

City of La Mirada Natural Hazards Mitigation Plan

Final Draft

October 26, 2004



Prepared under contract with:

*Emergency Planning Consultants
San Diego, California
Carolyn J. Harshman, President*

Special Recognition

The Disaster Management Area Coordinators (DMAC) of Los Angeles County prepared planning guidance materials that were utilized by the City of La Mirada in preparing this Natural Hazards Mitigation Plan. The DMAC planning guidance materials were based on the Mitigation Plan from Clackamas County, Oregon. The City is grateful to DMAC and the Clackamas County Natural Hazards Mitigation Committee for their contributions to this project.

Acknowledgments

City of La Mirada City Council

- Susan Tripp, Mayor
- Bob Chotiner, Mayor Pro Tem
- Pete Dames, Councilmember
- Steve Jones, Councilmember
- Hal Malkin, Councilmember

City of La Mirada Administration

- Andrea M. Travis, City Manager
- John Di Mario, Assistant City Manager

Special Thanks

Hazard Mitigation Planning Team:

City of La Mirada

- Steve Forster, Public Works Director, Public Works Department
 - Steven Mendoza, City Planner, Planning and Community Development
 - Daniel Parra, Administrative Aide, Public Safety Department
- Office of Disaster Management, Area E: Fan Abel, Coordinator

Mapping

Other than Internet-sourced maps, the City of La Mirada provided all of the maps included in this plan.

Consulting Services

Project Management and planning services for this project were provided under contract by Emergency Planning Consultants.

- Project Management Services: Carolyn J. Harshman, President
- Planning Services: Carolyn J. Harshman, President
Daniel Robeson, Jr., Associate
April Ratcliff, Assistant
Timothy Harshman, Intern

List of Natural Hazards Mitigation Plan Tables, Maps, and Photos

	Type of Table, Map, or Photo	Section of the Plan
Map 1-1	Base Map of City of La Mirada	Section 1: Introduction
Table 4-1	Federal Criteria for Risk Assessment	Section 4: Risk Assessment
Table 4-2	City of La Mirada Critical and Essential Facilities Vulnerable to Hazards	Section 4: Risk Assessment
Table 5-1	Earthquake Events In Southern California	Section 5: Earthquake
Figure 5-1	Causes and Characteristics of Earthquakes in Southern California	Section 5: Earthquake
Map 5-1	Seismic Zones in California	Section 5: Earthquake
Map 5-2	Major Active Surface Faults in Southern California	Section 5: Earthquake
Map 5-3	Liquefaction and EQ-Induced Landslide Areas in the City of La Mirada	Section 5: Earthquake
Table 5-4	Partial List of the Over 200 California Laws on Earthquake Safety	Section 5: Earthquake
Table 6-1	Major Floods of the Los Angeles River	Section 6: Flood
Table 6-2	Tropical Cyclones of Southern California	Section 6: Flood
Map 6-1	Floodplains in the City of La Mirada	Section 6: Flood
Table 6-3	Dam Failures in Southern California	Section 6: Flood
Photo 6-1	Baldwin Hills Dam	Section 6: Flood
Map 7-1	Liquefaction and EQ-Induced Landslide Areas in the City of La Mirada	Section 7: Landslides
Table 8-1	October 2003 Firestorm Statistics	Section 8: Wildfire
Table 8-2	Large Historic Fires in California 1961-2003	Section 8: Wildfire
Table 8-3	National Fire Suppression Costs	Section 8: Wildfire
Table 8-4:	Sample Hazard Identification Rating System	Section 8: Wildfire

Note: The maps in this plan were provided by the City of La Mirada or were acquired from public Internet sources. Care was taken in the creation of these maps, but they are provided "as is". The City of La Mirada cannot accept any responsibility for any errors, omissions or positional accuracy, and therefore, there are no warranties that accompany these products (the maps). Although information from land surveys may have been used in the creation of these products, in no way does this product represent or constitute a land survey. Users are cautioned to field verify information on this product before making any decisions.

City of La Mirada Natural Hazards Mitigation Plan

Index

Title Page.....	i
Acknowledgments.....	ii
List of Maps	iii
Index.....	iv

Part I: Mitigation Actions

Executive Summary	
Attachment 1: Mitigation Actions Matrix	
Section 1: Introduction	
Section 2: Plan Maintenance	

Part II: Hazard Analysis

Section 3: Community Profile	
Section 4: Risk Assessment	
Section 5: Earthquake	
Section 6: Flood	
Section 7: Landslides	
Section 8: Wildfire	

Part III: Resources

Appendix A: Plan Resource Directory	
Appendix B: Public Participation Process	
Appendix C: Benefit Cost Analysis	
Appendix D: List of Acronyms	
Appendix E: Glossary	

PART I: MITIGATION ACTIONS

Executive Summary: Hazard Mitigation Action Plan

The City of La Mirada Natural Hazards Mitigation Plan includes resources and information to assist City residents, public and private sector organizations, and others interested in participating in planning for natural hazards. The mitigation plan provides a list of activities that may assist the City of La Mirada in reducing risk and preventing loss from future natural hazard events. The action items address multi-hazard issues, as well as activities for earthquakes, flooding, landslides, and wildfires.

How is the Plan Organized?

The Mitigation Plan contains a Mitigation Actions Matrix, background on the purpose and methodology used to develop the mitigation plan, a profile of the City of La Mirada, sections on four natural hazards that occur within the City, and a number of appendices. All of the sections are described in detail in Section 1, Introduction.

Who Participated in Developing the Plan?

The City of La Mirada Natural Hazards Mitigation Plan is the result of a collaborative planning effort between City of La Mirada citizens, public agencies, non-profit organizations, and regional and state organizations. Public participation played a key role in development of goals and action items. Various public outreach activities were conducted to include City of La Mirada residents in plan development. A project Planning Team guided the process of developing the plan.

The Planning Team was comprised of the following representatives:

City of La Mirada – John Di Mario, Assistant City Manager/Community Development Director
City of La Mirada - Steve Forster, Public Works Director, Public Works Department
City of La Mirada - Steven Mendoza, City Planner, Community Development Department
City of La Mirada - Daniel Parra, Administrative Aide, Public Safety Department
Office of Disaster Management, Area E: Fan Abel, Coordinator

What is the Plan Mission?

The mission of the City of La Mirada Natural Hazards Mitigation Plan is to promote sound public policy designed to protect citizens, critical facilities, infrastructure, private property, and the environment from natural hazards. This can be achieved by increasing public awareness, documenting the resources for

risk reduction and loss-prevention, and identifying activities to guide the City towards building a Disaster Resistant Community.

What are the Plan Goals?

The plan goals describe the overall direction that City of La Mirada agencies, organizations and citizens can take to work toward mitigating risk from natural hazards. The goals are stepping-stones between the broad direction of the mission statement and the specific recommendations outlined in the action items.

Protect Life and Property

Implement activities that assist in protecting lives by making homes, businesses, infrastructure, critical facilities and other property more resistant to losses from natural hazards.

Reduce losses and repetitive damages for chronic hazard events.

Improve hazard assessment information to make recommendations encouraging preventative measures for existing and future development in areas vulnerable to natural hazards.

Public Awareness

Develop and implement education and outreach programs to increase public awareness of the risks associated with natural hazards.

Convey information to assist in implementing mitigation activities.

Natural Systems

Balance natural resource management and land use planning with natural hazard mitigation to protect life, property and the environment.

Preserve, rehabilitate and enhance natural systems to serve natural hazard mitigation functions as appropriate.

Partnerships and Implementation

Strengthen communication and coordinate participation among and within public agencies, citizens, non-profit organizations, business and industry to gain a vested interest in implementation.

Encourage leadership within public and private sector organizations to prioritize and implement local, county, regional and state hazard mitigation activities.

Emergency Services

Establish policy to ensure mitigation projects for critical facilities, services, and infrastructure.

Strengthen emergency operations by increasing collaboration and coordination among public agencies, non-profit organizations, business, and industry.

Coordinate and integrate natural hazard mitigation activities, where appropriate, with emergency operations plans and procedures.

How are the Action Items Organized?

The action items are a listing of activities in which City agencies and citizens can be engaged to reduce risk. Each action item includes an estimate of the timeline for implementation (see Executive Summary, Attachment 1: Mitigation Actions Matrix).

The action items are organized within the following matrix, which lists all of the multi-hazard and hazard-specific action items included in the mitigation plan. Data collection and research and the public participation process resulted in the development of these action items (see Appendix B). The Matrix includes the following information for each action item:

Coordinating Organization. The coordinating organization is the public agency with regulatory responsibility to address natural hazards, or that is willing and able to organize resources, find appropriate funding, or oversee activity implementation, monitoring, and evaluation. Coordinating organizations may include local, county, or regional agencies that are capable of or responsible for implementing activities and programs.

Timeline. Action items include both short and long-term activities. Each action item includes an estimate of the timeline for implementation.

Plan Goals Addressed. The plan goals addressed by each action item are included as a way to monitor and evaluate how well the mitigation plan is achieving its goals once implementation begins. The plan goals are organized into the following five areas:

- Protect Life and Property**
- Public Awareness**
- Natural Systems**
- Partnerships and Implementation**
- Emergency Services**

How Will the Plan be Implemented, Monitored, and Evaluated?

The Plan Maintenance Section (Section 2) of this document details the formal process that will ensure that the City of La Mirada Natural Hazards Mitigation

Plan remains an active and relevant document. The plan maintenance process includes a schedule for monitoring and evaluating the Plan annually and producing a plan revision every five years. This section describes how the City will integrate public participation throughout the plan maintenance process. Finally, this section includes an explanation of how the City of La Mirada government intends to incorporate the mitigation strategies outlined in this Plan into existing planning mechanisms such as the City's General Plan, Capital Improvement Plans, and Building & Safety Codes.

Plan Adoption

Adoption of the Natural Hazards Mitigation Plan by the local jurisdiction's governing body is one of the prime requirements for approval of the plan. Once the plan is completed, the City Council will be responsible for adopting the City of La Mirada Natural Hazards Mitigation Plan. The local agency governing body has the responsibility and authority to promote sound public policy regarding natural hazards. The City Council will periodically need to re-adopt the plan as it is revised to meet changes in the natural hazard risks and exposures in the community. The approved Natural Hazard Mitigation Plan will be significant in the future growth and development of the community.

Coordinating Body

The coordinating body is the City of La Mirada's Emergency Preparedness and Response Committee, which consists of the City Manager, Assistant City Manager, and Department heads.

The Emergency Preparedness and Response Committee (EPRC) will play a role in the responsibility for coordinating implementation of Plan action items and the Public Safety Department will undertake the formal review process. The City Council (or other authority) will assign representatives from City agencies, including, but not limited to, the current Hazard Mitigation Planning Team members.

Convener

The City Council will adopt the City of La Mirada Natural Hazards Mitigation Plan and the Public Safety Department will take lead responsibility for plan implementation. The City Manager will serve as a convener to facilitate the EPRC meetings dealing with the Plan, and will assign tasks such as updating and presenting the Plan to the members of the Committee. Plan implementation and evaluation will be the responsibility of Public Safety Department.

Implementation through Existing Programs

The City of La Mirada addresses statewide planning goals and legislative requirements through its General Plan, Capital Improvement Plans, Municipal Code and Building & Safety Codes. The Natural Hazards Mitigation Plan provides a series of recommendations that are closely related to the goals and objectives of these existing planning programs. The City of La Mirada will have the opportunity to implement recommended mitigation action items through existing programs and procedures.

Economic Analysis of Mitigation Projects

The Federal Emergency Management Agency's approaches to identify costs and benefits associated with natural hazard mitigation strategies or projects fall into two general categories: benefit/cost analysis and cost-effectiveness analysis. Conducting benefit/cost analysis for a mitigation activity can assist communities in determining whether a project is worth undertaking now, in order to avoid disaster-related damages later. Cost-effectiveness analysis evaluates how best to spend a given amount of money to achieve a specific goal. Determining the economic feasibility of mitigating natural hazards can provide decision makers with an understanding of the potential benefits and costs of an activity, as well as a basis upon which to compare alternative projects.

Formal Review Process

The City of La Mirada Natural Hazards Mitigation Plan will be evaluated on an annual basis to determine the effectiveness of programs, and to reflect changes in land development or programs that may affect mitigation priorities. The evaluation process includes a firm schedule and timeline, and identifies the local agencies and organizations participating in plan evaluation. The Public Safety Department will be responsible for contacting the Emergency Preparedness and Response Committee members and organizing the annual meeting. Committee members will be responsible for monitoring and evaluating the progress of the mitigation strategies in the Plan.

Continued Public Involvement

The City of La Mirada is dedicated to involving the public directly in the continual review and update of the Hazard Mitigation Plan. Copies of the plan will be catalogued and made available through the City Clerk's office located in City Hall. The existence and location of these copies will be publicized in City newsletters and the City's website. The Plan also includes the address and the phone number of the City Clerk's office, which is responsible for keeping track of public comments on the Plan.

City of La Mirada Mitigation Actions Matrix

Natural Hazard	Action Item	Coordinating Organization	Timeline	Plan Goals Addressed				
				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services
Multi-Hazard Action Items								
MH #1-1	Establish an Emergency Preparedness & Response Committee (EPRC) to advise and support the Public Safety Department in the development of direction and policy related to emergency preparedness and response in La Mirada. EPRC to meet monthly.	Public Safety Department and EPRC	1 year	X	X	X	X	X
MH #1-2	Integrate the goals and action items from the La Mirada Natural Hazards Mitigation Plan into existing regulatory documents and programs, where appropriate.	EPRC, Public Safety Department, and Community Development Department	Ongoing	X	X		X	
MH #1-3	Identify and pursue funding opportunities to develop and implement local mitigation activities.	Public Safety Department	Ongoing				X	
MH #1-4	Develop a sustainable process for implementing, monitoring, and evaluating citywide mitigation activities.	Public Safety Department	1 - 2 years				X	

City of La Mirada Mitigation Actions Matrix

Natural Hazard	Action Item	Coordinating Organization	Timeline	Plan Goals Addressed				
				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services
MH #1-5	Identify, improve, and sustain collaborative relationships with internal and external entities to avoid activity that increases risk to natural hazards.	EPRC	Ongoing	X	X	X	X	
MH #1-6	Develop inventories of City owned and operated at-risk buildings and infrastructure and prioritize mitigation projects.	Community Development and Public Works Departments	1-2 Years	X			X	
MH #1-7	Strengthen emergency services preparedness and response by linking emergency services with natural hazard mitigation activities and enhancing local public education.	Public Safety Department	Ongoing	X	X		X	X
MH #1-8	Develop, enhance, and implement education activities aimed at mitigating natural hazards, and reducing the risk to citizens, public agencies, private property owners, businesses, and schools.	Public Safety Department	Ongoing	X	X		X	X

City of La Mirada Mitigation Actions Matrix

Natural Hazard	Action Item	Coordinating Organization	Timeline	Plan Goals Addressed				
				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services
MH #1-9	Analyze all-hazards warning systems and make recommendations for improvements.	Public Safety Department	1-2 years	X	X			X
MH #1-10	Identify existing mutual aid systems at the local level.	Public Safety Department	1-2 years	X			X	X
MH #1-11	Identify utility and communications systems operated by the City and retrofit or relocate systems if needed to withstand the impacts of disasters.	Public Safety Department	1-3 years	X				X
MH #1-12	Improve the City's capability to identify areas needing future mitigation.	Public Safety Department and EPRC	Ongoing	X		X		X
MH #1-13	Improve the community's capability to identify areas needing future mitigation.	Public Safety Department and EPRC	Ongoing	X	X	X	X	X
MH #1-14	Consider revising the Zoning and Subdivision Ordinance to require the utilization of various pervious surfaces within the floodplain in order to reduce storm water runoff.	Community Development and Public Works Departments	Ongoing			X		

City of La Mirada Mitigation Actions Matrix

Natural Hazard	Action Item	Coordinating Organization	Timeline	Plan Goals Addressed				
				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services
MH #1-15	Consider the purchase of a complete GIS/GPS system and training for system implementation.	Public Works Department and EPRC	3-5 years	X		X		X
MH #1-16	Maintain Unmet Drainage Needs Report.	Public Works Department	Ongoing	X		X		X
MH #1-17	Review observed damage with a view toward revising codes to help mitigate damage from future disasters.	Community Development Department	Ongoing	X				X
MH #1-18	Determine appropriate locations for disposal of disaster/restoration debris.	Public Works Department	Ongoing	X		X		
MH #1-19	Continue to underground utility lines.	Public Works Department	Ongoing	X				X
MH #1-20	Following a disaster, conduct damage assessment to determine if structures are safe and capable of being used.	Building and Safety Department	Ongoing	X				
MH #1-21	Develop an understanding of the National Flood Insurance Program (NFIP) requirements for new	Community Development Department	Ongoing	X				

City of La Mirada Mitigation Actions Matrix

Natural Hazard	Action Item	Coordinating Organization	Timeline	Plan Goals Addressed				
				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services
	construction and substantially improved buildings and implement as appropriate.							
MH #1-22	Coordinate the efforts of the Federal Insurance Administration (FIA) and the U.S. Army Corps of Engineers (COE) as needed.	Public Works Department	Ongoing	X		X		X
MH #1-23	Improve water quality, protect wildlife habitats, encourage waterfront revitalization, enhance recreational opportunities, and balance public and private property rights.	Community Development and Public Works Departments	Ongoing	X		X		X
MH #1-24	Determine the necessity and/or desirability of establishing a general reconstruction policy.	Community Development Department	1-2 years	X	X			
MH #1-25	Determine how, when, and under what circumstances government will demolish structures.	Community Development Department	As Needed	X	X			
MH #1-26	Limit activities in identified potential and historical landslide areas through regulation and public outreach.	Community Development Department	Ongoing	X	X			X

City of La Mirada Mitigation Actions Matrix

Natural Hazard	Action Item	Coordinating Organization	Timeline	Plan Goals Addressed				
				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services
MH #1-27	Develop updates for the Natural Hazards Mitigation Action Plan based on new information.	Public Safety Department and EPRC	Ongoing	X	X	X	X	X
MH #1-28	Determine and review priorities for restoration of the community's infrastructure and vital public facilities following a disaster.	Community Development and Public Works Departments	1-2 years	X				X
MH #1-29	Create a database with information to track the status of repair or reconstruction.	Public Works Department	1-2 years		X			X
MH #1-30	Establish policy to ensure mitigation projects for critical facilities, services, and infrastructure.	Community Development and Public Works Departments	1-2 years	X				X
MH #1-31	Evaluate back-up power in critical facilities and make recommendations as necessary.	Public Works Department	1-2 years					X
MH #1-32	Identify existing buildings that may be used as shelters and recommend acquisition of necessary equipment.	Public Works and Community Services Departments	1 year					X

City of La Mirada Mitigation Actions Matrix

Natural Hazard	Action Item	Coordinating Organization	Timeline	Plan Goals Addressed				
				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services
MH #1-33	Work with interested parties, including animal control and others on animal-specific evacuation and sheltering needs.	Public Safety Department	1-2 years		X		X	
MH #1-34	Evaluate CERT classes to determine if this is a viable program for interested citizens in the City to assist their neighbors during emergencies. Make appropriate recommendations for program implementation.	Public Safety Department	1 year	X	X			X
MH #1-35	Publicize the documents associated with emergency response and mitigation.	Public Safety and Community Services Departments	1-2 years		X		X	
MH #1-36	Develop and implement education and outreach programs to increase public awareness of the risks associated with natural hazards.	Public Safety Department	Ongoing		X			
MH #1-37	Send news releases to local media about pre-disaster information.	Public Safety Department	Ongoing	X	X			

City of La Mirada Mitigation Actions Matrix

Natural Hazard	Action Item	Coordinating Organization	Timeline	Plan Goals Addressed				
				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services
MH #1-38	Coordinate with the American Red Cross and other entities to provide a variety of courses, including: CPR, Basic First Aid, Introduction to Disaster Services, Mass Care, Shelter Operations, babysitting, Healthcare Provider, pet first-aid and others as appropriate.	Public Safety Department and Community Services Department	Ongoing	X	X		X	X
MH #1-39	Utilize the City's website, press releases, local media and public displays to encourage community awareness of and use of resources provided by agencies such as the American Red Cross, Community Awareness and Emergency Response, and the Disaster Preparedness Steering Committee.	Public Safety and Community Services Departments	Ongoing		X		X	
MH #1-40	Distribute FEMA's or other emergency preparedness materials to local businesses.	Public Safety Department	Ongoing		X			

City of La Mirada Mitigation Actions Matrix

Natural Hazard	Action Item	Coordinating Organization	Timeline	Plan Goals Addressed				
				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services
MH #1-41	Promote public education for the residential and business communities to increase awareness of hazards and opportunities for mitigation.	Public Safety and Community Services Departments	Ongoing		X		X	
MH #1-42	Encourage interested individuals to participate in hazard mitigation planning and training activities.	Public Safety Department	Ongoing	X	X		X	
MH #1-43	Monitor and publicize the effectiveness of mitigation initiatives implemented in the community.	Public Safety Department	1-2 years		X			
MH #1-44	Educate the public about emergency sheltering and evacuation procedures.	Public Safety Department	Ongoing	X	X			X
MH #1-45	Conduct full-scale and table top exercises that include evaluation tools that will identify critical performance expectations for each EOC section every year.	Public Safety Department and EPRC	Ongoing		X			X
MH #1-46	Train City staff in unified command using the SEMS model. Understanding the role of each	Public Safety Department	Ongoing		X		X	X

City of La Mirada Mitigation Actions Matrix

Natural Hazard	Action Item	Coordinating Organization	Timeline	Plan Goals Addressed				
				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services
	section will result in a cohesive performance of participants' assigned tasks yielding an overall emergency response that is not only effective, but rapid with optimal outcome.							
MH #1-47	Review and update the Multi-Hazard Functional Plan and ensure appropriate adoption when needed.	Public Safety Department	1-2 years		X			
MH #1-48	Evaluate whether the City has the capability to communicate with all EOC agencies with redundant backups in voice and data communications.	Public Safety Department	1-2 years	X			X	
MH #1-49	Develop plan to locate, set up, and manage temporary sites where government functions and business as needed can continue their operations during recovery.	Public Safety Department and EPRC	1-2 years	X				X

City of La Mirada Mitigation Actions Matrix

Natural Hazard	Action Item	Coordinating Organization	Timeline	Plan Goals Addressed				
				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services
MH #1-50	Conduct site plan review to determine new constructions, repair and reconstruction of damaged structures.	Community Development Department	Ongoing	X				
MH #1-51	Promote hazard mitigation as a public value in recognition of its importance to the health, safety, and welfare of the population.	Public Safety Department	1-2 years	X	X	X	X	X
MH #1-52	Engage the private sector to participate in disaster preparedness and loss reduction.	Public Safety Department	Ongoing	X	X		X	X
MH #1-53	Write and administer appropriate grants to enhance all agencies/departments' incident response capabilities.	Public Safety Department	1-2 years			X	X	
MH #1-54	Incorporate the building inventory into the hazard assessment.	Community Development Department	1-2 years	X	X			X
MH #1-55	Adoption of Uniform Building Code by municipality as appropriate.	Community Development Department	Ongoing	X	X		X	X
MH #1-56	Develop policy for structures damaged during a disaster.	Community Development Department	2-3 years	X			X	X

City of La Mirada Mitigation Actions Matrix

Natural Hazard	Action Item	Coordinating Organization	Timeline	Plan Goals Addressed				
				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services
MH #1-57	Identify temporary protection measures for contents of a building to protect against further damage and publicize information.	Public Safety Department	1-2 years	X	X		X	X
MH #1-58	Ensure compliance to rebuilding in conformance with applicable codes, specifications, and standards.	Community Development and Public Safety Departments	Ongoing	X	X		X	
MH #1-59	Ensure repairs or construction funded by Federal disaster assistance conform to applicable codes and standards.	Community Development Department	Ongoing	X	X		X	X
MH #1-60	Minimize any adverse impacts on the natural resources and functions of floodplains according to local codes.	Community Development Department	Ongoing		X		X	
MH #1-61	Continue to enforce the Uniform Building Code.	Community Development and Public Safety Departments	Ongoing		X		X	

City of La Mirada Mitigation Actions Matrix

Natural Hazard	Action Item	Coordinating Organization	Timeline	Plan Goals Addressed				
				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services
Earthquake Action Items								
EQ #2-1	Review the Disaster Route Plan of Los Angeles County and determine the necessity or desirability of incorporating the evacuation routes or ingress routes designated for goods/equipment delivery into appropriate City planning documents.	Public Safety Department	1-2 years				X	
EQ #2-2	Encourage reduction of nonstructural and structural earthquake hazards in homes, schools, businesses, and government offices.	Public Safety Department	1-2 years	X	X		X	
EQ #2-3	Integrate updated earthquake hazard mapping information and improve technical analysis of earthquake hazards.	Public Safety and Public Works Departments	2-3 years	X		X		X
EQ #2-4	Identify current landslide warning systems to ensure effectiveness and efficiency and increase coordination between local jurisdictions and the state for landslide warning systems.	Public Safety Department and EPRC	1-2 years	X	X	X		X

City of La Mirada Mitigation Actions Matrix

Natural Hazard	Action Item	Coordinating Organization	Timeline	Plan Goals Addressed				
				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services
EQ #2-5	Evaluate earthquake damage risk and possible retrofitting of critical facilities.	Public Works Department	1-2 years	X				X
Flood Action Items								
FLD #3-1	Identify potential repetitive flood property within the City of La Mirada and identify feasible mitigation options.	Community Development and Public Works Departments	1-2 years	X			X	
FLD #3-2	Comply with federal, state, and county requirements for development within the floodplain, where appropriate.	Community Development Department	Ongoing	X				
FLD #3-3	Identify surface water drainage obstructions for all parts of the City.	Public Works Department	Ongoing	X				
FLD #3-4	Review and amend where necessary nonstructural measures for regulations, flood warning, preparedness, and flood insurance.	Public Works Department	Ongoing	X		X		X

City of La Mirada Mitigation Actions Matrix

Natural Hazard	Action Item	Coordinating Organization	Timeline	Plan Goals Addressed				
				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services
FLD #3-5	Protect surrounding surface water and ecosystems from pollutants often associated with flooding and storm water runoff through ecological and mechanical methods.	Public Works Department	Ongoing			X		
FLD #3-6	Comply with current regulations that require any building that has been substantially damaged, for any reason, must be brought into compliance with the NFIP regulations.	Community Development Department	Ongoing	X	X	X	X	
Wildfire Action Items								
WF #4-1	Work with emergency services to increase the efficiency of wildfire response and recovery activities.	Public Safety Department	2 years	X				X
WF #4-2	Inventory alternative firefighting water sources where appropriate.	Public Safety Department	1-2 years	X				X
WF #4-3	Coordinate outreach and education programs aimed at mitigating wildfire hazards.	Public Safety Department	1-2 years	X	X			

City of La Mirada Mitigation Actions Matrix

Natural Hazard	Action Item	Coordinating Organization	Timeline	Plan Goals Addressed				
				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services
WF #4-4	Develop a comprehensive approach to reducing the possibility of damage and loss of function due to the exposure of critical facilities and infrastructure to wildfire.	Community Development and Public Works Departments	1-3 years	X				X
WF #4-5	Improve water systems to assist with Wildfire and Drought conditions.	Community Development Department	Ongoing		X			
Landslide Mitigation Actions Items								
LS #5-1	Improve knowledge of landslide hazard areas and understanding of vulnerability and risk to life and property in hazard-prone areas.	Community Development Department	Ongoing	X	X			
LS #5-2	Encourage construction and subdivision design that can be applied to steep slopes to reduce the potential adverse impacts from development	Community Development Department	Ongoing	X		X	X	
LS #5-3	Limit activities in identified potential and historical landslide areas through regulations and public outreach.	Community Development Department	Ongoing	X	X	X		

Section 1

Introduction

Throughout history, the people residing in what is present day La Mirada have dealt with the various natural hazards affecting the area. Photos, journal entries, and newspapers from the 1800's show that the residents of the area dealt with earthquakes, flooding, land movement, and wildfires.

Although there were fewer people in the area, the natural hazards adversely affected the lives of those who depended on the land and climate conditions for food and welfare. As the population of the City continues to increase, the exposure to natural hazards creates an even higher risk than previously experienced.

The City of La Mirada is the 40th most populous city in Los Angeles County, and offers the benefits of living in a Mediterranean type of climate. The City is characterized by the unique and attractive landscape that makes the area so popular. However, the potential impacts of natural hazards associated with the terrain make the environment and population vulnerable to natural disasters.

The City is subject to earthquakes, flooding, landslides, and wildfires. It is impossible to predict exactly when these disasters will occur, or the extent to which they will affect the City. However, with careful planning and collaboration among public agencies, private sector organizations, and citizens within the community, it is possible to minimize the losses that can result from these natural disasters.

Why Develop a Mitigation Plan?

As the cost of damage from natural disasters continues to increase, the community realizes the importance of identifying effective ways to reduce vulnerability to disasters. Natural hazard mitigation plans assist communities in reducing risk from natural hazards by identifying resources, information, and strategies for risk reduction, while helping to guide and coordinate mitigation activities throughout the City.

The plan provides a set of action items to reduce risk from natural hazards through education and outreach programs and to foster the development of partnerships, and implementation of preventative activities such as land use programs that restrict and control development in areas subject to damage from natural hazards.

The resources and information within the Mitigation Plan:

- (1) establish a basis for coordination and collaboration among agencies and the public in City of La Mirada;
- (2) identify and prioritize future mitigation projects; and

(3) assist in meeting the requirements of federal assistance programs.

The mitigation plan works in conjunction with other City plans, including the Multi-Hazard Functional Plan.

Whom Does the Mitigation Plan Affect?

The City of La Mirada Natural Hazards Mitigation Plan affects the entire city. Map 1-1 shows major roads in the City of La Mirada. This plan provides a framework for planning for natural hazards. The resources and background information in the plan is applicable City-wide, and the goals and recommendations can lay groundwork for other local mitigation plans and partnerships.

**Map 1-1: Base Map of City of La Mirada
(Source: City of La Mirada General Plan)**

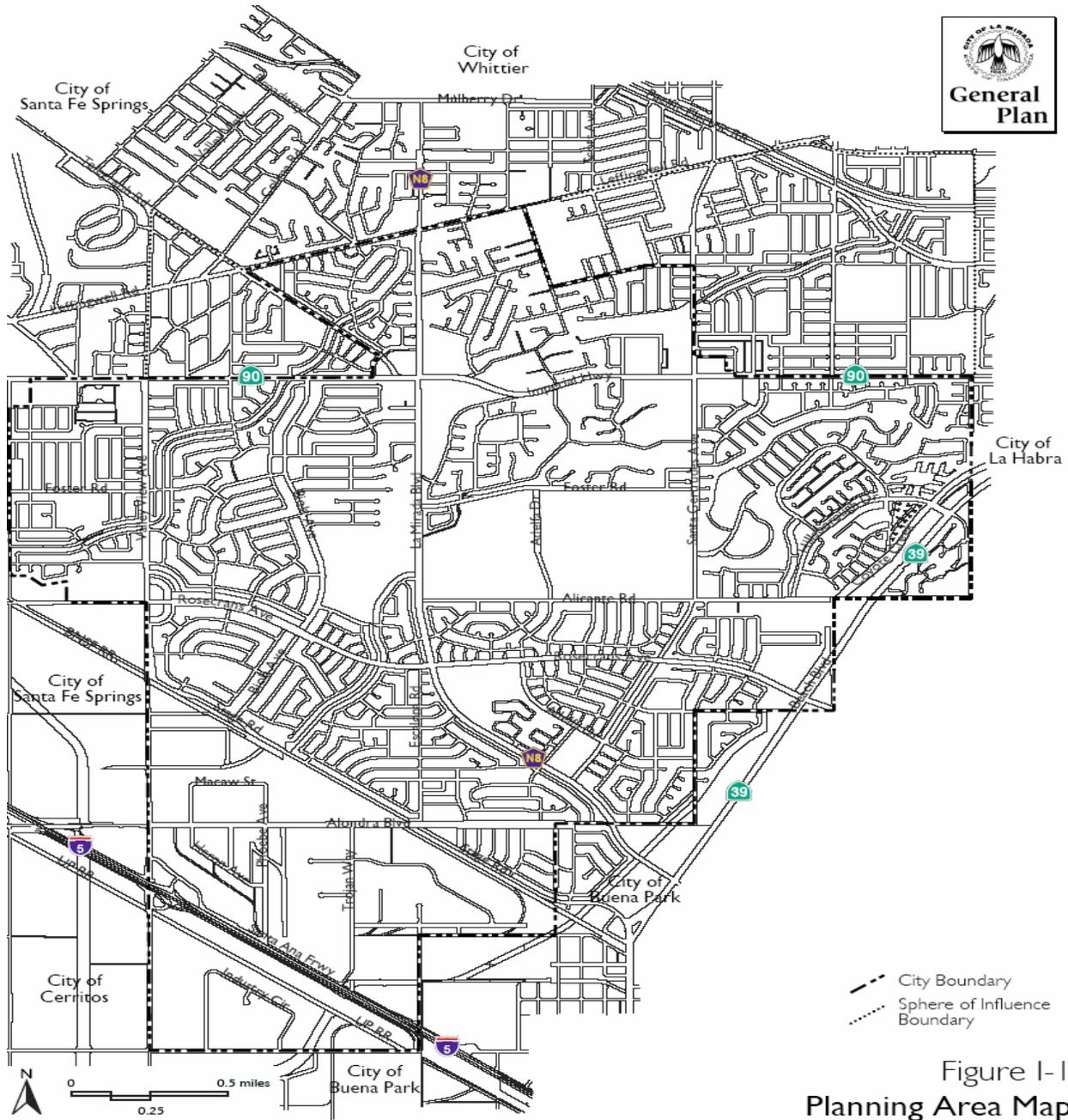


Figure I-1
Planning Area Map

Natural Hazard Land Use Policy in California

Planning for natural hazards should be an integral element of any city's land use planning program. All California cities and counties have General Plans and the implementing ordinances that are required to comply with the statewide planning regulations.

The continuing challenge faced by local officials and state government is to keep the network of local plans effective in responding to the changing conditions and needs of California's diverse communities, particularly in light of the very active seismic region in which we live.

This is particularly true in the case of planning for natural hazards where communities must balance development pressures with detailed information on the nature and extent of hazards.

Planning for natural hazards, calls for local plans to include inventories, policies, and ordinances to guide development in hazard areas. These inventories should include the compendium of hazards facing the community, the built environment at risk, the personal property that may be damaged by hazard events and most of all, the people who live in the shadow of these hazards.

Support for Natural Hazard Mitigation

All mitigation is local, and the primary responsibility for development and implementation of risk reduction strategies and policies lies with local jurisdictions. Local jurisdictions, however, are not alone. Partners and resources exist at the regional, state and federal levels. Numerous California state agencies have a role in natural hazards and natural hazard mitigation. Some of the key agencies include:

- The Governor's Office of Emergency Services (OES) is responsible for disaster mitigation, preparedness, response, recovery, and the administration of federal funds after a major disaster declaration;
- The Southern California Earthquake Center (SCEC), gathers information about earthquakes, integrates this information on earthquake phenomena, and communicates this to end-users and the general public to increase earthquake awareness, reduce economic losses, and save lives.
- The California Division of Forestry (CDF) is responsible for all aspects of wildland fire protection on private, state, and administers forest practices regulations, including landslide mitigation, on non-federal lands.
- The California Division of Mines and Geology (DMG) is responsible for geologic hazard characterization, public education, the development of

partnerships aimed at reducing risk, and exceptions (based on science-based refinement of tsunami inundation zone delineation) to state mandated tsunami zone restrictions; and

- The California Division of Water Resources (DWR) plans, designs, constructs, operates, and maintains the State Water Project; regulates dams; provides flood protection and assists in emergency management. It also educates the public, serves local water needs by providing technical assistance

Plan Methodology

Information in the Mitigation Plan is based on research from a variety of sources. Staff from the City of La Mirada conducted data research and analysis, facilitated Planning Team meetings and public outreach activities, and developed the final mitigation plan. The research methods and various contributions to the plan include:

Input from the Planning Team

The Planning Team convened four times to guide development of the Mitigation Plan. The Team played an integral role in developing the mission, goals, and action items for the Mitigation Plan. The Team consisted of representatives of the following local government entities:

City of La Mirada City Manager's Office
City of La Mirada Community Development Department
City of La Mirada Public Works Department
City of La Mirada Public Safety Department
Office of Disaster Management, Area E

Public Involvement

The City of La Mirada encouraged public participation and input in the Natural Hazards Mitigation Plan by posting its activities in various City publications and on the internet. The Plan was presented to the City's Public Safety Commission on August 26, 2004. The Planning Commission reviewed the Plan on September 16, 2004 and the Plan was also be presented to the to Council on September 21, 2004. City staff also distributed copies of the Plan to various City facilities. Members of the Planning and Public Safety Commissions, as well as the City Council also received copies of the Plan. Citizens were encouraged to review public copies of the Plan Draft and participate in the development of the Plan. The data and support gained from the review process proved to be valuable to the overall planning effort. A complete synopsis of the public involvement is located in Appendix B: Public Participation.

State and federal guidelines and requirements for mitigation plans:

Following are the Federal requirements for approval of a Natural Hazards Mitigation Plan:

- Open public involvement, with public meetings that introduce the process and project requirements.
- The public must be afforded opportunities for involvement in: identifying and assessing risk, drafting a plan, and public involvement in approval stages of the plan.
- Community cooperation, with opportunity for other local government agencies, the business community, educational institutions, and non-profit organizations to participate in the process.
- Incorporation of local documents, including the local General Plan, the Zoning Ordinance, the Building Codes, and other pertinent documents.

The following components must be part of the planning process:

- Complete documentation of the planning process.
- A detailed risk assessment on hazard exposures in the community.
- A comprehensive mitigation strategy, which describes the goals and objectives, including proposed strategies, programs and actions to avoid long-term vulnerabilities.
- A plan maintenance process, which describes the method and schedule of monitoring, evaluating and updating the plan and integration of the Natural Hazards Mitigation Plan into other planning mechanisms.
- Formal adoption by the City Council.
- Plan Review by both State OES and FEMA.

These requirements are spelled out in greater detail in the following plan sections and supporting documentation.

Public participation opportunities were created through use of local media, the City's website, the Planning and Public Safety Commission meetings, and the City Council meeting. In addition, the makeup of a planning team insured a constant exchange of data and input from outside organizations.

Through its consultant, Emergency Planning Consultants, the City had access to numerous existing mitigation plans from around the country, as well as current FEMA hazard mitigation planning standards (386 series).

Other reference materials consisted of county and city mitigation plans, including:
Clackamas County (Oregon) Natural Hazards Mitigation Plan
Six County (Utah) Association of Governments
Upper Arkansas Area Risk Assessment and Hazard Mitigation Plan
Urbandale-Polk County, Iowa Plan
Hamilton County, Ohio Plan
Natural Hazard Planning Guidebook from Butler County, Ohio

Hazard specific research: City of La Mirada staff collected data and compiled research on four hazards: earthquakes, flooding, landslides, and wildfires. Research materials came from the City General Plan, the City's Threat Assessment contained in the Multi-Hazard Functional Plan, and state agencies including OES and CDF. The City of La Mirada staff conducted research by referencing historical local newspapers, and locating City of La Mirada information in historical documents. The City of La Mirada staff identified current mitigation activities, resources and programs, and potential action items from research materials.

How Is the Plan Used?

Each section of the mitigation plan provides information and resources to assist people in understanding the City and the hazard-related issues facing citizens, businesses, and the environment. Combined, the sections of the plan work together to create a document that guides the mission to reduce risk and prevent loss from future natural hazard events.

The structure of the plan enables people to use a section of interest to them. It also allows City government to review and update sections when new data becomes available. The ability to update individual sections of the mitigation plan places less of a financial burden on the City. Decision-makers can allocate funding and staff resources to selected pieces in need of review, thereby avoiding a full update, which can be costly and time-consuming. New data can be easily incorporated, resulting in a natural hazards mitigation plan that remains current and relevant to the City of La Mirada.

The mitigation plan is organized into three parts. Part I contains an executive summary, Mitigation Actions Matrix, introduction, plan maintenance and implementation. Part II contains the community profile, risk assessment, and hazard-specific sections. Part III includes the appendices. Each section of the plan is described below.

Part I: Mitigation Actions

Executive Summary: Hazard Mitigation Action Plan

The Hazard Mitigation Action Plan provides an overview of the mitigation plan mission, goals, and action items.

Attachment 1: Mitigation Actions Matrix

The plan action items are included in this section, and address multi-hazard issues, as well as hazard-specific activities that can be implemented to reduce risk and prevent loss from future natural hazard events.

Section 1: Introduction

The Introduction describes the background and purpose of developing the mitigation plan for the City of La Mirada.

Section 2: Plan Maintenance

This section provides information on plan implementation, monitoring and evaluation.

Part II: Hazard Analysis

Section 3: Community Profile

This section presents the history, geography, demographics, and socioeconomics of the City of La Mirada. It serves as a tool to provide an historical perspective of natural hazards in the City.

Section 4: Risk Assessment

This section provides information on hazard identification, vulnerability and risk associated with natural hazards in the City of La Mirada.

Sections 5-8: Hazard Specific Information

Hazard-Specific Information on the four chronic hazards is addressed in this plan. Chronic hazards occur with some regularity and may be predicted through historic evidence and scientific methods. The chronic hazards addressed in the plan include:

- Section 5: Earthquake
- Section 6: Flooding
- Section 7: Landslides
- Section 8: Wildfires

Each of the hazard-specific sections includes information on the history, hazard causes and characteristics, hazard assessment, goals and action items, and local, state, and national resources.

Part III: Resources

The plan appendices are designed to provide users of the City of La Mirada Natural Hazards Mitigation Plan with additional information to assist them in understanding the contents of the mitigation plan, and potential resources to assist them with implementation.

Appendix A: Plan Resource Directory

The resource directory includes City, regional, state, and national resources and programs that may be of technical and/or financial assistance to City of La Mirada during plan implementation.

Appendix B: Public Participation Process

This appendix includes specific information on the various public processes used during development of the plan.

Appendix C: Benefit Cost Analysis

This section describes FEMA's requirements for benefit cost analysis in natural hazards mitigation, as well as various approaches for conducting economic analysis of proposed mitigation activities.

Appendix D: List of Acronyms

This section provides a list of acronyms for City, regional, state, and federal agencies and organizations that may be referred to within the City of La Mirada Natural Hazards Mitigation Plan.

Appendix E: Glossary

This section provides a glossary of terms used throughout the plan.

Section 2:

Plan Maintenance

The Plan Maintenance Section of this document details the formal process that will ensure that the Natural Hazards Mitigation Plan remains an active and relevant document. The plan maintenance process includes a schedule for monitoring and evaluating the Plan annually and producing a plan revision every five years. This section describes how the City will integrate public participation throughout the plan maintenance process. Finally, this Section includes an explanation of how the City of La Mirada government intends to incorporate the mitigation strategies outlined in this Plan into existing planning mechanisms such as the City's General Plan, Capital Improvement Plans, and Building and Safety Codes.

Monitoring and Implementing the Plan

Plan Adoption

The City Council will be responsible for adopting the Natural Hazards Mitigation Plan. This governing body has the authority to promote sound public policy regarding natural hazards. Once the plan has been adopted, the City's Public Safety Department staff will be responsible for submitting it to the State Hazard Mitigation Officer at The Governor's Office of Emergency Services. The Governor's Office of Emergency Services will then submit the plan to the Federal Emergency Management Agency (FEMA) for review. This review will address the federal criteria outlined in FEMA Interim Final Rule 44 CFR Part 201. Upon acceptance by FEMA, the City will gain eligibility for Hazard Mitigation Grant Program funds.

Coordinating Body

The City's Public Safety Department will be responsible for coordinating implementation of plan action items and undertaking the formal review process. The City Manager will assign representatives from City agencies, including, but not limited to, the current Hazard Mitigation Planning Team members. The City will utilize the Emergency Preparedness and Response Committee, which consists of the City Manager, Assistant City Manager and various staff:

City of La Mirada – John Di Mario, Assistant City Manager/Community Development Director
City of La Mirada - Steve Forster, Public Works Director, Public Works Department
City of La Mirada - Steven Mendoza, City Planner, Community Development Department
City of La Mirada - Daniel Parra, Administrative Aide, Public Safety Department

The Emergency Preparedness and Response Committee will focus its attention on the Natural Hazards Mitigation Plan semi-annually. These meetings will provide an opportunity to discuss the progress of the action items and maintain the partnerships that are essential for the sustainability of the mitigation plan.

Convener

The City Council will adopt the Natural Hazards Mitigation Plan, and the Emergency Preparedness and Response Committee will take responsibility for plan implementation. The City Manager (or designee) will serve as a convener to facilitate the Committee meetings, and will assign tasks such as updating and presenting the Plan to the members of the Committee. Plan implementation and evaluation will be a shared responsibility among all of the Committee members.

Implementation through Existing Programs

The City addresses statewide planning goals and legislative requirements through its General Plan, Capital Improvement Plans, and City Building and Safety Codes. The Natural Hazards Mitigation Plan provides a series of recommendations - many of which are closely related to the goals and objectives of existing planning programs. The City will have the opportunity to implement recommended mitigation action items through existing programs and procedures.

The City's Building & Safety Department is responsible for administering the Building & Safety Codes. In addition, the Committee will work with other agencies at the state level to review, develop and ensure Building & Safety Codes that are adequate to mitigate or prevent damage by natural hazards. This is to ensure that life-safety criteria are met for new construction.

The goals and action items in the mitigation plan may be achieved through activities recommended in the City's Capital Improvement Plans (CIP). Various City departments participate in the development of the CIP plan, which is reviewed on an annual basis. Upon annual review of the CIP, the Committee will work with the City departments to identify action items in the Natural Hazards Mitigation Plan consistent with CIP planning goals and integrate them where appropriate.

Within six months of formal adoption of the Mitigation Plan, the recommendations listed above will be incorporated into the process of existing planning mechanisms at the City level. The meetings of the Committee will provide an opportunity for Committee members to report back on the progress made on the integration of mitigation planning elements into the City's planning documents and procedures.

Economic Analysis of Mitigation Projects

FEMA's approaches to identify the costs and benefits associated with natural hazard mitigation strategies, measures, or projects fall into two general categories: benefit/cost analysis and cost-effectiveness analysis.

Conducting benefit/cost analysis for a mitigation activity can assist communities in determining whether a project is worth undertaking now, in order to avoid disaster-related damages later.

Cost-effectiveness analysis evaluates how best to spend a given amount of money to achieve a specific goal. Determining the economic feasibility of mitigating natural hazards can provide decision-makers with an understanding of the potential benefits and costs of an activity, as well as a basis upon which to compare alternative projects.

Given federal funding, the Committee will use a FEMA-approved benefit/cost analysis approach to identify and prioritize mitigation action items. For other projects and funding sources, the Committee will use other approaches to understand the costs and benefits of each action item and develop a prioritized list. For more information regarding economic analysis of mitigation action items, please see Appendix C: Benefit/Cost Analysis.

Evaluating and Updating the Plan

Formal Review Process

The Natural Hazards Mitigation Plan will be evaluated on an annual basis to determine the effectiveness of programs, and to reflect changes in land development or programs that may affect mitigation priorities. The evaluation process includes a firm schedule and timeline, and identifies the local agencies and organizations participating in plan evaluation. The convener or designee will be responsible for contacting the Committee members and organizing the quarterly meeting.

Committee members will be responsible for monitoring and evaluating the progress of the mitigation strategies in the Plan.

The Committee will review the goals and action items to determine their relevance to changing situations in the City, as well as changes in State or Federal policy, and to ensure they are addressing current and expected conditions. The Committee will also review the Risk Assessment portion of the Plan to determine if this information should be updated or modified, given any new available data. The coordinating organizations responsible for the various action items will report on the status of their projects, the success of various implementation processes, difficulties encountered, success of coordination

efforts, and which strategies should be revised.

The convener will assign the duty of updating the plan to one or more of the Committee members. The designated Committee members will have three months to make appropriate changes to the Plan before submitting it to the Committee members, and presenting it to the City Council (or other authority). The Committee will also notify all holders of the City's Plan when changes have been made. Every five years the updated Plan will be submitted to the State Hazard Mitigation Officer and the Federal Emergency Management Agency for review.

Continued Public Involvement

The City is dedicated to involving the public directly in review and updates of the Natural Hazards Mitigation Plan. The Committee members are responsible for the annual review and update of the plan.

The public will also have the opportunity to provide feedback about the Plan. Copies of the Plan will be catalogued and kept at the City Clerk's office. The existence and location of these copies will be publicized in the quarterly City newsletters, which reaches every household in the City. The plan also includes the address and the phone number of the City Clerk's office, which responsible for keeping track of public comments on the Plan.

In addition, copies of the Plan and any proposed changes will be posted on the City's Website. This site will also contain an email address and phone number to which people can direct their comments and concerns.

A public meeting will also be held after each annual evaluation or as deemed necessary by the Committee. The meetings will provide the public a forum for which they can express its concerns, opinions, or ideas about the Plan. The City Public Information Officer will be responsible for using City resources to publicize the annual public meetings and maintain public involvement through the various City publications, the City's Website, and local newspapers.

Section 3:

Community Profile

Why Plan for Natural Hazards in City of La Mirada?

Natural hazards impact citizens, property, the environment, and the economy of City of La Mirada. Earthquakes, flooding, landslides, and wildfires have exposed City of La Mirada residents and businesses to the financial and emotional costs of recovering after natural disasters. The risk associated with natural hazards increases as more people move to areas affected by natural hazards.

Even in those communities that are essentially “built-out” i.e., have little or no vacant land remaining for development; population density continues to increase when low density housing is replaced with medium and high density development projects.

The inevitability of natural hazards, and the growing population and activity within the City create an urgent need to develop strategies, coordinate resources, and increase public awareness to reduce risk and prevent loss from future natural hazard events. Identifying the risks posed by natural hazards, and developing strategies to reduce the impact of a hazard event can assist in protecting life and property of citizens and communities. Local residents and businesses can work together with the City to create a natural hazards mitigation plan that addresses the potential impacts of hazard events.

Geography and the Environment

City of La Mirada has an area of 7.78 square miles and is located in southeastern Los Angeles County.

The elevation at the La Mirada City Hall is 115 feet. The vicinity is urbanized and relatively flat with a few rolling hills.

Community Profile

The City of La Mirada is as rich in history. The City of La Mirada was incorporated on March 23rd, 1960.

According to the City’s General Plan, the City of La Mirada is served by Interstate 5 and the major arterial highways are Alondra Boulevard, Artesia Boulevard, Beach Boulevard, Firestone Boulevard North, Hillsborough Drive, Imperial Highway, La Mirada Boulevard, Leffingwell Road, Rosecrans Avenue, Santa Gertrudes Avenue, Telegraph Road, and Valley View Avenue. The minor roads are Adelfa Road, Alicante Road, Biola Avenue, Firestone Boulevard South, Foster Road, Knott Avenue, Marquardt Avenue, Stage Road, and Trojan Way.

The Union Pacific Railroad and the Burlington Northern/Santa Fe traverse the City of La Mirada.

Major Rivers

The nearest major river is the San Gabriel however the City's General Plan identifies La Mirada Creek, Milan Creek, and Coyote Creek as the only potential riverine flooding risks. The river channel is part of the County Flood Control District.

Climate

Average temperatures in the City of La Mirada range from 58 degrees in the winter months to 75 degrees in the summer months. However the temperatures can vary over a wide range, particularly when the Santa Ana winds blow, bringing higher temperatures and very low humidity. Temperatures rarely exceed 86 degrees in the summer months (June - September), and rarely drop below 46 degrees in the winter months (November-March).

Rainfall in the city averages 14.7 inches of rain per year.

Furthermore, actual rainfall in Southern California tends to fall in large amounts during sporadic and often heavy storms rather than consistently over storms at somewhat regular intervals. In short, rainfall in Southern California might be characterized as feast or famine within a single year. Because the metropolitan basin is largely built out, water originating in higher elevation communities can have a sudden impact on adjoining communities that have a lower elevation.

Minerals and Soils

The characteristics of the minerals and soils present in the City of La Mirada indicate that potential types of hazards that may occur. Rock hardness and soil characteristics can determine whether or not an area will be prone to geologic hazards such as earthquakes, liquefaction and landslides.

The natural soil consists predominately of silty clays and clayey silts with some layers of silty sands and sands. The clays and silts are stiff to hard and the silty sand and sand layers are dense. The upper one to two feet of the soil are somewhat weaker than the underlying materials.

Other Significant Geologic Features

The City of La Mirada, like most of the Los Angeles Basin, lie over the area of one or more known earthquake faults, and potentially many more unknown faults, particularly so-called lateral or blind thrust faults.

The City's General Plan and Multi-Hazard Functional Plan identify the following major faults as potential threats to the City of La Mirada:

- San Andreas
- Newport Inglewood
- Whittier-Elsinore
- Norwalk
- San Jacinto
- Verdugo

The Los Angeles Basin has a history of powerful and relatively frequent earthquakes, dating back to the powerful 8.0+ San Andreas earthquake of 1857 which did substantial damage to the relatively few buildings that existed at the time. Paleoseismological research indicates that large (8.0+) earthquakes occur on the San Andreas fault at intervals between 45 and 332 years with an average interval of 140 years¹. Other lesser faults have also caused very damaging earthquakes since 1857. Notable earthquakes include the Long Beach earthquake of 1933, the San Fernando Earthquake of 1971, the 1987 Whittier Earthquake and the 1994 Northridge Earthquake.

In addition, many areas in the Los Angeles Basin have sandy soils that are subject to liquefaction. The City of La Mirada has liquefaction zones and is discussed in Section 5: Earthquake.

The City of La Mirada also has areas with landslide potential. The General Plan identifies the northeastern portion of the city as an area with earthquake induced landslide potential.

Population and Demographics

The City of La Mirada has a population of about 50,136 in an area of 7.78 square miles. The population of the City of La Mirada has steadily increased from the mid 1800's through 2000, and increased 18.3% from 1990 to 2000 according to the 2000 State Department of Finance.

The increase of people living in the City of La Mirada creates more community exposure, and changes how agencies prepare for and respond to natural hazards. For example, more people living on the urban fringe can increase risk of fire. Wildfire has an increased chance of starting due to human activities in the urban/rural interface, and has the potential to injure more people and cause more property damage. But an urban/wildland fire is not the only exposure to the City of La Mirada. In the 1987 publication, Fire Following Earthquake issued by the

¹ Peacock, Simon M.,
<http://aamc.geo.lsa.umich.edu/eduQuakes/EQpredLab/EQprediction.peacock.html>

All Industry Research Advisory Council, Charles Scawthorn explains how a post-earthquake urban conflagration would develop. The conflagration would be started by fires resulting from earthquake damage, but made much worse by the loss of pressure in the fire mains, caused by either lack of electricity to power water pumps, and/or loss of water pressure resulting from broken fire mains.

Furthermore, increased density can affect risk. For example, narrower streets are more difficult for emergency service vehicles to navigate, the higher ratio of residents to emergency responders affects response times, and homes located closer together increase the chances of fires spreading.

The City of La Mirada is experiencing a moderate amount of in-fill building, which is increasing the population density creating greater service loads on the built infrastructure, including roads, water supply, sewer services and storm drains.

Natural hazards do not discriminate, but the impacts in terms of vulnerability and the ability to recover vary greatly among the population. According to Peggy Stahl of the Federal Emergency Management Agency (FEMA) Preparedness, Training, and Exercise Directorate, 80% of the disaster burden falls on the public, and within that number, a disproportionate burden is placed upon special needs groups: women, children, minorities, and the poor.²

According to the 2000 census figures, the demographic make up of the city is as follows:

	City of La Mirada
Caucasian	47.1%
Hispanic	33.5%
African American	2.3%
Asian	16.0%
Native American	1.4%

The ethnic and cultural diversity suggests a need to address multi-cultural needs and services.

Although the percentage of poverty in City of La Mirada (5.6%) is about 40% that of the state's (13.7%), 6.1% of the people living in poverty in City of La Mirada are under 18 years old, and 4.5% are over 65.

Vulnerable populations, including seniors, disabled citizens, women, and children, as well as those people living in poverty, may be disproportionately impacted by natural hazards.

² www.fema.gov

Examining the reach of hazard mitigation policies to special needs populations may assist in increasing access to services and programs. FEMA's Office of Equal Rights addresses this need by suggesting that agencies and organizations planning for natural disasters identify special needs populations, make recovery centers more accessible, and review practices and procedures to remedy any discrimination in relief application or assistance.

The cost of natural hazards recovery can place an unequal financial responsibility on the general population when only a small proportion may benefit from governmental funds used to rebuild private structures. Discussions about natural hazards that include local citizen groups, insurance companies, and other public and private sector organizations can help ensure that all members of the population are a part of the decision-making processes.

Land and Development

Development in Southern California from the earliest days was a cycle of boom and bust. The Second World War, however dramatically changed that cycle. Military personnel and defense workers came to Southern California to fill the logistical needs created by the war effort. The available housing was rapidly exhausted and existing commercial centers proved inadequate for the influx of people. Immediately after the war, construction began on the freeway system, and the face of Southern California was forever changed. Home developments and shopping centers sprung up everywhere and within a few decades the central basin of Los Angeles County was virtually built out. This pushed new development further and further away from the urban center.

The City of La Mirada General Plan addresses the use and development of private land, including residential and commercial areas. This plan is one of the City's most important tools in addressing environmental challenges including transportation and air quality; growth management; conservation of natural resources; clean water and open spaces.

The environment of most Los Angeles County cities is nearly identical with that of their immediate neighbors and the transition from one incorporated municipality to another is seamless to most people. Seamless too are the exposures to the natural hazards that affect all of Southern California.

Housing and Community Development

	City of La Mirada
Development Type	
Residential	38%
Commercial/Industrial	21%

Open Space	31%
Housing Type	
Single-Family	12,102
Multi-Residential (20+ units)	2,889
Mobilehomes	159
Housing Statistics	
Total Available Housing Units	15,150
Owner-Occupied Housing	12,423 (82%)
Average Household Size	3.11 persons

Demand for low to medium priced homes continues to be strong. The median value of homes in the City of La Mirada is estimated at \$451,000.

Employment and Industry

Principal Employment Activities	City of La Mirada
Management, Business, and Financial Operations	14.2%
Professional Related Operations	22.2%
Service	11.9%
Sales and Office	32.4%
Farming, Fishing, and Forestry	0.0%
Construction, Extraction, and Maintenance	7.1%
Production, Transportation, and Material Moving	12.2%
Major Industries	
Retail Trade	23.3%
Finance/Insurance/Real Estate	7.3%
Services	37.8%
Agriculture	0.4%
Mining	0.0%
Construction	6.6%
Manufacturing	9%
Transportation/Communication/ Public Utilities	4.8%
Wholesale Trade	10.1%
Government	0.7%

Mitigation activities are needed at the business level to ensure the safety and welfare of workers and limit damage to industrial infrastructure. Employees are highly mobile, commuting from surrounding areas to industrial and business centers. This creates a greater dependency on roads, communications, accessibility and emergency plans to reunite people with their families. Before a natural hazard event, large and small businesses can develop strategies to prepare for natural hazards, respond efficiently, and prevent loss of life and property.

Transportation and Commuting Patterns

Private automobiles are the dominant means of transportation in Southern California and in the City of La Mirada. However, according to the general plan, the regional and local public transportation providers are as follows; Los Angeles County Metropolitan Transportation Authority, Orange County Transportation Authority, and Norwalk Transit. In addition to these services, the City promotes alternative transportation activities. The alternate transportation methods that are supported by the City of La Mirada are: bicycle routes, pedestrian routes, public transit, and air transportation.

According to the State Department of Finance, the City has a population of 50,136 and a daytime population estimated at around 19,318. According to the US Census, the mean travel time to work for the residents of the City of La Mirada is 28.4 minutes.

As stated in the City's General Plan, the City of La Mirada is served by the Interstate 5, connecting the city to adjoining parts of Los Angeles County. The City's 128 mile road system includes 16.8 miles of arterial highways, 6.6 miles of secondary collector streets, 104.9 miles of local roads, and 21 bridges. As daily transit rises, there is an increased risk that a natural hazard event will disrupt the travel plans of residents across the region, as well as local, regional and national commercial traffic.

Localized flooding can render roads unusable. A severe winter storm has the potential to disrupt the daily driving routine of hundreds of thousands of people. Natural hazards can disrupt automobile traffic and shut down local and regional transit systems.

Section 4:

Risk Assessment

What is a Risk Assessment?

Conducting a risk assessment can provide information: on the location of hazards, the value of existing land and property in hazard locations, and an analysis of risk to life, property, and the environment that may result from natural hazard events. Specifically, the five levels of a risk assessment are as follows:

1) Hazard Identification

This is the description of the geographic extent, potential intensity and the probability of occurrence of a given hazard. Maps are frequently used to display hazard identification data. The City of La Mirada identified four major hazards that affect this geographic area. These hazards - earthquakes, flooding, landslides, and wildfires - were identified through an extensive process that utilized input from the Hazard Mitigation Planning Team. The geographic extent of each of the identified hazards has been identified by the City of La Mirada utilizing the maps contained in the City's General Plan and the MHFP Threat Assessment, and are illustrated in the tables, maps, and photos listed on page iii.

2) Profiling Hazard Events

The maps help to describe the causes and characteristics of each hazard and what part of the City's population, infrastructure, and environment may be vulnerable to each specific hazard. A profile of each hazard discussed in this plan is provided in each hazard section. For a full description of the history of hazard specific events, please see the appropriate hazard chapter.

3) Vulnerability Assessment/Inventorying Assets

This is a combination of hazard identification with an inventory of the existing (or planned) property development(s) and population(s) exposed to a hazard. Critical facilities are of particular concern because these facilities provide critical products and services to the general public that are necessary to preserve the welfare and quality of life in the City and fulfill important public safety, emergency response, and/or disaster recovery functions. The critical facilities have been identified and are illustrated in Table 4-2. A description of the critical facilities in the City is also provided in this section. In addition, these tables indicate vulnerabilities to the various identified hazards.

4) Risk Analysis

Estimating potential losses involves assessing the damage, injuries, and financial

costs likely to be sustained in a geographic area over a given period of time. This level of analysis involves using mathematical models. The two measurable components of risk analysis are magnitude of the harm that may result and the likelihood of the harm occurring. Describing vulnerability in terms of dollar losses provides the community and the state with a common framework in which to measure the effects of hazards on assets. For each hazard where data was available, quantitative estimates for potential losses have been included in the hazard assessment.

5) Assessing Vulnerability/ Analyzing Development Trends

This step provides a general description of land uses and development trends within the community so that mitigation options can be considered in land use planning and future land use decisions. This plan provides a comprehensive description of the character of the City of La Mirada in the Community Profile. This description includes the geography and environment, population and demographics, land use and development, housing and community development, employment and industry, and transportation and commuting patterns. Analyzing these components of City of La Mirada can help in identifying potential problem areas and can serve as a guide for incorporating the goals and ideas contained in this mitigation plan into other community development plans.

Hazard assessments are subject to the availability of hazard-specific data. Gathering data for a hazard assessment requires a commitment of resources on the part of participating organizations and agencies. Each hazard-specific section of the plan includes a section on hazard identification using data and information from City, County or State agency sources.

Regardless of the data available for hazard assessments, there are numerous strategies the City can take to reduce risk. These strategies are described in the action items detailed in each hazard section of this Plan. Mitigation strategies can further reduce disruption to critical services, reduce the risk to human life, and alleviate damage to personal and public property and infrastructure. Action items throughout the hazard sections provide recommendations to collect further data to map hazard locations and conduct hazard assessments.

Federal Requirements for Risk Assessment

Recent federal regulations for hazard mitigation plans outlined in 44 CFR Part 201 include a requirement for risk assessment. This risk assessment requirement is intended to provide information that will help communities to identify and prioritize mitigation activities that will reduce losses from the identified hazards. There are four hazards profiled in the mitigation plan, including earthquakes, flooding, land movement, and wildfires. The Federal criteria for risk assessment and information on how the City of La Mirada Natural Hazards Mitigation Plan meets those criteria is outlined in Table 4-1 below.

Table 4-1: Federal Criteria for Risk Assessment

Section 322 Plan Requirement	How is this addressed?
Identifying Hazards	Each hazard section includes an inventory of the best available data sources that identify hazard areas. To the extent data are available; the existing maps identifying the location of the hazard were utilized. The Executive Summary and the Risk Assessment sections of the plan include a list of the hazard maps.
Profiling Hazard Events	Each hazard section includes documentation of the history, and causes and characteristics of the hazard in the City.
Assessing Vulnerability: Identifying Assets	Where data is available, the vulnerability assessment for each hazard addressed in the mitigation plan includes an inventory of all publicly owned land within hazardous areas. Each hazard section provides information on vulnerable areas in the City in the Community Issues section. Each hazard section also identifies potential mitigation strategies.
Assessing Vulnerability: Estimating Potential Losses:	The Risk Assessment Section of this mitigation plan identifies key critical facilities in the City and includes a map of these facilities. Vulnerability assessments have been completed for the hazards addressed in the plan, and quantitative estimates were made for each hazard where data was available.
Assessing Vulnerability: Analyzing Development Trends	The City of La Mirada Profile Section of this plan provides a description of the development trends in the City, including the geography and environment, population and demographics, land use and development, housing and community development, employment and industry, and transportation and commuting patterns.

Critical and Essential Facilities

Facilities critical to government response and recovery activities (i.e., life safety and property and environmental protection) include: 911 centers, emergency operations centers, police and fire stations, public works facilities, communications centers, sewer and water facilities, hospitals, bridges and roads,

shelters, and shelters. Also, facilities that, if damaged, could cause serious secondary impacts may also be considered "critical". A hazardous materials facility is one example of this type of critical facility.

Essential facilities are those facilities that are vital to the continued delivery of key government services or that may significantly impact the public's ability to recover from the emergency. These facilities may include: buildings such as the law enforcement center, public services building, and other public facilities such as schools. Table 4-2 illustrates the critical and essential facilities for the City of La Mirada.

Table 4-2: City of La Mirada Critical and Essential Facilities Vulnerable to Hazards

Earthquakes	Flooding	Landslides	Wildfires	Facility	Address
X	X	X	X	Behringer Park	16044 Alicante Drive
X	X	X	X	Frontier Park	13212 Marquardt Avenue
X				Gardenhill	14435 Gardenhill Road
X			X	Gymnasium	15105 Alicante Drive
X				Los Coyotes Athletic Field	Rosecrans Avenue & Beach Boulevard
X				Neff Park	14300 San Cristobal Drive
X	X		X	Wilderness Area	Los Coyotes/Las Flores
X		X		Windermere Park	15261 Cheshire Street
X			X	City Hall	13700 La Mirada Boulevard
X	X		X	Activity Center	13810 La Mirada Boulevard
X	X		X	Resource Center	13710 La Mirada Boulevard
X				Public Safety Annex	15715 Phoebe Avenue
X				Public Works Office	15515 Phoebe Avenue
X				Vehicle Maintenance Garage	15677 Phoebe Avenue
X				Transit Facility	15679 Phoebe Avenue
X	X			Mc Coy Rigby Theatre Warehouse	15519 Phoebe Avenue
X	X			Theatre Warehouse	15517 Phoebe Avenue
X				Civic Theatre	14900 La Mirada Boulevard

Summary

Natural hazard mitigation strategies can reduce the impacts concentrated at large employment and industrial centers, public infrastructure, and critical facilities. Natural hazard mitigation for industries and employers may include developing relationships with emergency management services and their employees before disaster strikes, and establishing mitigation strategies together. Collaboration among the public and private sector to create mitigation plans and actions can reduce the impacts of natural hazards.

Section 5: Earthquake Hazards in the City of La Mirada

Why Are Earthquakes a Threat to the City of La Mirada?

The most recent significant earthquake event affecting Southern California was the January 17, 1994 Northridge Earthquake. At 4:31 A.M. on Monday, January 17, a moderate but very damaging earthquake with a magnitude of 6.7 struck the San Fernando Valley. In the following days and weeks, thousands of aftershocks occurred, causing additional damage to affected structures.

57 people were killed and more than 1,500 people seriously injured. For days afterward, thousands of homes and businesses were without electricity; tens of thousands had no gas; and nearly 50,000 had little or no water. Approximately 15,000 structures were moderately to severely damaged, which left thousands of people temporarily homeless. 66,500 buildings were inspected. Nearly 4,000 were severely damaged and over 11,000 were moderately damaged. Several collapsed bridges and overpasses created commuter havoc on the freeway system. Extensive damage was caused by ground shaking, but earthquake triggered liquefaction and dozens of fires also caused additional severe damage. This extremely strong ground motion in large portions of Los Angeles County resulted in record economic losses.

However, the earthquake occurred early in the morning on a holiday. This circumstance considerably reduced the potential effects. Many collapsed buildings were unoccupied, and most businesses were not yet open. The direct and indirect economic losses ran into the 10's of billions of dollars.

Historical and geological records show that California has a long history of seismic events. Southern California is probably best known for the San Andreas Fault, a 400 mile long fault running from the Mexican border to a point offshore, west of San Francisco. "Geologic studies show that over the past 1,400 to 1,500 years large earthquakes have occurred at about 130 year intervals on the southern San Andreas Fault. As the last large earthquake on the Southern San Andreas occurred in 1857, that section of the fault is considered a likely location for an earthquake within the next few decades."¹

But San Andreas is only one of dozens of known earthquake faults that crisscross Southern California. Some of the better known faults include the Newport-Inglewood, Whittier, Chatsworth, Elsinore, Hollywood, Los Alamitos, Puente Hills, and Palos Verdes faults. Beyond the known faults, there are a potentially large number of "blind" faults that underlie the surface of Southern California. One such blind fault was involved in the Whittier Narrows earthquake in October 1987.

Although the most famous of the faults, the San Andreas, is capable of producing an earthquake with a magnitude of 8+ on the Richter scale, some of the "lesser" faults have the potential to inflict greater damage on the urban core of the Los Angeles Basin. Seismologists believe that a 6.0 earthquake on the Newport-

Inglewood would result in far more death and destruction than a “great” quake on the San Andreas, because the San Andreas is relatively remote from the urban centers of Southern California.

For decades, partnerships have flourished between the USGS, Cal Tech, the California Geological Survey and universities to share research and educational efforts with Californians. Tremendous earthquake mapping and mitigation efforts have been made in California in the past two decades, and public awareness has risen remarkably during this time. Major federal, state, and local government agencies and private organizations support earthquake risk reduction, and have made significant contributions in reducing the adverse impacts of earthquakes. Despite the progress, the majority of California communities remain unprepared because there is a general lack of understanding regarding earthquake hazards among Californians.

Table 5-1: Earthquake Events in the Southern California Region

Southern California Region Earthquakes with a Magnitude 5.0 or Greater			
1769	Los Angeles Basin	1916	Tejon Pass Region
1800	San Diego Region	1918	San Jacinto
1812	Wrightwood	1923	San Bernardino Region
1812	Santa Barbara Channel	1925	Santa Barbara
1827	Los Angeles Region	1933	Long Beach
1855	Los Angeles Region	1941	Carpenteria
1857	Great Fort Tejon Earthquake	1952	Kern County
1858	San Bernardino Region	1954	W. of Wheeler Ridge
1862	San Diego Region	1971	San Fernando
1892	San Jacinto or Elsinore Fault	1973	Point Mugu
1893	Pico Canyon	1986	North Palm Springs
1894	Lytle Creek Region	1987	Whittier Narrows
1894	E. of San Diego	1992	Landers
1899	Lytle Creek Region	1992	Big Bear
1899	San Jacinto and Hemet	1994	Northridge
1907	San Bernardino Region	1999	Hector Mine
1910	Glen Ivy Hot Springs		

Source:
http://geology.about.com/gi/dynamic/offsite.htm?site=http%3A%2F%2Fpasadena.wr.usgs.gov%2Finfo%2Fcahist_eqs.html

To better understand the earthquake hazard, the scientific community has looked at historical records and accelerated research on those faults that are the sources of the earthquakes occurring in the Southern California region. Historical earthquake records can generally be divided into records of the pre-instrumental period and the instrumental period. In the absence of instrumentation, the detection of earthquakes is based on observations and felt reports, and is dependent upon population density and distribution. Since California was sparsely populated in the 1800s, the detection of pre-instrumental earthquakes is relatively difficult. However, two very large earthquakes, the Fort Tejon in 1857 (7.9) and the Owens Valley in 1872 (7.6) are evidence of the tremendously damaging potential of earthquakes in Southern California. In more recent times two 7.3 earthquakes struck Southern California, in Kern County (1952) and Landers (1992). The damage from these four large earthquakes was limited because they occurred in areas which were sparsely populated at the time they happened. The seismic risk is much more severe today than in the past because the population at risk is in the millions, rather than a few hundred or a few thousand persons.

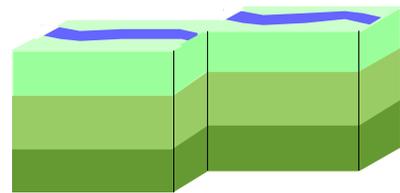
History of Earthquake Events in Southern California

Since seismologists started recording and measuring earthquakes, there have been tens of thousands of recorded earthquakes in Southern California, most with a magnitude below three. No community in Southern California is beyond the reach of a damaging earthquake. Figure 5-1 describes the historical earthquake events that have affected Southern California.

Figure 5-1: Causes and Characteristics of Earthquakes in Southern California

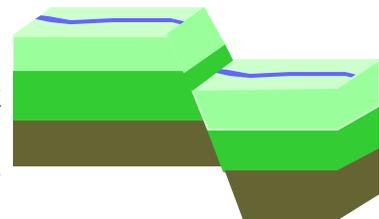
Earthquake Faults

A fault is a fracture along between blocks of the earth's crust where either side moves relative to the other along a parallel plane to the fracture.



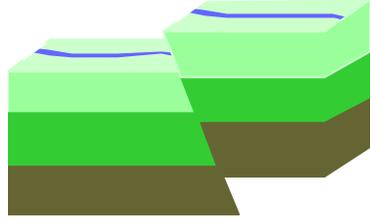
Strike-slip

Strike-slip faults are vertical or almost vertical rifts where the earth's plates move mostly horizontally. From the observer's perspective, if the opposite block looking across the fault moves to the right, the slip style is called a right lateral fault; if the block moves left, the shift is called a left lateral fault.



Dip-slip

Dip-slip faults are slanted fractures where the blocks mostly shift vertically. If the earth above an inclined fault moves down, the fault is called a normal fault, but when the rock above the fault moves up, the fault is called a reverse fault. Thrust faults have a reverse fault with a dip of 45 ° or less.



Dr. Kerry Sieh of Cal Tech has investigated the San Andreas Fault at Pallett Creek. “The record at Pallett Creek shows that rupture has recurred about every 130 years, on average, over the past 1500 years. But actual intervals have varied greatly, from less than 50 years to more than 300. The physical cause of such irregular recurrence remains unknown.”² Damage from a great quake on the San Andreas would be widespread throughout Southern California.

Earthquake Related Hazards

Ground shaking, landslides, liquefaction, and amplification are the specific hazards associated with earthquakes. The severity of these hazards depends on several factors, including soil and slope conditions, proximity to the fault, earthquake magnitude, and the type of earthquake.

Ground Shaking

Ground shaking is the motion felt on the earth's surface caused by seismic waves generated by the earthquake. It is the primary cause of earthquake damage. The strength of ground shaking depends on the magnitude of the earthquake, the type of fault, and distance from the epicenter (where the earthquake originates). Buildings on poorly consolidated and thick soils will typically see more damage than buildings on consolidated soils and bedrock.

Earthquake-Induced Landslides

Earthquake-induced landslides are secondary earthquake hazards that occur from ground shaking. They can destroy the roads, buildings, utilities, and other critical facilities necessary to respond and recover from an earthquake. Many communities in Southern California have a high likelihood of encountering such risks, especially in areas with steep slopes.

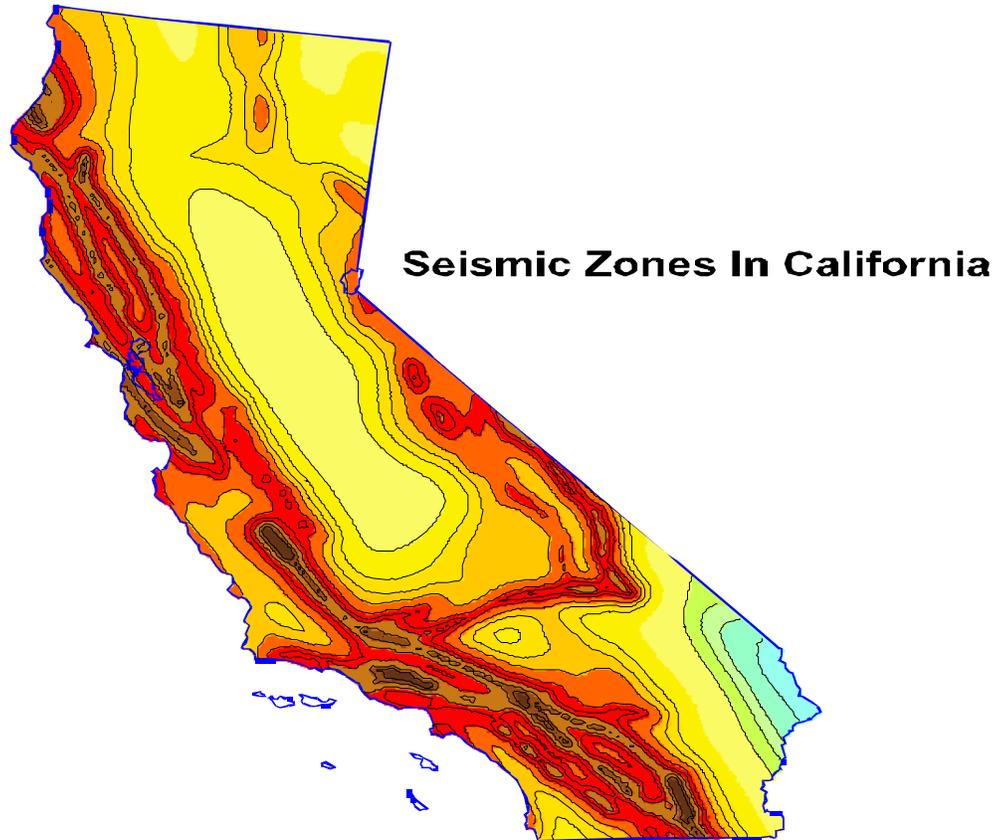
Liquefaction

Liquefaction occurs when ground shaking causes wet granular soils to change from a solid state to a liquid state. This results in the loss of soil strength and the soil's ability to support weight. Buildings and their occupants are at risk when the ground can no longer support these buildings and structures. Many communities in Southern California are built on ancient river bottoms and have sandy soil. In some cases this ground may be subject to liquefaction, depending on the depth of the water table.

Amplification

Soils and soft sedimentary rocks near the earth's surface can modify ground shaking caused by earthquakes. One of these modifications is amplification. Amplification increases the magnitude of the seismic waves generated by the earthquake. The amount of amplification is influenced by the thickness of geologic materials and their physical properties. Buildings and structures built on soft and unconsolidated soils can face greater risk.³ Amplification can also occur in areas with deep sediment filled basins and on ridge tops.

Map 5-1: Seismic Zones in California



Darker Shaded Areas indicate Greater Potential Shaking

Source: USGS Website

Earthquake Hazard Assessment

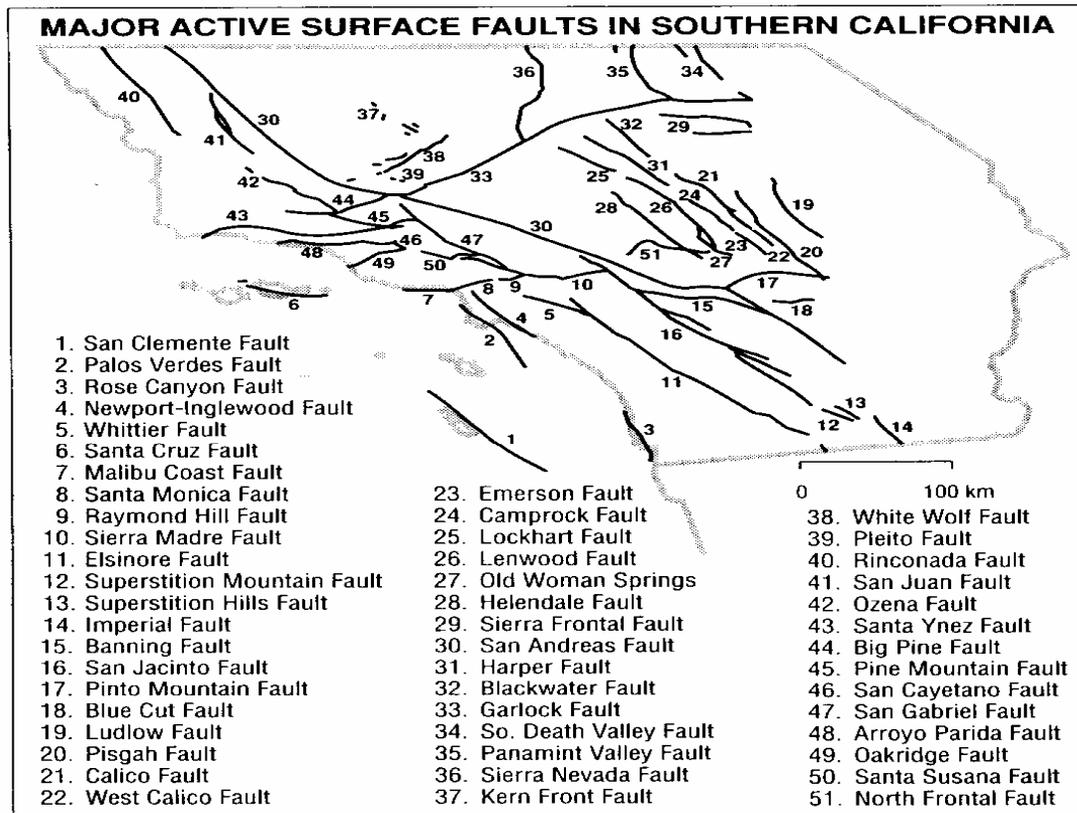
Hazard Identification

In California, many agencies are focused on seismic safety issues: the State's Seismic Safety Commission, the Applied Technology Council, Governor's Office of Emergency Services, United States Geological Survey, Cal Tech, the California Geological Survey as well as a number of universities and private foundations.

These organizations, in partnership with other state and federal agencies, have undertaken a rigorous program in California to identify seismic hazards and risks

including active fault identification, bedrock shaking, tsunami inundation zones, ground motion amplification, liquefaction, and earthquake induced landslides. Seismic hazard maps have been published and are available for many communities in California through the State Division of Mines and Geology. Map 5-2 illustrates the known earthquake faults in Southern California.

Map 5-2: Major Active Surface Faults in Southern California



Source: Adapted from the map of major active Southern California surface faults published in "Seismic Hazards in Southern California: Probable Earthquakes, 1994-2024," Southern California Earthquake Center.

In California, each earthquake is followed by revisions and improvements in the Building Codes. The 1933 Long Beach resulted in the Field Act, affecting school construction. The 1971 Sylmar earthquake brought another set of increased structural standards. Similar re-evaluations occurred after the 1989 Loma Prieta and 1994 Northridge earthquakes. These code changes have resulted in stronger and more earthquake resistant structures.

The Alquist-Priolo Earthquake Fault Zoning Act was passed in 1972 to mitigate the hazard of surface faulting to structures for human occupancy. This state law was a direct result of the 1971 San Fernando Earthquake, which was associated with extensive surface fault ruptures that damaged numerous homes, commercial buildings, and other structures. Surface rupture is the most easily avoided seismic hazard.⁴

The Seismic Hazards Mapping Act, passed in 1990, addresses non-surface fault rupture earthquake hazards, including liquefaction and seismically induced landslides.⁵ The State Department of Conservation operates the Seismic Mapping Program for California. Extensive information is available at their website: <http://gmw.consrv.ca.gov/shmp/index.htm>

Vulnerability Assessment

The effects of earthquakes span a large area, and large earthquakes occurring in many parts of the Southern California region would probably be felt throughout the region. However, the degree to which the earthquakes are felt, and the damages associated with them may vary. At risk from earthquake damage are large stocks of old buildings and bridges; many high tech and hazardous materials facilities; extensive sewer, water, and natural gas pipelines; earth dams; petroleum pipelines; and other critical facilities and private property located in the county. The relative or secondary earthquake hazards, which are liquefaction, ground shaking, amplification, and earthquake-induced landslides, can be just as devastating as the earthquake.

The California Geological Survey has identified areas most vulnerable to liquefaction. Liquefaction occurs when ground shaking causes wet granular soils to change from a solid state to a liquid state. This results in the loss of soil strength and the soil's ability to support weight. Buildings and their occupants are at risk when the ground can no longer support these buildings and structures. Table 5-3 identifies the local population centers in the City of La Mirada that have soils vulnerable to liquefaction.

The City of La Mirada has liquefaction zones as shown on Map 5-3: Landslide and Liquefaction Areas in the City of La Mirada. The majority of the liquefaction prone areas are located in the southern portion of the city.

The City's General Plan and Multi-Hazard Functional Plan identify the following major faults as potential threats to the City of La Mirada:

- San Andreas
- Newport Inglewood
- Whittier-Elsinore
- Norwalk
- San Jacinto
- Verdugo

Southern California has many active landslide areas, and a large earthquake could trigger accelerated movement in these slide areas, in addition to jarring loose other unknown areas of landslide risk.

Risk Analysis

Risk analysis is the third phase of a hazard assessment. Risk analysis involves estimating the damage and costs likely to be experienced in a geographic area over a period of time.⁶ Factors included in assessing earthquake risk include population and property distribution in the hazard area, the frequency of earthquake events, landslide susceptibility, buildings, infrastructure, and disaster preparedness of the region. This type of analysis can generate estimates of the damages to the region due to an earthquake event in a specific location. FEMA's software program, HAZUS, uses mathematical formulas and information about building stock, local geology and the location and size of potential earthquakes, economic data, and other information to estimate losses from a potential earthquake.⁷ The HAZUS software is available from FEMA at no cost.

For greater Southern California there are multiple worst case scenarios, depending on which fault might rupture, and which communities are in proximity to the fault. But damage will not necessarily be limited to immediately adjoining communities. Depending on the hypocenter of the earthquake, seismic waves may be transmitted through the ground to unsuspecting communities. In the 1994 Northridge Earthquake, Santa Monica suffered extensive damage, even though there was a range of mountains between it and the origin of the earthquake.

Damages for a large earthquake almost anywhere in Southern California are likely to run into the billions of dollars. Although building codes are some of the most stringent in the world, ten's of thousands of older existing buildings were built under much less rigid codes. California has laws affecting unreinforced masonry buildings (URM's) and although many building owners have retrofitted their buildings, hundreds of pre-1933 buildings still have not been brought up to current standards. The City of La Mirada has no unreinforced masonry buildings.

Non-structural bracing of equipment and contents is often the most cost-effective type of seismic mitigation. Inexpensive bracing and anchoring may be the most cost effective way to protect expensive equipment. Non-structural bracing of equipment and furnishings will also reduce the chance of injury for the occupants of a building.

Community Earthquake Issues

What is Susceptible to Earthquakes?

Earthquake damage occurs because humans have built structures that cannot withstand severe shaking. Buildings, airports, schools, and lifelines (highways and utility lines) suffer damage in earthquakes and can cause death or injury to humans. The welfare of homes, major businesses, and public infrastructure is very important. Addressing the reliability of buildings, critical facilities, and infrastructure, and understanding the potential costs to government, businesses, and individuals as a result of an earthquake, are challenges faced by the city.

Dams

There are a total of 103 dams in Los Angeles County, owned by 23 agencies or organizations, ranging from the Federal government to Homeowner's Associations.⁸ These dams hold billions of gallons of water in reservoirs. Releases of water from the major reservoirs are designed to protect Southern California from flood waters and to store domestic water. Seismic activity can compromise the dam structures, and the resultant flooding could cause catastrophic flooding. Following the 1971 Sylmar earthquake the Lower Van Norman Dam showed signs of structural compromise, and tens of thousands of persons had to be evacuated until the dam could be drained. The dam has never been refilled. The City's Multi-Hazard Functional Plan states that the City of La Mirada is not subject to dam failure.

Buildings

The built environment is susceptible to damage from earthquakes. Buildings that collapse can trap and bury people. Lives are at risk and the cost to clean up the damages is great. In most California communities, including the City of La Mirada, many buildings were built before 1993 when building codes were not as strict. In addition, retrofitting is not required except under certain conditions and can be expensive. Therefore, the number of buildings at risk remains high. The California Seismic Safety Commission makes annual reports on the progress of the retrofitting of unreinforced masonry buildings.

Infrastructure and Communication

Residents in the City of La Mirada commute frequently by automobiles and public transportation such as buses and light rail. An earthquake can greatly damage bridges and roads, hampering emergency response efforts and the normal movement of people and goods. Damaged infrastructure strongly affects the economy of the community because it disconnects people from work, school, food, and leisure, and separates businesses from their customers and suppliers.

Bridge Damage

Even modern bridges can sustain damage during earthquakes, leaving them unsafe for use. Some bridges have failed completely due to strong ground motion. Bridges are a vital transportation link - with even minor damages making some areas inaccessible. Because bridges vary in size, materials, location and design, any given earthquake will affect them differently. Bridges built before the

mid-1970' s have a significantly higher risk of suffering structural damage during a moderate to large earthquake compared with those built after 1980 when design improvements were made.

Much of the interstate highway system was built in the mid to late 1960's. The bridges in the City of La Mirada are state, county or privately owned (including railroad bridges). Caltrans has retrofitted most bridges on the freeway systems; however there are still some county maintained bridges that are not retrofitted. The FHWA requires that bridges on the National Bridge Inventory be inspected every 2 years. Caltrans checks when the bridges are inspected because they administer the Federal funds for bridge projects.

Damage to Lifelines

Lifelines are the connections between communities and outside services. They include water and gas lines, transportation systems, electricity, and communication networks. Ground shaking and amplification can cause pipes to break open, power lines to fall, roads and railways to crack or move, and radio and telephone communication to cease. Disruption to transportation makes it especially difficult to bring in supplies or services. Lifelines need to be usable after earthquake to allow for rescue, recovery, and rebuilding efforts and to relay important information to the public.

Disruption of Critical Services

Critical facilities include police stations, fire stations, hospitals, shelters, and other facilities that provide important services to the community. These facilities and their services need to be functional after an earthquake event. Some critical facilities are housed in older buildings that are not up to current seismic codes. See Section 1, Introduction for critical and essential facilities vulnerable to earthquakes.

Businesses

Seismic activity can cause great loss to businesses, both large-scale corporations and small retail shops. When a company is forced to stop production for just a day, the economic loss can be tremendous, especially when its market is at a national or global level. Seismic activity can create economic loss that presents a burden to large and small shop owners who may have difficulty recovering from their losses.

Forty percent of businesses do not reopen after a disaster and another twenty-five percent fail within one year according to the Federal Emergency Management Agency (FEMA). Similar statistics from the United States Small Business Administration indicate that over ninety percent of businesses fail within two years after being struck by a disaster.⁹

Individual Preparedness

Because the potential for earthquake occurrences and earthquake related property damage is relatively high in the City of La Mirada, increasing individual preparedness is a significant need. Strapping down heavy furniture, water heaters, and expensive personal property, as well as being earthquake insured, and anchoring buildings to foundations are just a few steps individuals can take to prepare for an earthquake.

Death and Injury

Death and injury can occur both inside and outside of buildings due to collapsed buildings falling equipment, furniture, debris, and structural materials. Downed power lines and broken water and gas lines can also endanger human life.

Fire

Downed power lines or broken gas mains may trigger fires. When fire stations suffer building or lifeline damage, quick response to extinguish fires is less likely. Furthermore, major incidents will demand a larger share of resources, and initially smaller fires and problems will receive little or insufficient resources in the initial hours after a major earthquake event. Loss of electricity may cause a loss of water pressure in some communities, further hampering fire fighting ability.

Debris

After damage to a variety of structures, much time is spent cleaning up bricks, glass, wood, steel or concrete building elements, office and home contents, and other materials. Developing a strong debris management strategy is essential in post-disaster recovery. Disasters do not exempt the City of La Mirada from compliance with AB 939 regulations.

Existing Mitigation Activities

Existing mitigation activities include current mitigation programs and activities that are being implemented by county, regional, state, or federal agencies or organizations.

City of La Mirada Codes

Implementation of earthquake mitigation policy most often takes place at the local government level. The City of La Mirada Building and Safety Department enforces building codes pertaining to earthquake hazards.

The Community Development Department enforces the zoning and land use regulations relating to earthquake hazards.

Generally, these codes seek to discourage development in areas that could be prone to flooding, landslide, wildfire and / or seismic hazards; and where development is permitted, that the applicable construction standards are met. Developers in hazard-prone areas may be required to retain a qualified professional engineer to evaluate the level of risk on the site and recommend appropriate mitigation measures.

Coordination Among Building Officials

The City of La Mirada has adopted the 2002 County of Los Angeles Building Code based upon the 2001 California Building Code and the 1997 Uniform Building Code. The Code sets the minimum design and construction standards for new buildings. The City of La Mirada adopted the most recent seismic standards in its building code, which requires that new buildings be built at a higher seismic standard.

Since 2002, the City of La Mirada also requires that site-specific seismic hazard investigations be performed for new essential facilities, major structures, hazardous facilities, and special occupancy structures such as schools, hospitals, and emergency response facilities.

Businesses/Private Sector

Natural hazards have a devastating impact on businesses. In fact, of all businesses which close following a disaster, more than forty-three percent never reopen, and an additional twenty-nine percent close for good within the next two years.¹⁰ The Institute of Business and Home Safety has developed “Open for Business”, which is a disaster planning toolkit to help guide businesses in preparing for and dealing with the adverse affects natural hazards. The kit integrates protection from natural disasters into the company's risk reduction measures to safeguard employees, customers, and the investment itself. The guide helps businesses secure human and physical resources during disasters, and helps to develop strategies to maintain business continuity before, during, and after a disaster occurs.

Hospitals

“The Alfred E. Alquist Hospital Seismic Safety Act (“Hospital Act”) was enacted in 1973 in response to the moderate Magnitude 6.6 Sylmar Earthquake in 1971 when four major hospital campuses were severely damaged and evacuated. Two hospital buildings collapsed killing forty seven people. Three others were killed in another hospital that nearly collapsed.

In approving the Act, the Legislature noted that: “Hospitals, that house patients who have less than the capacity of normally healthy persons to protect themselves, and that must be reasonably capable of providing services to the public after a disaster, shall be designed and constructed to resist, insofar as practical, the forces generated by earthquakes, gravity and winds.” (Health and Safety Code Section 129680)

When the Hospital Act was passed in 1973, the State anticipated that, based on the regular and timely replacement of aging hospital facilities, the majority of hospital buildings would be in compliance with the Act's standards within 25 years. However, hospital buildings were not, and are not, being replaced at that anticipated rate. In fact, the great majority of the State's urgent care facilities are now more than 40 years old.

The moderate Magnitude 6.7 Northridge Earthquake in 1994 caused \$3 billion in hospital-related damage and evacuations. Twelve hospital buildings constructed before the Act were cited (red tagged) as unsafe for occupancy after the earthquake. Those hospitals that had been built in accordance with the 1973 Hospital Act were very successful in resisting structural damage. However, nonstructural damage (for example, plumbing and ceiling systems) was still extensive in those post-1973 buildings.

Senate Bill 1953 (“SB 1953”), enacted in 1994 after the Northridge Earthquake, expanded the scope of the 1973 Hospital Act. Under SB 1953, all hospitals are required, as of January 1, 2008, to survive earthquakes without collapsing or posing the threat of significant loss of life. The 1994 Act further mandates that all existing hospitals be seismically evaluated, and retrofitted, if needed, by 2030, so that they are in substantial compliance with the Act (which requires that the hospital buildings be reasonably capable of providing services to the public after disasters). SB 1953 applies to all urgent care facilities (including those built prior to the 1973 Hospital Act) and affects approximately 2,500 buildings on 475 campuses.

SB 1953 directed the Office of Statewide Health Planning and Development (“OSHPD”), in consultation with the Hospital Building Safety Board, to develop emergency regulations including “...earthquake performance categories with sub gradations for risk to life, structural soundness, building contents, and nonstructural systems that are critical to providing basic services to hospital inpatients and the public after a disaster.” (Health and Safety Code Section 130005).

The Seismic Safety Commission Evaluation of the State’s Hospital Seismic Safety Policies

In 2001, recognizing the continuing need to assess the adequacy of policies, and the application of advances in technical knowledge and understanding, the California Seismic Safety Commission created an Ad Hoc Committee to re-examine the compliance with the Alquist Hospital Seismic Safety Act. The formation of the Committee was also prompted by the recent evaluations of hospital buildings reported to OSHPD that revealed that a large percentage (40%) of California’s operating hospitals are in the highest category of collapse risk.”¹¹

California Earthquake Mitigation Legislation

California is painfully aware of the threats it faces from earthquakes. Dating back to the 19th Century, Californians have been killed, injured, and lost property as a result of earthquakes. As the State’s population continues to grow, and urban areas become even more densely developed, the risk will continue to increase. For decades the legislature has passed laws to strengthen the built environment

and protect the citizens. Table 5-2 provides a sampling of some of the 200 plus laws in the State's codes.

Table 5-4: Partial List of the Over 200 California Laws on Earthquake Safety

Government Code Section 8870-8870.95	Creates Seismic Safety Commission.
Government Code Section 8876.1-8876.10	Established the California Center for Earthquake Engineering Research.
Public Resources Code Section 2800-2804.6	Authorized a prototype earthquake prediction system along the Central San Andreas Fault near the City of Parkfield.
Public Resources Code Section 2810-2815	Continued the Southern California Earthquake Preparedness Project and the Bay Area Regional Earthquake Preparedness Project.
Health and Safety Code Section 16100-16110	The Seismic Safety Commission and State Architect, will develop a state policy on acceptable levels of earthquake risk for new and existing state-owned buildings.
Government Code Section 8871-8871.5	Established the California Earthquake Hazards Reduction Act of 1986.
Health and Safety Code Section 130000-130025	Defined earthquake performance standards for hospitals.
Public Resources Code Section 2805-2808	Established the California Earthquake Education Project.
Government Code Section 8899.10-8899.16	Established the Earthquake Research Evaluation Conference.
Public Resources Code Section 2621-2630 2621.	Established the Alquist-Priolo Earthquake Fault Zoning Act.
Government Code Section 8878.50-8878.52 8878.50.	Created the Earthquake Safety and Public Buildings Rehabilitation Bond Act of 1990.
Education Code Section 35295-35297 35295.	Established emergency procedure systems in kindergarten through grade 12 in all the public or private schools.
Health and Safety Code Section 19160-19169	Established standards for seismic retrofitting of unreinforced masonry buildings.
Health and Safety Code Section 1596.80-1596.879	Required all child day care facilities to include an Earthquake Preparedness Checklist as an attachment to their disaster plan.
Source: http://www.leginfo.ca.gov/calaw.html	

Earthquake Education

Earthquake research and education activities are conducted at several major universities in the Southern California region, including Cal Tech, USC, UCLA, UCSB, UCI, and UCSB. The local clearinghouse for earthquake information is the Southern California Earthquake Center located at the University of Southern California, Los Angeles, CA 90089, Telephone: (213) 740-5843, Fax: (213) 740-0011, Email: SCEinfo@usc.edu, Website: <http://www.scec.org>. The Southern California Earthquake Center (SCEC) is a community of scientists and specialists who actively coordinate research on earthquake hazards at nine core institutions, and communicate earthquake information to the public. SCEC is a National Science Foundation (NSF) Science and Technology Center and is co-funded by the United States Geological Survey (USGS).

In addition, Los Angeles County along with other Southern California counties, sponsors the Emergency Survival Program (ESP), an educational program for learning how to prepare for earthquakes and other disasters. Many school districts have very active emergency preparedness programs that include earthquake drills and periodic disaster response team exercises.

End Notes

- 1 <http://pubs.usgs.gov/gip/earthq3/when.html>
- 2 <http://www.gps.caltech.edu/~sieh/home.html>
- 3 Planning for Natural Hazards: The California Technical Resource Guide, Department of Land Conservation and Development (July 2000)
- 4 <http://www.consrv.ca.gov/CGS/rghm/ap/>
- 5 Ibid
- 6 Burby, R. (Ed.) Cooperating with Nature: Confronting Natural Hazards with Land Use Planning for Sustainable Communities (1998), Washington D.C., Joseph Henry Press.
- 7 FEMA HAZUS <http://www.fema.gov/hazus/hazus2.htm> (May 2001).
- 8 Source: Los Angeles County Public Works Department, March 2004
- 9 http://www.chamber101.com/programs_committee/natural_disasters/DisasterPreparedness/Forty.htm
- 10 Institute for Business and Home Safety Resources (April 2001),
- 11 http://www.seismic.ca.gov/pub/CSSC_2001-04_Hospital.pdf

Section 6: Flooding Hazards in the City of La Mirada

Why are Floods a Threat to the City of La Mirada?

The City of La Mirada contains the Rio Hondo Flood Control Channel and the Coyote Creek Basin, which are both susceptible to flooding events. Flooding poses a threat to life and safety, and can cause severe damage to public and private property. The City's Multi-Hazard Functional Plan states that there are nine areas that are designated as zone B (within the 500-year floodplain) and one area as zone A (within the 100-year floodplain) according to the National Flood Insurance Program.

The City of La Mirada was most recently affected by the flooding in 1996 during heavy El Nino rains. Streets and flood control channels were at or above capacity. However, there was only sporadic flooding of homes with minimal monetary loss.

History of Flooding in the City of La Mirada

The City of La Mirada is susceptible to flooding from the Rio Hondo Flood Control Channel and the Coyote Creek Basin. Additionally, according to the Multi-Hazard Functional Plan, portions of the City are susceptible to urban flooding due to overburdened pumping systems and older drainage systems.

There are a number of rivers in the Southern California region, but the river with the best recorded history is the Los Angeles River. The flood history of the Los Angeles River is generally indicative of the flood history of much of Southern California.

Historic Flooding in Los Angeles County

Records show that since 1811, the Los Angeles River has flooded 30 times, on average once every 6.1 years. But averages are deceiving, for the Los Angeles basin goes through periods of drought and then periods of above average rainfall. Between 1889 and 1891 the river flooded every year, and from 1941 to 1945, the river flooded 5 times. Conversely, from 1896 to 1914, a period of 18 years, and again from 1944 to 1969, a period of 25 years, the river did not have serious floods.¹

Table 6-1: Major Floods of the Los Angeles River

Major Floods of the Los Angeles River	
1811	Flooding
1815	Flooding
1825	L.A. River changed its course back from the Ballona wetlands to San Pedro
1832	Heavy flooding
1861-62	Heavy flooding. Fifty inches of rain falls during December and January.
1867	Floods create a large, temporary lake out to Ballona Creek.

1876	The Novician Deluge
1884	Heavy flooding causes the river to change course again, turning east to Vernon and then southward to San Pedro.
1888-1891	Annual floods
1914	Heavy flooding. Great damage to the harbor.
1921	Flooding
1927	Moderate flood
1934	Moderate flood starting January 1. Forty dead in La Canada.
1938	Great County-wide flood with 4 days of rain. Most rain on day 4.
1941-44	L.A. River floods five times.
1952	Moderate flooding
1969	One heavy flood after 9 day storm. One moderate flood.
1978	Two moderate floods
1979	Los Angeles experiences severe flooding and mudslides.
1980	Flood tops banks of river in Long Beach. Sepulveda Basin spillway almost opened.
1983	Flooding kills six people.
1992	15 year flood. Motorists trapped in Sepulveda basin. Six people dead.
1994	Heavy flooding
Sources: http://www.lalc.k12.ca.us/target/units/river/tour/hist.html and http://www.losangelesalmanac.com/topics/History/hi01i.htm	

While the City of La Mirada is 19 miles southeast of the city of Los Angeles, it is not so far away as to not be affected by the heavy rains that brought flooding to Los Angeles. In addition, the towering mountains that give the Los Angeles region its spectacular views also wring a great deal of rain out of the storm clouds that pass through. Because the mountains are so steep, the rainwater moves rapidly down the slopes and across the coastal plains on its way to the ocean.

“The Santa Monica, Santa Susana and Verdugo Mountains, which surround three sides of the valley, seldom reach heights above three thousand feet. The Western San Gabriel Mountains, in contrast, have elevations of more than seven thousand feet. These higher ridges often trap eastern-moving winter storms. Although downtown Los Angeles averages just fifteen inches of rain a year, some mountain peaks in the San Gabriels receive more than forty inches of precipitation annually”²

Naturally, this rainfall moves rapidly down stream, often with severe consequences for anything in its path. In extreme cases, flood-generated debris flows will roar down a canyon at speeds near 40 miles per hour with a wall of mud, debris and water tens of feet high.

In Southern California, stories of floods, debris flows, persons buried alive under tons of mud and rock and persons swept away to their death in a river flowing at thirty-five miles an hour are without end.

What Factors Create Flood Risk?

Flooding occurs when climate, geology, and hydrology combine to create conditions where water flows outside of its usual course. In the City of La Mirada, geography and climate combine to create some chronic seasonal or flooding conditions. The City's Multi-Hazard Functional Plan states that there are nine areas that are designated as Zone B (within the 500-year floodplain) and one area as zone A (within the 100-year floodplain) according to the National Flood Insurance Program. The following areas have been identified as Zone B areas:

- San Ardo Drive and Borda West of Crosswood and north of the Atchison, Topeka, and Santa Fe Railroad;
- Crosswood Road north of Excelsior Drive and south of San Feliciano Drive;
- San Feliciano Drive and Figueres Road northwest of La Mirada Creek;
- North of the Atchison, Topeka, and Santa Fe Railroad between Valley View Avenue and including the southern part of Castellon Road;
- Coolbank and Valeda Drive north of Foster Road and De Alcala Drive south of Bridgewood and west of Milan Creek;
- Calpella Street east of Gandra Street;
- Telegraph Road south of Springview and north of Singleton Drive;
- La Mirada Creek west of La Mirada Boulevard north of Ramo Drive and south of Garden Hill Drive; and
- North and south of La Mirada Creek west of Stamy Road northeast of Imperial Highway including Las Flores Road and Ocaso Avenue North of Crestaloma Road.

The following area is identified as Zone A:

- The perimeter of La Mirada Creek east of Stamy Road and north of Roma Drive

Winter Rainfall

Over the last 125 years, the average annual rainfall in Los Angeles is 14.9 inches. But the term "average" means very little as the annual rainfall during this time period has ranged from only 4.35 inches in 2001-2002 to 38.2 inches in 1883-1884. In fact, in only fifteen of the past 125 years, has the annual rainfall been within plus or minus 10% of the 14.9 inch average. And in only 38 years has the annual rainfall been within plus or minus 20% of the 14.9 inch average.

This makes the Los Angeles basin a land of extremes in terms of annual precipitation.

The City of La Mirada is in the southeastern section of the Los Angeles Basin. The City's General Plan states that the City of La Mirada is at the base of rolling hills, which increase the collection of rainwater.

Monsoons

Another relatively regular source for heavy rainfall, particularly in the mountains and adjoining cities is from summer tropical storms. Table 6-2 lists tropical storms that have had significant rainfall in the past century, and the general areas affected by these storms. These tropical storms usually coincide with El Niño years.

Table 6-2: Tropical Cyclones of Southern California

Tropical cyclones that have affected Southern California during the 20th Century			
Month-Year	Date(s)	Area(s) Affected	Rainfall
July 1902	20th & 21 st	Deserts & Southern Mountains	up to 2"
Aug. 1906	18th & 19th	Deserts & Southern Mountains	up to 5"
Sept. 1910	15 th	Mountains of Santa Barbara County	2"
Aug. 1921	20th & 21st	Deserts & Southern Mountains	up to 2"
Sept. 1921	30 th	Deserts	up to 4"
Sept. 1929	18 th	Southern Mountains & Deserts	up to 4"
Sept. 1932	28 th - Oct 1st	Mountains & Deserts, 15 Fatalities	up to 7"
Aug. 1935	25 th	Southern Valleys, Mountains & Deserts	up to 2"
Sept. 1939	4th - 7 th	Southern Mountains, Southern & Eastern Deserts	up to 7"
	11th & 12th	Deserts, Central & Southern Mountains	up to 4"
	19th - 21st	Deserts, Central & Southern Mountains	up to 3"
	25 th	Long Beach, W/ Sustained Winds of 50 Mph	5"
Surrounding Mountains		6 to 12"	
Sept. 1945	9th & 10 th	Central & Southern Mountains	up to 2"
Sept. 1946	30 th - Oct 1 st	Southern Mountains	up to 4"
Aug. 1951	27th - 29th	Southern Mountains & Deserts	2 to 5"
Sept. 1952	19th - 21st	Central & Southern Mountains	up to 2"
July 1954	17th - 19th	Deserts & Southern Mountains	up to 2"
July 1958	28th & 29th	Deserts & Southern Mountains	up to 2"
Sept. 1960	9th & 10 th	Julian	3.40"

Tropical cyclones that have affected Southern California during the 20th Century			
Sept. 1963	17th - 19th	Central & Southern Mountains	up to 7"
Sept. 1967	1st - 3 rd	Southern Mountains & Deserts	2"
Oct. 1972	6 th	Southeast Deserts	up to 2"
Sept. 1976	10th & 11th	Central & Southern Mountains. Ocotillo, CA was Destroyed 3 Fatalities	6 to 12"
Aug. 1977	n/a	Los Angeles	2"
		Mountains	up to 8"
Oct. 1977	6th & 7 th	Southern Mountains & Deserts	up to 2
Sept. 1978	5th & 6 th	Mountains	3"
Sept. 1982	24th - 26th	Mountains	up to 4"
Sept. 1983	20th & 21st	Southern Mountains & Deserts	up to 3"
http://www.fema.gov/nwz97/el_n_scal.shtm			

Geography and Geology

The greater Los Angeles Basin is the product of rainstorms and erosion for millennia. "Most of the mountains that ring the valleys and coastal plain are deeply fractured faults and, as they (the mountains) grew taller, their brittle slopes were continually eroded. Rivers and streams carried boulders, rocks, gravel, sand, and silt down these slopes to the valleys and coastal plain....In places these sediments are as much as twenty thousand feet thick"³.

Much of the coastal plain rests on the ancient rock debris and sediment washed down from the mountains. This sediment can act as a sponge, absorbing vast quantities of rain in those years when heavy rains follow a dry period. But like a sponge that is near saturation, the same soil fills up rapidly when a heavy rain follows a period of relatively wet weather. So even in some years of heavy rain, flooding is minimal because the ground is relatively dry. The same amount of rain following a wet period of time can cause extensive flooding.

The greater Los Angeles basin is for all intents and purposes developed. This leaves precious little open land to absorb rainfall. This lack of open ground forces water to remain on the surface and rapidly accumulate. If it were not for the massive flood control system with its concrete lined river and stream beds, flooding would be a much more common occurrence. And the tendency is towards even less and less open land. In-fill building is becoming a much more common practice in many areas. Developers tear down an older home which typically covers up to 40% of the lot size and replacing it with three or four town homes or apartments which may cover 90-95% of the lot.

Another potential source of flooding is "asphalt creep." The street space between the curbs of a street is a part of the flood control system. Water leaves

property and accumulates in the streets, where it is directed towards the underground portion of the flood control system. The carrying capacity of the street is determined by the width of the street and the height of the curbs along the street. Often, when streets are being resurfaced, a one to two inch layer of asphalt is laid down over the existing asphalt. This added layer of asphalt subtracts from the rated capacity of the street to carry water. Thus the original engineered capacity of the entire storm drain system is marginally reduced over time. Subsequent re-paving of the street will further reduce the engineered capacity even more.

Flood Terminology

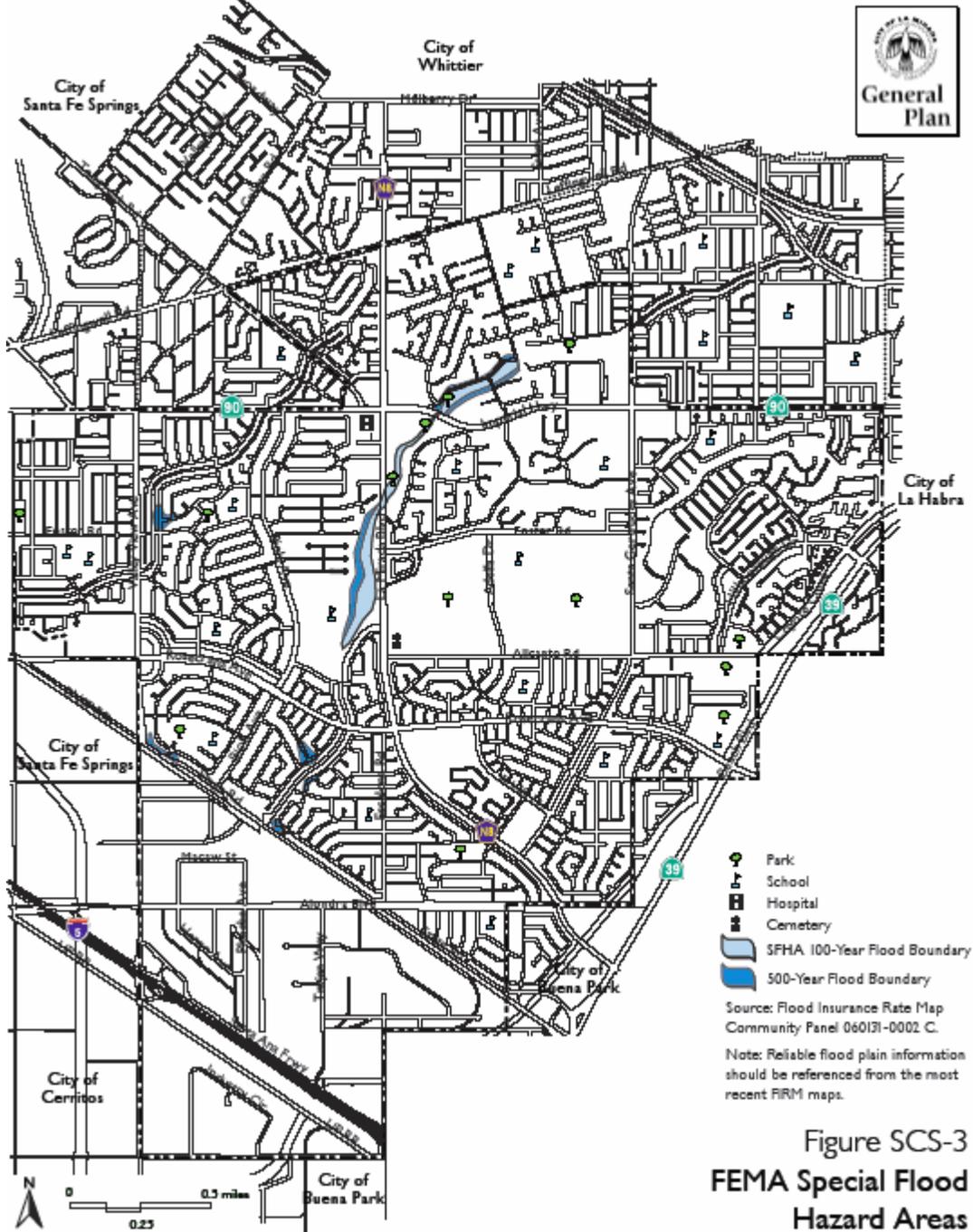
Floodplain

A floodplain is a land area adjacent to a river, stream, lake, estuary, or other water body that is subject to flooding. This area, if left undisturbed, acts to store excess flood water. The floodplain is made up of two sections: the floodway and the flood fringe.

100-Year Flood

The 100-year flooding event is the flood having a one percent chance of being equaled or exceeded in magnitude in any given year. Contrary to popular belief, it is not a flood occurring once every 100 years. The 100-year floodplain is the area adjoining a river, stream, or watercourse covered by water in the event of a 100-year flood. Map 6-1 illustrates the 100-year floodplain in the City of La Mirada. The City's Multi-Hazard Functional Plan states that there are nine areas that are designated as Zone B (within the 500-year floodplain) and one area as Zone A (within the 100-year floodplain) according to the National Flood Insurance Program.

**Map 6-1: Floodplains in the City of La Mirada
(Source: City of La Mirada General Plan)**



**Figure SCS-3
FEMA Special Flood
Hazard Areas**

Floodway

The floodway is one of two main sections that make up the floodplain. Floodways are defined for regulatory purposes. Unlike floodplains, floodways do not reflect a recognizable geologic feature. For NFIP purposes, floodways are defined as the channel of a river or stream, and the overbank areas adjacent to the channel. The floodway carries the bulk of the flood water downstream and is usually the area where water velocities and forces are the greatest. NFIP regulations require that the floodway be kept open and free from development or other structures that would obstruct or divert flood flows onto other properties.

The City of La Mirada regulations prohibit all development in the floodway. The NFIP floodway definition is "the channel of a river or other watercourse and adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot.

Flood Fringe

The flood fringe refers to the outer portions of the floodplain, beginning at the edge of the floodway and continuing outward. The City of La Mirada Zoning and Development Ordinance (Zoning Ordinance), the flood fringe is defined as "the land area, which is outside of the stream flood way, but is subject to periodic inundation by regular flooding." This is the area where development is most likely to occur, and where precautions to protect life and property need to be taken.

Development

For floodplain ordinance purposes, development is broadly defined by the City of La Mirada Zoning Ordinance to mean "any manmade change to improved or unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation, or drilling operations located within the area of special flood hazard." The definition of development for floodplain purposes is generally broader and includes more activities than the definition of development used in other sections of local land use ordinances.

Base Flood Elevation (BFE)

The term "Base Flood Elevation" refers to the elevation (normally measured in feet above sea level) that the base flood is expected to reach. Base flood elevations can be set at levels other than the 100-year flood. Some communities choose to use higher frequency flood events as their base flood elevation for certain activities, while using lower frequency events for others. For example, for the purpose of storm water management, a 25-year flood event might serve as the base flood elevation; while the 500-year flood event may serve as base flood elevation for the tie down of mobile homes. The regulations of the NFIP focus on development in the 100-year floodplain.

Characteristics of Flooding

Two types of flooding primarily affect the City of La Mirada: riverine flooding (from the flood control channels) and urban flooding (see descriptions below). In addition, any low-lying area has the potential to flood. The flooding of developed areas may occur when the amount of water generated from rainfall and runoff exceeds a storm water system's capability to remove it.

Riverine Flooding

Riverine flooding is the overbank flooding of rivers and streams. The natural processes of riverine flooding add sediment and nutrients to fertile floodplain areas. Flooding in large river systems typically results from large-scale weather systems that generate prolonged rainfall over a wide geographic area, causing flooding in hundreds of smaller streams, which then drain into the major rivers. Map 6-1 shows the various river basins (or flood zones) in the City of La Mirada.

Shallow area flooding is a special type of riverine flooding. FEMA defines shallow flood hazards as areas that are inundated by the 100-year flood with flood depths of only one to three feet. These areas are generally flooded by low velocity sheet flows of water.

Urban Flooding

As land is converted from fields or woodlands to roads and parking lots, it loses its ability to absorb rainfall. Urbanization of a watershed changes the hydrologic systems of the basin. Heavy rainfall collects and flows faster on impervious concrete and asphalt surfaces. The water moves from the clouds, to the ground, and into streams at a much faster rate in urban areas. Adding these elements to the hydrological systems can result in flood waters that rise very rapidly and peak with violent force.

During periods of urban flooding, streets can become swift moving rivers and basements can fill with water. Storm drains often back up with vegetative debris causing additional, localized flooding.

Dam Failure Flooding

Loss of life and damage to structures, roads, and utilities may result from a dam failure. Economic losses can also result from a lowered tax base and lack of utility profits. The Multi-Hazard Functional Plan states that the City is not subject to dam failure. Because dam failure can have severe consequences, FEMA requires that all dam owners develop Emergency Action Plans (EAP) for warning, evacuation, and post-flood actions. Although there may be coordination with county officials in the development of the EAP, the responsibility for developing potential flood inundation maps and facilitation of emergency response is the responsibility of the dam owner.

There have been a total of 45 dam failures in California, since the 19th century. The significant dam failures in Southern California are listed in Table 6-3.

Table 6-3: Dam Failures in Southern California

Dam Failures in Southern California			
Sheffield	Santa Barbara	1925	Earthquake slide
Puddingstone	Pomona	1926	Overtopping during construction
Lake Hemet	Palm Springs	1927	Overtopping
Saint Francis	San Francisquito Canyon	1928	Sudden failure at full capacity through foundation, 426 deaths
Cogswell	Monrovia	1934	Breaching of concrete cover
Baldwin Hills	Los Angeles	1963	Leak through embankment turned into washout, 5 deaths

http://cee.engr.ucdavis.edu/faculty/lund/dams/Dam_History_Page/Failures.htm

The two most significant dam failures are the St. Francis Dam in 1928 and the Baldwin Hills Dam in 1963.

“The failure of the St. Francis Dam, and the resulting loss of over 500 lives in the path of a roaring wall of water, was a scandal that resulted in the almost complete destruction of the reputation of its builder, William Mulholland.

Mulholland was an immigrant from Ireland who rose up through the ranks of the city's water department to the position of chief engineer. It was he who proposed, designed, and supervised the construction of the Los Angeles Aqueduct, which brought water from the Owens Valley to the city. The St. Francis Dam, built in 1926, was 180 feet high and 600 feet long; it was located near Saugus in the San Francisquito Canyon.

The dam gave way on March 12, 1928, three minutes before midnight. Its waters swept through the Santa Clara Valley toward the Pacific Ocean, about 54 miles away. 65 miles of valley was devastated before the water finally made its way into the ocean between Oxnard and Ventura. At its peak the wall of water was said to be 78 feet high; by the time it hit Santa Paula, 42 miles south of the dam, the water was estimated to be 25 feet deep. Almost everything in its path was destroyed: livestock, structures, railways, bridges, and orchards. By the time it was over, parts of

Ventura County lay under 70 feet of mud and debris. Over 500 people were killed and damage estimates topped \$20 million.”⁴

The Baldwin Hills dam failed during the daylight hours, and was one of the first disaster events documented a live helicopter broadcast.

“The Baldwin Hills Dam collapsed with the fury of a thousand cloudbursts, sending a 50-foot wall of water down Cloverdale Avenue and slamming into homes and cars on Dec. 14, 1963.

Five people were killed. Sixty-five hillside houses were ripped apart, and 210 homes and apartments were damaged. The flood swept northward in a V-shaped path roughly bounded by La Brea Avenue and Jefferson and La Cienega boulevards.

Photo 6-1: Baldwin Hills Dam



Baldwin Hills Dam - Dark spot in upper right hand quadrant shows the beginning of the break in the dam.

The earthen dam that created a 19-acre reservoir to supply drinking water for West Los Angeles residents ruptured at 3:38 p.m. As a pencil-thin crack widened to a 75-foot gash, 292 million gallons surged out. It took 77 minutes for the lake to empty. But it took a generation for the neighborhood below to recover. And two decades passed before the Baldwin Hills ridge top was reborn.

The cascade caused an unexpected ripple effect that is still being

felt in Los Angeles and beyond. It foreshadowed the end of urban-area earthen dams as a major element of the Department of Water and Power's water storage system. It prompted a tightening of Division of Safety of Dams control over reservoirs throughout the state.

The live telecast of the collapse from a KTLA-TV helicopter is considered the precursor to airborne news coverage that is now routine everywhere.”⁵

Debris Flows

Another flood related hazard that can affect certain parts of the Southern California region are debris flows. Most typically debris flows occur in mountain canyons and the foothills against the San Gabriel Mountains. However, any hilly or mountainous area with intense rainfall and the proper geologic conditions may experience one of these very sudden and devastating events.

“Debris flows, sometimes referred to as mudslides, mudflows, lahars, or debris avalanches, are common types of fast-moving landslides. These flows generally occur during periods of intense rainfall or rapid snow melt. They usually start on steep hillsides as shallow landslides that liquefy and accelerate to speeds that are typically about 10 miles per hour, but can exceed 35 miles per hour. The consistency of debris flow ranges from watery mud to thick, rocky mud that can carry large items such as boulders, trees, and cars. Debris flows from many different sources can combine in channels, and their destructive power may be greatly increased. They continue flowing down hills and through channels, growing in volume with the addition of water, sand, mud, boulders, trees, and other materials. When the flows reach flatter ground, the debris spreads over a broad area, sometimes accumulating in thick deposits that can wreak havoc in developed areas.”⁶

Coastal Flooding

Low lying coastal communities of Southern California have one other source of flooding, coastal flooding. This occurs most often during storms which bring higher than normal tides. Storms, the time of year and the tidal cycle can sometimes work to bring much higher than normal tides which cause flooding in low lying coastal areas. This hazard however is limited to those areas.

What is the Effect of Development on Floods?

When structures or fill are placed in the floodway or floodplain water is displaced. Development raises the river levels by forcing the river to compensate for the flow space obstructed by the inserted structures and/or fill. When structures or materials are added to the floodway or floodplain and no fill is removed to compensate, serious problems can arise. Flood waters may be forced away

from historic floodplain areas. As a result, other existing floodplain areas may experience flood waters that rise above historic levels. Local governments must require engineer certification to ensure that proposed developments will not adversely affect the flood carrying capacity of the Special Flood Hazard Area (SFHA). Displacement of only a few inches of water can mean the difference between no structural damage occurring in a given flood event, and the inundation of many homes, businesses, and other facilities. Careful attention should be given to development that occurs within the floodway to ensure that structures are prepared to withstand base flood events. In highly urbanized areas, increased paving can lead to an increase in volume and velocity of runoff after a rainfall event, exacerbating the potential flood hazards. Care should be taken in the development and implementation of storm water management systems to ensure that these runoff waters are dealt with effectively.

How are Flood-Prone Areas Identified?

Flood maps and Flood Insurance Studies (FIS) are often used to identify flood-prone areas. The NFIP was established in 1968 as a means of providing low-cost flood insurance to the nation's flood-prone communities. The NFIP also reduces flood losses through regulations that focus on building codes and sound floodplain management. In the City of La Mirada, the NFIP and related building code regulations went into effect on June 28, 1974. NFIP regulations (44 Code of Federal Regulations (CFR) Chapter 1, Section 60, 3) require that all new construction in floodplains must be elevated at or above base flood level.

Through the plan check process, the County of Los Angeles Public Works Department assures the City's compliance with the requirements of the National Flood Insurance Program (NFIP). The County requires that an analysis of the impact on the existing floodplain be performed. The consultant is required to demonstrate that the cumulative effect of the encroachment does/does not cause a rise of more than 1-foot above the base flood elevation, while ensuring that the structure is "protected from flooding."

Flood Insurance Rate Maps (FIRM) and Flood Insurance Studies (FIS) Floodplain maps are the basis for implementing floodplain regulations and for delineating flood insurance purchase requirements. A Flood Insurance Rate Map (FIRM) is the official map produced by FEMA which delineates SFHA in communities where NFIP regulations apply. FIRMs are also used by insurance agents and mortgage lenders to determine if flood insurance is required and what insurance rates should apply.

Water surface elevations are combined with topographic data to develop FIRMs. FIRMs illustrate areas that would be inundated during a 100-year flood, floodway areas, and elevations marking the 100-year-flood level. In some cases they also include base flood elevations (BFEs) and areas located within the 500-year floodplain. Flood Insurance Studies and FIRMs produced for the NFIP provide assessments of the probability of flooding at a given location. FEMA conducted

many Flood Insurance Studies in the late 1970s and early 1980s. These studies and maps represent flood risk at the point in time when FEMA completed the studies. However, it is important to note that not all 100-year or 500-year floodplains have been mapped by FEMA. It is estimated that the flood maps cover 100% of the total population in the City of La Mirada.

FEMA flood maps are not entirely accurate. These studies and maps represent flood risk at the point in time when FEMA completed the studies, and does not incorporate planning for floodplain changes in the future due to new development. Although FEMA is considering changing that policy, it is optional for local communities. The FEMA FIRM map for the City of La Mirada was completed in 1980. Man-made and natural changes to the environment have changed the dynamics of storm water run-off since then.

Flood Mapping Methods and Techniques

Although many communities rely exclusively on FIRMs to characterize the risk of flooding in their area, there are some flood-prone areas that are not mapped but remain susceptible to flooding. These areas include locations next to small creeks, local drainage areas, and areas susceptible to manmade flooding. About 5% to 10% of all flood-related damage from past floods in the City of La Mirada is located outside the boundaries of the FEMA's FIRMs.

Communities find it particularly useful to overlay flood hazard areas on tax assessment parcel maps. This allows a community to evaluate the flood hazard risk for a specific parcel during review of a development request. Coordination between FEMA and local planning jurisdictions is the key to making a strong connection with GIS technology for the purpose of flood hazard mapping.

FEMA and the Environmental Systems Research Institute (ESRI), a private company, have formed a partnership to provide multi-hazard maps and information to the public via the Internet. ESRI produces GIS software, including ArcViewC9 and ArcInfoC9 . The ESRI web site has information on GIS technology and downloadable maps. The hazards maps provided on the ESRI site are intended to assist communities in evaluating geographic information about natural hazards. Flood information for most communities is available on the ESRI web site. Visit www.esri.com for more information.

Hazard Assessment

Hazard Identification

Hazard identification is the first phase of flood-hazard assessment. Identification is the process of estimating: (1) the geographic extent of the floodplain (i.e., the area at risk from flooding); (2) the intensity of the flooding that can be expected in specific areas of the floodplain; and (3) the probability of occurrence of flood events. This process usually results in the creation of a floodplain map. Floodplain maps provide detailed information that can assist jurisdictions in

making policies and land-use decisions.

Data Sources

FEMA mapped the 100 -year and 500-year floodplains through the Flood Insurance Study (FIS) in conjunction with the United States Army Corps of Engineers (USACE) in July of 1980. There were previous studies done, including a Housing and Urban Development (HUD) study, which mapped the floodplain in June of 1974, this is when the City of La Mirada initially entered into the NFIP. The county has updated portions of the USACE and FEMA maps through smaller drainage studies in the county since that time.

Vulnerability Assessment

Vulnerability assessment is the second step of flood-hazard assessment. It combines the floodplain boundary, generated through hazard identification, with an inventory of the property within the floodplain. Understanding the population and property exposed to natural hazards will assist in reducing risk and preventing loss from future events. Because site-specific inventory data and inundation levels given for a particular flood event (10-year, 25-year, 50-year, 100-year, and 500-year) are not readily available, calculating a community's vulnerability to flood events is not straightforward. The amount of property in the floodplain, as well as the type and value of structures on those properties, should be calculated to provide a working estimate for potential flood losses.

Risk Analysis

Risk analysis is the third and most advanced phase of a hazard assessment. It builds upon the hazard identification and vulnerability assessment. A flood risk analysis for the City of La Mirada should include two components: (1) the life and value of property that may incur losses from a flood event (defined through the vulnerability assessment); and (2) the number and type of flood events expected to occur over time. Within the broad components of a risk analysis, it is possible to predict the severity of damage from a range of events. Flow velocity models can assist in predicting the amount of damage expected from different magnitudes of flood events. The data used to develop these models is based on hydrological analysis of landscape features. Changes in the landscape, often associated with human development, can alter the flow velocity and the severity of damage that can be expected from a flood event.

Using GIS technology and flow velocity models, it is possible to map the damage that can be expected from flood events over time. It is also possible to pinpoint the effects of certain flood events on individual properties. At the time of publication of this plan, data was insufficient to conduct a risk analysis for flood events in the City of La Mirada. However, the current mapping projects will result in better data that will assist in understanding risk. This plan includes recommendations for building partnerships that will support the development of a flood risk analysis in the City of La Mirada.

Community Flood Issues

What is Susceptible to Damage during a Flood Event?

The largest impact on communities from flood events is the loss of life and property. During certain years, property losses resulting from flood damage are extensive. Development in the floodplains of the City of La Mirada will continue to be at risk from flooding because flood damage occurs on a regular basis throughout the county. Property loss from floods strikes both private and public property. Historically, flooding has affected areas of the City, but efforts to control flooding with improvements to La Mirada Creek have been successful in reducing flood hazards.

Property Loss Resulting from Flooding Events

The type of property damage caused by flood events depends on the depth and velocity of the flood waters. Faster moving flood waters can wash buildings off their foundations and sweep cars downstream. Pipelines, bridges, and other infrastructure can be damaged when high waters combine with flood debris. Extensive damage can be caused by basement flooding and landslide damage related to soil saturation from flood events. Most flood damage is caused by water saturating materials susceptible to loss (i.e., wood, insulation, wallboard, fabric, furnishings, floor coverings, and appliances). In many cases, flood damage to homes renders them unlivable.

Mobilehomes

Statewide, the 1996 floods destroyed 156 housing units. Of those units, 61% were mobile homes and trailers. Many older mobilehome parks are located in floodplain areas. Mobilehomes have a lower level of structural stability than stick-built homes, and must be anchored to provide additional structural stability during flood events. Because of confusion in the late 1980s resulting from multiple changes in NFIP regulations, there are some communities that do not actively enforce anchoring requirements. Lack of enforcement of mobilehome construction standards in floodplains can contribute to severe damages from flood events.

Business/Industry

Flood events impact businesses by damaging property and by interrupting business. Flood events can cut off customer access to a business as well as close a business for repairs. A quick response to the needs of businesses affected by flood events can help a community maintain economic vitality in the face of flood damage. Responses to business damages can include funding to assist owners in elevating or relocating flood-prone business structures.

Public Infrastructure

Publicly owned facilities are a key component of daily life for all citizens of the county. Damage to public water and sewer systems, transportation networks, flood control facilities, emergency facilities, and offices can hinder the ability of

the government to deliver services. Government can take action to reduce risk to public infrastructure from flood events, as well as craft public policy that reduces risk to private property from flood events.

Roads

During natural hazard events, or any type of emergency or disaster, dependable road connections are critical for providing emergency services. Roads systems in the City of La Mirada are maintained by multiple jurisdictions. Federal, state, county, and city governments all have a stake in protecting roads from flood damage. Road networks often traverse floodplain and floodway areas. Transportation agencies responsible for road maintenance are typically aware of roads at risk from flooding.

Bridges

Bridges are key points of concern during flood events because they are important links in road networks, river crossings, and they can be obstructions in watercourses, inhibiting the flow of water during flood events. The bridges in the City of La Mirada are state, county, city, or privately owned. A state-designated inspector must inspect all state, county, and city bridges every two years; but private bridges are not inspected, and can be very dangerous. The inspections are rigorous, looking at everything from seismic capability to erosion and scour.

The five highest priority bridges in the City of La Mirada include:

- Valley View at Milan Creek
- Imperial Highway at La Mirada Creek
- Artesian Blvd at Coyote Creek
- Rosecrans Ave at L.M. Channel
- Rosecrans Ave at Coyote Creek

Storm Water Systems

Local drainage problems are common throughout the City of La Mirada. There is a drainage master plan, and City of La Mirada Public Works Department is aware of local drainage threats. The City's General Plan states that the local storm drains are maintained and monitored by the Los Angeles County Public Works Department. The problems are often present where storm water runoff enters culverts or goes underground into storm sewers. Inadequate maintenance can also contribute to the flood hazard in urban areas.

Water/Wastewater Treatment Facilities

There is one sanitary district in the City of La Mirada, and there are no sewage treatment facilities. The City's General Plan states that the sewer lines are controlled by the Los Angeles County Department of Public Works and that the Suburban Water Systems provides drinking water in the City of La Mirada.

Water Quality

Environmental quality problems include bacteria, toxins, and pollution. The City's General Plan states that the City participates with the County of Los Angeles in the National Pollutant Discharge Elimination System to reduce pollutants in urban runoff.

Flood Endnotes

1. <http://www.lalc.k12.ca.us/target/units/river/tour/hist.html>
2. Gumprecht, Blake, 1999, Johns Hopkins University Press, Baltimore, MD.
3. Ibid
4. http://www.usc.edu/isd/archives/la/scandals/st_francis_dam.html
5. <http://www.latimes.com/news/local/surroundings/la-me-surround11dec11,0,1754871.story?coll=la-adelphia-right-rail>
6. <http://www.fema.gov/rrr/talkdiz/landslide.shtm#what>

Section 7: Landslides in the City of La Mirada

Why are Landslides a Threat to City of La Mirada

Landslides are a serious geologic hazard in almost every state in America. Nationally, landslides cause 25 to 50 deaths each year.¹ The best estimate of direct and indirect costs of landslide damage in the United States range between \$1 and \$2 billion annually.² As a seismically active region, California has had significant number of locations impacted by landslides. Some landslides result in private property damage; other landslides impact transportation corridors, fuel and energy conduits, and communication facilities. They can also pose a serious threat to human life.

Landslides can be broken down into two categories: (1) rapidly moving (generally known as debris flows), and (2) slow moving. Rapidly moving landslides or debris flows present the greatest risk to human life, and people living in or traveling through areas prone to rapidly moving landslides are at increased risk of serious injury. Slow moving landslides can cause significant property damage, but are less likely to result in serious human injuries.

The City of La Mirada has liquefaction zones in the southern, eastern, and western portion of the City as indicated on Map 7-1. Since the settlement of the city in the mid 1900's, there have not (or have) been any instances of liquefaction associated with seismic activity.

Historic Southern California Landslides

1928 St. Francis Dam failure

Los Angeles County, California. The dam gave way on March 12, and its waters swept through the Santa Clara Valley toward the Pacific Ocean, about 54 miles away. Sixty five miles of valley was devastated, and over 500 people were killed. Damages were estimated at \$672.1 million (year 2000 dollars).³

1956 Portuguese Bend, California

Cost, \$14.6 million (2000 dollars) California Highway 14, Palos Verdes Hills. Land use on the Palos Verdes Peninsula consists mostly of single-family homes built on large lots, many of which have panoramic ocean views. All of the houses were constructed with individual septic systems, generally consisting of septic tanks and seepage pits. Landslides have been active here for thousands of years, but recent landslide activity has been attributed in part to human activity. The Portuguese Bend landslide began its modern movement in August 1956, when displacement was noticed at its northeast margin. Movement gradually extended downslope so that the entire eastern edge of the slide mass was moving within 6 weeks. By the summer of 1957, the entire slide mass was sliding towards the sea.⁴

1958-1971 Pacific Palisades, California

Cost, \$29.1 million (2000 dollars) California Highway 1 and house damaged.⁵

1961 Mulholland Cut, California

Cost, \$41.5 million (2000 dollars) On Interstate 405, 11 miles north of Santa Monica, Los Angeles County.⁶

1963 Baldwin Hills Dam Failure.

On December 14, the 650 foot long by 155 foot high earth fill dam gave way and sent 360 million gallons of water in a fifty foot high wall cascading onto the community below, killing five persons, and damaging 50 million (1963 dollars) of dollars in property.

1969 Glendora, California

Cost, \$26.9 million (2000 dollars) Los Angeles County, 175 houses damaged, mainly by debris flows.⁷

1969 Seventh Ave., Los Angeles County, California

Cost, \$14.6 million (2000 dollars) California Highway 60.⁸

1970 Princess Park, California

Cost, \$29.1 million (2000 dollars) California Highway 14, 10 miles north of Newhall, near Saugus, northern Los Angeles County.⁹

1971 Upper and Lower Van Norman Dams, San Fernando, California

Earthquake-induced landslides Cost, \$302.4 million (2000 dollars). Damage due to the February 9, 1971, magnitude 7.5 San Fernando, California, earthquake. The earthquake of February 9 severely damaged the Upper and Lower Van Norman Dams.¹⁰

1971 Juvenile Hall, San Fernando, California

Landslides caused by the February 9, 1971, San Fernando, California, earthquake Cost, \$266.6 million (2000 dollars). In addition to damaging the San Fernando Juvenile Hall, this 1.2 km-long slide damaged trunk lines of the Southern Pacific Railroad, San Fernando Boulevard, Interstate Highway 5, the Sylmar, California, electrical converter station, and several pipelines and canals.¹¹

1977-1980 Monterey Park, Repetto Hills, Los Angeles County, California

Cost, \$14.6 million (2000 dollars) 100 houses damaged in 1980 due to debris flows.¹²

1978 Bluebird Canyon Orange County

California October 2, cost, \$52.7 million (2000 dollars) 60 houses destroyed or damaged. Unusually heavy rains in March of 1978 may have contributed to initiation of the landslide. Although the 1978 slide area was approximately 3.5 acres, it is suspected to be a portion of a larger, ancient landslide.¹³

1979 Big Rock, California, Los Angeles County

Cost, approximately \$1.08 billion (2000 dollars) California Highway 1 rockslide.¹⁴

1980 Southern California slides

\$1.1 billion in damage (2000 dollars) Heavy winter rainfall in 1979-90 caused damage in six Southern California counties. In 1980, the rainstorm started on February 8. A sequence of 5 days of continuous rain and 7 inches of precipitation had occurred by February 14. Slope failures were beginning to develop by February 15 and then very high-intensity rainfall occurred on February 16. As much as 8 inches of rain fell in a 6 hour period in many locations. Records and personal observations in the field on February 16 and 17 showed that the mountains and slopes literally fell apart on those 2 days.¹⁵

1983 San Clemente, California, Orange County

Cost, \$65 million (2000 dollars), California Highway 1. Litigation at that time involved approximately \$43.7 million (2000 dollars).¹⁶

1983 Big Rock Mesa, California

Cost, \$706 million (2000 dollars) in legal claims condemnation of 13 houses, and

300 more threatened rockslide caused by rainfall ¹⁷

1978-1979, 1980 San Diego County, California

Experienced major damage from storms in 1978, 1979, and 1979-80, as did neighboring areas of Los Angeles and Orange County, California. One hundred and twenty landslides were reported to have occurred in San Diego County during these 2 years. Rainfall for the rainy seasons of 78-79 and 79-80 was 14.82 and 15.61 inches (37.6 and 39.6 cm) respectively, compared to a 125-year average (1850-1975) of 9.71 inches (24.7 cm). Significant landslides occurred in the Friars Formation, a unit that was noted as slide-prone in the Seismic Safety Study for the City of San Diego. Of the nine landslides that caused damage in excess of \$1 million, seven occurred in the Friars Formation, and two in the Santiago Formation in the northern part of San Diego County. ¹⁸

1994 Northridge, California earthquake landslides

As a result of the magnitude 6.7 Northridge, California, earthquake, more than 11,000 landslides occurred over an area of 10,000 km². Most were in the Santa Susana Mountains and in mountains north of the Santa Clara River Valley. Destroyed dozens of homes, blocked roads, and damaged oil-field infrastructure. Caused deaths from Coccidioidomycosis (valley fever) the spore of which was released from the soil and blown toward the coastal populated areas. The spore was released from the soil by the landslide activity. ¹⁹

March 1995 Los Angeles and Ventura Counties, Southern California

Above normal rainfall triggered damaging debris flows, deep-seated landslides, and flooding. Several deep-seated landslides were triggered by the storms, the most notable was the La Conchita landslide, which in combination with a local debris flow, destroyed or badly damaged 11 to 12 homes in the small town of La Conchita, about 20 km west of Ventura. There also was widespread debris-flow and flood damage to homes, commercial buildings, and roads and highways in areas along the Malibu coast that had been devastated by wildfire 2 years before. ²⁰

Landslide Characteristics

What is a landslide?

“A landslide is defined as, the movement of a mass of rock, debris, or earth down a slope. Landslides are a type of “mass wasting” which denotes any down slope movement of soil and rock under the direct influence of gravity. The term “landslide” encompasses events such as rock falls, topples, slides, spreads, and flows. Landslides can be initiated by rainfall, earthquakes, volcanic activity, changes in groundwater, disturbance and change of a slope by man-made construction activities, or any combination of these factors. Landslides can also occur underwater, causing tidal waves and damage to coastal areas. These landslides are called submarine landslides.”²¹

The size of a landslide usually depends on the geology and the initial cause of the landslide. Landslides vary greatly in their volume of rock and soil, the length, width, and depth of the area affected, frequency of occurrence, and speed of movement. Some characteristics that determine the type of landslide are slope of the hillside, moisture content, and the nature of the underlying materials. Landslides are given different names, depending on the type of failure and their composition and characteristics.

Slides move in contact with the underlying surface. These movements include rotational slides where sliding material moves along a curved surface and translational slides where movement occurs along a flat surface. These slides are generally slow moving and can be deep. Slumps are small rotational slides that are generally shallow. Slow-moving landslides can occur on relatively gentle slopes and can cause significant property damage, but are far less likely to result in serious injuries than rapidly moving landslides.²²

“Failure of a slope occurs when the force that is pulling the slope downward (gravity) exceeds the strength of the earth materials that compose the slope. They can move slowly, (millimeters per year) or can move quickly and disastrously, as is the case with debris-flows. Debris-flows can travel down a hillside of speeds up to 200 miles per hour (more commonly, 30 – 50 miles per hour), depending on the slope angle, water content, and type of earth and debris in the flow. These flows are initiated by heavy, usually sustained, periods of rainfall, but sometimes can happen as a result of short bursts of concentrated rainfall in susceptible areas. Burned areas charred by wildfires are particularly susceptible to debris flows, given certain soil characteristics and slope conditions.”²³

What is a Debris Flow?

A debris or mud flow is a river of rock, earth and other materials, including vegetation that is saturated with water. This high percentage of water gives the debris flow a very rapid rate of movement down a slope. Debris flows often with speeds greater than 20 mile per hour, and can often move much faster.²⁴ This high rate of speed makes debris flows extremely dangerous to people and property in its path.

Landslide Events and Impacts

Landslides are a common hazard in California. Weathering and the decomposition of geologic materials produces conditions conducive to landslides and human activity further exacerbates many landslide problems. Many landslides are difficult to mitigate, particularly in areas of large historic movement with weak underlying geologic materials. As communities continue to modify the terrain and influence natural processes, it is important to be aware of the physical

properties of the underlying soils as they, along with climate, create landslide hazards. Even with proper planning, landslides will continue to threaten the safety of people, property, and infrastructure, but without proper planning, landslide hazards will be even more common and more destructive.

The increasing scarcity of build-able land, particularly in urban areas, increases the tendency to build on geologically marginal land. Additionally, hillside housing developments in Southern California are prized for the view lots that they provide.

Rock falls occur when blocks of material come loose on steep slopes. Weathering, erosion, or excavations, such as those along highways, can cause falls where the road has been cut through bedrock. They are fast moving with the materials free falling or bouncing down the slope. In falls, material is detached from a steep slope or cliff. The volume of material involved is generally small, but large boulders or blocks of rock can cause significant damage.

Earth flows are plastic or liquid movements in which land mass (e.g. soil and rock) breaks up and flows during movement. Earthquakes often trigger flows.²⁵ Debris flows normally occur when a landslide moves downslope as a semi-fluid mass scouring, or partially scouring soils from the slope along its path. Flows are typically rapidly moving and also tend to increase in volume as they scour out the channel.²⁶ Flows often occur during heavy rainfall, can occur on gentle slopes, and can move rapidly for large distances.

Landslide Conditions

Landslides are often triggered by periods of heavy rainfall. Earthquakes, subterranean water flow and excavations may also trigger landslides. Certain geologic formations are more susceptible to landslides than others. Human activities, including locating development near steep slopes, can increase susceptibility to landslide events. Landslides on steep slopes are more dangerous because movements can be rapid.

Although landslides are a natural geologic process, the incidence of landslides and their impacts on people can be exacerbated by human activities. Grading for road construction and development can increase slope steepness. Grading and construction can decrease the stability of a hill slope by adding weight to the top of the slope, removing support at the base of the slope, and increasing water content. Other human activities effecting landslides include: excavation, drainage and groundwater alterations, and changes in vegetation.²⁷

Wildland fires in hills covered with chaparral are often a precursor to debris flows in burned out canyons. The extreme heat of a wildfire can create a soil condition in which the earth becomes impervious to water by creating a waxy-like layer just below the ground surface. Since the water cannot be absorbed into the soil, it

rapidly accumulates on slopes, often gathering loose particles of soil in to a sheet of mud and debris. Debris flows can often originate miles away from unsuspecting persons, and approach them at a high rate of speed with little warning.

Natural Conditions

Natural processes can cause landslides or re-activate historical landslide sites. The removal or undercutting of shoreline-supporting material along bodies of water by currents and waves produces countless small slides each year. Seismic tremors can trigger landslides on slopes historically known to have landslide movement. Earthquakes can also cause additional failure (lateral spreading) that can occur on gentle slopes above steep streams and riverbanks.

Particularly Hazardous Landslide Areas

Locations at risk from landslides or debris flows include areas with one or more of the following conditions:

1. On or close to steep hills;
2. Steep road-cuts or excavations;
3. Existing landslides or places of known historic landslides (such sites often have tilted power lines, trees tilted in various directions, cracks in the ground, and irregular-surfaced ground);
4. Steep areas where surface runoff is channeled, such as below culverts, V-shaped valleys, canyon bottoms, and steep stream channels; and
5. Fan-shaped areas of sediment and boulder accumulation at the outlets of canyons.
6. Canyon areas below hillside and mountains that have recently (within 1-6 years) been subjected to a wildland fire.

Impacts of Development

Although landslides are a natural occurrence, human impacts can substantially affect the potential for landslide failures in City of La Mirada. Proper planning and geotechnical engineering can be exercised to reduce the threat of safety of people, property, and infrastructure.

Excavation and Grading

Slope excavation is common in the development of home sites or roads on sloping terrain. Grading these slopes can result in some slopes that are steeper than the pre-existing natural slopes. Since slope steepness is a major factor in landslides, these steeper slopes can be at an increased risk for landslides. The added weight of fill placed on slopes can also result in an increased landslide hazard. Small landslides can be fairly common along roads, in either the road cut or the road fill. Landslides occurring below new construction sites are indicators of the potential impacts stemming from excavation.

Drainage and Groundwater Alterations

Water flowing through or above ground is often the trigger for landslides. Any activity that increases the amount of water flowing into landslide-prone slopes can increase landslide hazards. Broken or leaking water or sewer lines can be especially problematic, as can water retention facilities that direct water onto slopes. However, even lawn irrigation in landslide prone locations can result in damaging landslides. Ineffective storm water management and excess runoff can also cause erosion and increase the risk of landslide hazards. Drainage can be affected naturally by the geology and topography of an area; Development that results in an increase in impervious surface impairs the ability of the land to absorb water and may redirect water to other areas. Channels, streams, ponding, and erosion on slopes all indicate potential slope problems.

Road and driveway drains, gutters, downspouts, and other constructed drainage facilities can concentrate and accelerate flow. Ground saturation and concentrated velocity flow are major causes of slope problems and may trigger landslides.²⁸

Changes in Vegetation

Removing vegetation from very steep slopes can increase landslide hazards. Areas that experience wildfire and land clearing for development may have long periods of increased landslide hazard. Also, certain types of ground cover have a much greater need for constant watering to remain green. Changing away from native ground cover plants may increase the risk of landslide.

Landslide Hazard Assessment

Hazard Identification

Identifying hazardous locations is an essential step towards implementing more informed mitigation activities. As development is proposed in hazardous areas, the developer is required to provide the City of La Mirada a Preliminary Geotechnical Investigation of the site which will outline proper mitigation measures to reduce potential hazards to future structures on the subject property.

Vulnerability and Risk

Vulnerability assessment for landslides will assist in predicting how different types of property and population groups will be affected by a hazard.²⁹ Data that includes specific landslide-prone and debris flow locations in the city can be used to assess the population and total value of property at risk from future landslide occurrences.

While a quantitative vulnerability assessment (an assessment that describes number of lives or amount of property exposed to the hazard) has not yet been

conducted for City of La Mirada landslide events, there are many qualitative factors that point to potential vulnerability. Landslides can impact major transportation arteries, blocking residents from essential services and businesses.

Past landslide events have caused major property damage or significantly impacted city residents, and continuing to map city landslide and debris flow areas will help in preventing future loss.

Factors included in assessing landslide risk include population and property distribution in the hazard area, the frequency of landslide or debris flow occurrences, slope steepness, soil characteristics, and precipitation intensity. This type of analysis could generate estimates of the damages to the city due to a specific landslide or debris flow event. At the time of publication of this plan, data was insufficient to conduct a risk analysis and the software needed to conduct this type of analysis was not available.

Community Landslide Issues

What is Susceptible to Landslides?

Landslides can affect utility services, transportation systems, and critical lifelines. Communities may suffer immediate damages and loss of service. Disruption of infrastructure, roads, and critical facilities may also have a long-term effect on the economy. Utilities, including potable water, wastewater, telecommunications, natural gas, and electric power are all essential to service community needs. Loss of electricity has the most widespread impact on other utilities and on the whole community. Natural gas pipes may also be at risk of breakage from landslide movements as small as an inch or two.

Roads and Bridges

Losses incurred from landslide hazards in the City of La Mirada have been associated with roads. The City of La Mirada Public Works Department is responsible for responding to slides that inhibit the flow of traffic or are damaging a road or a bridge. The public works department does its best to communicate with residents impacted by landslides, but can usually only repair the road itself, as well as the areas adjacent to the slide where the city has the right of way.

It is not cost effective to mitigate all slides because of limited funds and the fact that some historical slides are likely to become active again even with mitigation measures. The City alleviates problem areas by installing new drainage systems on the slopes to divert water from the landslides. This type of response activity is often the most cost-effective in the short-term, but is only temporary. Unfortunately, many property owners are unaware of slides and the dangers associated with them.

Lifelines and Critical Facilities

Lifelines and critical facilities should remain accessible, if possible, during a natural hazard event. The impact of closed transportation arteries may be increased if the closed road or bridge is critical for hospitals and other emergency facilities. Therefore, inspection and repair of critical transportation facilities and routes is essential and should receive high priority. Losses of power and phone service are also potential consequences of landslide events. Due to heavy rains, soil erosion in hillside areas can be accelerated, resulting in loss of soil support beneath high voltage transmission towers in hillsides and remote areas. Flood events can also cause landslides, which can have serious impacts on gas lines that are located in vulnerable soils.

Landslide Mitigation Activities

Landslide mitigation activities include current mitigation programs and activities that are being implemented by local or city organizations.

Landslide Building/Zoning Codes

Generally, the City of La Mirada requires soils and engineering geologic studies for new or proposed developments. More detailed surface and subsurface investigations shall be warranted if indicated by engineering and geologic studies to sufficiently describe existing conditions. This may include soils, vegetation, geologic formations, and drainage patterns. Site evaluations may also occur where stability might be lessened by proposed grading/filling or land clearing.

Special attention is given to construction proposed within an area zoned Water Hazard. Water Hazard is a special designation to give recognition to special conditions of hazards related to drainage, flood and water run-off.

Landslide Mitigation Action Items

The landslide mitigation action items provide direction on specific activities that the city, organizations, and residents in City of La Mirada can undertake to reduce risk and prevent loss from landslide events. Each action item is followed by ideas for implementation, which can be used by the steering committee and local decision makers in pursuing strategies for implementation.

Landslide Endnotes

1. Mileti, Dennis, *Disasters by Design: A Reassessment of Natural Hazards in the United States* (1999) Joseph Henry Press, Washington D.C.
2. Brabb, E.E., and B.L Harrod. (Eds) *Landslides: Extent and Economic Significance. Proceedings of the 28th International Geological Congress Symposium on Landslides.* (1989) Washington D.C., Rotterdam: Balkema.
3. Highland, L.M., and Schuster, R.L., *Significant Landslide Events in the United States.* (No Date) USGS, Washington D.C.,
http://landslides.usgs.gov.html_files/pubs/report1/Landslides_pass_508.pdf
4. Ibid.
5. Ibid.
6. Ibid.
7. Ibid.
8. Ibid.
9. Ibid.
10. Ibid.
11. Ibid.
12. Ibid.
13. Ibid.
14. Ibid.
15. Ibid.
16. Ibid.
17. Ibid.
18. Ibid.
19. Ibid.

20. Ibid.

21. Landslide Hazards, U.S. Geological Survey Fact Sheet 0071-00, Version 1.0, U.S. Department of the Interior - U.S. Geological Survey, <http://pubs.usgs.gov/fs/fs-0071-00/>

22. Interagency Hazard Mitigation Team, *State Hazard Mitigation Plan* (2000) Oregon Emergency Management

23. Ibid.

24. Barrows, Alan and Smith, Ted, DMG Note 13, http://www.consrv.ca.gov/cgs/information/publications/cgs_notes/note_33/

25. Robert Olson Associates, *Metro Regional Hazard Mitigation and Planning Guide* (June 1999) Metro

26. Ibid.

27. Planning For Natural Hazards: *The Oregon Technical Resource Guide*, Department of Land Conservation and Development (2000), Ch 5.

28. *Homeowners Guide for Landslide Control, Hillside Flooding, Debris Flows, Soil Erosion*, (March 1997)

29. Burby, R. (Ed.) *Cooperating With Nature* (1998) Washington, D.C.: Joseph Henry Press.

Section 8:
Wildland/Urban
Interface Fire
Hazards
in the
City of La Mirada

Why are Wildfires a Threat to Southern California?

For thousands of years, fires have been a natural part of the ecosystem in Southern California. However, wildfires present a substantial hazard to life and property in communities built within or adjacent to hillsides and mountainous areas. There is a huge potential for losses due to wildland/urban interface fires in Southern California. According to the California Division of Forestry (CDF), there were over seven thousand reportable fires in California in 2003, with over one million acres burned.¹ According to CDF statistics, in the October 2003 Firestorms, over 4,800 homes were destroyed and 22 lives were lost.²

The 2003 Southern California Fires

The fall of 2003 marked the most destructive wildfire season in California history. In a ten day period, 12 separate fires raged across Southern California in Los Angeles, Riverside, San Bernardino, San Diego and Ventura counties. The massive "Cedar" fire in San Diego County alone consumed of 2,800 homes and burned over a quarter of a million acres.

Table 8-1: October 2003 Firestorm Statistics

County	Fire Name	Date Began	Acres Burned	Homes Lost	Homes Damaged	Lives Lost
Riverside	Pass	10/21/03	2,397	3	7	0
Los Angeles	Padua	10/21/03	10,446	59	0	0
San Bernardino	Grand Prix	10/21/03	69,894	136	71	0
San Diego	Roblar 2	10/21/03	8,592	0	0	0
Ventura	Piru	10/23/03	63,991	8	0	0
Los Angeles	Verdale	10/24/03	8,650	1	0	0
Ventura	Simi	10/25/03	108,204	300	11	0
San Diego	Cedar	10/25/03	273,246	2,820	63	14
San Bernardino	Old	10/25/03	91,281	1,003	7	6
San Diego	Otay / Mine	10/26/03	46,000	6	11	0
Riverside	Mountain	10/26/03	10,000	61	0	0
San Diego	Paradise	10/26/03	56,700	415	15	2
Total Losses			749,401	4,812	185	22

Source: http://www.fire.ca.gov/php/fire_er_content/downloads/2003LargeFires.pdf

Historic Fires in Southern California

Large fires have been part of the Southern California landscape for millennia. “Written documents reveal that during the 19th century human settlement of southern California altered the fire regime of coastal California by increasing the fire frequency. This was an era of very limited fire suppression, and yet like today, large crown fires covering tens of thousands of acres were not uncommon. One of the largest fires in Los Angeles County (60,000 acres) occurred in 1878, and the largest fire in Orange County’s history, in 1889, was over half a million acres.”³

Table 8-2: Large Historic Fires in California 1961-2003

20 Largest California Wildland Fires (Structures Destroyed)

	Fire Name	Date	County	Acres	Structures	Deaths
1	Tunnel	October 1991	Alameda	1,600	2,900	25
2	Cedar	October 2003	San Diego	273,246	2,820	14
3	Old	October 2003	San Bernardino	91,281	1,003	6
4	Jones	October 1999	Shasta	26,200	954	1
5	Paint	June 1990	Santa Barbara	4,900	641	1
6	Fountain	August 1992	Shasta	63,960	636	0
7	City of Berkeley	September 1923	Alameda	130	584	0
8	Bel Air	November 1961	Los Angeles	6,090	484	0
9	Laguna Fire	October 1993	Orange	14,437	441	0
10	Paradise	October 2003	San Diego	56,700	415	2
11	Laguna	September 1970	San Diego	175,425	382	5
12	Panorama	November 1980	San Bernardino	23,600	325	4
13	Topanga	November 1993	Los Angeles	18,000	323	3
14	49er	September 1988	Nevada	33,700	312	0
15	Simi	October 2003	Ventura	108,204	300	0
16	Sycamore	July 1977	Santa Barbara	805	234	0
17	Canyon	September 1999	Shasta	2,580	230	0
18	Kannan	October 1978	Los Angeles	25,385	224	0
19	Kinneloa	October 1993	Los Angeles	5,485	196	1

19	Grand Prix	October 2003	San Bernardino	59,448	196	0
20	Old Gulch	August 1992	Calaveras	17,386	170	0

<http://www.fire.ca.gov/FireEmergencyResponse/HistoricalStatistics/PDF/20LSTRUCTURES.pdf>

“Structures” is meant to include all loss - homes and outbuildings, etc.

During the 2002 fire season, more than 6.9 million acres of public and private lands burned in the US, resulting in loss of property, damage to resources and disruption of community services.⁴ Taxpayers spent more than \$1.6 billion⁵ to combat more than 88,400 fires nationwide. Many of these fires burned in wildland/urban interface areas and exceeded the fire suppression capabilities of those areas. Table 8-3 illustrates fire suppression costs for state, private and federal lands.

Table 8-3: National Fire Suppression Costs

Year	Suppression Costs	Acres Burned	Structures Burned
2000	\$1.3 billion	8,422,237	861
2001	\$0.5 billion	3,570,911	731
2002	\$1.6 billion	6,937,584	815

http://research.yale.edu/gisf/assets/pdf/ppf/wildfire_report.pdf

Wildfire Characteristics

There are three categories of interface fire:⁶ The classic wildland/urban interface exists where well-defined urban and suburban development presses up against open expanses of wildland areas; the mixed wildland/urban interface is characterized by isolated homes, subdivisions and small communities situated predominantly in wildland settings; and the occluded wildland/urban interface exists where islands of wildland vegetation occur inside a largely urbanized area. Certain conditions must be present for significant interface fires to occur. The most common conditions include: hot, dry and windy weather; the inability of fire protection forces to contain or suppress the fire; the occurrence of multiple fires that overwhelm committed resources; and a large fuel load (dense vegetation). Once a fire has started, several conditions influence its behavior, including fuel topography, weather, drought and development.

Southern California has two distinct areas of risk for wildland fire. The foothills and lower mountain areas are most often covered with scrub brush or chaparral. The higher elevations of mountains also have heavily forested terrain. The lower elevations covered with chaparral create one type of exposure.

“Past fire suppression is not to blame for causing large shrub land wildfires, nor has it proven effective in halting them.” said Dr. Jon

Keeley, a USGS fire researcher who studies both southern California shrub lands and Sierra Nevada forests. ““Under Santa Ana conditions, fires carry through all chaparral regardless of age class. Therefore, prescribed burning programs over large areas to remove old stands and maintain young growth as bands of firebreaks resistant to ignition are futile at stopping these wildfires.””⁷

The higher elevations of Southern California’s mountains are typically heavily forested.

The magnitude of the 2003 fires is the result of three primary factors: (1) severe drought, accompanied by a series of storms that produce thousands of lightning strikes and windy conditions; (2) an infestation of bark beetles that has killed thousands of mature trees; and (3) the effects of wildfire suppression over the past century that has led to buildup of brush and small diameter trees in the forests.

“When Lewis and Clark explored the Northwest, the forests were relatively open, with 20 to 25 mature trees per acre. Periodically, lightning would start fires that would clear out underbrush and small trees, renewing the forests. Today's forests are completely different, with as many as 400 trees crowded onto each acre, along with thick undergrowth. This density of growth makes forests susceptible to disease, drought and severe wildfires. Instead of restoring forests, these wildfires destroy them and it can take decades to recover. This radical change in our forests is the result of nearly a century of well-intentioned but misguided management.”⁸

The Interface

One challenge Southern California faces regarding the wildfire hazard is from the increasing number of houses being built on the urban/wildland interface. Every year the growing population has expanded further and further into the hills and mountains, including forest lands. The increased "interface" between urban/suburban areas and the open spaces created by this expansion has produced a significant increase in threats to life and property from fires and has pushed existing fire protection systems beyond original or current design and capability. Property owners in the interface are not aware of the problems and threats they face. Therefore, many owners have done very little to manage or offset fire hazards or risks on their own property. Furthermore, human activities increase the incidence of fire ignition and potential damage.

Fuel

Fuel is the material that feeds a fire and is a key factor in wildfire behavior. Fuel is classified by volume and by type. Volume is described in terms of "fuel loading", or the amount of available vegetative fuel.

The type of fuel also influences wildfire. Chaparral is a primary fuel of Southern California wildfires. Chaparral habitat ranges in elevation from near sea level to over 5,000' in Southern California. Chaparral communities experience long dry summers and receive most of their annual precipitation from winter rains. Although chaparral is often considered as a single species, there are two distinct types; hard chaparral and soft chaparral. Within these two types are dozens of different plants, each with its own particular characteristics.

“Fire has been important in the life cycle of chaparral communities for over 2 million years; however, the true nature of the "fire cycle" has been subject to interpretation. In a period of 750 years, it generally thought that fire occurs once every 65 years in coastal drainages and once every 30 to 35 years inland.”⁹

“The vegetation of chaparral communities has evolved to a point it requires fire to spawn regeneration. Many species invite fire through the production of plant materials with large surface-to-volume ratios, volatile oils and through periodic die-back of vegetation. These species have further adapted to possess special reproductive mechanisms following fire. Several species produce vast quantities of seeds which lie dormant until fire triggers germination. The parent plant which produces these seeds defends itself from fire by a thick layer of bark which allows enough of the plant to survive so that the plant can crown sprout following the blaze. In general, chaparral community plants have adapted to fire through the following methods; a) fire induced flowering; b) bud production and sprouting subsequent to fire; c) in-soil seed storage and fire stimulated germination; and d) on plant seed storage and fire stimulated dispersal.”¹⁰

An important element in understanding the danger of wildfire is the availability of diverse fuels in the landscape, such as natural vegetation, manmade structures and combustible materials. A house surrounded by brushy growth rather than cleared space allows for greater continuity of fuel and increases the fire's ability to spread. After decades of fire suppression “dog-hair” thickets have accumulated, which enable high intensity fires to flare and spread rapidly.

Topography

Topography influences the movement of air, thereby directing a fire course. For example, if the percentage of uphill slope doubles, the rate of spread in wildfire will likely double. Gulches and canyons can funnel air and act as chimneys, which intensify fire behavior and cause the fire to spread faster. Solar heating of dry, south-facing slopes produces up slope drafts that can complicate fire behavior. Unfortunately, hillsides with hazardous topographic characteristics are also desirable residential areas in many communities. This underscores the need for wildfire hazard mitigation and increased education and outreach to homeowners living in interface areas.

Weather

Weather patterns combined with certain geographic locations can create a favorable climate for wildfire activity. Areas where annual precipitation is less than 30 inches per year are extremely fire susceptible.¹¹ High-risk areas in Southern California share a hot, dry season in late summer and early fall when high temperatures and low humidity favor fire activity. The so-called “Santa Ana” winds, which are heated by compression as they flow down to Southern California from Utah, create a particularly high risk, as they can rapidly spread what might otherwise be a small fire.

Drought

Recent concerns about the effects of climate change, particularly drought, are contributing to concerns about wildfire vulnerability. The term drought is applied to a period in which an unusual scarcity of rain causes a serious hydrological imbalance. Unusually dry winters, or significantly less rainfall than normal, can lead to relatively drier conditions and leave reservoirs and water tables lower. Drought leads to problems with irrigation and may contribute to additional fires, or additional difficulties in fighting fires.

Development

Growth and development in scrubland and forested areas is increasing the number of human-made structures in Southern California interface areas. Wildfire has an effect on development, yet development can also influence wildfire. Owners often prefer homes that are private, have scenic views, are nestled in vegetation and use natural materials. A private setting may be far from public roads, or hidden behind a narrow, curving driveway. These conditions, however, make evacuation and fire fighting difficult. The scenic views found along mountain ridges can also mean areas of dangerous topography. Natural vegetation contributes to scenic beauty, but it may also provide a ready trail of fuel leading a fire directly to the combustible fuels of the home itself.

Wildfire Hazard Assessment

Wildfire Hazard Identification

Wildfire hazard areas are commonly identified in regions of the wildland/urban interface. Ranges of the wildfire hazard are further determined by the ease of fire ignition due to natural or human conditions and the difficulty of fire suppression. The wildfire hazard is also magnified by several factors related to fire suppression/control such as the surrounding fuel load, weather, topography and property characteristics. Generally, hazard identification rating systems are based on weighted factors of fuels, weather and topography.

Table 8-4 illustrates a rating system to identify wildfire hazard risk (with a score of 3 equaling the most danger and a score of 1 equaling the least danger.)

Table 8-4: Sample Hazard Identification Rating System

Category	Indicator	Rating
Roads and Signage	Steep; narrow; poorly signed	3
	One or two of the above	2
	Meets all requirements	1
Water Supply	None, except domestic	3
	Hydrant, tank, or pool over 500 feet away	2
	Hydrant, tank, or pool within 500 feet	1
Location of the Structure	Top of steep slope with brush/grass below	3
	Mid-slope with clearance	2
	Level with lawn, or watered groundcover	1
Exterior Construction	Combustible roofing, open eaves, Combustible siding	3
	One or two of the above	2
	Non-combustible roof, boxed eaves, non-combustible siding	1

In order to determine the "base hazard factor" of specific wildfire hazard sites and interface regions, several factors must be taken into account. Categories used to assess the base hazard factor include:

- Topographic location, characteristics and fuels
- Site/building construction and design
- Site/region fuel profile (landscaping)
- Defensible space
- Accessibility
- Fire protection response
- Water availability

The use of Geographic Information System (GIS) technology in recent years has been a great asset to fire hazard assessment, allowing further integration of fuels, weather and topography data for such ends as fire behavior prediction, watershed evaluation, mitigation strategies and hazard mapping.

Vulnerability and Risk

Although the City of La Mirada has no history of wildfires, there exist areas of the City adjacent to Imperial Highway that due to the density, community design, access and vegetative fuel, may be susceptible to wildfires.

Southern California residents are served by a variety of local fire departments as well as county, state and federal fire resources. Data that includes the location of

interface areas in the county can be used to assess the population and total value of property at risk from wildfire and direct these fire agencies in fire prevention and response.

Key factors included in assessing wildfire risk include ignition sources, building materials and design, community design, structural density, slope, vegetative fuel, fire occurrence and weather, as well as occurrences of drought.

The National Wildland/Urban Fire Protection Program has developed the Wildland/Urban Fire Hazard Assessment Methodology tool for communities to assess their risk to wildfire. For more information on wildfire hazard assessment refer to <http://www.Firewise.org>.

Community Wildfire Issues

What is Susceptible to Wildfire?

Growth and Development in the Interface

The hills and mountainous areas of Southern California are considered to be interface areas. The development of homes and other structures is encroaching onto the wildlands and is expanding the wildland/urban interface. The interface neighborhoods are characterized by a diverse mixture of varying housing structures, development patterns, ornamental and natural vegetation and natural fuels.

In the event of a wildfire, vegetation, structures and other flammables can merge into unwieldy and unpredictable events. Factors important to the fighting of such fires include access, firebreaks, proximity of water sources, distance from a fire station and available firefighting personnel and equipment. Reviewing past wildland/urban interface fires shows that many structures are destroyed or damaged for one or more of the following reasons:

- Combustible roofing material
- Wood construction
- Structures with no defensible space
- Fire department with poor access to structures
- Subdivisions located in heavy natural fuel types
- Structures located on steep slopes covered with flammable vegetation
- Limited water supply
- Winds over 30 miles per hour

Disruption of Critical Services

Critical facilities include police stations, fire stations, hospitals, shelters, and other facilities that provide important services to the community. These facilities and their services need to be functional during a wildfire event. See Section 4, Risk Assessment Table 4-2 for a listing of critical and essential facilities and their vulnerability to wildfire.

Road Access

Road access is a major issue for all emergency service providers. As development encroaches into the rural areas of the county, the number of houses without adequate turn-around space is increasing. In many areas, there is not adequate space for emergency vehicle turnarounds in single-family residential neighborhoods, causing emergency workers to have difficulty doing their jobs because they cannot access houses. As fire trucks are large, firefighters are challenged by narrow roads and limited access when there is inadequate turn around space, the fire fighters can only work to remove the occupants, but cannot safely remain to save the threatened structures.

Water Supply

Fire fighters in remote and rural areas are faced by limited water supply and lack of hydrant taps. Rural areas are characteristically outfitted with small diameter pipe water systems, inadequate for providing sustained fire fighting flows.

Interface Fire Education Programs and Enforcement

Fire protection in urban/wildland interface areas may rely heavily more on the landowner's personal initiative to take measures to protect his or her own property. Therefore, public education and awareness may play a greater role in interface areas. In those areas with strict fire codes, property owners who are resist maintaining the minimum brush clearances may be cited for failure to clear brush.

The Need for Mitigation Programs

Continued development into the interface areas will have growing impacts on the wildland/urban interface. Periodically, the historical losses from wildfires in Southern California have been catastrophic, with deadly and expensive fires going back decades. The continued growth and development increases the public need for natural hazards mitigation planning in Southern California.

-
- 1 http://www.fire.ca.gov/php/2003fireseasonstats_v2.asp
 - 2 http://www.fire.ca.gov/php/fire_er_content/downloads/2003LargeFires.pdf
 - 3 http://www.usgs.gov/public/press/public_affairs/press_releases/pr1805m.html
 - 4 <http://www.nifc.gov/stats/wildlandfirestats.html>
 - 5 http://research.yale.edu/gisf/assets/pdf/ppf/wildfire_report.pdf
 - 6 Planning for Natural Hazards: The Oregon Technical Resource Guide, (July 2000) Department of Land Conservation and Development
 - 7 http://www.usgs.gov/public/press/public_affairs/press_releases/pr1805m.html
 - 8 Overgrown Forests Require Preventive Measures, By Gale A. Norton (Secretary of the Interior), USA Today Editorial, August 21, 2002
 - 9 <http://www.coastal.ca.gov/fire/ucsbfire.html>
 - 10 Ibid
 - 11 Planning for Natural Hazards: The Oregon Technical Resource Guide, (July 2000), Department of Land Conservation and Development

Appendix A - Resources

Master Resource Directory

The Resource Directory provides contact information for local, regional, state, and federal programs that are currently involved in hazard mitigation activities. The Risk Management Committee may look to the organizations on the following pages for resources and technical assistance. The Resource Directory provides a foundation for potential partners in action item implementation.

The Risk Management Committee will continue to add contact information for organizations currently engaged in hazard mitigation activities. This section may also be used by various community members interested in hazard mitigation information and projects.

American Public Works Association		
Level: National	Hazard: Multi	http://www.apwa.net
2345 Grand Boulevard		Suite 500
Kansas City, MO 64108-2641	Ph: 816-472-6100	Fx: 816-472-1610
Notes: The American Public Works Association is an international educational and professional association of public agencies, private sector companies, and individuals dedicated to providing high quality public works goods and services.		
Association of State Floodplain Managers		
Level: Federal	Hazard: Flood	www.floods.org
2809 Fish Hatchery Road		
Madison, WI 53713	Ph: 608-274-0123	Fx:
Notes: The Association of State Floodplain Managers is an organization of professionals involved in floodplain management, flood hazard mitigation, the National Flood Insurance Program, and flood preparedness, warning and recovery		
Building Seismic Safety Council (BSSC)		
Level: National	Hazard: Earthquake	www.bssconline.org
1090 Vermont Ave., NW		Suite 700
Washington, DC 20005	Ph: 202-289-7800	Fx: 202-289-109
Notes: The Building Seismic Safety Council (BSSC) develops and promotes building earthquake risk mitigation regulatory provisions for the nation.		

Appendix A - Resources

California Department of Transportation (CalTrans)		
Level: State	Hazard: Multi	http://www.dot.ca.gov/
120 S. Spring Street		
Los Angeles, CA 90012	Ph: 213-897-3656	Fx:
Notes: CalTrans is responsible for the design, construction, maintenance, and operation of the California State Highway System, as well as that portion of the Interstate Highway System within the state's boundaries. Alone and in partnership with Amtrak, Caltrans is also involved in the support of intercity passenger rail service in California.		
California Resources Agency		
Level: State	Hazard: Multi	http://resources.ca.gov/
1416 Ninth Street		Suite 1311
Sacramento, CA 95814	Ph: 916-653-5656	Fx:
Notes: The California Resources Agency restores, protects and manages the state's natural, historical and cultural resources for current and future generations using solutions based on science, collaboration and respect for all the communities and interests involved.		
California Division of Forestry (CDF)		
Level: State	Hazard: Multi	http://www.fire.ca.gov/php/index.php
210 W. San Jacinto		
Perris CA 92570	Ph: 909-940-6900	Fx:
Notes: The California Department of Forestry and Fire Protection protects over 31 million acres of California's privately-owned wildlands. CDF emphasizes the management and protection of California's natural resources.		
California Division of Mines and Geology (DMG)		
Level: State	Hazard: Multi	www.consrv.ca.gov/cgs/index.htm
801 K Street		MS 12-30
Sacramento, CA 95814	Ph: 916-445-1825	Fx: 916-445-5718
Notes: The California Geological Survey develops and disseminates technical information and advice on California's geology, geologic hazards, and mineral resources.		

Appendix A - Resources

California Environmental Resources Evaluation System (CERES)			
Level: State	Hazard: Multi	http://ceres.ca.gov/	
900 N St.		Suite 250	
Sacramento, Ca. 95814		Ph: 916-653-2238	Fx:
Notes: CERES is an excellent website for access to environmental information and websites.			
California Department of Water Resources (DWR)			
Level: State	Hazard: Flood	http://wwwdwr.water.ca.gov	
1416 9th Street			
Sacramento, CA 95814		Ph: 916-653-6192	Fx:
Notes: The Department of Water Resources manages the water resources of California in cooperation with other agencies, to benefit the State's people, and to protect, restore, and enhance the natural and human environments.			
California Department of Conservation: Southern California Regional Office			
Level: State	Hazard: Multi	www.consrv.ca.gov	
655 S. Hope Street		#700	
Los Angeles, CA 90017-2321		Ph: 213-239-0878	Fx: 213-239-0984
Notes: The Department of Conservation provides services and information that promote environmental health, economic vitality, informed land-use decisions and sound management of our state's natural resources.			
California Planning Information Network			
Level: State	Hazard: Multi	www.calpin.ca.gov	
		Ph:	Fx:
Notes: The Governor's Office of Planning and Research (OPR) publishes basic information on local planning agencies, known as the California Planners' Book of Lists. This local planning information is available on-line with new search capabilities and up-to-the-minute updates.			

Appendix A - Resources

EPA, Region 9		
Level: Regional	Hazard: Multi	http://www.epa.gov/region09
75 Hawthorne Street		
San Francisco, CA 94105	Ph: 415-947-8000	Fx: 415-947-3553
Notes: The mission of the U.S. Environmental Protection Agency is to protect human health and to safeguard the natural environment through the themes of air and global climate change, water, land, communities and ecosystems, and compliance and environmental stewardship.		
Federal Emergency Management Agency, Region IX		
Level: Federal	Hazard: Multi	www.fema.gov
1111 Broadway		Suite 1200
Oakland, CA 94607	Ph: 510-627-7100	Fx: 510-627-7112
Notes: The Federal Emergency Management Agency is tasked with responding to, planning for, recovering from and mitigating against disasters.		
Federal Emergency Management Agency, Mitigation Division		
Level: Federal	Hazard: Multi	www.fema.gov/fima/planhowto.shtm
500 C Street, S.W.		
Washington, D.C. 20472	Ph: 202-566-1600	Fx:
Notes: The Mitigation Division manages the National Flood Insurance Program and oversees FEMA's mitigation programs. It has of a number of programs and activities of which provide citizens Protection, with flood insurance; Prevention, with mitigation measures and Partnerships, with communities throughout the country.		
Floodplain Management Association		
Level: Federal	Hazard: Flood	www.floodplain.org
P.O. Box 50891		
Sparks, NV 89435-0891	Ph: 775-626-6389	Fx: 775-626-6389
Notes: The Floodplain Management Association is a nonprofit educational association. It was established in 1990 to promote the reduction of flood losses and to encourage the protection and enhancement of natural floodplain values. Members include representatives of federal, state and local government agencies as well as private firms.		

Appendix A - Resources

Gateway Cities Partnership		
Level: Regional	Hazard: Multi	www.gatewaycities.org
16401 Paramount Boulevard		
Paramount, CA 90723	Ph: 562-663-6850	Fx: 562-634-8216
<p>Notes: Gateway Cities Partnership is a 501 C 3 non-profit Community Development Corporation for the Gateway Cities region of southeast LA County. The region comprises 27 cities that roughly speaking extends from Montebello on the north to Long Beach on the South, the Alameda Corridor on the west to the Orange County line on the east.</p>		
Governor's Office of Emergency Services (OES)		
Level: State	Hazard: Multi	www.oes.ca.gov
P.O. Box 419047		
Rancho Cordova, CA 95741-9047	Ph: 916 845- 8911	Fx: 916 845- 8910
<p>Notes: The Governor's Office of Emergency Services coordinates overall state agency response to major disasters in support of local government. The office is responsible for assuring the state's readiness to respond to and recover from natural, manmade, and war-caused emergencies, and for assisting local governments in their emergency preparedness, response and recovery efforts.</p>		
Landslide Hazards Program, USGS		
Level: Federal	Hazard: Landslide	http://landslides.usgs.gov/index.html
12201 Sunrise Valley Drive		MS 906
Reston, VA 20192	Ph: 703-648- 4000	Fx:
<p>Notes: The NLIC website provides good information on the programs and resources regarding landslides. The page includes information on the National Landslide Hazards Program Information Center, a bibliography, publications, and current projects. USGS scientists are working to reduce long-term losses and casualties from landslide hazards through better understanding of the causes and mechanisms of ground failure both nationally and worldwide.</p>		

Appendix A - Resources

Los Angeles County Economic Development Corporation		
Level: Regional	Hazard: Multi	www.laedc.org
444 S. Flower Street		34th Floor
Los Angeles, CA 90071	Ph: 213-236-4813	Fx: 213- 623-0281
<p>Notes: The LAEDC is a private, non-profit 501 (c) 3 organization established in 1981 with the mission to attract, retain and grow businesses and jobs in the Los Angeles region. The LAEDC is widely relied upon for its Southern California Economic Forecasts and Industry Trend Reports. Lead by the renowned Jack Kyser (Sr. Vice President, Chief Economist) his team of researchers produces numerous publications to help business, media and government navigate the LA region's diverse economy.</p>		
Los Angeles County Public Works Department		
Level: County	Hazard: Multi	http://ladpw.org
900 S. Fremont Ave.		
Alhambra, CA 91803	Ph: 626-458-5100	Fx:
<p>Notes: The Los Angeles County Department of Public Works protects property and promotes public safety through Flood Control, Water Conservation, Road Maintenance, Bridges, Buses and Bicycle Trails, Building and Safety, Land Development, Waterworks, Sewers, Engineering, Capital Projects and Airports</p>		
National Wildland/Urban Interface Fire Program		
Level: Federal	Hazard: Wildfire	www.firewise.org/
1 Batterymarch Park		
Quincy, MA 02169-7471	Ph: 617-770-3000	Fx: 617 770-0700
<p>Notes: FIREWISE maintains a Website designed for people who live in wildfire- prone areas, but it also can be of use to local planners and decision makers. The site offers online wildfire protection information and checklists, as well as listings of other publications, videos, and conferences.</p>		
National Resources Conservation Service		
Level: Federal	Hazard: Multi	http://www.nrcs.usda.gov/
14th and Independence Ave., SW		Room 5105-A
Washington, DC 20250	Ph: 202-720-7246	Fx: 202-720-7690
<p>Notes: NRCS assists owners of America's private land with conserving their soil, water, and other natural resources, by delivering technical assistance based on sound science and suited to a customer's specific needs. Cost shares and financial incentives are available in some cases.</p>		

Appendix A - Resources

National Interagency Fire Center (NIFC)		
Level: Federal	Hazard: Wildfire	www.nifc.gov
3833 S. Development Ave.		
Boise, Idaho 83705-5354	Ph: 208-387- 5512	Fx:
Notes: The NIFC in Boise, Idaho is the nation's support center for wildland firefighting. Seven federal agencies work together to coordinate and support wildland fire and disaster operations.		
National Fire Protection Association (NFPA)		
Level: National	Hazard: Wildfire	http://www.nfpa.org/catalog/home/index.asp
1 Batterymarch Park		
Quincy, MA 02169-7471	Ph: 617-770-3000	Fx: 617 770-0700
Notes: The mission of the international nonprofit NFPA is to reduce the worldwide burden of fire and other hazards on the quality of life by providing and advocating scientifically-based consensus codes and standards, research, training and education		
National Floodplain Insurance Program (NFIP)		
Level: Federal	Hazard: Flood	www.fema.gov/nfip/
500 C Street, S.W.		
Washington, D.C. 20472	Ph: 202-566-1600	Fx:
Notes: The Mitigation Division manages the National Flood Insurance Program and oversees FEMA's mitigation programs. It has of a number of programs and activities providing citizens Protection, with flood insurance; Prevention, with mitigation measures and Partnerships, with communities throughout the country.		
National Oceanic /Atmospheric Administration		
Level: Federal	Hazard: Multi	www.noaa.gov
14th Street & Constitution Ave NW		Rm 6013
Washington, DC 20230	Ph: 202-482-6090	Fx: 202-482-3154
Notes: NOAA's historical role has been to predict environmental changes, protect life and property, provide decision makers with reliable scientific information, and foster global environmental stewardship.		

Appendix A - Resources

National Weather Service, Office of Hydrologic Development		
Level: Federal	Hazard: Flood	http://www.nws.noaa.gov/
1325 East West Highway		SSMC2
Silver Spring, MD 20910	Ph: 301-713-1658	Fx: 301-713-0963
Notes: The Office of Hydrologic Development (OHD) enhances National Weather Service (NWS) products by: infusing new hydrologic science, developing hydrologic techniques for operational use, managing hydrologic development by NWS field office, providing advanced hydrologic products to meet needs identified by NWS customers		
National Weather Service		
Level: Federal	Hazard: Multi	http://www.nws.noaa.gov/
520 North Elevar Street		
Oxnard, CA 93030	Ph: 805-988- 6615	Fx:
Notes: The National Weather Service is responsible for providing weather service to the nation. It is charged with the responsibility of observing and reporting the weather and with issuing forecasts and warnings of weather and floods in the interest of national safety and economy. Briefly, the priorities for service to the nation are: 1. protection of life, 2. protection of property, and 3. promotion of the nation's welfare and economy.		
Sanitation Districts of Los Angeles County		
Level: County	Hazard: Flood	http://www.lacsd.org/
1955 Workman Mill Road		
Whittier, CA 90607	Ph:562-699-7411 x2301	Fx:
Notes: The Sanitation Districts provide wastewater and solid waste management for over half the population of Los Angeles County and turn waste products into resources such as reclaimed water, energy, and recyclable materials.		

Appendix A - Resources

South Coast Air Quality Management District (AQMD)			
Level: Regional	Hazard: Multi	www.aqmd.gov	
21865 E. Copley Drive			
Diamond Bar, CA 91765		Ph: 800-CUT-SMOG	Fx:
<p>Notes: AQMD is a regional government agency that seeks to achieve and maintain healthful air quality through a comprehensive program of research, regulations, enforcement, and communication. The AQMD covers Los Angeles and Orange Counties and parts of Riverside and San Bernardino Counties.</p>			
Southern California Earthquake Center (SCEC)			
Level: Regional	Hazard: Earthquake	www.scec.org	
3651 Trousdale Parkway		Suite 169	
Los Angeles, CA 90089-0742		Ph: 213-740-5843	Fx: 213/740-0011
<p>Notes: The Southern California Earthquake Center (SCEC) gathers new information about earthquakes in Southern California, integrates this information into a comprehensive and predictive understanding of earthquake phenomena, and communicates this understanding to end-users and the general public in order to increase earthquake awareness, reduce economic losses, and save lives.</p>			
Southern California Association of Governments (SCAG)			
Level: Regional	Hazard: Multi	www.scag.ca.gov	
818 W. Seventh Street		12th Floor	
Los Angeles, CA 90017		Ph: 213-236-1800	Fx: 213-236-1825
<p>Notes: The Southern California Association of Governments functions as the Metropolitan Planning Organization for six counties: Los Angeles, Orange, San Bernardino, Riverside, Ventura and Imperial. As the designated Metropolitan Planning Organization, the Association of Governments is mandated by the federal government to research and draw up plans for transportation, growth management, hazardous waste management, and air quality.</p>			

Appendix A - Resources

State Fire Marshal (SFM)		
Level: State	Hazard: Wildfire	http://osfm.fire.ca.gov
1131 "S" Street		
Sacramento, CA 95814	Ph: 916-445-8200	Fx: 916-445-8509
<p>Notes: The Office of the State Fire Marshal (SFM) supports the mission of the California Department of Forestry and Fire Protection (CDF) by focusing on fire prevention. SFM regulates buildings in which people live, controls substances which may, cause injuries, death and destruction by fire; provides statewide direction for fire prevention within wildland areas; regulates hazardous liquid pipelines; reviews regulations and building standards; and trains and educates in fire protection methods and responsibilities.</p>		
The Community Rating System (CRS)		
Level: Federal	Hazard: Flood	http://www.fema.gov/nfip/crs.shtm
500 C Street, S.W.		
Washington, D.C. 20472	Ph: 202-566-1600	Fx:
<p>Notes: The Community Rating System (CRS) recognizes community floodplain management efforts that go beyond the minimum requirements of the NFIP. Property owners within the County would receive reduced NFIP flood insurance premiums if the County implements floodplain management practices that qualify it for a CRS rating. For further information on the CRS, visit FEMA's website.</p>		
United States Geological Survey		
Level: Federal	Hazard: Multi	http://www.usgs.gov/
345 Middlefield Road		
Menlo Park, CA 94025	Ph: 650-853-8300	Fx:
<p>Notes: The USGS provides reliable scientific information to describe and understand the Earth; minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect our quality of life.</p>		

Appendix A - Resources

U.S. Army Corps of Engineers		
Level: Federal	Hazard: Multi	http://www.usace.army.mil
P.O. Box 532711		
Los Angeles CA 90053- 2325	Ph: 213-452- 3921	Fx:
Notes: The United States Army Corps of Engineers work in engineering and environmental matters. A workforce of biologists, engineers, geologists, hydrologists, natural resource managers and other professionals provide engineering services to the nation including planning, designing, building and operating water resources and other civil works projects.		
USDA Forest Service		
Level: Federal	Hazard: Wildfire	http://www.fs.fed.us
1400 Independence Ave. SW		
Washington, D.C. 20250-0002	Ph: 202-205-8333	Fx:
Notes: The Forest Service is an agency of the U.S. Department of Agriculture. The Forest Service manages public lands in national forests and grasslands.		
USGS Water Resources		
Level: Federal	Hazard: Multi	www.water.usgs.gov
6000 J Street		Placer Hall
Sacramento, CA 95819-6129	Ph: 916-278-3000	Fx: 916-278-3070
Notes: The USGS Water Resources mission is to provide water information that benefits the Nation's citizens: publications, data, maps, and applications software.		
Western States Seismic Policy Council (WSSPC)		
Level: Regional	Hazard: Earthquake	www.wsspc.org/home.html
125 California Avenue		Suite D201, #1
Palo Alto, CA 94306	Ph: 650-330-1101	Fx: 650-326-1769
Notes: WSSPC is a regional earthquake consortium funded mainly by FEMA. Its website is a great resource, with information clearly categorized - from policy to engineering to education.		

Appendix B:

The Public Participation Process

Public participation is a key component to any strategic planning process. It is very important that such broad-reaching plans not be written in isolation. Agency participation offers an opportunity for impacted departments and organizations to provide expertise and insight into the planning process. Citizen participation offers citizens the chance to voice their ideas, interests, and opinions. The Federal Emergency Management Agency also requires public input during the development of mitigation plans.

The City of La Mirada Natural Hazards Mitigation Plan integrates a cross-section of public input throughout the planning process. To accomplish this goal, the Hazard Mitigation Planning Team developed a public participation process through four components: (1) developing a Planning Team comprised of knowledgeable individuals representative of the City's Public Safety, Planning and Community Development, and Public Works Departments as well as the DMAC Area E Coordinator; (2) soliciting input through press releases, the City's website, and various community newsletters to announce the progress of the planning activities and to announce the availability of the Draft Natural Hazards Mitigation Plan; (3) creating opportunities for the citizens and public agencies to review the Draft Natural Hazards Mitigation Plan; (4) conducting public meetings at the Planning and Public Safety Commissions and City Council where the public had an opportunity to express their views concerning the Draft Natural Hazards Mitigation Plan.

Integrating public participation during the development of the Natural Hazards Mitigation Plan has ultimately resulted in increased public awareness. Through public involvement, the mitigation plan reflects community issues, concerns, and new ideas and perspectives on mitigation opportunities and plan action items.

Advisory Committee

Hazard mitigation in the City of La Mirada will be overseen by the City's existing Emergency Preparedness and Response Committee, which consists of representatives from various city departments. The members have an understanding of how the community is structured and how residents, businesses, and the environment may be affected by natural hazard events. The Committee will implement the work of the Planning Team which was responsible for guiding the development of the Plan, and assisting in developing plan goals and action items, identifying stakeholders and plan reviewers, and sharing local expertise to create a more comprehensive plan.

Meeting #1: Pre-Training May 5, 2004

The meeting was held at La Mirada City Hall. EPC delivered pre-training to the Planning Team. The pre-training consisted of the history of the Disaster Mitigation Act of 2000, the purpose and role of hazard mitigation, and the planning process. The Pre-Training lasted approximately 1 hour.

Meeting #2: Kick-Off Meeting May 5, 2004

EPC facilitated a workshop where participants had an opportunity to learn about various natural hazards, assess and rank the local threats, examine hazard maps, and complete the FEMA Worksheets contained in FEMA 386-2 Understanding Your Risks. Part of the discussion included a presentation by EPC of historical disaster events across the country. Those slides served as a backdrop for discussing potential mitigation activities.

There was an extensive discussion on various methods of engaging the public in the mitigation process. The Planning Team prepared a draft media release and discussed a public opinion survey provided by EPC. EPC committed to revising the media release and survey and distributing electronic copies to each of the Planning Team entities. The Kick-Off Meeting lasted approximately 4 hours.

Meeting #3 Pre-Training: Mitigation July 7, 2004

The meeting was held at La Mirada City Hall. EPC delivered pre-training to the Planning Team. The pre-training consisted of the concepts and issues related to developing mitigation actions. The pre-training lasted approximately 1 hour.

Meeting #4 Mitigation Actions July 7, 2004

EPC delivered the Draft Hazard Analysis and the Planning Team discussed missing information, data, and maps. EPC distributed copies of the Mitigation Actions Planning Tools to assist the Team in developing Goals and Action Items appropriate to their natural hazards. The Planning Tools provided a process for collecting the mitigation actions presently in practice in the City of La Mirada, as well as identifying future mitigation actions.

A brainstorming process was then conducted to develop the goals for the Plan. The Planning Team discussed sample goal language then finalized the goal language. Following a discussion of alternative ranking techniques, the Team agreed to cluster the rankings of the Mitigation Actions by type of actions as follows: #1 Multi-Hazard, #2 Earthquakes, #3 Flooding, and #4 Wildfire.

The next task was to examine a FEMA-approved Mitigation Plan to get an idea of how mitigation actions are written. Throughout the workshops the consultant encouraged participants to keep benefit costs issues in mind as they drafted mitigation actions. Each of the jurisdictions was pleased to announce the broad range of mitigation actions already being practiced. The Planning Tools, developed by EPC, consisted of nearly

300 mitigation actions gathered from dozens of Mitigation Plans across the country.

The Planning Team broke into individual jurisdictions to develop their own mitigation actions, utilizing the sample plans and Planning Tools list. Because of the plan samples and Tools, the process of identifying appropriate mitigations actions was accomplished in a very efficient manner.

Public Meetings

City of La Mirada conducted three public meetings where the Draft Natural Hazard Mitigation Plan was presented and discussed. Both the Public Safety and Planning Commissions (August 26, 2004 and September 16, 2004 respectively) and City Council (September 21, 2004) were impressed with the range of mitigation actions already in practice throughout the City. The City Council was supportive of the overall goal established by the Planning Team to become a Disaster Resistant Community.

Invitation Process

The City worked to identify possible public notice sources. A press release was submitted. Additionally, notices were placed in several editions of the La Mirada Living newsletter that is mailed to all residents.

Appendix C:

Economic Analysis of Natural Hazard Mitigation Projects

Benefit/Cost Analysis is a key mechanism used by the California Office of Emergency Services (OES), the Federal Emergency Management Agency, and other state and federal agencies in evaluating hazard mitigation projects, and is required by the Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law 93-288, as amended.

This Appendix outlines several approaches for conducting economic analysis of natural hazard mitigation projects. It describes the importance of implementing mitigation activities, different approaches to economic analysis of mitigation strategies, and methods to calculate costs and benefits associated with mitigation strategies. Information in this section is derived in part from: Federal Emergency Management Agency Publication 331, Report on Costs and Benefits of Natural Hazard Mitigation.

This section is not intended to provide a comprehensive description of benefit/cost analysis, nor is it intended to provide the details of economic analysis methods that can be used to evaluate local projects. It is intended to (1) raise benefit/cost analysis as an important issue, and (2) provide some background on how economic analysis can be used to evaluate mitigation projects.

Why Evaluate Mitigation Strategies?

Mitigation activities reduce the cost of disasters by minimizing property damage, injuries, and the potential for loss of life, and by reducing emergency response costs, which would otherwise be incurred.

Evaluating natural hazard mitigation provides decision-makers with an understanding of the potential benefits and costs of an activity, as well as a basis upon which to compare alternative projects. Evaluating mitigation projects is a complex and difficult undertaking, which is influenced by many variables. First, natural disasters affect all segments of the communities they strike, including individuals, businesses, and public services such as fire, police, utilities, and schools.

Second, while some of the direct and indirect costs of disaster damages are measurable, some of the costs are non-financial and difficult to quantify in dollars. Third, many of the impacts of such events produce “ripple-effects” throughout the community, greatly increasing the disaster’s social and economic consequences.

While not easily accomplished, there is value, from a public policy perspective, in assessing the positive and negative impacts from mitigation activities, and obtaining an instructive benefit/cost comparison. Otherwise, the decision to pursue or not pursue

various mitigation options would not be based on an objective understanding of the net benefit or loss associated with these actions.

What are Some Economic Analysis Approaches for Mitigation Strategies?

The approaches used to identify the costs and benefits associated with natural hazard mitigation strategies, measures, or projects fall into two general categories: benefit/cost analysis and cost-effectiveness analysis. The distinction between the two methods is the way in which the relative costs and benefits are measured. Additionally, there are varying approaches to assessing the value of mitigation for public sector and private sector activities.

Benefit/Cost Analysis

Benefit/Cost Analysis is used in natural hazards mitigation to show if the benefits to life and property protected through mitigation efforts exceed the cost of the mitigation activity. Conducting benefit/cost analysis for a mitigation activity can assist communities in determining whether a project is worth undertaking now, in order to avoid disaster related damages later. Benefit/cost analysis is based on calculating the frequency and severity of a hazard, avoided future damages, and risk.

In benefit/cost analysis, all costs and benefits are evaluated in terms of dollars, and a net benefit/cost ratio is computed to determine whether a project should be implemented (i.e., if net benefits exceed net costs, the project is worth pursuing). A project must have a benefit/cost ratio greater than 1 in order to be funded.

Cost-Effectiveness Analysis

Cost-effectiveness analysis evaluates how best to spend a given amount of money to achieve a specific goal. This type of analysis, however, does not necessarily measure costs and benefits in terms of dollars. Determining the economic feasibility of mitigating natural hazards can also be organized according to the perspective of those with an economic interest in the outcome. Hence, economic analysis approaches are covered for both public and private sectors as follows.

Investing in public sector mitigation activities

Evaluating mitigation strategies in the public sector is complicated because it involves estimating all of the economic benefits and costs regardless of who realizes them, and potentially to a large number of people and economic entities. Some benefits cannot be evaluated monetarily, but still affect the public in profound ways. Economists have developed methods to evaluate the economic feasibility of public decisions that involve a diverse set of beneficiaries and non-market benefits.

Investing in private sector mitigation activities

Private sector mitigation projects may occur on the basis of one of two approaches: it may be mandated by a regulation or standard, or it may be economically justified on its own merits. A building or landowner, whether a

private entity or a public agency, are required to conform to a mandated standard may consider the following options:

1. Request cost sharing from public agencies;
2. Dispose of the building or land either by sale or demolition;

Estimating the costs and benefits of a hazard mitigation strategy can be a complex process.

Employing the services of a specialist can assist in this process.

3. Change the designated use of the building or land and change the hazard mitigation compliance requirement; or
4. Evaluate the most feasible alternatives and initiate the most cost effective hazard mitigation alternative.

The sale of a building or land triggers another set of concerns. For example, real estate disclosure laws can be developed which require sellers of real property to disclose known defects and deficiencies in the property, including earthquake weaknesses and hazards to prospective purchasers. Correcting deficiencies can be expensive and time consuming, but their existence can prevent the sale of the building. Conditions of a sale regarding the deficiencies and the price of the building can be negotiated between a buyer and seller.

How can an Economic Analysis be Conducted?

Benefit/cost analysis and cost-effectiveness analysis are important tools in evaluating whether or not to implement a mitigation activity. A framework for evaluating alternative mitigation activities is outlined below:

1. Identify the Alternatives: Alternatives for reducing risk from natural hazards can include structural projects to enhance disaster resistance, education and outreach, and acquisition or demolition of exposed properties, among others. Different mitigation project can assist in minimizing risk to natural hazards, but do so at varying economic costs.

2. Calculate the Costs and Benefits: Choosing economic criteria is essential to systematically calculating costs and benefits of mitigation projects and selecting the most appropriate alternative. Potential economic criteria to evaluate alternatives include:

- **Determine the project cost.** This may include initial project development costs, and repair and operating costs of maintaining projects over time.

- **Estimate the benefits.** Projecting the benefits or cash flow resulting from a project can be difficult. Expected future returns from the mitigation effort depend on the correct specification of the risk and the effectiveness of the project, which may not be well known. Expected future costs depend on the physical durability and potential economic obsolescence of the investment. This is difficult to project. These considerations will also provide guidance in selecting an appropriate salvage value. Future tax structures and rates must be projected. Financing alternatives must be researched, and they may include retained earnings, bond and stock issues, and commercial loans.

- **Consider costs and benefits to society and the environment.** These are not easily measured, but can be assessed through a variety of economic tools including existence value or contingent value theories. These theories provide quantitative data on the value people attribute to physical or social environments. Even without hard data, however, impacts of structural projects to the physical environment or to society should be considered when implementing mitigation projects.

- **Determine the correct discount rate.** Determination of the discount rate can just be the risk-free cost of capital, but it may include the decision maker's time preference and also a risk premium. Including inflation should also be considered.

3. Analyze and Rank the Alternatives: Once costs and benefits have been quantified, economic analysis tools can rank the alternatives. Two methods for determining the best alternative given varying costs and benefits include net present value and internal rate of return.

- **Net present value.** Net present value is the value of the expected future returns of an investment minus the value of expected future cost expressed in today's dollars. If the net present value is greater than the project costs, the project may be determined feasible for implementation. Selecting the discount rate, and identifying the present and future costs and benefits of the project calculates the net present value of projects.

- **Internal Rate of Return.** Using the internal rate of return method to evaluate mitigation projects provides the interest rate equivalent to the dollar returns expected from the project. Once the rate has been calculated, it can be compared to rates earned by investing in alternative projects. Projects may be feasible to implement when the internal rate of return is greater than the total costs of the project.

Once the mitigation projects are ranked on the basis of economic criteria, decision-makers can consider other factors, such as risk; project effectiveness; and economic, environmental, and social returns in choosing the appropriate project for implementation.

How are Benefits of Mitigation Calculated?

Economic Returns of Natural Hazard Mitigation

The estimation of economic returns, which accrue to building or land owner as a result of natural hazard mitigation, is difficult. Owners evaluating the economic feasibility of mitigation should consider reductions in physical damages and financial losses. A partial list follows:

- Building damages avoided
- Content damages avoided
- Inventory damages avoided
- Rental income losses avoided
- Relocation and disruption expenses avoided
- Proprietor's income losses avoided

These parameters can be estimated using observed prices, costs, and engineering data. The difficult part is to correctly determine the effectiveness of the hazard mitigation project and the resulting reduction in damages and losses. Equally as difficult is assessing the probability that an event will occur. The damages and losses should only include those that will be borne by the owner. The salvage value of the investment can be important in determining economic feasibility. Salvage value becomes more important as the time horizon of the owner declines. This is important because most businesses depreciate assets over a period of time.

Additional Costs from Natural Hazards

Property owners should also assess changes in a broader set of factors that can change as a result of a large natural disaster. These are usually termed "indirect" effects, but they can have a very direct effect on the economic value of the owner's building or land. They can be positive or negative, and include changes in the following:

- Commodity and resource prices
- Availability of resource supplies
- Commodity and resource demand changes
- Building and land values
- Capital availability and interest rates
- Availability of labor
- Economic structure
- Infrastructure
- Regional exports and imports
- Local, state, and national regulations and policies
- Insurance availability and rates

Changes in the resources and industries listed above are more difficult to estimate and require models that are structured to estimate total economic impacts. Total economic impacts are the sum of direct and indirect economic impacts. Total economic impact models are usually not combined with economic feasibility models. Many models exist to estimate total economic impacts of changes in an economy. Decision makers should understand the total economic impacts of natural disasters in order to calculate the benefits of a mitigation activity. This suggests that understanding the local economy is an important first step in being able to understand the potential impacts of a disaster, and the benefits of mitigation activities.

Additional Considerations

Conducting an economic analysis for potential mitigation activities can assist decision-makers in choosing the most appropriate strategy for their community to reduce risk and prevent loss from natural hazards. Economic analysis can also save time and resources from being spent on inappropriate or unfeasible projects. Several resources and models are listed on the following page that can assist in conducting an economic analysis for natural hazard mitigation activities.

Benefit/cost analysis is complicated, and the numbers may divert attention from other important issues. It is important to consider the qualitative factors of a project associated with mitigation that cannot be evaluated economically. There are alternative approaches to implementing mitigation projects. Many communities are looking towards developing multi-objective projects. With this in mind, opportunity rises to develop strategies that integrate natural hazard mitigation with projects related to watersheds, environmental planning, community economic development, and small business development, among others. Incorporating natural hazard mitigation with other community projects can increase the viability of project implementation.

Resources

CUREe Kajima Project, Methodologies For Evaluating The Socio-Economic Consequences Of Large Earthquakes, Task 7.2 Economic Impact Analysis, Prepared by University of California, Berkeley Team, Robert A. Olson, VSP Associates, Team Leader; John M. Eiding, G&E Engineering Systems; Kenneth A. Goettel, Goettel and Associates Inc.; and Gerald L. Horner, Hazard Mitigation Economics Inc., 1997.

Federal Emergency Management Agency, Benefit/Cost Analysis of Hazard Mitigation Projects, Riverine Flood, Version 1.05, Hazard Mitigation Economics Inc., 1996.

Federal Emergency Management Agency Report on Costs and Benefits of Natural Hazard Mitigation. Publication 331, 1996.

Goettel & Horner Inc., Earthquake Risk Analysis Volume III: The Economic Feasibility of Seismic Rehabilitation of Buildings in The City of Portland, Submitted to the Bureau of Buildings, City of Portland, August 30, 1995.

Goettel & Horner Inc., Benefit/Cost Analysis of Hazard Mitigation Projects Volume V, Earthquakes, Prepared for FEMA's Hazard Mitigation Branch, October 25, 1995.

Horner, Gerald, Benefit/Cost Methodologies for Use in Evaluating the Cost Effectiveness of Proposed Hazard Mitigation Measures, Robert Olson Associates, Prepared for Oregon State Police, Office of Emergency Management, July 1999.

Interagency Hazards Mitigation Team, State Hazard Mitigation Plan, (Oregon State Police – Office of Emergency Management, 2000).

Risk Management Solutions, Inc., Development of a Standardized Earthquake Loss Estimation Methodology, National Institute of Building Sciences, Volume I and II, 1994.

VSP Associates, Inc., A Benefit/Cost Model for the Seismic Rehabilitation of Buildings, Volumes 1 & 2, Federal Emergency Management Agency, FEMA, Publication Numbers 227 and 228, 1991.

VSP Associates, Inc., Benefit/Cost Analysis of Hazard Mitigation Projects: Section 404 Hazard Mitigation Program and Section 406 Public Assistance Program, Volume 3: Seismic Hazard Mitigation Projects, 1993.

VSP Associates, Inc., Seismic Rehabilitation of Federal Buildings: A Benefit/Cost Model, Volume 1, Federal Emergency Management Agency, FEMA, Publication Number 255, 1994.

Appendix D: Acronyms

Federal Acronyms

AASHTO	American Association of State Highway and Transportation Officials
ATC	Applied Technology Council
b/ca	benefit/cost analysis
BFE	Base Flood Elevation
BLM	Bureau of Land Management
BSSC	Building Seismic Safety Council
CDBG	Community Development Block Grant
CFR	Code of Federal Regulations
CRS	Community Rating System
DOE	Department of Energy
EDA	Economic Development Administration
EPA	Environmental Protection Agency
ER	Emergency Relief
EWP	Emergency Watershed Protection (NRCS Program)
FAS	Federal Aid System
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FMA	Flood Mitigation Assistance (FEMA Program)
FTE	Full Time Equivalent
GIS	Geographic Information System
GNS	Institute of Geological and Nuclear Sciences (International)
GSA	General Services Administration
HAZUS	Hazards U.S.
HMGP	Hazard Mitigation Grant Program
HMST	Hazard Mitigation Survey Team
HUD	Housing and Urban Development (United States, Department of)
IBHS	Institute for Business and Home Safety
ICC	Increased Cost of Compliance
IHMT	Interagency Hazard Mitigation Team
NCDC	National Climate Data Center
NFIP	National Flood Insurance Program
NFPA	National Fire Protection Association
NHMP	Natural Hazard Mitigation Plan (also known as "409 Plan")
NIBS	National Institute of Building Sciences
NIFC	National Interagency Fire Center
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NWS	National Weather Service

SBA	Small Business Administration
SHMO	State Hazard Mitigation Officer
TOR	Transfer of Development Rights
UGB	Urban Growth Boundary
URM	Unreinforced Masonry
USACE	United States Army Corps of Engineers
USBR	United States Bureau of Reclamation
USDA	United States Department of Agriculture
USFA	United States Fire Administration
USFS	United States Forest Service
USGS	United States Geological Survey
WSSPC	Western States Seismic Policy Council

California Acronyms

A&W	Alert and Warning
AA	Administering Areas
AAR	After Action Report
ARC	American Red Cross
ARP	Accidental Risk Prevention
ATC20	Applied Technology Council20
ATC21	Applied Technology Council21
BCP	Budget Change Proposal
BSA	California Bureau of State Audits
CAER	Community Awareness & Emergency Response
CalARP	California Accidental Release Prevention
CalBO	California Building Officials
CalEPA	California Environmental Protection Agency
CalREP	California Radiological Emergency Plan
CALSTARS	California State Accounting Reporting System
CalTRANS	California Department of Transportation
CBO	Community Based Organization
CD	Civil Defense
CDF	California Department of Forestry and Fire Protection
CDMG	California Division of Mines and Geology
CEC	California Energy Commission
CEPEC	California Earthquake Prediction Evaluation Council
CESRS	California Emergency Services Radio System
CHIP	California Hazardous Identification Program
CHMIRS	California Hazardous Materials Incident Reporting System
CHP	California Highway Patrol
CLETS	California Law Enforcement Telecommunications System
CSTI	California Specialized Training Institute
CUEA	California Utilities Emergency Association
CUPA	Certified Unified Program Agency

DAD Services)	Disaster Assistance Division (California Office of Emergency Services)
DFO	Disaster Field Office
DGS	California Department of General Services
DHSRHB Branch	California Department of Health Services, Radiological Health Branch
DO	Duty Officer
DOC	Department Operations Center
DOF	California Department of Finance
DOJ	California Department of Justice
DPA	California Department of Personnel Administration
DPIG	Disaster Preparedness Improvement Grant
DR	Disaster Response
DSA	Division of the State Architect
DSR	Damage Survey Report
DSW	Disaster Service Worker
DWR	California Department of Water Resources
EAS	Emergency Alerting System
EDIS	Emergency Digital Information System
EERI	Earthquake Engineering Research Institute
EMA	Emergency Management Assistance
EMI	Emergency Management Institute
EMMA	Emergency Managers Mutual Aid
EMS	Emergency Medical Services
EOC	Emergency Operations Center
EOP	Emergency Operations Plan
EPEDAT	Early Post Earthquake Damage Assessment Tool
EPI	Emergency Public Information
EPIC	Emergency Public Information Council
ESC	Emergency Services Coordinator
FAY	Federal Award Year
FDAA	Federal Disaster Assistance Administration
FEAT	Governor's Flood Emergency Action Team
FEMA	Federal Emergency Management Agency
FFY	Federal Fiscal Year
FIR	Final Inspection Reports
FIRESCOPE	Firefighting Resources of Southern California Organized for Potential Emergencies
FMA	Flood Management Assistance
FSR	Feasibility Study Report
FY	Fiscal Year
GIS	Geographical Information System
HAZMAT	Hazardous Materials
HAZMIT	Hazardous Mitigation
HAZUS	Hazards United States (an earthquake damage assessment

prediction tool)

HAD	Housing and Community Development
HEICS	Hospital Emergency Incident Command System
HEPG	Hospital Emergency Planning Guidance
HIA	Hazard Identification and Analysis Unit
HMEP	Hazardous Materials Emergency Preparedness
HMGP	Hazard Mitigation Grant Program
IDE	Initial Damage Estimate
IA	Individual Assistance
IFG	Individual & Family Grant (program)
IRG	Incident Response Geographic Information System
IPA	Information and Public Affairs (of state Office of Emergency Services)
LAN	Local Area Network
LEMMA	Law Enforcement Master Mutual Aid
LEPC	Local Emergency Planning Committee
MARAC	Mutual Aid Regional Advisory Council
MHFP	Multi-Hazard Functional Plan
MHID	Multi-Hazard Identification
MOU	Memorandum of Understanding
NBC	Nuclear, Biological, Chemical
NEMA	National Emergency Management Agency
NEMIS	National Emergency Management Information System
NFIP	National Flood Insurance Program
NOAA	National Oceanic and Atmospheric Association
NPP	Nuclear Power Plant
NSF	National Science Foundation
NWS	National Weather Service
OA	Operational Area
OASIS	Operational Area Satellite Information System
OCC	Operations Coordination Center
OCD	Office of Civil Defense
OEP	Office of Emergency Planning
OES	California Governor's Office of Emergency Services
OSHPD	Office of Statewide Health Planning and Development
OSPR	Oil Spill Prevention and Response
PA	Public Assistance
PC	Personal Computer
PDA	Preliminary Damage Assessment
PIO	Public Information Office
POST	Police Officer Standards and Training
PPA/CA (FEMA)	Performance Partnership Agreement/Cooperative Agreement
PSA	Public Service Announcement
PTAB	Planning and Technological Assistance Branch

PTR	Project Time Report
RA	Regional Administrator (OES)
RADEF	Radiological Defense (program)
RAMP	Regional Assessment of Mitigation Priorities
RAPID	Railroad Accident Prevention & Immediate Deployment
RDO	Radiological Defense Officer
RDMHC	Regional Disaster Medical Health Coordinator
REOC	Regional Emergency Operations Center
REPI	Reserve Emergency Public Information
RES	Regional Emergency Staff
RIMS	Response Information Management System
RMP	Risk Management Plan
RPU	Radiological Preparedness Unit (OES)
RRT	Regional Response Team
SAM	State Administrative Manual
SARA	Superfund Amendments & Reauthorization Act
SAVP	Safety Assessment Volunteer Program
SBA	Small Business Administration
SCO	California State Controller's Office
SEMS	Standardized Emergency Management System
SEPIC	State Emergency Public Information Committee
SLA	State and Local Assistance
SONGS	San Onofre Nuclear Generating Station
SOP	Standard Operating Procedure
SWEPC	Statewide Emergency Planning Committee
TEC	Travel Expense Claim
TRU	Transuranic
TTT	Train the Trainer
UPA	Unified Program Account
UPS	Uninterrupted Power Source
USAR	Urban Search and Rescue
USGS	United States Geological Survey
WC	California State Warning Center
WAN	Wide Area Network
WIPP	Waste Isolation Pilot Project

Appendix E

Glossary

Acceleration	The rate of change of velocity with respect to time. Acceleration due to gravity at the earth's surface is 9.8 meters per second squared. That means that every second that something falls toward the surface of earth its velocity increases by 9.8 meters per second.
Asset	Any manmade or natural feature that has value, including, but not limited to people; buildings; infrastructure like bridges, roads, and sewer and water systems; lifelines like electricity and communication resources; or environmental, cultural, or recreational features like parks, dunes, wetlands, or landmarks.
Base Flood	Flood that has a 1 percent probability of being equaled or exceeded in any given year. Also known as the 100-year flood.
Base Flood Elevation (BFE)	Elevation of the base flood in relation to a specified datum, such as the National Geodetic Vertical Datum of 1929. The Base Flood Elevation is used as the standard for the National Flood Insurance Program.
Bedrock	The solid rock that underlies loose material, such as soil, sand, clay, or gravel.
Building	A structure that is walled and roofed, principally above ground and permanently affixed to a site. The term includes a manufactured home on a permanent foundation on which the wheels and axles carry no weight.
Coastal High Hazard Area	Area, usually along an open coast, bay, or inlet that is subject to inundation by storm surge and, in some instances, wave action caused by storms or seismic sources.
Coastal Zones	The area along the shore where the ocean meets the land as the surface of the land rises above the ocean. This land/water interface includes barrier islands, estuaries, beaches, coastal wetlands, and land areas having direct drainage to the ocean.
Community Rating System (CRS)	An NFIP program that provides incentives for NFIP communities to complete activities that reduce flood hazard risk. When the community completes specified activities, the insurance premiums of policyholders in these communities are reduced.
Computer-Aided Design And Drafting (CADD)	A computerized system enabling quick and accurate electronic 2-D and 3-D drawings, topographic mapping, site plans, and profile/cross-section drawings.

Contour	A line of equal ground elevation on a topographic (contour) map.
Critical Facility	Facilities that are critical to the health and welfare of the population and that are especially important following hazard events. Critical facilities include, but are not limited to, shelters, police and fire stations, and hospitals.
Debris	The scattered remains of assets broken or destroyed in a hazard event. Debris caused by a wind or water hazard event can cause additional damage to other assets.
Digitize	To convert electronically points, lines, and area boundaries shown on maps into x, y coordinates (e.g., latitude and longitude, universal transverse mercator (UTM), or table coordinates) for use in computer applications.
Displacement Time	The average time (in days) which the building's occupants typically must operate from a temporary location while repairs are made to the original building due to damages resulting from a hazard event.
Duration	How long a hazard event lasts.
Earthquake	A sudden motion or trembling that is caused by a release of strain accumulated within or along the edge of earth's tectonic plates.
Erosion	Wearing away of the land surface by detachment and movement of soil and rock fragments, during a flood or storm or over a period of years, through the action of wind, water, or other geologic processes.
Erosion Hazard Area	Area anticipated being lost to shoreline retreat over a given period of time. The projected inland extent of the area is measured by multiplying the average annual long-term recession rate by the number of years desired.
Essential Facility	Elements important to ensure a full recovery of a community or state following a hazard event. These would include: government functions, major employers, banks, schools, and certain commercial establishments, such as grocery stores, hardware stores, and gas stations.
Extent	The size of an area affected by a hazard or hazard event.

Extratropical Cyclone	Cyclonic storm events like Nor'easters and severe winter low-pressure systems. Both West and East coasts can experience these non-tropical storms that produce gale-force winds and precipitation in the form of heavy rain or snow. These cyclonic storms, commonly called Nor'easters on the East Coast because of the direction of the storm winds, can last for several days and can be very large – 1,000-mile wide storms are not uncommon.
Fault	A fracture in the continuity of a rock formation caused by a shifting or dislodging of the earth's crust, in which adjacent surfaces are differentially displaced parallel to the plane of fracture.
Federal Emergency Management Agency (FEMA)	Independent agency created in 1978 to provide a single point of accountability for all Federal activities related to disaster mitigation and emergency preparedness, response and recovery.
Fire Potential Index (FPI)	Developed by USGS and USFS to assess and map fire hazard potential over broad areas. Based on such geographic information, national policy makers and on-the-ground fire managers established priorities for prevention activities in the defined area to reduce the risk of managed and wildfire ignition and spread. Prediction of fire hazard shortens the time between fire ignition and initial attack by enabling fire managers to pre-allocate and stage suppression forces to high fire risk areas.
Flash Flood	A flood event occurring with little or no warning where water levels rise at an extremely fast rate.
Flood	A general and temporary condition of partial or complete inundation of normally dry land areas from (1) the overflow of inland or tidal waters, (2) the unusual and rapid accumulation or runoff of surface waters from any source, or (3) mudflows or the sudden collapse of shoreline land.
Flood Depth	Height of the flood water surface above the ground surface.
Flood Elevation	Elevation of the water surface above an established datum, e.g. National Geodetic Vertical Datum of 1929, North American Vertical Datum of 1988, or Mean Sea Level.
Flood Hazard Area	The area shown to be inundated by a flood of a given magnitude on a map.
Flood Insurance Rate Map (FIRM)	Map of a community, prepared by the Federal Emergency Management Agency that shows both the special flood hazard areas and the risk premium zones applicable to the community.

Flood Insurance Study (FIS)	A study that provides an examination, evaluation, and determination of flood hazards and, if appropriate, corresponding water surface elevations in a community or communities.
Floodplain	Any land area, including watercourse, susceptible to partial or complete inundation by water from any source.
Frequency	A measure of how often events of a particular magnitude are expected to occur. Frequency describes how often a hazard of a specific magnitude, duration, and/or extent typically occurs, on average. Statistically, a hazard with a 100-year recurrence interval is expected to occur once every 100 years on average, and would have a 1 percent chance – its probability – of happening in any given year. The reliability of this information varies depending on the kind of hazard being considered.
Fujita Scale of Tornado Intensity	Rates tornadoes with numeric values from F0 to F5 based on tornado wind speed and damage sustained. An F0 indicates minimal damage such as broken tree limbs or signs, while and F5 indicated severe damage sustained.
Functional Downtime	The average time (in days) during which a function (business or service) is unable to provide its services due to a hazard event.
Geographic Area Impacted	The physical area in which the effects of the hazard are experienced.
Geographic Information Systems (GIS)	A computer software application that relates physical features on the earth to a database to be used for mapping and analysis.
Ground Motion	The vibration or shaking of the ground during an earthquake. When a fault ruptures, seismic waves radiate, causing the ground to vibrate. The severity of the vibration increases with the amount of energy released and decreases with distance from the causative fault or epicenter, but soft soils can further amplify ground motions
Hazard	A source of potential danger or adverse condition. Hazards in this how to series will include naturally occurring events such as floods, earthquakes, tornadoes, tsunamis, coastal storms, landslides, and wildfires that strike populated areas. A natural event is a hazard when it has the potential to harm people or property.
Hazard Event	A specific occurrence of a particular type of hazard.
Hazard Identification	The process of identifying hazards that threaten an area.

Hazard Mitigation	Sustained actions taken to reduce or eliminate long-term risk from hazards and their effects.
Hazard Profile	A description of the physical characteristics of hazards and a determination of various descriptors including magnitude, duration, frequency, probability, and extent. In most cases, a community can most easily use these descriptors when they are recorded and displayed as maps.
HAZUS (Hazards U.S.)	A GIS-based nationally standardized earthquake loss estimation tool developed by FEMA.
Hurricane	An intense tropical cyclone, formed in the atmosphere over warm ocean areas, in which wind speeds reach 74-miles-per-hour or more and blow in a large spiral around a relatively calm center or "eye." Hurricanes develop over the north Atlantic Ocean, northeast Pacific Ocean, or the south Pacific Ocean east of 160°E longitude. Hurricane circulation is counter-clockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere.
Hydrology	The science of dealing with the waters of the earth. A flood discharge is developed by a hydrologic study.
Infrastructure	Refers to the public services of a community that have a direct impact on the quality of life. Infrastructure includes communication technology such as phone lines or Internet access, vital services such as public water supplies and sewer treatment facilities, and includes an area's transportation system such as airports, heliports; highways, bridges, tunnels, roadbeds, overpasses, railways, bridges, rail yards, depots; and waterways, canals, locks, seaports, ferries, harbors, dry docks, piers and regional dams.
Intensity	A measure of the effects of a hazard event at a particular place.
Landslide	Downward movement of a slope and materials under the force of gravity.
Lateral Spreads	Develop on gentle slopes and entail the sidelong movement of large masses of soil as an underlying layer liquefies in a seismic event. The phenomenon that occurs when ground shaking causes loose soils to lose strength and act like viscous fluid. Liquefaction causes two types of ground failure: lateral spread and loss of bearing strength.

Liquefaction	Results when the soil supporting structures liquefies. This can cause structures to tip and topple.
Lowest Floor	Under the NFIP, the lowest floor of the lowest enclosed area (including basement) of a structure.
Magnitude	A measure of the strength of a hazard event. The magnitude (also referred to as severity) of a given hazard event is usually determined using technical measures specific to the hazard.
Mitigation Plan	A systematic evaluation of the nature and extent of vulnerability to the effects of natural hazards typically present in the state and includes a description of actions to minimize future vulnerability to hazards.
National Flood Insurance Program (NFIP)	Federal program created by Congress in 1968 that makes flood insurance available in communities that enact minimum floodplain management regulations in 44 CFR §60.3.
National Geodetic Vertical Datum of 1929 (NGVD)	Datum established in 1929 and used in the NFIP as a basis for measuring flood, ground, and structural elevations, previously referred to as Sea Level Datum or Mean Sea Level. The Base Flood Elevations shown on most of the Flood Insurance Rate Maps issued by the Federal Emergency Management Agency are referenced to NGVD.
National Weather Service (NWS)	Prepares and issues flood, severe weather, and coastal storm warnings and can provide technical assistance to Federal and state entities in preparing weather and flood warning plans.
Nor'easter	An extra-tropical cyclone producing gale-force winds and precipitation in the form of heavy snow or rain.
Outflow	Follows water inundation creating strong currents that rip at structures and pound them with debris, and erode beaches and coastal structures.
Planimetric	Describes maps that indicate only man-made features like buildings.
Planning	The act or process of making or carrying out plans; the establishment of goals, policies and procedures for a social or economic unit.
Probability	A statistical measure of the likelihood that a hazard event will occur.

Recurrence Interval	The time between hazard events of similar size in a given location. It is based on the probability that the given event will be equaled or exceeded in any given year.
Repetitive Loss Property	A property that is currently insured for which two or more National Flood Insurance Program losses (occurring more than ten days apart) of at least \$1000 each have been paid within any 10-year period since 1978.
Replacement Value	The cost of rebuilding a structure. This is usually expressed in terms of cost per square foot, and reflects the present-day cost of labor and materials to construct a building of a particular size, type and quality.
Richter Scale	A numerical scale of earthquake magnitude devised by seismologist C.F. Richter in 1935.
Risk	The estimated impact that a hazard would have on people, services, facilities, and structures in a community; the likelihood of a hazard event resulting in an adverse condition that causes injury or damage. Risk is often expressed in relative terms such as a high, moderate or low likelihood of sustaining damage above a particular threshold due to a specific type of hazard event. It also can be expressed in terms of potential monetary losses associated with the intensity of the hazard.
Riverine	Of or produced by a river.
Scale	A proportion used in determining a dimensional relationship; the ratio of the distance between two points on a map and the actual distance between the two points on the earth's surface.
Scarp	A steep slope.
Scour	Removal of soil or fill material by the flow of flood waters. The term is frequently used to describe storm-induced, localized conical erosion around pilings and other foundation supports where the obstruction of flow increases turbulence.
Seismicity	Describes the likelihood of an area being subject to earthquakes.
Special Flood Hazard Area (SFHA)	An area within a floodplain having a 1 percent or greater chance of flood occurrence in any given year (100-year floodplain); represented on Flood Insurance Rate Maps by darkly shaded areas with zone designations that include the letter A or V.

Stafford Act	The Robert T. Stafford Disaster Relief and Emergency Assistance Act, PL 100-107 was signed into law November 23, 1988 and amended the Disaster Relief Act of 1974, PL 93-288. The Stafford Act is the statutory authority for most Federal disaster response activities, especially as they pertain to FEMA and its programs.
State Hazard Mitigation Officer (SHMO)	The representative of state government who is the primary point of contact with FEMA, other state and Federal agencies, and local units of government in the planning and implementation of pre- and post-disaster mitigation activities.
Storm Surge	Rise in the water surface above normal water level on the open coast due to the action of wind stress and atmospheric pressure on the water surface.
Structure	Something constructed. (See also Building)
Substantial Damage	Damage of any origin sustained by a structure in a Special Flood Hazard Area whereby the cost of restoring the structure to its before-damaged condition would equal or exceeds 50 percent of the market value of the structure before the damage.
Super Typhoon	A typhoon with maximum sustained winds of 150 mph or more.
Surface Faulting	The differential movement of two sides of a fracture – in other words, the location where the ground breaks apart. The length, width, and displacement of the ground characterize surface faults.
Tectonic Plate	Torsionally rigid, thin segments of the earth's lithosphere that may be assumed to move horizontally and adjoin other plates. It is the friction between plate boundaries that cause seismic activity.
Topographic	Characterizes maps that show natural features and indicate the physical shape of the land using contour lines. These maps may also include manmade features.
Tornado	A violently rotating column of air extending from a thunderstorm to the ground.
Tropical Cyclone	A generic term for a cyclonic, low-pressure system over tropical or subtropical waters.
Tropical Depression	A tropical cyclone with maximum sustained winds of less than 39 mph.

Tropical Storm	A tropical cyclone with maximum sustained winds greater than 39 mph and less than 74 mph.
Tsunami	Great sea wave produced by submarine earth movement or volcanic eruption.
Typhoon	A special category of tropical cyclone peculiar to the western North Pacific Basin, frequently affecting areas in the vicinity of Guam and the North Mariana Islands. Typhoons whose maximum sustained winds attain or exceed 150 mph are called super typhoons.
Vulnerability	Describes how exposed or susceptible to damage an asset is. Vulnerability depends on an asset's construction, contents, and the economic value of its functions. Like indirect damages, the vulnerability of one element of the community is often related to the vulnerability of another. For example, many businesses depend on uninterrupted electrical power – if an electric substation is flooded, it will affect not only the substation itself, but a number of businesses as well. Often, indirect effects can be much more widespread and damaging than direct ones.
Vulnerability Assessment	The extent of injury and damage that may result from a hazard event of a given intensity in a given area. The vulnerability assessment should address impacts of hazard events on the existing and future built environment.
Water Displacement	When a large mass of earth on the ocean bottom sinks or uplifts, the column of water directly above it is displaced, forming the tsunami wave. The rate of displacement, motion of the ocean floor at the epicenter, the amount of displacement of the rupture zone, and the depth of water above the rupture zone all contribute to the intensity of the tsunami.
Wave Run-up	The height that the wave extends up to on steep shorelines, measured above a reference level (the normal height of the sea, corrected to the state of the tide at the time of wave arrival).
Wildfire	An uncontrolled fire spreading through vegetative fuels, exposing and possibly consuming structures.
Zone	A geographical area shown on a Flood Insurance Rate Map (FIRM) that reflects the severity or type of flooding in the area.

City of La Mirada

ADDENDUM TO HAZARD MITIGATION PLAN

Following is a list of the additions/corrections/clarifications that were prepared to address the items identified on the recent FEMA Crosswalk. Since the revisions are scattered throughout the document, we have chosen to issue this Addendum. Once we receive approval from FEMA, the Plan will be updated to include the matters addressed in the Addendum. At that point, the Natural Hazards Mitigation Plan will become a final document.

The attached Crosswalk will serve as a guide through the contents of the Addendum.

EXECUTIVE SUMMARY

How are the Action Items Organized?

Add a subsection called “Funding Source”

“The actions items will be funded through a variety of sources, possibly including: operating budget/general fund, development fees, Community Development Block Grant (CDBG), Hazard Mitigation Grant Program (HMGP), other Grants, private funding, Capital Improvement Program (CIP), and other funding opportunities.”

Coordinating Organization

Add the following to the beginning of the subsection: “The Mitigation Actions Matrix assigns primary responsibility for each of the action items. The hierarchies of the assignments vary – some are positions, others departments, and others Committees. No matter, the primary responsibility for implementing the action items falls to the entity shown as the “Coordinating Organization”.

Attachment 1 – Mitigation Actions Matrix

Add the following action item to the Multi-Hazard list: “Conduct a detailed vulnerability assessment in the future in order to accurately identify the extent of damages to vulnerable buildings, infrastructure, and critical facilities”.

SECTION 3: PLAN MAINTENANCE

Economic Analysis of Mitigation Projects

Insert the following at the beginning of this section: “At the Hazard Mitigation Advisory Committee’s first implementation meeting, the STAPLEE Tool (Plan Maintenance – Attachment 1) or some other prioritizing tool will be utilized to prioritize the action items identified in the Mitigation Actions Matrix (Executive Summary – Attachment 1). In addition, appropriate funding sources will be identified for the “top ten” priority action items.

SECTION 4: RISK ASSESSMENT

1) Hazard Identification

Begin this subsection with the following: “The Planning Team considered a range of natural hazards facing the region including: Earthquakes, Flooding, Earth Movement, Windstorms, Wildfire, Tsunami, and Drought. The attached Ranking Your Hazards - Attachment 1 handout guided the Team in prioritizing the natural hazards with the highest probability of significantly impacting the City of La Mirada. The Team agreed that any hazards receiving a Team average score of “3” or higher would be included in the Natural Hazards Mitigation Plan. Utilizing the ranking technique, the Team identified: Earthquakes, Flooding, Landslides and Wildfires as the most prominent hazards facing the community.

2) Profiling Hazard Events

Revise as follows: “This process describes the causes and characteristics of each hazard...”

At end of paragraph, refer to Risk Assessment – Attachment 2 Vulnerability: Location, Extent, & Probability:

**Risk Assessment – Attachment 2
Vulnerability: Location, Extent, and Probability***

	Location (Where)	Extent (How Big)	Probability (How Often)*
Hazard			
Earthquake	Entire Project Area	According to USGS, there is a 60% chance in the next 30 years of an earthquake measuring greater than 6.7 occurring in southern California.	Moderate
Flood	The Rio Hondo Flood Control Channel and the Coyote Creek Basin	FEMA Zones A and B	Low/Moderate
Landslide	Small area east of Highway 39 near boundary with City of La Habra	Inches to several feet	Moderate
Wildfire	Areas of the City adjacent to Imperial Highway	California CDF-FRAP wildfire rating is “Moderate”	Moderate
* Probability is defined as: Low = 1:500 years, Moderate = 1:100 years, High = 1:10 years			

4) Risk Analysis

Last sentence should be revised to read: “Data was not available to make vulnerability determinations in terms of dollar losses. The Mitigation Actions Matrix (Executive Summary – Attachment 1) includes an action item to conduct such an assessment in the future.

Table 4-2

Add an asterisk to the title and the following: (*data not available to determine the extent of damages to the critical and essential facilities).

EARTHQUAKE

Why Are Earthquakes a Threat to the Jurisdiction?

Begin the subsection with the following: “La Mirada was most recently impacted by the Whittier Narrows and Northridge Earthquakes, however data is not available on the extent or values of those damages”.

Earthquake Hazard Assessment – Hazard Identification

Begin the subsection with the following: “Earthquake – Attachment 1 Southern California Earthquake Fault Map plots the various major faults in the region. A list of Earthquake Probable Events gathered from the Southern California Earthquake Data Center is located in Earthquake – Attachment 2”. The list includes various faults and projected magnitude earthquakes likely to impact the region. The Southern California Earthquake Data Center predicts that somewhere in southern California (not everywhere-many residents would not be affected) should experience a magnitude 7.0 or greater earthquake about seven times each century. About half of these will be on the San Andreas "system" (the San Andreas, San Jacinto, Imperial, and Elsinore Faults) and half will be on other faults. The equivalent probability in the next 30 years is 85%.

LANDSLIDE

Why Are Landslides a Threat to the Jurisdiction?

Begin the subsection with the following: “La Mirada can potentially be impacted by a landslide, however data is not available on the extent or values of the damages”.

APPENDIX B

Toward the end of page 2 following the list of Meetings, insert the following: “Throughout the planning process, the consultant reminded the Planning Team of the importance of considering Benefit/Cost issues including: social issues, political realities, economic benefits, and environmental concerns. During Meeting #4, the consultant introduced the Planning Team to the STAPLEE Tool (Social, Technical, Administrative, Political, Legal, Economic, and Environmental) as one of many means available to prioritize mitigation actions. Following a discussion of a range of benefit/cost issues, the Planning Team voted to cluster the action items by hazard as follows: #1 Multi-Hazard, #2 Earthquake, #3 Flooding, #4 Landslide and #5 Wildfires. The Team was unanimous in its belief that the “Multi-Hazard” actions would yield the greatest benefit to the jurisdiction.”

Plan Maintenance – Attachment 1: Simplified STAPLEE Worksheet

**Simplified STAPLEE Worksheet – Prioritizing Mitigation Actions
(Social, Technical, Administrative, Political, Legal, Economic, Environmental)**

1. Fill in the goal. Use a separate worksheet for each goal. The considerations under each criterion are suggested ones to use; you can revise these to reflect your own considerations.
2. Fill in the action items associated with the goal.
3. **Scoring:** For each action item, indicate a plus (+) for favorable, and a negative (-) for less favorable.

When you complete the scoring, add up the positives to establish your priorities. For STAPLEE categories that do not apply, fill in N/A for not applicable. Only leave a blank if you do not know an answer – seek the input of an expert.

Goal: _____

STAPLEE Category	S (Social)		T (Technical)			A (Administrative)			P (Political)		
	Community Acceptance	Effect on Segment of Population	Technical Feasibility	Long-term Solution	Secondary Impacts	Staffing	Funding Allocated	Maintenance/Operations	Political Support	Local Champion	Public Support
Categories (right)											
Action Items (below)											
1.											
2.											
3.											
4.											
5.											
6.											

STAPLEE Categories	L (Legal)			E (Economic)				E (Environmental)				
Categories (right) Action Items (below)	State Authority	Existing Local Authority	Potential Legal Challenge	Benefit of Action	Cost of Action	Contributes to Economic Goals	Outside Funding Required	Effect on Land/Water	Effect on Endangered Species	Effect on HAZMAT/Waste Sites	Consistent with Community Environmental Goals	Consistent with Federal Laws
1.												
2.												
3.												
4.												
5.												
6.												

Risk Assessment - Attachment 1

Ranking Your Hazards

It is important to keep in mind that your rankings should be based on a hazard event that would overwhelm your jurisdiction's ability to respond effectively.

For each hazard listed assign a score. Place a number in the appropriate box.

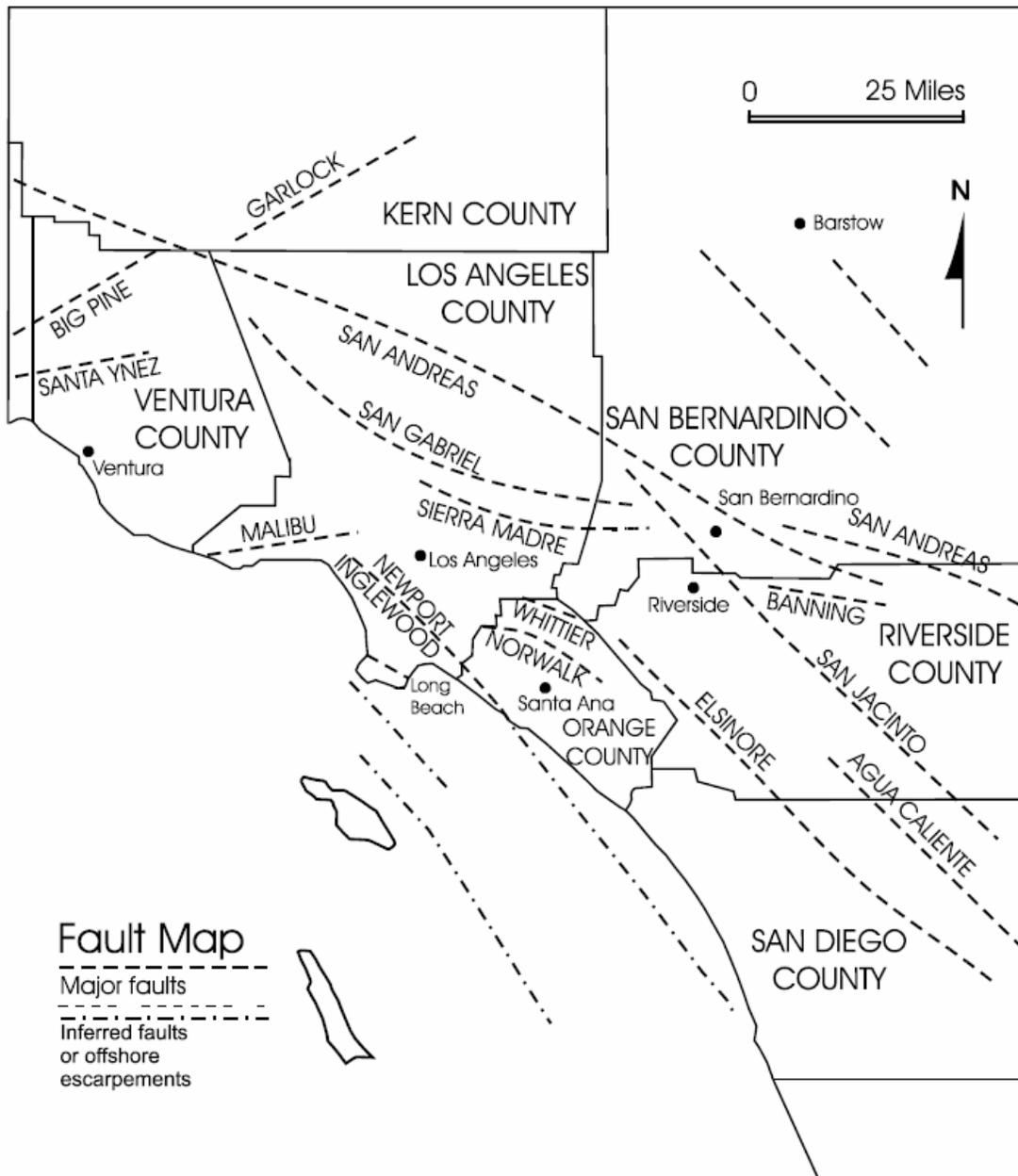
Hazard Scoring	
1	An event of that magnitude is not likely to occur
2	There is a slight chance that an event of that magnitude will occur
3	It is possible that an event of that magnitude will occur
4	An event of that magnitude has occurred here in the past and is likely to occur again
5	There is a high probability that an event of that magnitude will occur

Identify any additional hazards for the jurisdiction at the end of the list labeled as "Other Hazard."

<i>Hazard</i>	<i>Score</i>
Earthquake	
Flooding	
Wildfire	
Windstorm	
Earth Movement (Landslide/Debris Flow)	
Tsunami	
Drought	
Other Hazard _____	

Earthquake – Attachment 1

Southern California Earthquake Fault Map



Earthquake - Attachment 2

Earthquake Probable Events (Source: Southern California Earthquake Data Center)

Elsinore Fault Zone

TYPE OF FAULTING: right-lateral strike-slip

LENGTH: about 180 km (not including the Whittier, Chino, and Laguna Salada faults)

NEARBY COMMUNITIES: Temecula, Lake Elsinore, Julian

LAST MAJOR RUPTURE: May 15, 1910; Magnitude 6 -- no surface rupture found

SLIP RATE: roughly 4.0 mm/yr

INTERVAL BETWEEN MAJOR RUPTURES: roughly 250 years

PROBABLE MAGNITUDES: M_w 6.5 - 7.5

MOST RECENT SURFACE RUPTURE: 18th century A.D.(?)

Newport-Inglewood Fault Zone

TYPE OF FAULTING: right-lateral; local reverse slip associated with fault steps

LENGTH: 75 km

NEAREST COMMUNITIES: Culver City, Inglewood, Gardena, Compton, Signal Hill, Long Beach, Seal Beach, Huntington Beach, Newport Beach, Costa Mesa

MOST RECENT MAJOR RUPTURE: March 10, 1933, M_w 6.4 (but no surface rupture)

SLIP RATE: 0.6 mm/yr

INTERVAL BETWEEN MAJOR RUPTURES: unknown

PROBABLE MAGNITUDES: M_w 6.0 - 7.4

OTHER NOTES: Surface trace is discontinuous in the Los Angeles Basin, but the fault zone can easily be noted there by the existence of a chain of low hills extending from Culver City to Signal Hill. South of Signal Hill, it roughly parallels the coastline until just south of Newport Bay, where it heads offshore, and becomes the Newport-Inglewood - Rose Canyon fault zone.

San Andreas Fault Zone

TYPE OF FAULT: right-lateral strike-slip

LENGTH: 1200 km 550 km south from Parkfield; 650km northward

NEARBY COMMUNITY: Parkfield, Frazier Park, Palmdale, Wrightwood, San Bernardino, Banning, Indio

LAST MAJOR RUPTURE: January 9, 1857 (Mojave segment); April 18, 1906 (Northern segment)

SLIP RATE: about 20 to 35 mm per year

INTERVAL BETWEEN MAJOR RUPTURES: average of about 140 years on the Mojave segment; recurrence interval varies greatly -- from under 20 years (at Parkfield only) to over 300 years

PROBABLE MAGNITUDES: M_w 6.8 - 8.0

San Fernando Fault Zone

TYPE OF FAULTING: thrust

LENGTH: 17 km

NEAREST COMMUNITIES: San Fernando, Sunland

LAST MAJOR RUPTURE: February 9, 1971, M_w 6.6

SLIP RATE: 5 mm/yr (?)

INTERVAL BETWEEN MAJOR RUPTURES: roughly 200 years

PROBABLE MAGNITUDES: M_w 6.0 - 6.8

OTHER NOTES: Dip is to the north. The slip rate is not well known, but trenching studies indicate recurrence interval as between 100 and 300 years.

San Jacinto Fault Zone

TYPE OF FAULTING : right-lateral strike-slip; minor right-reverse

LENGTH: 210 km, including Coyote Creek fault

NEARBY COMMUNITIES: Lytle Creek, San Bernardino, Loma Linda, San Jacinto, Hemet, Anza, Borrego Springs, Ocotillo Wells

MOST RECENT SURFACE RUPTURE: within the last few centuries; April 9, 1968, M_w 6.5 on Coyote Creek segment

SLIP RATE: typically between 7 and 17 mm/yr

INTERVAL BETWEEN SURFACE RUPTURES: between 100 and 300 years, per segment

PROBABLE MAGNITUDES: M_w 6.5 - 7.5

Sierra Madre Fault System

TYPE OF FAULTING: reverse - ANIMATION

LENGTH: the zone is about 55 km long;

total length of main fault segments is about 75 km, with each segment measuring roughly 15 km long

NEARBY COMMUNITIES: Sunland, Altadena, Sierra Madre, Monrovia, Duarte, Glendora

MOST RECENT SURFACE RUPTURE: Holocene

SLIP RATE: between 0.36 and 4 mm/yr

INTERVAL BETWEEN SURFACE RUPTURES: several thousand years (?)

PROBABLE MAGNITUDES: M_w 6.0 - 7.0 (?)

OTHER NOTES: This fault zone dips to the north. It was not the fault responsible for the 1991 Sierra Madre earthquake.

Whittier Fault

TYPE OF FAULTING: right-lateral strike-slip with some reverse slip

LENGTH: about 40 km

NEARBY COMMUNITIES: Yorba Linda, Hacienda Heights, Whittier

MOST RECENT SURFACE RUPTURE: Holocene

SLIP RATE: between 2.5 and 3.0 mm/yr

INTERVAL BETWEEN MAJOR RUPTURES: unknown

PROBABLE MAGNITUDES: M_w 6.0 - 7.2

OTHER NOTES: The Whittier fault dips toward the northeast.