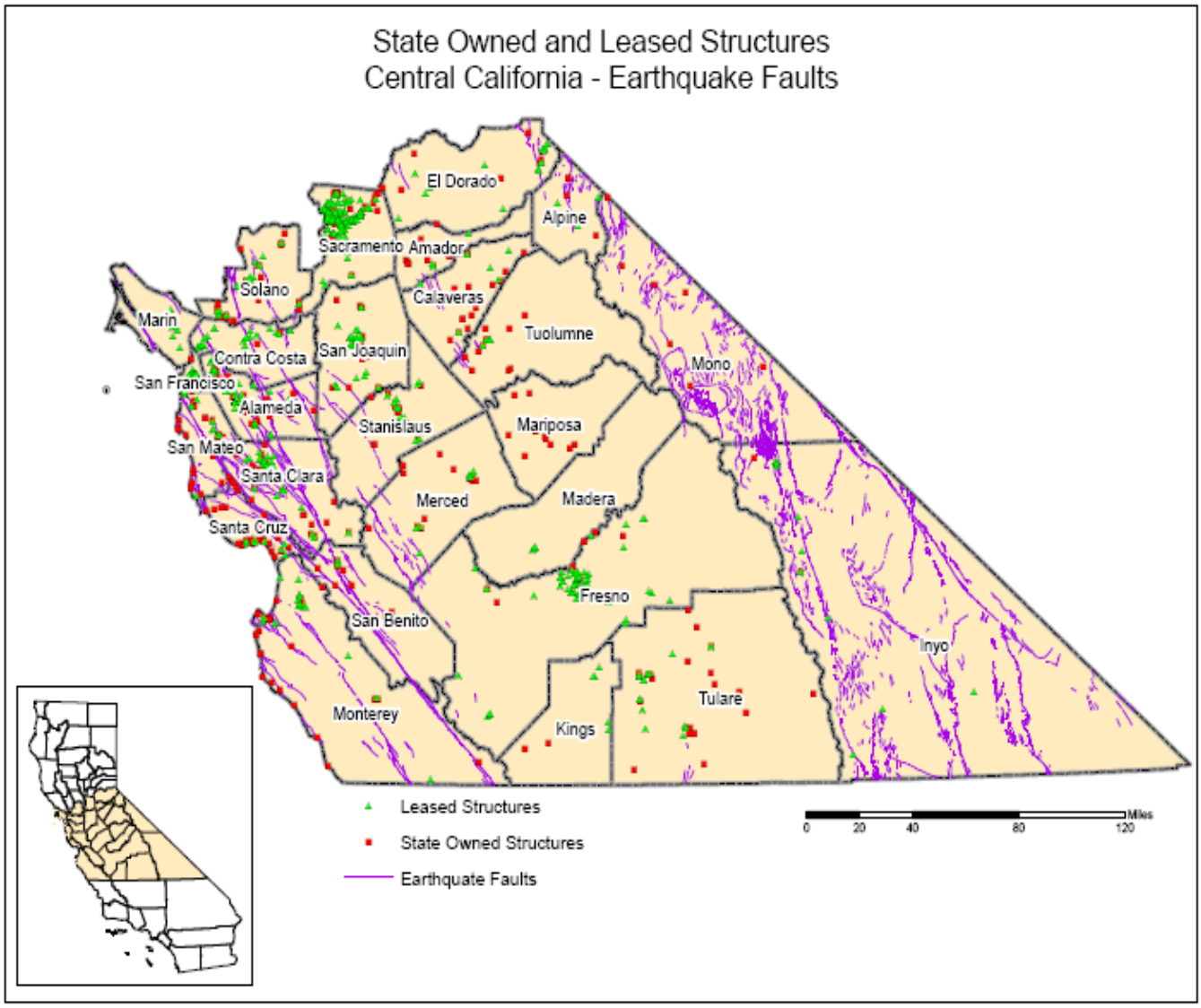


Weighted combination		Multi-Hazard 50%		
		1	2	3
Vuln Pop 50%	1	1	2	2
	2	2	2	3
	3	2	3	3

Map 5.5.4.1B State Owned and Leased Structures, Northern California – Earthquake Faults



Map 5.5.4.1C State Owned & Leased Structures, Central California – Earthquake Faults



Map 5.5.4.1D State Owned & Leased Structures Southern California – Earthquake Faults

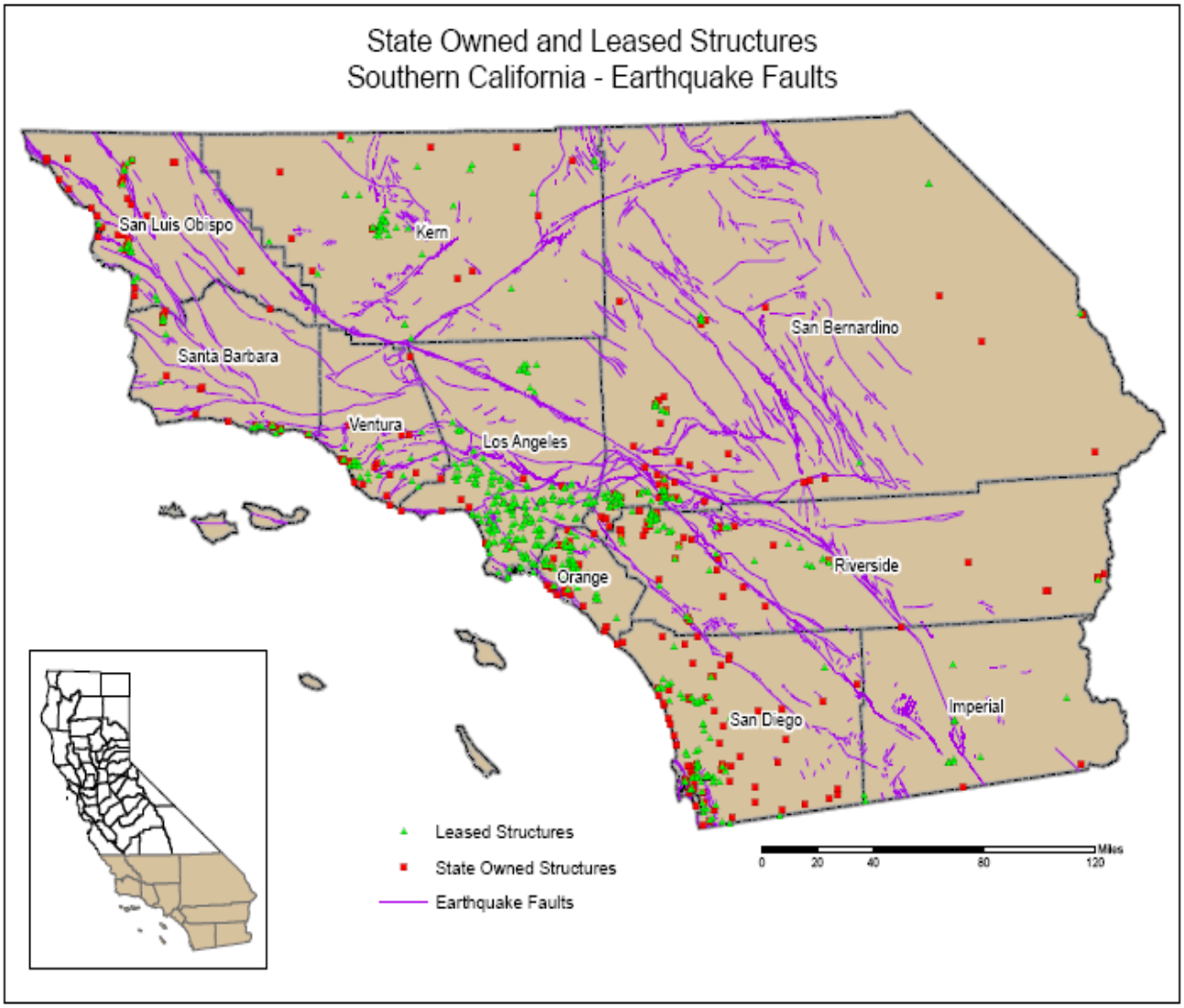


Table 5.5.4.1G-1 Draft Overall Progress Toward Earthquake Mitigation of Key Building Inventories in California

Inventory Category	Number in Inventory	Geo-Located	Mitigation Program	Seismic Evaluation	Mitigation Goal	Mitigation Progress	2nd Gen. Mitigation Program	Number in 2nd Gen. Inventory	2nd Seismic Evaluation Or Retrofit	Primary Responsible Agencies	References and Notes
By Occupancy or Jurisdiction											
Hospitals	2,673	Yes	●	◕	NS 2002 LS2008 IO 2030	◕ ◔ ○				OSHPD	
Essential Serv. Facilities	?	Yes	○	○	IO					DSA,OES	
Public Schools K-14	70,000	No	●	●	DC	●	◓	7537 K-12 1600 13-14	○ ○	DSA	
Public Universities	264 UC ?? CSU	Yes	● ●	◕ ●	RR RR	◓ ◓			●	UC,CSU	
Other State Bldgs	17,282	Yes	◔	◔	Varies	○				DGS, et al	
Non-state-regulated Buildings	12 mill.	No	○	○	Varies	○				Local Govts Special Distrs	
By Type of Construction											
URM Zone 4 Zone 3	25,945 4000+/-	No No	● ○	◓	RR	◓ ○				Local Govts	
Tiltups	57,000?	No	◔	◔	RR	◔				Local Govts	
Nonductile Concrete	40,000?	No	○		Varies					Local Govts	
Soft Story Apartments	46,000	No	○		RR					HCD	
Dwellings, Single-Unit	1.5 million?	No	○	○	RR	○				HCD	
Mobile Homes	473,000	No								HCD	

Legend:
●Mostly completed, periodic monitoring and updating is occurring ◕Nearly completed ◓About halfway completed

◔Partially completed ○begun **IO** Immediate Occupancy **DC** Damage Control **LS** Life Safety
RR Risk Reduction

(Please note Table 5.5.4.1F-1 to be merged with Table 5.5.4.1F-2)

Source: California Seismic Safety Commission

Table 5.5.4.1G-2 Draft Overall Progress Toward Earthquake Mitigation of Key Building Inventories in California

(To be merged with Table 5.5.4.1G-1)

Inventory Category	Number in Inventory	Geo-Located	Mitigation Program	Seismic Evaluation	Mitigation Goal	Mitigation Progress	2nd Gen. Mitigation Program	Number in 2nd Gen. Inventory	2nd Seismic Evaluation Or Retrofit	Primary Responsible Agencies	References and Notes
By Occupancy or Jurisdiction											
Hospitals	2,673	Yes	●	◕	NS 2002 LS2008 IO 2030	◕ ◔ ○				OSHPD	
Essential Serv. Facilities	?	Yes	○	○	IO					DSA,OES	
Public Schools K-14	~~70,000~~ 86,000	~~No~~ Yes	●	●	DC	●	◓	7537 K-12 1600 13-14	○ ○	DSA	
Public Universities	____ UC ____ CSU	Yes	● ●	◕ ◕	RR RR	◓ ◓				UC,CSU	
Other State Bldgs	24000?	Yes	◔	◔	Varies	○				DGS, et al	
Non-state-regulated Buildings	12 mill.	No	○	○	Varies	○				Local Govts Special Distrs	
By Type of Construction											
URM Zone 4 Zone 3	25,515 4000+/-	No No	● ○	◓	RR	◓ ○				Local Govts	
Tiltups	?	No	◔	◔	RR	◔				Local Govts	
Nonductile Concrete	?	No	○		Varies					Local Govts	
Apartments	?	No	○		RR					HCD	
Dwellings, Single-Unit	1.5 million?	No	○	○	RR	○				HCD	

Legend:

● Most nearly completed, needs updating ◕ Nearly completed ◓ About halfway completed

◔ Partially completed ○ begun **IO** Immediate Occupancy **DC** Damage Control **LS** Life Safety

RR Risk Reduction

Source: Department of General Services

Chart 5.7.1B Dollar Damage on State Responsibility Area (SRA) Since 2000

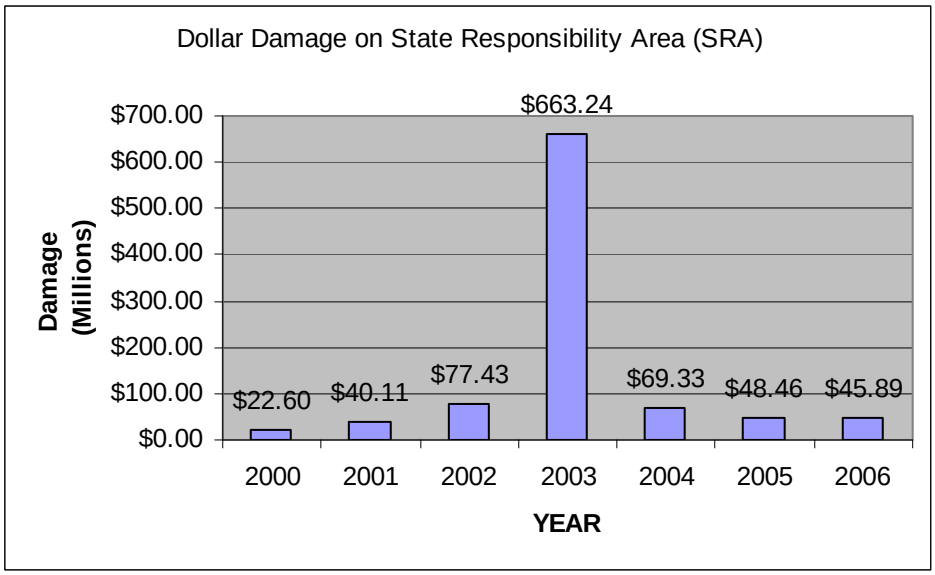
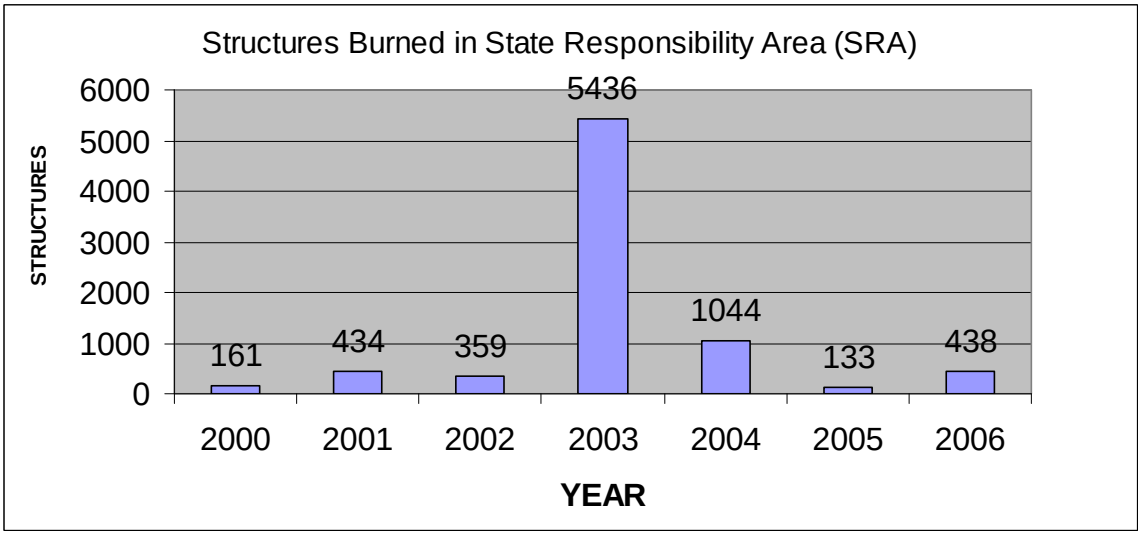
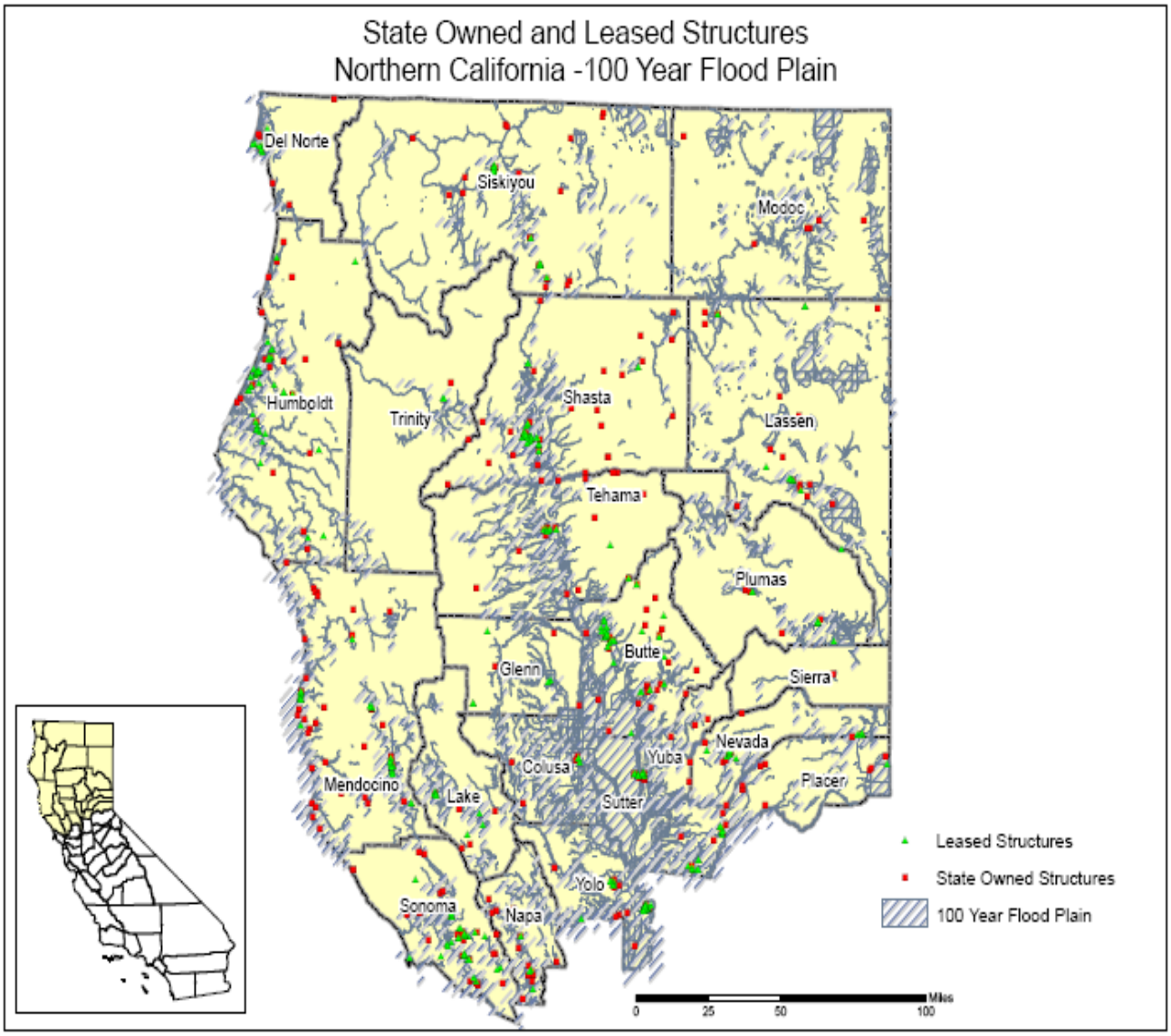


Chart 5.7.1C Structures Burned in State Responsibility Area Since 2000

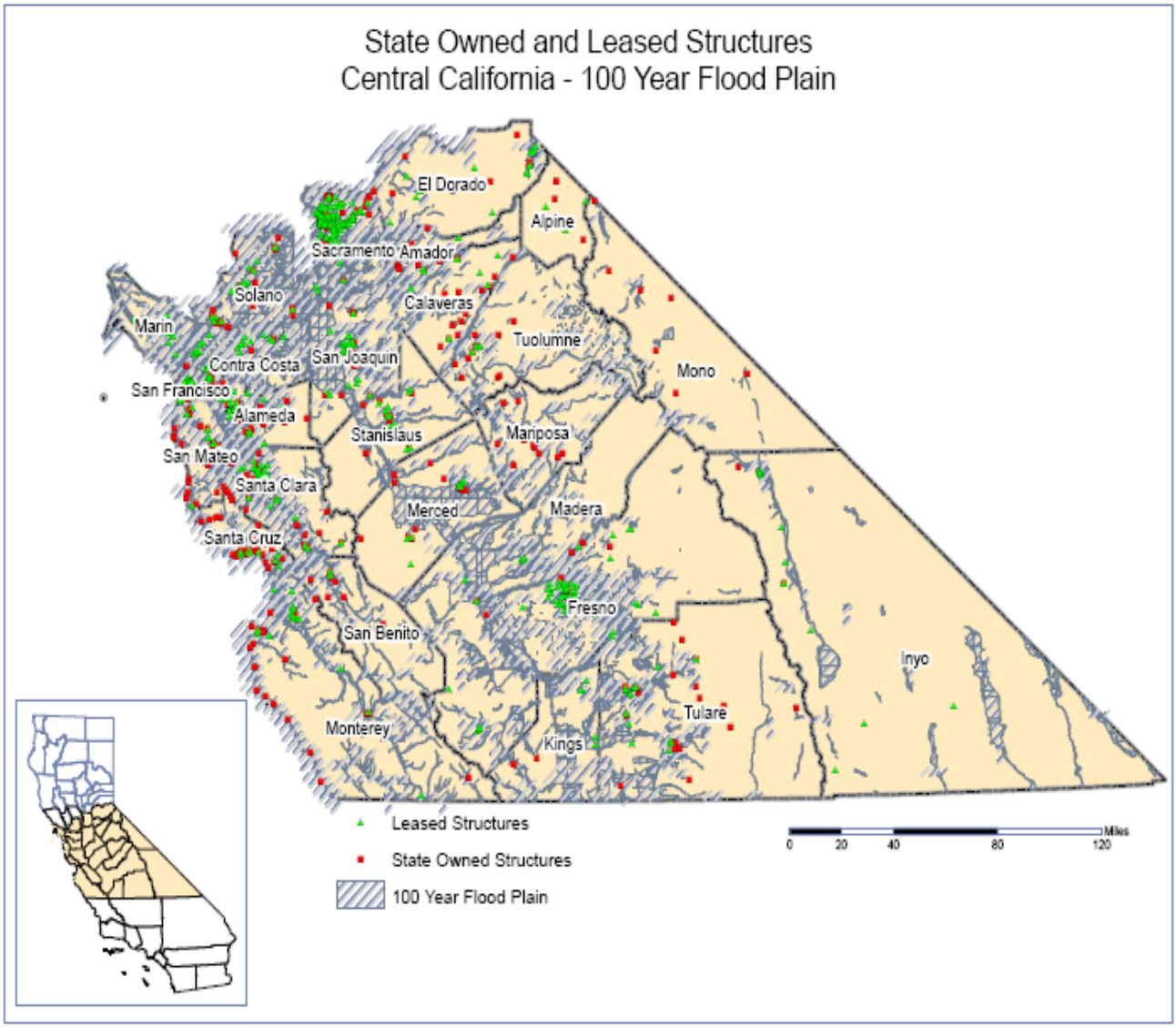


Source: CAL FIRE, Emergency Activity Reporting System (EARS) data from the EARS Data Warehouse. Compiled data and charts are in a Microsoft Excel document named structanddollars2k.xls.

Map 5.6.3B State Owned & Leased Structures, Northern California – 100 Year Flood Plain



Map 5.6.3C State Owned & Leased Structures, Central California – 100 Year Flood Plain



Map 5.6.3D State Owned & Leased Structures, Southern California – 100 Year Flood Plain

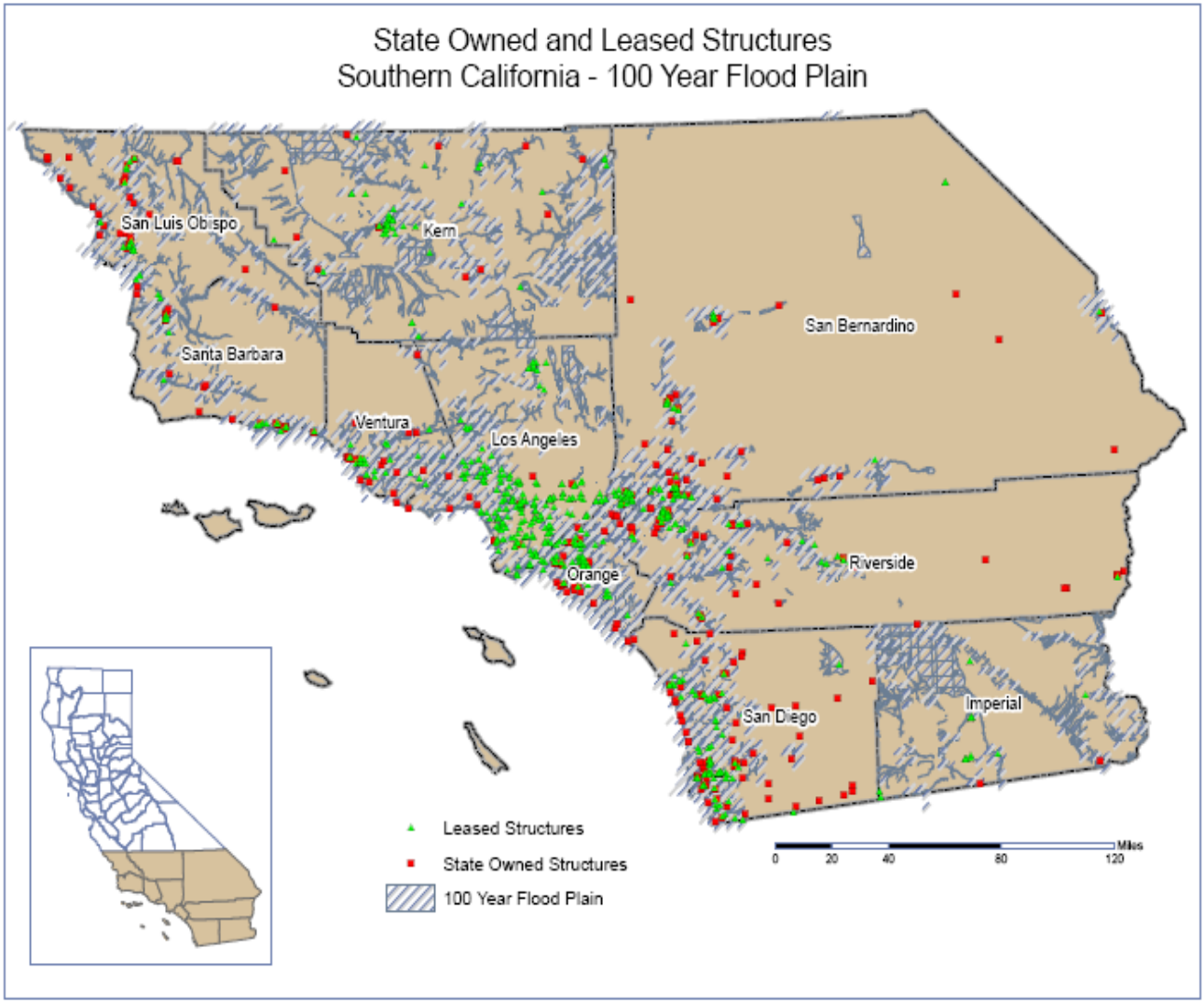


Table 5.7.2B Structures and Life Loss by Wildfire Event, 2004-2007

FIRENAME	STRUCTURES	DEATHS	YEAR
46	1	0	2004
4FKU006484	1	0	2004
59	0	2	2004
63RD	1	0	2004
ALTA	2	0	2004
ALTA	2	0	2004
ANDERSON	2	0	2004
ANDREAGOFF	0	1	2004
ANGEL	1	0	2004
APEX	1	0	2004
ARMSTRONG #1	1	0	2004
ARMSTRONG #2	2	0	2004
ASSIST	0	3	2004
ATKINSON	2	0	2004
AVILA	0	1	2004
AYON	0	1	2004
BARBOUR	5	0	2004
BEAR	129	0	2004
BED FIRE	3	0	2004
BELL	4	1	2004
BENNETT	0	4	2004
BLACK, H	0	1	2004
BLOSSOM	1	0	2004
BLUM	1	0	2004
BORDER # 16	1	0	2004
BOSTON	0	1	2004
BROWN	1	0	2004
BURKE	0	1	2004
BUS	1	0	2004
CA-BEU-004138	0	2	2004
CABEU 003065	1	0	2004
CABEU003001	1	0	2004
CABEU004099	0	3	2004
CALKINS	2	0	2004
CAR	0	1	2004
CARRICK	2	0	2004
CARRINGTON	1	0	2004
CASEY	1	0	2004
CASLU 005688	1	0	2004
CAUGHLIN	1	0	2004
CENTRAL # 1	0	2	2004
CERRITO FIRE 681	30	0	2004
CHEROKEE	1	0	2004
CLOVIS	0	1	2004
COBB	1	0	2004
COLONY	1	0	2004

FIRENAME	STRUCTURES	DEATHS	YEAR
CON FIRE ASST # 38	0	5	2004
COPCO	0	1	2004
COTTAGE	0	1	2004
COX	2	0	2004
CRATER	0	1	2004
DESCHUTES	2	0	2004
DODD	1	0	2004
DUNT,A	0	1	2004
EAGLE	41	0	2004
EDGEWOOD	2	0	2004
ELDER	2	0	2004
ENCHANTED	1	0	2004
EVANS RD	2	0	2004
FA-139	0	3	2004
FAIRWAY	0	1	2004
FAIRWAY	0	1	2004
FHF ASSIST	0	1	2004
FICKLE	1	0	2004
FORT	4	0	2004
FREEWAY	4	0	2004
FREMONT ASSIST #19	0	1	2004
FRENCH	45	0	2004
FUZZY	1	0	2004
GARRISON	1	0	2004
GATOS	9	0	2004
GEYSERS	28	0	2004
GILL	1	0	2004
GOODFELLOW	0	1	2004
GUERTIN	1	0	2004
HEIGHTS	1	0	2004
HESTERS	1	0	2004
HIGHWAY	1	0	2004
HONEY	0	1	2004
HORSESHOE	1	0	2004
HORTEN	0	1	2004
HOUDEK, M	1	0	2004
HUNT	1	0	2004
INTERSTATE	0	1	2004
ISHI	2	0	2004
JACOBY	1	0	2004
JUNIPER	13	0	2004
KIM	1	0	2004
KING	1	0	2004
KITS	0	1	2004
KNOLLS	1	0	2004
KNOX	1	0	2004
LA LONDE	1	0	2004
LABROUCHE	1	0	2004
LAKESHORE	0	1	2004

FIRENAME	STRUCTURES	DEATHS	YEAR
LAKEVIEW	2	0	2004
LAPORTE	1	0	2004
LAWLEY	1	0	2004
LEMON HILL	1	0	2004
LINDBLOOM	2	0	2004
LLOYD	1	0	2004
LOCAL	1	1	2004
LOCAL 12108	1	0	2004
LOCAL AIRCRAFT	0	2	2004
LOCAL ASSIST	0	5	2004
LOCAL FALSE ALARM	0	3	2004
LOCAL FIRE	5	1	2004
LONG	1	0	2004
LOUIS INCIDENT	1	0	2004
LYNN	1	0	2004
MARIGOLD	0	1	2004
MATAGUAY	3	0	2004
MEADOWVIEW	1	0	2004
MELTON	20	0	2004
MERCY	0	1	2004
MILLER	1	0	2004
MIXON	4	0	2004
MOONSHINE	1	0	2004
MOUNTAIN	0	1	2004
MTF ASST #17	0	1	2004
OCEGUERA	1	0	2004
OREGON	5	0	2004
OSOS	0	1	2004
P.G.& E. 11	1	0	2004
PALLET	1	0	2004
PATTISON	66	0	2004
PHILBRICK	1	0	2004
PIG	1	0	2004
PINE	0	1	2004
PINK	2	0	2004
PLEASURE FIRE	9	0	2004
PNV ASSIST	0	1	2004
PUMPHOUSE	1	0	2004
REEDS CREEK	1	0	2004
RHONDA	1	0	2004
ROBINSON	0	1	2004
ROSAS	3	0	2004
RUMSEY	7	0	2004
SALT	0	1	2004
SANDY	1	0	2004
SANTA BARBARA	1	0	2004
SCHMIDT	1	0	2004
SCOTTS VALLEY ASS.#7	0	1	2004
SEASIDE	0	2	2004

FIRENAME	STRUCTURES	DEATHS	YEAR
SELTER	1	0	2004
SHADOW	0	1	2004
SIEBER	1	0	2004
SKAGGS	1	0	2004
SLCFD ASSIST	0	1	2004
SMITH	1	0	2004
SOUTH	1	0	2004
SPRING HILL	0	1	2004
STAKE	1	0	2004
STATE	1	1	2004
STEVENS	2	0	2004
STF #2191	0	1	2004
THOMAS	1	0	2004
TNF 1706	0	1	2004
TRAILER	0	1	2004
TUCKER	0	2	2004
TURNER	1	0	2004
TYROLITE	1	0	2004
UKV ASSIST	0	1	2004
UNION	1	0	2004
UNIONTOWN 2	2	0	2004
VACA	0	1	2004
VARNI	0	1	2004
VISALIA #49	0	1	2004
VISTA	1	0	2004
WEBB, C	1	0	2004
WET	1	0	2004
WILLIAMS	1	0	2004
WOLF	1	0	2004
WOODY	1	0	2004
"WARREN" STATE FIRE	2	0	2005
6TH STREET	0	1	2005
7277	0	2	2005
810	1	0	2005
99	0	2	2005
9TH ST	0	2	2005
AARONDALE	1	0	2005
AIRPORT FIRE	0	2	2005
AMERICAN	0	1	2005
ASSIST	0	2	2005
ASSIST BDF	0	1	2005
ASSIST#61	0	1	2005
ATWATER CITY #1616	0	1	2005
BAILEY	2	0	2005
BEAR 2	1	0	2005
BELLA	3	0	2005
BRUNNUM	1	0	2005
CABEU002936	3	0	2005
CAFKU010381	2	0	2005

FIRENAME	STRUCTURES	DEATHS	YEAR
CAMP	1	0	2005
CAPILI	0	1	2005
CASTILLO FIRE	0	1	2005
CDV#1	0	1	2005
CLEVELAND	1	0	2005
CLIFTON MILK	0	1	2005
CLOVER	1	0	2005
CLV # 136	1	0	2005
COLD	0	2	2005
COMSTOCK	1	0	2005
COOK	0	1	2005
COTA	4	0	2005
CREEKVIEW	1	0	2005
CRYSTAL	1	0	2005
CUMMINGS	0	4	2005
DAY INCIDENT	0	1	2005
DEER	2	0	2005
DOBBS	0	1	2005
DRY CREEK	0	1	2005
DURHAM	1	0	2005
DURNELL	0	1	2005
EL POMAR	0	1	2005
FAIR	1	0	2005
FAIR	1	0	2005
FARLEY	0	1	2005
FIFTY SEVEN	4	0	2005
FKU-5334	0	1	2005
FORBESTOWN	0	2	2005
FORD	1	0	2005
FRANSISCO	0	1	2005
FRAZIER	1	0	2005
FREGUERO	0	1	2005
FRONTAGE	0	4	2005
GAS	1	0	2005
GENERATOR	0	1	2005
GUNDERSON	0	1	2005
H STREET	0	1	2005
HALYARD	1	0	2005
HARRIS	0	1	2005
HAYES	0	1	2005
HERNANDEZ	1	0	2005
HILLTOP	1	0	2005
HOLLAND	3	0	2005
HOLM	1	0	2005
HOPKINS	0	1	2005
HUDSON	1	0	2005
INC.#11,316	0	1	2005
IRISH	0	1	2005
ISLAY	0	1	2005

FIRENAME	STRUCTURES	DEATHS	YEAR
JUNIPER FIRE	2	0	2005
KEYES	1	0	2005
KING	2	0	2005
KITCHING	0	1	2005
LAZY	1	0	2005
LOCAL	0	1	2005
LOCAL	3	0	2005
LOCAL 10884	0	1	2005
LOCAL 63RD INCIDENT	1	0	2005
LOCAL 63RD INCIDENT	1	0	2005
LOCAL FIRE	0	1	2005
LOCAL VEHICLE	0	1	2005
LOCUST	1	0	2005
LOMPICO	2	0	2005
LPA	0	1	2005
MANNING	0	5	2005
MANTON	30	0	2005
MCCANN	1	0	2005
MEDEIROS	1	0	2005
MEYER	1	0	2005
MOORE	1	0	2005
MOTHERLODE	1	0	2005
MOUNTAIN	0	3	2005
MT VIEW	0	1	2005
MYSTERY	0	3	2005
NIMSHEW	0	1	2005
NORD	1	0	2005
PALA MESA	0	1	2005
PALOMARESVELARDE,J	1	0	2005
PARADISE	14	0	2005
PATHWAY	2	0	2005
PENON BLANCO FIRE	1	0	2005
PETERBUILT	0	1	2005
PG&E 13	1	0	2005
PHELPS	1	0	2005
PIERCY	1	0	2005
PISMO IC	0	1	2005
PLEASANT	0	1	2005
PNV ASSIST	0	1	2005
PONTIAC	0	1	2005
QUARTZ	2	0	2005
QUINCY	0	1	2005
RAIL ROAD	0	1	2005
RANCHO	0	1	2005
RDN ASSIST	0	5	2005
RECHE	0	1	2005
REDWOOD	0	1	2005
RIDGE	2	0	2005
ROGERS, K.	0	1	2005

FIRENAME	STRUCTURES	DEATHS	YEAR
ROVING	1	0	2005
SAGEBRUSH	1	0	2005
SAND	0	1	2005
SCHOOL	0	1	2005
SHAMROCK	0	1	2005
SILVERLEAF	1	0	2005
SLATE	1	0	2005
SLO CITY ASSIST #53	0	1	2005
SPRING	1	0	2005
STATE	2	0	2005
STATE FIRE	3	0	2005
STATE VEG	1	0	2005
STATE VEG	1	0	2005
STATE VEGETATION FIR	3	0	2005
SUMMER	1	0	2005
SWETZER	1	0	2005
SWIFT	0	1	2005
TERRILL	0	1	2005
TESLA	1	0	2005
UNKNOWN	0	2	2005
VOLCAN	30	0	2005
WARREN, R	2	0	2005
WASHINGTON STATE	0	1	2005
WATSON	1	0	2005
WENTWORTH	0	1	2005
WILLOW	2	0	2005
WITT	0	1	2005
WOODS	2	0	2005
YOSEMITE	0	4	2005
ZEIBRIGHT	1	0	2005
"MAYBERRY"	2	0	2006
06FKU3877	1	0	2006
139	1	0	2006
29	3	0	2006
53	1	0	2006
7615	0	1	2006
7TH	0	2	2006
ANTELOPE	0	3	2006
ARROWHEAD	1	0	2006
ASSIST 36	0	1	2006
AVE. 23	1	0	2006
BARONA	1	0	2006
BARTON	1	0	2006
BLACKBERRY	1	0	2006
BOTHWELL	1	0	2006
BREWSTER	4	0	2006
BROOKS	1	0	2006
BROWN	0	2	2006
BRYANT	0	2	2006

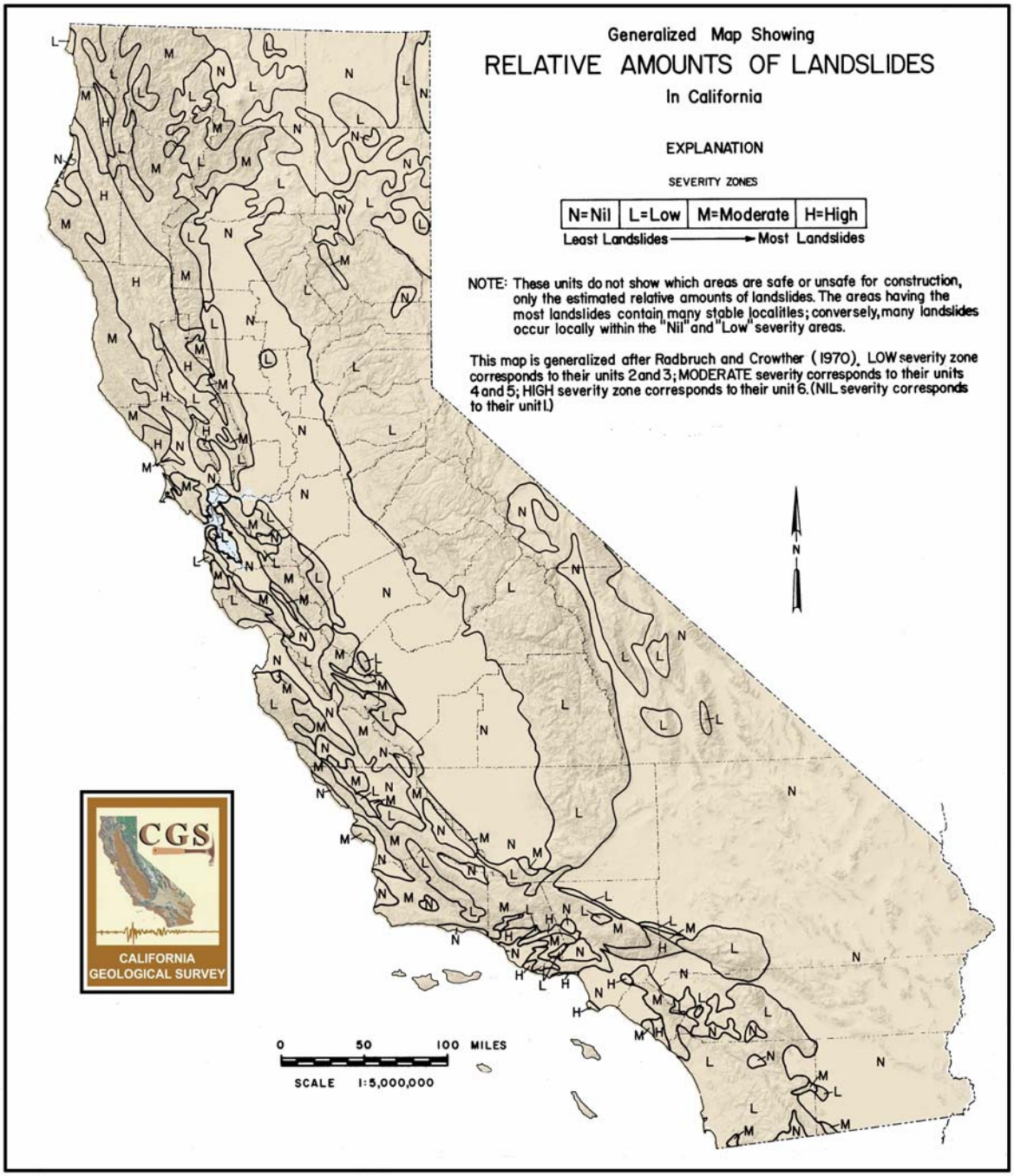
FIRENAME	STRUCTURES	DEATHS	YEAR
CABEU002444	0	1	2006
CACTUS FIRE	0	1	2006
CAFKU004998	1	0	2006
CALAVERAS	1	0	2006
CAMP	0	3	2006
CANYON	12	0	2006
CHIPMUNK	0	1	2006
CLARK	1	0	2006
CLOVIS 108	1	0	2006
CLV37	0	3	2006
DODGE	0	2	2006
DOGPATCH	1	0	2006
DWYER	2	0	2006
DWYER	0	1	2006
EASTSIDE	2	1	2006
ELM	2	0	2006
ELSINORE	1	0	2006
EMERALD	2	0	2006
ESPERANZA-STATE	54	5	2006
ETTAWA SPRINGS COBB	1	0	2006
F ST	1	0	2006
FKU 000383	0	1	2006
FKU 6353	1	0	2006
FOOTHILL	1	0	2006
GARCIA	1	0	2006
GARDNER	1	0	2006
GILROY ASSIST	0	1	2006
GIRARD	1	0	2006
GORDEN	1	0	2006
GREEN	0	1	2006
GREEN	0	1	2006
GREENSTONE	4	0	2006
GRIER	2	0	2006
HASTINGS	0	1	2006
HIDDEN	1	0	2006
HIGHWAY	0	1	2006
HMM ASSIST #3	0	1	2006
HOFFMAN	1	0	2006
HORN	0	1	2006
HORSESHOE	1	0	2006
HOTLUM	4	0	2006
HOY	2	0	2006
HYUNDAIS	0	2	2006
ILLEGAL BURN	0	10	2006
INDIO	0	1	2006
JACKSON	0	4	2006
JASPER	1	0	2006
JENSON	2	0	2006
JUNCTION	1	0	2006

FIRENAME	STRUCTURES	DEATHS	YEAR
KENNEDY	0	1	2006
KERN 19 - COTTONWOOD	1	0	2006
KNF ASST #12	0	2	2006
LAS PALMAS	4	0	2006
LINCOLN	0	1	2006
LOCAL	2	1	2006
LOCAL VEHICLE	0	3	2006
LOUIS	2	0	2006
LOWER	1	0	2006
MADERA 1434	1	0	2006
MARSHALL	0	2	2006
MARYSVILLE	1	0	2006
MAYER	4	0	2006
MCCLELLAN	0	1	2006
MEADOW	3	0	2006
MIDWAY	3	0	2006
MILLERICK	1	0	2006
MISSION	1	0	2006
MOJAVE	1	0	2006
MOORE	1	0	2006
MOUNTAIN	0	2	2006
MT UMUNHUM	1	0	2006
MURAL	1	0	2006
NCN 103	1	0	2006
NICOLET	1	0	2006
OAK	1	0	2006
OLIVE	1	0	2006
ORCHARD	5	0	2006
OREGON	0	1	2006
PALA	1	0	2006
PEARL	0	1	2006
PETRIFIED	0	1	2006
PHILLIPS,B	1	0	2006
PINEWOOD	1	0	2006
PLEASANT	0	1	2006
POPE	0	1	2006
PORTERVILLE #68	0	3	2006
QUARRY	3	0	2006
RAINBOW	1	0	2006
RANCH	5	0	2006
REYNOLDS, W	0	1	2006
REYNOLDS, W	0	1	2006
RIVER	1	0	2006
ROLLING	2	0	2006
ROSEMEAD	6	0	2006
RYAN	1	0	2006
SALAMONE	1	0	2006
SALMON	1	0	2006
SAN SEVAINE FIRE	1	0	2006

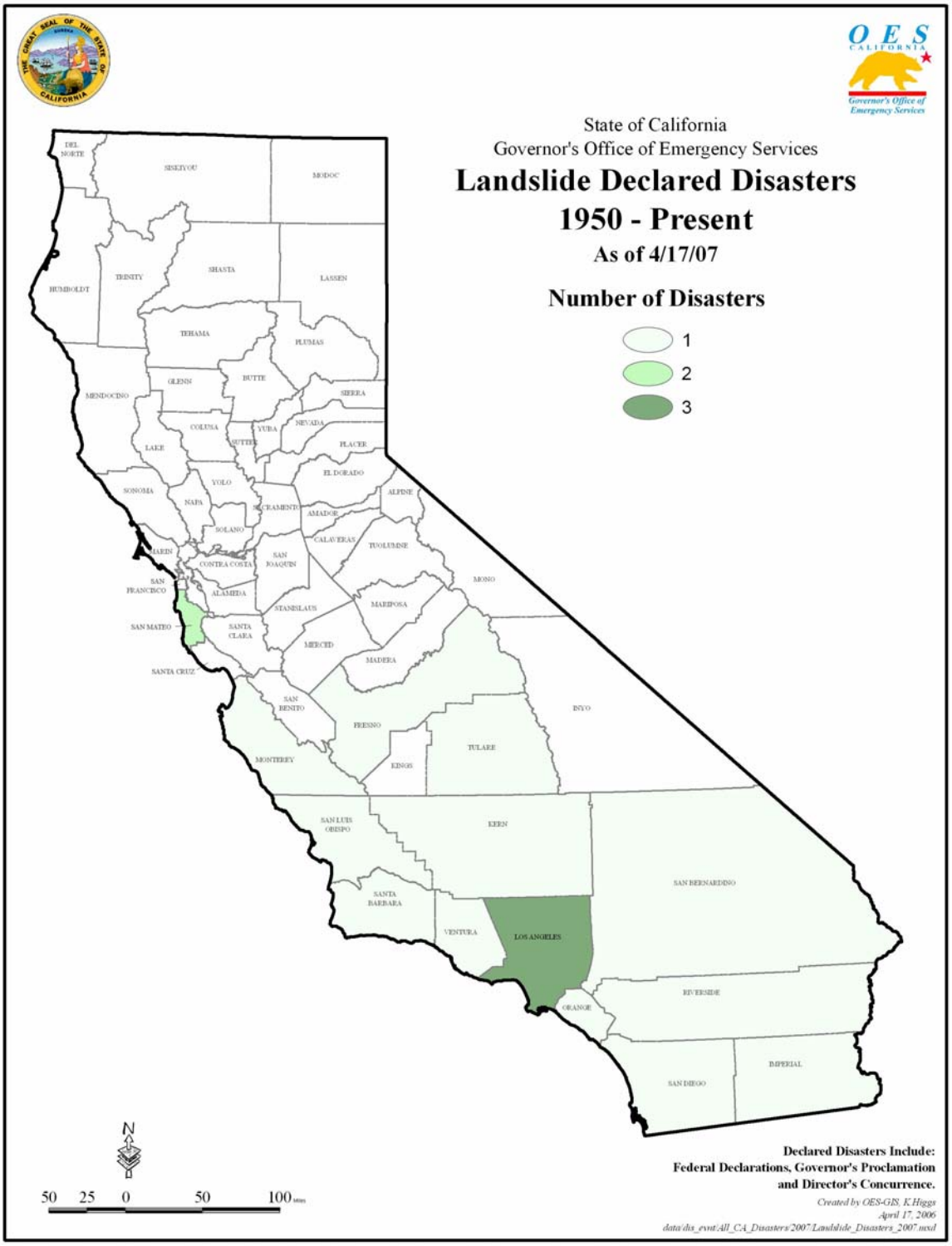
FIRENAME	STRUCTURES	DEATHS	YEAR
SANCHEZ	1	0	2006
SAWTOOTH	287	1	2006
SHADOW	1	0	2006
SHADY	1	0	2006
SHAWMUT	1	0	2006
SLY	0	1	2006
SMITH,S	0	1	2006
SMITHS	0	1	2006
SONOMA	2	0	2006
SOUDER	0	4	2006
SQUIRREL	1	0	2006
STATE FIRE	0	3	2006
STONEY CREEK	0	1	2006
STOY	1	0	2006
SUMMIT #2	1	0	2006
T/C CASE	0	1	2006
TABLE	0	1	2006
TAM	1	0	2006
TC	0	1	2006
THE Y	1	2	2006
TIA2005	0	3	2006
TOYOTA	0	5	2006
TREE	0	1	2006
TRUCK	0	1	2006
TRUCK	0	1	2006
VIEW	0	1	2006
VILLARREAL	0	1	2006
W	1	0	2006
WALL	0	1	2006
WEAVER	0	1	2006
WILDER	1	0	2006
YOSEMITE	1	0	2006

Source: CAL FIRE, Emergency Activity Reporting System (EARS) - All exposures for an incident have been summarized into a single entry. The source for the original table is not shown, so EARS data was used to produce the results shown in the table below.

Map 5.8.2B General Areas Susceptible to Landslides



Map 5.8.2C Landslide Declared Disasters



Document 5.11A. Additional Hazards

Air Pollution

Although as a single event air pollution is less significant than flood, fire, or earthquake, cumulatively it is much more hazardous to the health of large numbers of Californians. Air pollution is a continuing problem, with the largest concentration of pollution in the highest populated air basins: the San Francisco Bay Area, the San Joaquin Valley, the Sacramento Valley, San Diego, and the South Coast. Pollutants include smog, soot, and toxic air contaminants (TACs).
(Source: Toxic Beginnings—Cancer Risks to Children from California's Air Pollution, National Environmental Trust)

However, toxic emissions in California are on the decline. The table below shows the average quantities of emissions in tons per day since 1975. In 2000, average statewide emissions of nitrogen oxide (NOx) dropped to 51 percent of those in 1975, reactive organic gasses (ROG) dropped to 36 percent, and carbon monoxide (CO) dropped to 30 percent. Only Particulate Matter (PM10, less than or equal to 10 microns) has increased since 1975.

Statewide Emissions (tons/day, annual average)								
	1975	1980	1985	1990	1995	2000	2005	2010
NO_x	4762	5050	4939	4901	4133	3523	2962	2462
ROG	6408	6210	5737	4595	3755	3117	2592	2331
PM_{10}	1813	1983	1985	2254	2221	2313	2447	2601
CO	38285	36315	34625	29631	22876	17937	14052	11423

Source: /www.arb.ca.gov/adam/cgibin/db2www/ozonereport_ytd.d2w/start#down

Airline Crashes

Airline crashes, like other transportation accidents, are less likely to lead to a state or federal disaster declaration than other hazards. OES recognizes the severity of these incidents which often lead to deaths and injuries.

Civil Disturbances

As summarized in the table below, there have been several significant civil disturbances in California since 1950. These disturbances have all taken place in metropolitan areas.

Disturbance	Location	Date	Deaths	Injuries	Damage
Watts	South Central Los Angeles	1965	32	874	$45 million
Berkeley	City of Berkeley	1964	0	20	N/A
San Francisco	City & Co. of SF	1966	U/A	42	N/A
Burning of Bank of American	Santa Barbara	1969	0	12+	$275,000-$300,000
Rodney King Riot	City of Los Angeles	1992	53	2300	N/A

Computer Breaches

Computer breach incidents have risen sharply since the 1980s. These include viruses, worms, Trojan horses, break–ins, and other damaging breaches. Whereas only six incidents were reported in 1988, the number rose gradually during the late 1980s and 1990s, they made a sharp rise beginning in 1998, and have risen exponentially since. As of 2004, there had been over 142,500 computer breaches.

Hurricanes

California is at very low risk of hurricanes, although it is possible for one to threaten the southern California coast.

(*Source: The Weather Channel* http://www.weather.com/encyclopedia/tropical/climo.html)

No hurricanes have hit California in recorded history because tropical storm winds generally blow from east to west, but California is affected by heavy rain resulting from tropical winds that blow north from Mexico and become colder by the time they hit California.
(Source: The USA TODAY Weather Book by Jack Williams)

In the future, monitoring is needed to determine whether present patterns of movement of such storms continue or are modified by the warming of waters off the Pacific Coast due to climate change.

Train Derailments

Train derailments are so localized that the incidents themselves would not constitute a disaster. However, if there are volatile or flammable substances on the train and the train is in a highly populated or densely forested area, death, injuries, damage to homes, or forest fires could occur.
There have been 14 train accidents affecting 12 communities since 1950.

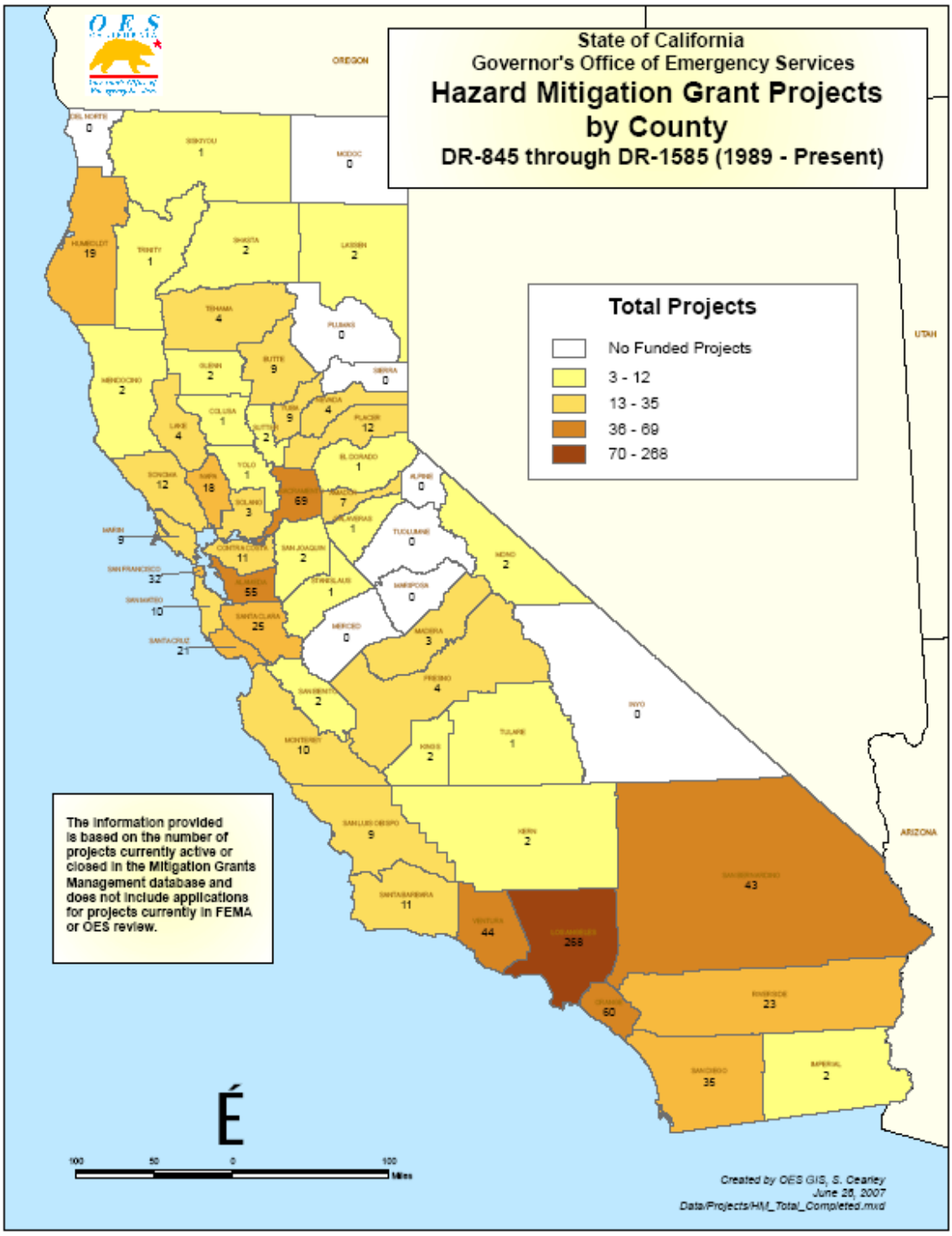
Table 7.1K FEMA Mitigation Funding and Technical Assistance Sources

CFDA #	Program	Details	Criteria
97.00	Infrastructure Protection Program (IPP)	Assistance for a range of emergency preparedness activities. http://www.ojp.usdoj.gov/odp/grants_programs.htm#fy2007ipp#fy2007ipp	States, localities and U.S. territories
97.00	Superfund Amendments and Reauthorization Act	Provides funding for training in emergency planning, preparedness, mitigation, response, and recovery capabilities associated with hazardous chemicals. http://www.fema.gov/government/grant/sara.shtm	Public officials, fire and police personnel, medical personnel, and first responders.
97.016	Reimbursement for Firefighting on Federal Property	Provides reimbursement only for direct costs and losses over and above normal operating costs. http://www.usfa.dhs.gov/fireservice/grants/rfff/	States, localities, tribal governments and fire departments
97.017	Pre-Disaster Mitigation Program (PDM)	Provides funds for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event. http://www.fema.gov/government/grant/pdm/index.shtm	States, localities and tribal governments
97.018	National Fire Academy Education and Training	Provides training to increase the professional level of the fire service and others responsible for fire prevention and control. http://www.usfa.dhs.gov/nfa/	Fire departments and firefighting personnel
97.02	Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)	Supports programs designed to improve capabilities associated with oil and hazardous materials emergency planning and exercising. http://www.fema.gov/pdf/government/grant/cercla_guidance.pdf	States, localities and tribal governments, U.S. territories, state emergency response committees (SERCs and LEPCs)
97.022	National Flood Insurance Program (NFIP)	Enables property owners to purchase insurance as a protection against flood losses in exchange for State and community floodplain management regulations that reduce future flood damages. http://www.fema.gov/business/nfip/	States, localities, and individuals
97.023	Community Assistance Program, State Support Services Element (CAP-SSSE)	Funding to provide technical assistance to communities in the National Flood Insurance Program (NFIP) and to evaluate community performance in implementing NFIP floodplain management activities. http://www.fema.gov/about/programs/nfip/index.shtm	States
97.024	Emergency Food and Shelter Program	Supplements the work of local social service organizations within the United States, both private and governmental, to help people in need of emergency assistance. http://www.fema.gov/government/grant/efs.shtm	Private-Nonprofit community and government organizations
97.025	National Urban Search and Rescue (US&R) Response System	Provides funding for the acquisition, maintenance, and storage of equipment, training, exercises, and training facilities to meet task force position criteria, and conduct and participate in meetings within the National US&R Response System. http://www.fema.gov/emergency/usr/index.shtm	US&R task forces

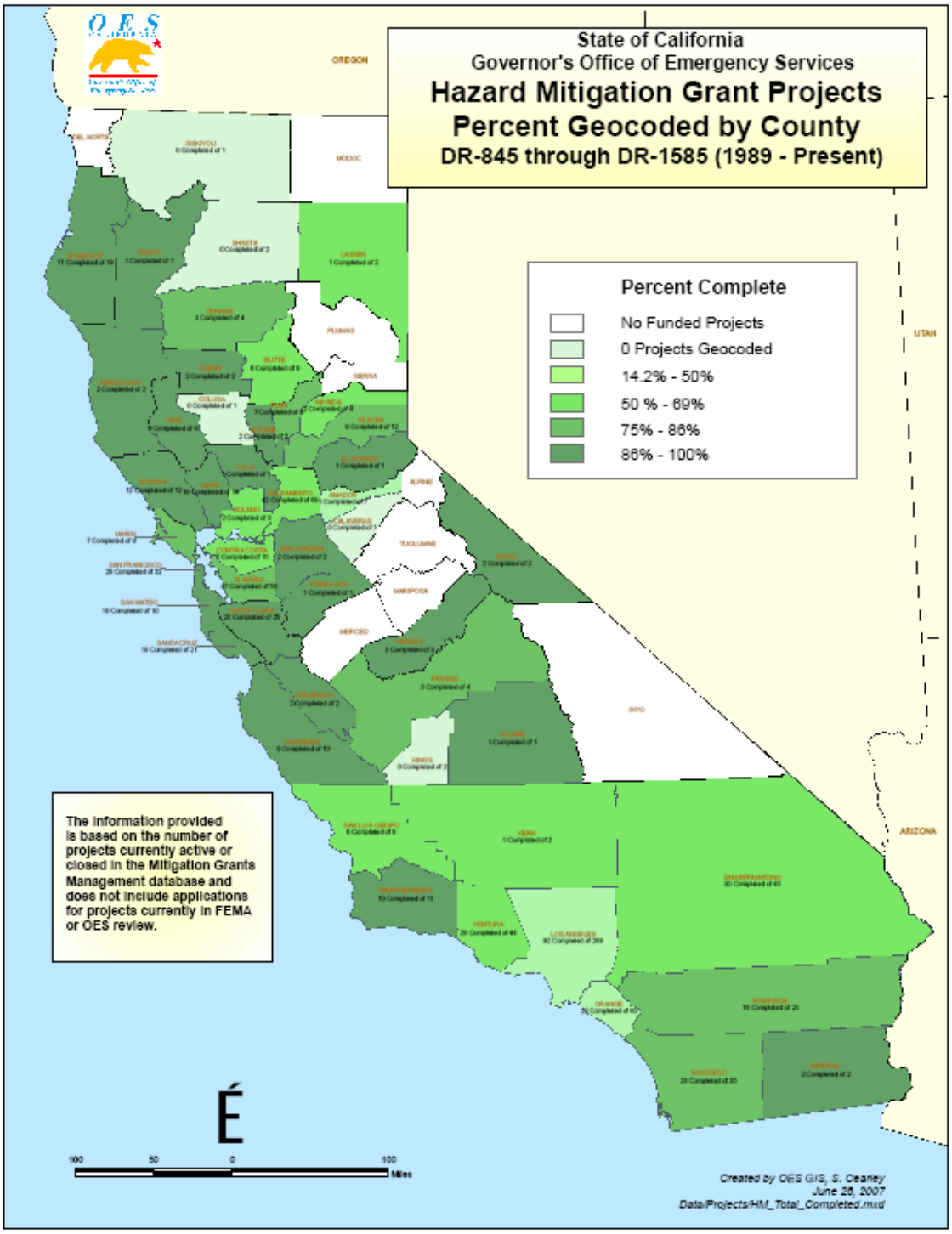
97.026	Emergency Management Institute	Provides training and education to the fire service, its allied professions, emergency management officials, and the general public. http://training.fema.gov/	Fire departments, other first responders, and emergency management officials.
97.029	Flood Mitigation Assistance Program (FMA)	Provides funding to implement measures to reduce or eliminate the long-term risk of flood damage. http://www.fema.gov/government/grant/fma/index.shtm	States and localities
97.03	Community Disaster Loan Program	Provides funds to any eligible jurisdiction in a designated disaster area that has suffered a substantial loss of tax and other revenue. http://www.fema.gov/government/grant/fs_cdl.shtm	Localities
97.032	Crisis Counseling	Provides supplemental funding to States for short-term crisis counseling services to people affected in Presidentially declared disasters. http://www.fema.gov/assistance/process/additional.shtm	States
97.033	Disaster Legal Services	Provides free legal assistance to disaster victims http://www.fema.gov/assistance/process/additional.shtm	Individuals
97.034	Disaster Unemployment Assistance Program	Provides unemployment benefits and re-employment services to individuals who have become unemployed because of major disasters. http://www.fema.gov/assistance/process/additional.shtm	Individuals
97.036	Public Assistance Grant Program	Provides assistance to alleviate suffering and hardship resulting from major disasters or emergencies declared by the President. http://www.fema.gov/government/grant/pa/index.shtm	States, localities, tribal governments and private-nonprofit organizations via states
97.039	Hazard Mitigation Grant Program (HMGP)	Provides grants to implement long-term hazard mitigation measures after a major disaster declaration. http://www.fema.gov/government/grant/hmgp/index.shtm	Open.
97.040	Chemical Stockpile Emergency Preparedness Program	Improves preparedness to protect the people of certain communities in the unlikely event of an accident involving this country's stockpiles of obsolete chemical munitions. http://www.fema.gov/government/grant/csepp.shtm	States, localities and tribal governments
97.041	National Dam Safety Program	Provides financial assistance to the states for strengthening their dam safety programs. http://www.fema.gov/plan/prevent/damfailure/ndsp.shtm	States
97.042	Emergency Management Performance Grant (EMPG)	Provides assistance for the development, maintenance, and improvement of state and local emergency management capabilities. http://www.ojp.usdoj.gov/odp/grants_programs.htm#fy2007empg#fy2007empg	States and U.S. territories via the State Administrative Agency (SAA)
97.043	State Fire Training System Grants (Source: U.S. Fire Administration)	Provide financial assistance to State Fire Training Systems for the delivery of a variety of National Fire Academy (NFA) courses/programs. http://www.usfa.dhs.gov/fireservice/grants/sfts/	State Fire Training Systems
97.044	Assistance to Firefighters Grant (Source: U.S. Fire Administration)	Provides assistance to local fire departments to protect citizens and firefighters against the effects of fire and fire-related incidents. http://www.usfa.dhs.gov/fireservice/grants/	Fire departments and first responders

97.045	Cooperating Technical Partners	Provides technical assistance, training, and/or data to support flood hazard data development activities. http://www.fema.gov/plan/prevent/fhm/ctp_main.shtm	States, localities, tribal governments
97.046	Fire Management Assistance Grant Program	Assistance for the mitigation, management, and control of fires on publicly or privately owned forests or grasslands. http://www.fema.gov/government/grant/fmagp/index.shtm	States, local and tribal governments
97.048	Individuals and Households Grant Program (Disaster Assistance)	Provides money or direct assistance to individuals, families and businesses in an area whose property has been damaged or destroyed and whose losses are not covered by insurance. http://www.fema.gov/assistance/process/individual_assistance.shtm	Individuals
97.067	Homeland Security Grant Program (HSGP)	Funds to enhance the capacity of emergency responders to prevent, respond to, and recover from acts of terrorism. http://www.ojp.usdoj.gov/odp/grants_programs.htm#fy2007hsgp#fy2007hsgp	States, localities and U.S. territories
97.07	Map Modernization Management Support	Provides funding to supplement, not supplant, ongoing flood hazard mapping management efforts by the local, regional, or State agencies. http://www.fema.gov/plan/prevent/fhm/mm_main.shtm	States and localities
97.092	Repetitive Flood Claims Program	Funding to reduce or eliminate the long-term risk of flood damage to structures insured under the NFIP that have had one or more claims for flood damages. http://www.fema.gov/government/grant/rfc/index.shtm	States and localities that cannot meet the requirements of the Flood Mitigation Assistance (FMA) program
Source: http://www.fema.gov/government/grant/index.shtm			

Map 8.3A Hazard Mitigation Grant Projects by County DR-845 through 1585 (1989-Present)



Map 8.3B Hazard Mitigation Grant Projects Percent Geocoded by County DR-845 through 1585 (1989-Present)



(End of Document)