EXHIBIT A

City of Palos Verdes Estates

Natural Hazard Mitigation Plan

Adopted by City Council
September 28, 2004

Special Thanks & Acknowledgments
Project Steering Committee:

City of Palos Verdes Estates Building and Safety
City of Palos Verdes Estates Finance
City of Palos Verdes Estates Planning
City of Palos Verdes Estates Public Works Department
South Bay Council of Governments: Jacki Bacharach, Executive Director
Office of Disaster Management, Area G: Mike Martinet, Executive Director
Los Angeles County Office of Emergency Management: Constance Perett, Manager
California Division of Mines and Geology
California Division of Forestry
Federal Emergency Management Agency, Region IX
Southern California Association of Governments
Governor's Office of Emergency Services

Project Manager: Allan Rigg, Director of Planning and Public Works

Geographic Information Systems (GIS) Maps:
Digital Map Central developed all of the maps included in this plan. Their services were essential in illustrating the extent and potential losses associated with the natural hazards affecting the City. The information on the maps in this plan was derived from the City of Palos Verdes Estates' GIS. Care was taken in the creation of these maps, but is provided "as is." The City of Palos Verdes Estates 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.

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City of Palos Verdes Estates Natural Hazard Mitigation Plan

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Executive Summary:

Purpose

The City of Palos Verdes Estates Natural Hazards Mitigation Action 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 Palos Verdes Estates in reducing risk and preventing loss from future natural hazard events. The action items address multi-hazard issues, as well as activities for earthquakes, earth movements, flooding, tsunamis, wildfires and windstorms.

How is the Plan Organized?

The Mitigation Plan contains a five-year action plan matrix, background on the purpose and methodology used to develop the mitigation plan, a profile of the City of Palos Verdes Estates, sections on six natural hazards that occur within the City, and a number of appendices. All of the sections are described in detail in Section 1, the plan introduction.

Who Participated in Developing the Plan?

The City of Palos Verdes Estates' Natural Hazards Mitigation Action Plan is the result of a collaborative effort between citizens, public agencies, public utilities, the private sector, and regional and state organizations. Public participation played a key role in development of goals and action items. Public workshops were held to include City of Palos Verdes Estates residents in plan development. A project Steering Committee guided the process of developing the plan.

The Steering Committee was comprised of representatives from:

City of Palos Verdes Estates Building and Safety
City of Palos Verdes Estates Finance
City of Palos Verdes Estates Planning
City of Palos Verdes Estates Public Works Department
City of Palos Verdes Estates Streets and Parks Department
California Water Service
Palos Verdes Peninsula Unified School District
Zeiser Kling Consultants (City Geotechnical Engineer and Geologist)
Cox Communications
The Gas Company
Southern California Edison
City of Palos Verdes Estates Police Department
Los Angeles County Fire Department
Office of Disaster Management, Area G

What is the Plan Mission?

The mission of the City of Palos Verdes Estates 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 safer, more sustainable community.

What are the Plan Goals?

The plan goals describe the overall direction that City of Palos Verdes Estates 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 while promoting insurance coverage for catastrophic hazards.
- Improve hazard assessment information to make recommendations for discouraging new development in high hazard areas and encouraging preventative measures for existing 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.
- Provide information on tools, partnership opportunities, and funding resources 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.

Partnerships and Implementation

- Strengthen communication and coordinate participation among and within public agencies, citizens, non-profit organizations, and businesses to gain a vested interest in implementation.
- Encourage leadership within public and private sector organizations to prioritize and implement local and regional 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 time line for implementation.

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.

Time line. Action items include both short and long-term activities. Each action item includes an estimate of the time line for implementation. Short-term action items are activities which City agencies are capable of implementing with existing resources and authorities within one to two years. Long-term action items may require new or additional resources or authorities, and may take between one and five years (or more) to implement.

Ideas for Implementation. Each action item includes ideas for implementation and potential resources, which may include grant programs or human resources. The matrix includes the page number within the mitigation plan where this information can be found.

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

Partner Organizations. The Partner organizations are not listed with the individual action items or in the plan matrix. Partner organizations listed in Appendix A, are agencies or public/private sector organizations that may be able to assist in the implementation of action items by providing relevant resources to the coordinating organization. The partner organizations listed in the Resource Directory of the City of Palos Verdes Estates Natural Hazards Mitigation Plan are potential partners recommended by the project steering committee, but were not necessarily contacted during the development of the Mitigation Plan. Partner organizations should be contacted by the coordinating organization to establish commitment of time and resources to action items.

Constraints. Constraints may apply to some of the action items. These constraints may be a lack of city staff, lack of funds, or vested property rights which might expose the City to legal action as a result of adverse impacts on private property.

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

The Plan Maintenance Section of this document details the formal process that will ensure that the City of Palos Verdes Estates' 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 City of Palos Verdes Estates' 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 Hazard 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 Palos Verdes Estates' 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

A City of Palos Verdes Estates' Hazard Mitigation Advisory Committee will be responsible for coordinating implementation of Plan action items and undertaking the formal review process. The City Council will assign representatives from City agencies, including, but not limited to, the current Hazard Mitigation Advisory Committee members.

Convener

The City Council will adopt the City of Palos Verdes Estates Natural Hazard Mitigation Plan, and the Hazard Mitigation Advisory Committee will take responsibility for plan implementation. The Director of Planning and Public Works will serve as a convener to facilitate the Hazard Mitigation Advisory 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 Natural Hazard Advisory Committee Members.

Implementation through Existing Programs

The City of Palos Verdes Estates addresses statewide planning goals and legislative requirements through its General Plan, Capital Improvement Plans, and City Building & Safety Codes. The Natural Hazard Mitigation Plan provides a series of recommendations that are closely related to the goals and objectives of these existing planning programs. The City of Palos Verdes Estates 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 Palos Verdes Estates 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 time line, and identifies the local agencies and organizations participating in plan evaluation. The convener will be responsible for contacting the Hazard Mitigation Advisory 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

City of Palos Verdes Estates is dedicated to involving the public directly in the continual review and updates of the Hazard Mitigation Plan. Copies of the plan will be catalogued and made available at city hall and at the Malaga Cove public library. The existence and location of these copies will be publicized in City newsletters. The plan also includes the address and the phone number of the City Planning Division, 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 website. This site will also contain an email address and phone number to which people can direct their comments and concerns.

Natural Hazard	Short Term Activity - Multi Hazard #l		
Action Item	Integrate the goals and action items from the City of Palos Verdes Estates Natural Hazard Mitigation Plan into existing regulatory documents and programs, where appropriate		
Coordinating Organization	Hazard Mitigation Advisory Committee		
Ideas for Implementation	Use the mitigation plan to help the city's General Plan meet State Land Use Planning Goal 7, designed to protect life and property from natural disasters and hazards through planning strategies that restrict development in areas of known hazards; Integrate the city's mitigation plan into current capital improvement plans to ensure that development does not encroach on known hazard areas; and Partner with other organizations and agencies with similar goals to promote Building & Safety Codes that are more disaster resistant at the state level.		
Time line	Ongoing		
Constraints	None		
Plan Goals Addressed		X	Protect Life and Property
	Public Awareness	X	Natural Systems
X	Partnerships and Implementation	X	Emergency Services

Natural Hazard	Short Term Activity - Multi Hazard #2:
Action Item	Identify and pursue funding opportunities to develop and implement local and city mitigation activities.
Coordinating Organization	Planning Department
Ideas for Implementation	Develop incentives for local governments, citizens, and businesses to pursue hazard mitigation projects; Allocate city resources and assistance to mitigation projects when possible; and Partner with other organizations and agencies in the City of Palos Verdes Estates to identify grant programs and foundations that may support mitigation activities
Time line	Ongoing
Constraints	None

Plan Goals Addressed		X	Protect Life and Property
X	Public Awareness		Natural Systems
X	Partnerships and Implementation	X	Emergency Services

Natural Hazard	Long Term Activity - Multi Hazard #3		
Action Item	Establish a formal role for the City of Palos Verdes Estates Natural Hazards Mitigation Committee to develop a sustainable process for implementing, monitoring, and evaluating citywide mitigation activities		
Coordinating Organization	Hazard Mitigation Advisory Committee		
Ideas for Implementation	Establish clear roles and authority for participants, meeting regularly to pursue and evaluate implementation of mitigation strategies. Oversee implementation of the mitigation plan. Establish measurable standards to evaluate mitigation policies and programs and provide a mechanism to update and revise the mitigation plan. Monitor hazard mitigation implementation by jurisdictions and participating organizations through surveys and other reporting methods. Develop updates for the Natural Hazards Mitigation Action Plan based on new information. Conduct a full review of the Natural Hazards Mitigation Action Plan every 5 years by evaluating mitigation successes, failures, and areas that were not addressed. Provide training for Committee members to remain current on developing issues in the natural hazard loss reduction field.		
Time line	Ongoing		
Constraints	None		
Plan Goals Addressed			Protect Life and Property
X	Public Awareness		Natural Systems
X	Partnerships and Implementation		Emergency Services

Natural Hazard	Short Term Activity – Multi Hazard #4		
Action Item	Identify, improve and sustain collaborative programs focusing on the real estate and insurance industries, public and private sector organizations, and individuals to avoid activity that increases risk to natural hazards.		
Coordinating Organization	Hazard Mitigation Advisory Committee		
Ideas for Implementation	Distribute information about flood, fire, earthquake, and other forms of natural hazards insurance to property owners in areas identified to be at risk through hazard mapping; Develop a one-page handout on types of insurance and deliver through city utility or service agencies; Educate individuals and businesses on the benefit of engaging in mitigation activities such as developing impact analyses; Pinpoint areas of high risk and transfer the cost of risk to property owners through insurance (rather than to the public); Encourage the development of unifying organizations to ensure communication and dissemination of natural hazard mitigation information.		
Time line	Ongoing		
Constraints	None		
Plan Goals Addressed		X	Protect Life and Property
X	Public Awareness		Natural Systems
X	Partnerships and Implementation		Emergency Services

Natural Hazard	Short Term Activity – Multi Hazard #5

Action Item	Develop public and private partnerships to foster natural hazard mitigation program coordination and collaboration in the City of Palos Verdes Estates.		
Coordinating Organization	City Planning Department		
Ideas for Implementation	Work with City governments to develop local Natural Hazards Mitigation Plans that are consistent with the goals and framework of the city plan. Identify all organizations within the City of Palos Verdes Estates that have programs or interests in natural hazards mitigation. Involve private businesses throughout the city in mitigation planning. Improve communication between Cal Trans and city road departments, and work together to prioritize and identify strategies to deal with road problems. Establish protocol for communication between electric providers and the Department of Transportation and Development to assure rapid restoration of transportation capabilities.		
Time line	Ongoing		
Constraints	none		
Plan Goals Addressed			Protect Life and Property
X	Public Awareness		Natural Systems
X	Partnerships and Implementation	X	Emergency Services

Natural Hazard	Long Term Activity – Multi Hazard #1		
Action Item	Develop, enhance and implement education programs aimed at mitigating natural hazards, and reducing the risk to citizens, public agencies, private property owners, businesses, and schools.		
Coordinating Organization	Planning Department		
Ideas for Implementation	Make the city of Palos Verdes Estates Natural Hazards Mitigation Plan available to the public by publishing the plan electronically on the city and emergency management websites. Enhance the City website by including information specific to City of Palos Verdes Estates residents, including site-specific hazards information, Building & Safety Codes information, insurance companies that provide earthquake insurance for city residents, and educational information on damage prevention. Use local radio and cable stations as a conduit for advertising public forums. Develop outreach materials for mitigation, preparedness, response and recovery.		
Time line	Ongoing		
Constraints	none		
Plan Goals Addressed		X	Protect Life and Property
X	Public Awareness		Natural Systems
	Partnerships and Implementation		Emergency Services

Natural Hazard	Long Term Activity – Multi Hazard #2
Action Item	Use technical knowledge of natural ecosystems and events to link natural resource management and land use organizations to mitigation activities and technical assistance.
Coordinating Organization	Planning Department
Ideas for Implementation	Review ordinances that protect natural systems and resources to mitigate for natural hazards for possible enhancements. Pursue vegetation and restoration practices that assist in enhancing and restoring the natural and beneficial functions of the watershed. Develop education and outreach programs that focus on protecting natural systems

	as a mitigation activity.		
Time line	Ongoing		
Constraints			
Plan Goals Addressed			Protect Life and Property
X	Public Awareness	X	Natural Systems
	Partnerships and Implementation		Emergency Services

Section 1

Introduction

Throughout history, the residents of City of Palos Verdes Estates have encountered minimal natural hazards affecting the area.

The City of Palos Verdes Estates is located on the northwest coast of the Palos Verdes peninsula, at the south end of Los Angeles County. Deed restrictions established when the land was originally subdivided coupled with the City's Neighborhood Compatibility ordinance and an aggressive plan for the maintenance of the urban forest have preserved Palos Verdes Estates as a highly desirable bedroom community characterized by its natural beauty and sweeping views of the ocean and City lights.

The City is subject to earthquakes, earth movements, flooding, tsunamis, wildfires and wind storms. 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.

The City of Palos Verdes Estates most recently experienced a significant landslide in 1982 when a portion of the land in Bluff Cove collapsed, causing significant damage to public and private property, partially caused by a failed storm drain. In 1995 a federal disaster emergency was declared due to severe flooding and mudslides. Total expenses/ losses for that fiscal year were $107,617.

In response to disasters created by storm water, the City developed and adopted a Master Storm Drain plan, identifying areas in need of new or improved storm drain systems and establishing a schedule for their construction. Since that time, the majority of identified projects have been implemented, producing to a significant reduction in the damage caused by storms. Implementation of storm water mitigation projects are ongoing, as dictated by the Master Storm Drain plan. Funds are budgeted annually to design and construct drains identified in the Plan.

Why Develop a Mitigation Plan?

The City of Palos Verdes Estates has historically proactively planned for natural disasters because the community realizes the importance of identifying effective ways to minimize its vulnerability. 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 and neighboring municipalities.

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 Palos Verdes Estates;
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 City General Plan and Emergency Operations Plans.

Whom Does the Mitigation Plan Affect?

The City of Palos Verdes Estates Natural Hazards Mitigation Plan affects the entire city. Exhibit A shows major roads in the City of Palos Verdes Estates. 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 local mitigation plans and partnerships.

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. The City has the added vulnerability of wildfire due to the extensive network of open parklands.

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 and state land, 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 and 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 Palos Verdes Estates conducted data research and analysis, facilitated steering committee meetings and public workshops, and developed the final mitigation plan. The research methods and various contributions to the plan include:

Input from the steering committee:

The Hazard Mitigation Advisory Committee convened periodically to guide development of the Mitigation Plan. The committee played an integral role in developing the mission, goals, and action items for the mitigation plan. The committee consisted of representatives of public and private agencies and organizations in City of Palos Verdes Estates including:

City of Palos Verdes Estates Building and Safety
City of Palos Verdes Estates Finance
City of Palos Verdes Estates Planning
City of Palos Verdes Estates Public Works Department
City of Palos Verdes Estates Streets and Parks Department
California Water Service
Palos Verdes Peninsula Unified School District
Zeiser Kling Consultants (City Geotechnical Engineer and Geologist)
Cox Communications
The Gas Company

Southern California Edison
City of Palos Verdes Estates Police Department
Los Angeles County Fire Department
Office of Disaster Management, Area G

State and federal guidelines and requirements for mitigation plans:

Following are the Federal requirements for approval of a Natural Hazard 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-profits 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 & objectives, including proposed strategies, programs & 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 All Hazard 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.

A minimum of two public workshops (or other public forums) is recommended to meet the requirement for public participation, in addition to the inclusion of representatives from outside organizations on the planning committee itself. The timing and scheduling of the workshops may vary from one community to another depending on how each city's committee organizes its work and the particular needs of the community.

City of Palos Verdes Estates staff examined existing mitigation plans from around the country, current FEMA hazard mitigation planning standards (386 series) and the State of California Natural Hazards Mitigation Plan Guidance.

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: The City of Palos Verdes Estates staff collected data and compiled research on six hazards: earthquakes, earth movements, flooding, tsunamis, wildfires and wind storms. Research materials came from state and local agencies. The City of Palos Verdes Estates staff conducted research by referencing historical local newspapers, meeting with representatives from utility companies and surrounding cities, examining historical records and listening to public comment. Staff then identified current mitigation activities, resources and programs, and potential action items from research materials and stakeholder interviews.

Public workshops

The City of Palos Verdes Estates staff facilitated two public workshops to gather comments and ideas from citizens about mitigation planning and priorities for mitigation plan goals. The first workshop, held February 26, 2004, was attended by 22 representatives from City departments, utility companies, private consultants and local citizens. On March 24, 2004 a second workshop was held where 12 individuals were in attendance.

The resources and information cited in the mitigation plan provide a strong local perspective and help identify strategies and activities to make the City of Palos Verdes Estates more disaster resilient.

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 Palos Verdes Estates.

The mitigation plan is organized in three volumes. Volume I contains an executive summary, introduction, City profile, risk assessment and multi-hazard, plan maintenance. Volume II

contains the six natural hazard sections and Volume III includes the appendices. Each section of the plan is described below.

Volume I: Mitigation Action Plan

Executive Summary: Five-Year Action Plan

The Five-Year Action Plan provides an overview of the mitigation plan mission, goals, and action items. 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 City of Palos Verdes Estates.

Section 2: Community Profile

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

Section 3: Risk Assessment

This section provides information on hazard identification, vulnerability and risk associated with natural hazards in City of Palos Verdes Estates.

Section 4: Multi-Hazard Goals and Action Items

This section provides information on the process used to develop goals and action items that cut across the six natural hazards addressed in the mitigation plan.

Section 5: Plan Maintenance

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

Volume II: Hazard Specific Information

Hazard-Specific Information on the six chronic hazards are 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 6: Earthquake
Section 7: Earth Movement (Landslide / Debris Flow)

Section 8: Flooding
Section 9: Tsunami
Section 10: Wildfire
Section 11: Windstorm

Catastrophic hazards do not occur with the frequency of chronic hazards, but can have devastating impacts on life, property, and the environment. In Southern California, because of the geology and terrain, earthquake, earth movement, flooding and wildfire also have the potential to be catastrophic as well as chronic hazards. For the coastal areas of Southern California, tsunamis, while very rare, have the potential to calamitously devastate low-lying coastal areas.

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.

Volume III: Resources

The plan appendices are designed to provide users of the City of Palos Verdes Estates 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 Palos Verdes Estates 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. The City’s analysis is included.

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 Palos Verdes Estates Natural Hazards Mitigation Plan.

Appendix E: Glossary

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

Section 2:

Community Profile

Why Plan for Natural Hazards in the City of Palos Verdes Estates?

Natural hazards impact citizens, property, the environment, and the economy of the City of Palos Verdes Estates. The risks associated with natural hazards increases as more people move to areas affected by natural hazards.

The inevitability of natural hazards, and the 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.

HISTORY AND CHARACTERISTICS

The City of Palos Verdes Estates, incorporated December 20, 1939, is the oldest of the four cities on the Palos Verdes Peninsula.

The Palos Verdes Peninsula, which became known as Rancho de los Palos Verdes, was part of a land grant deeded to Don Delores Sepulveda in 1822, in return for his support of the Mexican Revolution. In 1882, the land was deeded to Jotham Bixby who brought farming to the Peninsula. The Bixby family in turn, sold the land to New York City Financier Frank A. Vanderlip, Sr. in 1913. Vanderlip, then President of National City Bank in New York, covered every mile of his new acquisition on horseback and formed his vision of a magnificent community by the sea. To achieve these goals, Vanderlip called in the most talented experts and professionals of his day.

Deed restrictions were imposed on the land in 1923, when the Bank of America as trustee for Vanderlip's Palos Verdes Project drafted a trust indenture and outlined provisions for development of the new community. The restrictions included specific items to "preserve the fine views of ocean, mountains and park," and "increase with the years the wonderful natural beauty of the property". The document established set- back requirements, prohibited billboards and imposed a system of architectural review on builders administered by the Palos Verdes Homes Association and the Palos Verdes Art Jury.

Vanderlip's plans were slowed by World War I, but subdivision of the land and construction of the first Spanish style homes in what is today Palos Verdes Estates began in the early 1920's.

The new community was laid out and landscaped by the famous Olmsted Brothers, sons of Frederick Law Olmsted, Sr., who designed Central Park in New York City. Gently winding roadways, green hillsides, paths, stands of eucalyptus, pepper, and coral trees were established, and a full 28% of the land area was dedicated to be permanent open space. This early planning and dedication of parklands gives the City its unique rural character and has resulted in its international reputation for scenic beauty.

Palos Verdes Estates first functioned as an unincorporated community and the Homes Association was liable for taxes on all parkland. After the economic crash in 1929, the Association owed parkland taxes to Los Angeles County and area residents were afraid that the parklands might be sold for payment. City incorporation was voted in 1939 and the parklands were deeded to the new City in 1940 by the Homes Association.

CITY FACTS AND FIGURES

Incorporated:	December 20, 1939
Population estimate January 2000	13,572
Area:	4.75 sq. miles or 3,038 acres
Approximate Linear Miles of Coastline:	4.5 miles
Highest Elevation:	1,134 feet
Lowest Elevation:	Sea level
Miles of Paved Streets:	87.9 miles
City Parkland:	849 acres, 28% of City land
Dwelling Units:	5,229
Single family	4,883
Multi-family	346
Average # of residents per household	2.67
Registered Voters:	9,862
Type of Government:	Council/Manager
Type of City:	General Law

CITY GOVERNMENT

City Council

As a "general law city" Palos Verdes Estates provides services to the public mandated by the California State Code. The City's authorized legislative body is the City Council which consists of five residents elected at large on a non-partisan ballot for four-year overlapping terms. Each year one member of the Council is selected by the Council to serve as Mayor and one as Mayor Pro Tempore. Regular City Council meetings are held on the second and fourth Tuesdays of each month in City Council Chambers at City Hall.

Council makes policy decisions which are implemented by the City Manager and City staff. City committees and commissions study issues and advise Council.

Planning Commission

Planning Commissioners are appointed by the Mayor and City Council and members serve overlapping terms. The Commission reviews and makes decisions on most construction projects, zoning changes, grading and neighborhood compatibility applications, utility projects and right-of-way encroachments in the City. It periodically updates the City's General Plan.

Parklands Committee

The Parklands Committee is an advisory body to the City Council. Members are appointed by the Mayor and Council to overlapping terms. The Committee has knowledge of local plants and trees and an appreciation of the City's Parklands and rights-of-way plantings. The Committee advises residents concerning designated street trees, tree management procedures, and right-of-way planting. It reviews and makes recommendations on homeowner proposals for right-of-way and parkland planting, and tree pruning, removals and maintenance.

Traffic and Safety Committee

The Traffic and Safety Committee is an advisory body to the City Council. The Committee suggests the best means for coordinating and administering traffic calming, assists in the publication of traffic reports, receives complaints having to do with traffic matters, and recommends the best means of improving traffic conditions and the administration and enforcement of traffic regulations.

CITY FINANCES

The City Manager prepares an annual budget which must be approved by the City Council. Regular audits of all City financial records are performed annually by a private, independent auditor.

Palos Verdes Estates is primarily a residential community, with little commercial tax base. From its incorporation until 1978, a significant portion of City revenues came from the property tax. Due to legislation and a change in the formula by the State Legislature in the late l970's, only 11% of the County property tax dollar is returned to the City today.

In June of 1980, the City voters passed two parcel taxes to restore revenues and lost services. The Police, Fire/Paramedic parcel tax assessed each parcel annually to provide funds for Police, Fire/Paramedic services. The Streets and Parklands parcel tax assessed each parcel annually for street and parkland maintenance. These parcel taxes were submitted to city voters every four

years for renewal until the Fire Suppression Benefit Assessment District was approved in 1991 and subsequently renewed 1996. The City Council abolished both parcel taxes in 1991.

In 2001, City voters approved a fire and paramedic special tax which replaced the Assessment District. These proceeds pay for the Los Angeles County Fire and Paramedic Services contract. The City also has a utility tax which funds the City's capital improvement program. This program includes major street repair and storm drain improvements.

CITY DEPARTMENTS

City Manager

The City Manager is appointed by the City Council and serves as the City's Chief Administrative Officer ensuring that the policies of the City Council are executed effectively and efficiently. He is responsible for recruiting and appointing all employees (with the exception of the City Attorney and City Treasurer), preparing and monitoring the City budget, analyzing policies and making recommendations to the City Council. The City Manager is responsible for personnel management and administration and oversees purchasing. The City Manager may be assisted by other staff members in these tasks but retains ultimate responsibility for them.

City Clerk

The City Clerk's office, under the supervision of the Assistant City Manager, maintains all official City records such as ordinances, resolutions, contracts, minutes, deeds and agreements. The Clerk prepares City Council agendas and back-up materials, maintains the Municipal Code and City Seal, administers City elections and the Fair Political Practices Act and publishes public information.

Finance Department

The Finance Department, supervised by the Assistant City Manager, operates and maintains the City's accounting and internal auditing systems and collects and disburses all City funds. The Department also administers the City’s payroll and license collection. In preparation of the annual budget, the Assistant City Manager acts as an advisor to the City Manager and also serves as the City's Risk Manager.

City Treasurer

The City Treasurer, an elected official, is responsible for keeping accurate accounting records and reporting cash balances monthly to the City Council. The Treasurer is in charge of the City’s investments, maintaining an investment portfolio to ensure liquidity, preserve principal and achieve maximum interest, while at the same time accomplishing the day to day cash flow needs of the City.

City Attorney

The City Attorney, a contract employee, is retained by the City on a part-time basis to advise the City Council, City Manager, staff, committees and commissions on matters of law as they relate to City activities. The City Attorney represents the City in litigation and drafts ordinances, resolutions, contracts, agreements and other legal documents.

Public Works/Planning Department

Engineering, planning, streets and parks are functions of the City's Public Works department. Services are provided by both City and contract employees with management provided by a contract consulting firm. The Department plans and supervises all capital improvement projects related to streets, storm drains and other City property. Also under its supervision are parklands and plaza maintenance, street sweeping, tree trimming, street resurfacing, storm drain maintenance, and processing of conditional use permits, variance applications, grading permits and neighborhood compatibility applications for construction projects. The planning section oversees land use and development policies of the City including all elements of the City's General Plan.

Building Department

The City's Building Department services are also provided by contract. The Building Department enforces construction standards to safeguard life, health and property. The standards are defined in the Municipal Code. Enforcement is achieved through inspection of new construction, alterations, demolition, repairs and use of buildings and structures. The Building Department issues required permits and checks building plans for compliance to City codes. The Department issues permits for all construction projects in the City and inspects all such projects.

Police Department

Palos Verdes Estates is the only City on the Palos Verdes Peninsula with its own Police Department. The Department enforces all local, state and federal laws, including criminal and traffic.

There are three divisions in the department: operations, investigations and administration. Department facilities include full, state-approved detention facilities with on-duty jailers. Officers are continuously updated in their training in new areas of law enforcement.

Using a balanced program of traditional service and thoughtful innovation, the Department strives to increase public safety in our community. A designated officer develops crime prevention programs and works with Neighborhood Watch and other community groups. A canine officer is used in house and building searches to apprehend suspects.

Residents are urged to register with the Police Department before they leave on vacation so that house security checks may be made.

Residents may request public information programs and canine demonstrations for community groups. The City is proud of its independent police department and rapid response to resident emergencies.

Fire Protection and Paramedic Services

The Consolidated Fire Protection District of Los Angeles County provides fire protection and paramedic services to the City of Palos Verdes Estates by contract. In addition to its firefighting, rescue and first aid duties, the County Fire Department makes fire prevention inspections; they also conduct fire safety programs in the schools.

COMMUNITY HELP ORGANIZATIONS

Neighborhood Watch

Law enforcement in Palos Verdes Estates receives support from an active Neighborhood Watch organization. The basis of Neighborhood Watch is simply neighbors cooperating to keep an eye on each others' homes and to report any suspicious circumstances to the Police. Groups have been organized throughout the City. Meetings are held for neighbors to meet each other and hear speakers on crime prevention.

HOMES ASSOCIATION AND ART JURY

The Palos Verdes Homes Association, founded in 1923, is a separate body from the City government. Prior to the founding of the City, the Homes Association provided many of the services of a city government. Since 1939 when the City was incorporated, the Homes Association has continued to enforce the deed restrictions on homes in Palos Verdes Estates.

SERVICES

Trash Collection

According to City Code, residents may not place their rubbish containers at the curb. Trash collectors pick up the trash from each property's enclosed trash yard.

Palos Verdes Peninsula Transportation

The City of Palos Verdes Estates, with its neighboring cities, Rolling Hills Estates, Rancho Palos Verdes and the unincorporated areas of the Peninsula, cooperate in providing local bus service within the Palos Verdes Peninsula through P.V. Transit buses.

Senior Citizen and Handicapped Transportation

Transportation for Senior Citizens and the handicapped is available through the Peninsula Dial-A-Ride program. Dial-A -Ride runs 24 hours a day, 7 days a week. This service transports users to medical facilities (within a designated area) off the Peninsula in addition to destinations on the Peninsula. Access Services Inc., a transit service for Dial-A -Ride registrants who cannot access regular bus service because of a disability, also offers an extended transit option to destinations throughout Los Angeles County.

Animal Control Services

Animal control services are handled by the City's Police Department. The City contracts with Los Angeles County Animal Control. All requests to pick up biting dogs, sick, injured or stray animals in distress, or animals causing a hazardous situation go through the Police Department.

The City issues dog licenses which are required for all dogs four months old and over. A rabies clinic is held at City Hall once a year in the summer and is announced in the City Newsletter.

COMMUNITY RECREATION FACILITIES

Palos Verdes Estates provides its residents with a number of outstanding opportunities for recreational and sporting activities. The City owns and maintains 382 acres of Parklands, 130 acres of shoreline preserve, a 3-mile equestrian trail, a 214 acre golf course, a tennis club, stable and beach and athletic club.

Golf Club

The Palos Verdes Golf and Country Club is located at 3301 Via Campesina. The land and facility belongs to the City, and the Club is operated under a concession agreement with the City.

The clubhouse is open to the general public for lunch, 11:00 a.m. to 2:30 p.m., Tuesday through Saturday. Thursday night dining and Sunday morning brunch are also available to the public. City residents and property owners may apply for either a social or golf membership for a fee. The golf course is open to the public all day Mondays (except holidays) and specified hours throughout the week. It is open on weekends to guests of members. Lessons are available.

Tennis Club

Located next to the Golf Club, the Tennis Club, at 3303 Via Campesina, is also owned by the City and operated under a concession agreement with the City. There are 10 lighted and 2 unlighted courts and a clubhouse. Members have preference, but non-members may play for a fee when courts are available.

Beach and Athletic Club

The Palos Verdes Beach and Athletic Club, opened in 1993 on the former Roessler Memorial Pool site, is owned by the City and operated under a concession agreement. It offers two pools, summer swim program, clubhouse, aerobics classes, weight facilities and training and a full social program. Some programs are restricted to members.

Palos Verdes Stable

The Palos Verdes Stable, located at 4057 Via Opata, is owned by the City and operated under a concession agreement. Guided rides, lessons, horse rentals, boarding and horse camps are offered. Trail rides are available on weekends in the summer months; summer horse camp for children is held each summer.

Parcourse

Located at the corner of Palos Verdes Drive West and Via Coronel, a parcourse for exercise enthusiasts is adjacent to the Little League fields.

Parklands

The City's original planners set aside 28% of the City's acreage as permanently protected parklands. The parklands are maintained largely in their original state helping to give Palos Verdes Estates its open semi-rural character. Some of the parklands contain pathways where walking or hiking is allowed. Various species of wildlife inhabit these areas.

Section 3:

Risk Assessment

What is a Risk Assessment?

Conducting a risk assessment can provide the following 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 three 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. The City of Palos Verdes Estates identified six major hazards that affect this geographic area. These hazards - earthquakes, earth movements, flooding, tsunamis, wildfires and wind storms - were identified through an extensive process that utilized input from the Hazard Mitigation Advisory Committee The geographic extent of each of the identified hazards has been identified and is illustrated by the charts/maps listed in Table 3-1.

2) Profiling Hazard Events

This process describes the causes and characteristics of each hazard, how it has affected the City of Palos Verdes Estates in the past, and what part of the City of Palos Verdes Estates' population, infrastructure, and environment has historically been 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 entities provide essential 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 *Chart/map 3* at the end of this section. A description of the critical facilities in the City is also provided in this section. In addition, this plan includes a community issues summary in each hazard section to identify the most vulnerable and problematic areas in the City, including critical facilities, and other public and private property.

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 are 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 Palos Verdes Estates 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 the City of Palos Verdes Estates 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.

Table 3-1. **List of Hazard Mitigation Plan Charts/maps**

Map #	Type of Map	Section of the Plan
1	*Base Map of City of Palos Verdes Estates*	*Section 1: Introduction*
2	*Precipitation*	*Section 2: Community Profile*
3	*Critical Facilities (Public Safety & Hospitals)*	*Section 3: Risk Assessment*
4	*Essential Facilities*	*Section 3: Risk Assessment*
5	*Infrastructure*	*Section 3: Risk Assessment*
6	*Earthquake Fault map (L.A. Basin)*	*Section 6: Earthquake*
7	*Earthquake Fault Map (Local)*	*Section 6: Earthquake*
8	*Liquefaction Areas*	*Section 6: Earthquake*
9	*City 100- Year Flood plain*	*Section 7: Flood*
10	*Dam Inundation Areas*	*Section 7: Flood*
11	*Wildland / Urban Interface Areas*	*Section 8: Wildfire*
12	*Landslide Areas*	*Section 9: Earth Movement*
13	*Debris Flow Areas*	*Section 9: Earth Movement*
14	*Tsunami Inundation Map*	*Section 10: Tsunami*

Note: The information on the maps in this plan was derived from City of Palos Verdes Estates' GIS. Care was taken in the creation of these maps, but is provided "as is." The City of Palos Verdes Estates 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.

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.

The City of Palos Verdes Estates conducted a vulnerability assessment for the flood hazard using Geographic Information Systems (GIS) to identify the geographic extent of the hazard and assess the land use and value at risk from the flood hazard. The vulnerability assessment for the earthquake hazard is addressed in part from FEMA's HAZUS analysis model. Insufficient data exists to conduct vulnerability assessments and risk analyses for the other hazards addressed in the plan: earthquakes, earth movements, flooding, tsunamis, wildfires and wind storms.

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 six hazards profiled in the mitigation plan, including earthquakes, earth movements, flooding, tsunamis, wildfires and wind storms. The Federal criteria for risk assessment and information on how the City of Palos Verdes Estates' Natural Hazard Mitigation Plan meets those criteria is outlined in Table 3-2 below.

Table 3-2. 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 GIS data are available, the City developed maps identifying the location of the hazard in the City. 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 and lifelines 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 Palos Verdes Estates' 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 Facilities and Infrastructure

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, bridges and roads. Facilities that, if damaged, could cause serious secondary impacts may also be considered "critical." A hazardous material facility is one example of this type of critical facility.

Critical and 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 jail, law enforcement center, public services building, community corrections center, the courthouse, and juvenile services building and other public facilities such as schools. The *charts/maps* on the following pages illustrate the critical facilities, essential facilities, public infrastructure, and emergency transportation routes within the City of Palos Verdes Estates.

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 4:

Multi-Hazard Goals and Action Items

This section provides information on the process used to develop goals and action items that pertain to the six natural hazards addressed in the mitigation plan. It also describes the framework that focuses the plan on developing successful mitigation strategies. The framework is made up of three parts: the Mission, Goals, and Action Items.

Mission

The mission of the City of Palos Verdes Estates' 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 safer, more sustainable community.

Goals

The plan goals describe the overall direction that City of Palos Verdes Estates' agencies, organizations, and citizens can take to minimize the impacts of natural hazards. The goals are stepping-stones between the broad direction of the mission statement and the specific recommendations that are outlined in the action items.

Action Items

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 time line for implementation. Short-term action items are activities that City agencies may implement with existing resources and authorities within one to two years. Long-term action items may require new or additional resources or authorities, and may take between one and five years (or more) to implement.

Mitigation Plan Goals and Public Participation

The Plan goals help to guide direction of future activities aimed at reducing risk and preventing loss from natural hazards. The goals listed here serve as checkpoints as agencies and organizations begin implementing mitigation 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 natural hazards.

- Reduce losses and repetitive damages for chronic hazard events while promoting insurance coverage for catastrophic hazards.

- Improve hazard assessment information to make recommendations for discouraging new development and encouraging preventative measures for existing 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.
- Provide information on tools, partnership opportunities, and funding resources to assist in implementing mitigation activities.

Natural Systems

- Balance watershed planning, 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.

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

Public Participation

- Public input during development of the mitigation plan assisted in creating plan goals. Meetings with the project steering committee, stakeholder interviews, and a public workshop served as methods to obtain input and identify priorities in developing goals for reducing risk and preventing loss from natural hazards in the City of Palos Verdes Estates.
- On February 26, 2004, the first public workshop was held to gather ideas from City of Palos Verdes Estates residents regarding the goals for the City of Palos Verdes Estates Natural Hazards Mitigation Plan. The 22 attendees included representatives from public agencies, utility companies, and private residents. The attendees identified goals for the plan by examining the issues and concerns that they have had regarding natural hazards, and further discussed potential action items for the Plan.
- The second public workshop was held March 24,2004 to review historical data. Twelve members of various agencies attended this workshop.

Natural Hazard Mitigation Plan Action Items

The mitigation plan identifies short and long-term action items developed through data collection and research, and the public participation process. Mitigation plan activities may be considered for funding through Federal and State grant programs, and when other funds are made available through the city. Action items address multi-hazard (MH) and hazard specific issues. To help ensure activity implementation, each action item includes information on the time line and coordinating organizations. Upon implementation, the coordinating organizations may look to partner organizations for resources and technical assistance.

Coordinating Organization

The coordinating organization is the organization that is willing and able to organize resources, find appropriate funding, or oversee activity implementation, monitoring, and evaluation. Coordinating organizations may include local, city, or regional agencies that are capable of or responsible for implementing activities and programs.

Time line

Action items include both short and long-term activities. Each action item includes an estimate of the time line for implementation. Short-term action items are activities that city agencies may implement with existing resources and authorities within one to two years. Long-term action items may require new or additional resources or authorities, and may take between one and five years (or more) to implement.

Ideas for Implementation

Each action item includes ideas for implementation and potential resources, which may include grant programs or human resources.

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.

Constraints

Constraints may apply to some of the action items. These constraints may be a lack of city staff, lack of funds, or vested property rights which might expose the City to legal action as a result of adverse impacts on private property.

Project Evaluation Worksheets:

Each jurisdiction will have The City of Palos Verdes Estates has some limitations on the number and cost of mitigation activities that can be completed within a given period of time. There are likely to be multiple ideas to mitigate the effects of a given hazard. Therefore it will bewas necessary for the committee to select the most cost effective mitigation projects and to further prioritize them. To assist the committee in the Benefit Cost Analysis (BCA) a Project Evaluation Worksheet was utilized and is included at the

end of Section 4. The data on these worksheets will help the committee determine the most cost effective mitigation solutions for the community. Some projects may need more detailed BCA, but this worksheet will provide a first screening methodology. This worksheet was referred to during the committee's discussions of potential mitigation projects. The data on these worksheets helped the committee determine the most cost effective mitigation solutions for the community.

Multi-Hazard Action Items

Multi-hazard action items are those activities that pertain to two or more of the six hazards in the mitigation plan: flood, landslide, wildfire, severe winter storm, windstorm and earthquake.

Short Term Activity - Multi Hazard #l: Integrate the goals and action items from the City of Palos Verdes Estates Natural Hazard Mitigation Plan into existing regulatory documents and programs, where appropriate.

Ideas for Implementation:

Use the mitigation plan to help the city's General Plan institutionalize guidelines for sustainable development in all new construction and development projects according to the hazards that impact the City of Palos Verdes Estates;

Integrate the city's mitigation plan into current capital improvement plans to ensure that development does not encroach on known hazard areas; and

Partner with other organizations and agencies with similar goals to promote Building & Safety Codes that are more disaster resistant at the state level.

Coordinating Organization: Hazard Mitigation Advisory Committee
Time line: Ongoing
Plan Goals Addressed: Partnerships and Implementation
Constraints: none

Short Term Activity - Multi Hazard #2: Identify and pursue funding opportunities to develop and implement local and city mitigation activities.

Ideas for Implementation:

Allocate city resources and assistance to mitigation projects when possible; and

Partner with other organizations and agencies in the City of Palos Verdes Estates to identify grant programs and foundations that may support mitigation activities.

Coordinating Organization: Planning Department
Time line: Ongoing
Plan Goals Addressed: Partnerships and Implementation
Constraints: none

SHORT TERM ACTIVITY - MULTI HAZARD *#3:* Establish a formal role for the City of Palos Verdes Estates Natural Hazards Mitigation Committee to develop a sustainable process for implementing, monitoring, and evaluating citywide mitigation activities.

Ideas for Implementation:

Establish clear roles for participants, meeting regularly to pursue and evaluate implementation of mitigation strategies.

Oversee implementation of the mitigation plan.

Establish measurable standards to evaluate mitigation policies and programs and provide a mechanism to update and revise the mitigation plan.

Monitor hazard mitigation implementation by jurisdictions and participating organizations through surveys and other reporting methods.

Develop updates for the Natural Hazards Mitigation Action Plan based on new information.

Conduct a full review of the Natural Hazards Mitigation Action Plan every 5 years by evaluating mitigation successes, failures, and areas that were not addressed.

Provide training for Committee members to remain current on developing issues in the natural hazard loss reduction field.

Coordinating Organization: Hazard Mitigation Advisory Committee
Time line: Ongoing
Plan Goals Addressed: Partnerships and Implementation
Constraints: none

SHORT TERM ACTIVITY - MULTI HAZARD #4: Identify, improve, and sustain collaborative programs focusing on the real estate and insurance industries, public and private sector organizations, and individuals to avoid activity that increases risk to natural hazards.

Ideas for Implementation:

Distribute information about flood, fire, earthquake, and other forms of natural hazards insurance to property owners in areas identified to be at risk through hazard mapping.

Develop a one-page handout on types of insurance and deliver through city utility or service agencies.

Educate individuals and businesses on the benefit of engaging in mitigation activities such as developing impact analyses.

Pinpoint areas of high risk and transfer the cost of risk to property owners through insurance (rather than to the public).

Encourage the development of unifying organizations to ensure communication and dissemination of natural hazard mitigation information.

Multi hazard Action Items

Identify activities for private sector and citizen involvement such as nonstructural seismic daycare retrofits.

Coordinating Organization: City Planning Department
Time line: Ongoing
Plan Goals Addressed: Protect Life and Property, Public Awareness, Partnerships and Implementation
Constraints: none

SHORT TERM ACTIVITY - MULTI HAZARD #5: Develop public and private partnerships to foster natural hazard mitigation program coordination and collaboration in the City of Palos Verdes Estates.

Ideas for Implementation:

Work with city governments to develop local Natural Hazards Mitigation Plans that are consistent with the goals and framework of the city plan.

Identify all organizations within the City of Palos Verdes Estates that have programs or interests in natural hazards mitigation.

Involve private businesses throughout the city in mitigation planning.

Improve communication between Cal Trans and city road departments, and work together to prioritize and identify strategies to deal with road problems.

Establish protocol for communication electric providers and the Department of Transportation and Development to assure rapid restoration of transportation capabilities.

Coordinating Organization: City Planning Department
Time line: Ongoing
Plan Goals Addressed: Partnerships and Implementation
Constraints: none

SHORT TERM ACTIVITY - MULTI HAZARD #6: Develop inventories of at-risk buildings and infrastructure and prioritize mitigation projects.

Ideas for Implementation:

Identify critical facilities at risk from natural hazards events.

Develop strategies to mitigate risk to these facilities, or to utilize alternative facilities should natural hazards events cause damages to the facilities in question.

Incorporate the building inventory developed by the Department of Geology and Mineral Industries (Dec. 2002) into the hazard assessment.

Identify bridges at risk from flood or earthquake hazards, identify enhancements, and implement projects needed to reduce the risks.

Coordinating Organization: City Planning Department
Time line: 1-2 Years
Plan Goals Addressed: Protect Life and Property, Partnerships and Implementation
Constraints: none

SHORT TERM ACTIVITY - MULTI HAZARD #l: Strengthen emergency services preparedness and response by linking emergency services with natural hazard mitigation programs, and enhancing public education on a regional scale.

Ideas for Implementation:

Educate private property owners on limitations of bridges and dangers associated with them.

Encourage individual and family preparedness through public education projects such as safety fairs.

Coordinate the maintenance of emergency transportation routes though communication among the City Roads Department, neighboring jurisdictions, and the California Department of Transportation.

Identify opportunities for partnering with citizens, private contractors, and other jurisdictions to increase availability of equipment and manpower for efficiency of response efforts.

Encourage community involvement in the Citizens' Emergency Response Team (CERT) program through the Police Department.

Familiarize public officials of requirements regarding public assistance for disaster response.

Coordinating Organization: City Planning Department
Time line: Ongoing
Plan Goals Addressed: Emergency Services
Constraints: none

LONG TERM ACTIVITY - MULTI HAZARD-MH #2: Develop, enhance, and implement education programs aimed at mitigating natural hazards, and reducing the risk to citizens, public agencies, private property owners, businesses, and schools.

Ideas for Implementation:

Make the City of Palos Verdes Estates Natural Hazards Mitigation Plan available to the public by publishing the plan electronically on the city and emergency management websites.

Enhance the City website by including information specific to City of Palos Verdes Estates residents, including site-specific hazards information, Building & Safety Codes information, insurance companies that provide earthquake insurance for city residents, and educational information on damage prevention.

Use local radio and cable stations as a conduit for advertising public forums.

Develop outreach materials for mitigation, preparedness, response and recovery.

Coordinating Organization: Planning Department
Time line: Ongoing
Plan Goals Addressed: Public Awareness, Protect Life and Property
Constraints: none

SHORT TERM ACTIVITY - MULTI HAZARD #3: Use technical knowledge of natural ecosystems and events to link natural resource management and land use organizations to mitigation activities and technical assistance.

Ideas for Implementation:

Review ordinances that protect natural systems and resources to mitigate for natural hazards for possible enhancements.

Pursue vegetation and restoration practices that assist in enhancing and restoring the natural and beneficial functions of the watershed.

Develop education and outreach programs that focus on protecting natural systems as a mitigation activity.

Coordinating Organization: City Planning Department
Time line: Ongoing
Plan Goals Addressed: Natural Systems
Constraints: none

Prioritization of Action Items

Once the Committee had compiled the action items, the worksheet which follows was utilized in prioritizing them. Consideration of the costs and benefits in social, technical, administrative, political, legal, economic and environmental terms were analyzed. The scoring sheet is included in the appendix. The following is the ranking order developed for the various activities:

Priority Ranking	Action Item		Priority Score
1	EQ	Continue to implement building code regulations for new construction, which require structures to be designed to withstand the impacts of future earthquakes.	35
2	WF	Continue the implementation of wildfire mitigation activities in a manner consistent with the goals of promoting sustainable ecological management and community stability	35
3	LS	Review local ordinances regarding building and development in landslide prone areas	34
4	LS	Identify safe evacuation routes in high-risk debris flow and landslide areas	33
5	TS	Work with the Beach and Athletic Club to minimize potential damage from tsunamis	33
6	WS	Improve local City and utility awareness of tree pruning and Fire Code Sections relevant to wind-resistant utility operations	32
7	MH	Develop inventories of at-risk buildings and infrastructure and prioritize mitigation projects	32
8	MH	Strengthen emergency services preparedness and response by linking emergency services with natural hazard mitigation programs, and enhancing public education on a regional scale	32
9	FL	Require proper drainage design to minimize flooding for new construction	31
10	FL	Improve public storm drain infrastructure	31
11	MH	Establish a formal role for the City of Palos Verdes Estates Natural Hazards Mitigation Committee to develop a sustainable process for implementing, monitoring, and evaluating citywide mitigation activities	31
12	EQ	Educate residents on the impacts of earthquakes and steps that can be taken to minimize their vulnerability	30

13	***EQ***	Identify needs of City staff and other agencies to optimize their ability to respond in the event of an earthquake	30
14	***FL***	Improve knowledge of flooding hazard areas and understanding of vulnerability and risk to life and property in hazard-prone areas	30
15	***LS***	Improve knowledge of landslide hazard areas and understanding of vulnerability and risk to life and property in hazard-prone areas	30
16	***WF***	Inventory alternative firefighting water sources and encourage the development of additional sources	30
17	***WS***	Public Awareness Campaign: To provide public education materials to City of Palos Verdes Estates residents and all School District staff, parents and age-appropriate students with mitigation materials pertaining to the protection of life and property before, during, and after a windstorm	30
18	***LS***	Encourage construction design that can be applied to steep slopes to reduce the potential adverse impacts from development	29
19	***LS***	Limit activities in identified potential and historical landslide areas through regulation and public outreach	29
20	***WS***	Encourage Critical City Facilities to purchase and/or test backup power facilities for use during a power failure. Create a equipment/testing log, if needed, to ensure backup power equipment is in working service	29
21	***MH***	Integrate the goals and action items from the City of Palos Verdes Estates Natural Hazard Mitigation Plan into existing regulatory documents and programs, where appropriate	29
22	***MH***	Develop, enhance, and implement education programs aimed at mitigating natural hazards, and reducing the risk to citizens, public agencies, private property owners, businesses, and schools	29
23	***MH***	Use technical knowledge of natural ecosystems and events to link natural resource management and land use organizations to mitigation activities and technical assistance	29
24	***WF***	Encourage development and dissemination of maps relating to the fire hazard to help educate and assist builders and homeowners in being engaged in wildfire mitigation activities and to help guide emergency services during response	28
25	***MH***	Identify and pursue funding opportunities to develop and implement local and city mitigation activities	28
26	***TS***	Tsunami Public Education Campaign	27
27	***WF***	Enhance outreach and education programs aimed at mitigating wildfire hazards and reducing or preventing the exposure of citizens, public agencies, private property owners and businesses to natural hazards	27
28	***MH***	Identify, improve, and sustain collaborative programs focusing on the real estate and insurance industries, public and private sector organizations, and individuals to avoid activity that increases risk to natural hazards	27
29	***MH***	Develop public and private partnerships to foster natural hazard mitigation program coordination and collaboration in the City of Palos Verdes Estates	27

Project Evaluation Worksheet

Jurisdiction:				Contact:	
Project Title				Phone:	
Agency:				E-mail:	
Hazard(s):					
Flood Zone:		Base Flood Elevation:		Erosion Rate:	
Critical Facility/Population At Risk:					

Environmental Impact:						Historic Preservation Impact:					
High		Medium		Low		High		Medium		Low	
Importance to Protection of Life/Property and Disaster Recovery						Risk of Hazard Impact:					
High		Medium		Low		High		Medium		Low	

Estimated Cost:		Project Duration:	
Value of Facility:		Value of Contents:	
Source(s) of Financing:			
Project Objectives:			
Project Description:			
Proposal Date:			

Evaluation Category	Considerations	Comments
Social	Community Acceptance	
	Adversely Affects Segments of the Population	
Technical	Technical Feasability	
	Long Term Solution	
	Secondary Impacts	
Administrative	Staffing	
	Funding Allocated	
	Maintenance / Operations	
Political	Political Support	
	Plan Proponent	
	Public Support	
Legal	Authority	
	Action Subject to Legal Challenge	
Economic	Benefit	
	Cost of Action	
	Contributes to Economic Goals	
	Outside Funding Required	
Environmental	Affects Land / Water Bodies	
	Affects Endangered Species	
	Affects Hazardous Materials and Waste Sites	
	Consistent with Community Environmental Goals	
	Consistent with Federal Laws	

Section 5:

Plan Maintenance

The plan maintenance section of this document details the formal process that will ensure that the City of Palos Verdes Estates' 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 Palos Verdes Estates' government intends to incorporate the mitigation strategies outlined in this Plan into existing planning mechanisms such as the City 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 City of Palos Verdes Estates' 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 Planning Director 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 of Palos Verdes Estates will gain eligibility for Hazard Mitigation Grant Program funds.

Coordinating Body

A City of Palos Verdes Estates Hazard Mitigation Committee will be responsible for coordinating implementation of plan action items and undertaking the formal review process. The city has formed a Hazard Mitigation Committee that consists of members from local agencies, organizations, and citizens, and includes the following:

City of Palos Verdes Estates Building and Safety
City of Palos Verdes Estates Finance
City of Palos Verdes Estates Planning
City of Palos Verdes Estates Public Works Department
City of Palos Verdes Estates Streets and Parks Department
California Water Service
Palos Verdes Peninsula Unified School District
Zeiser Kling Consultants (City Geotechnical Engineer and Geologist)
Cox Communications
The Gas Company

Southern California Edison
City of Palos Verdes Estates Police Department
Los Angeles County Fire Department
Office of Disaster Management, Area G

The Hazard Mitigation Advisory Committee will meet no less than quarterly. Meeting dates will be scheduled once the final Hazard Mitigation Advisory Committee has been established. 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 City of Palos Verdes Estates Natural Hazard Mitigation Plan, and the Hazard Mitigation Advisory Committee will take responsibility for plan implementation. The City Planning Director will serve as a convener to facilitate the Hazard Mitigation Advisory 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 Natural Hazard Advisory Committee Members.

Implementation through Existing Programs

The City of Palos Verdes Estates addresses statewide planning goals and legislative requirements through its General Plan, Capital Improvement Plans, and City Building and Safety Codes. The Natural Hazard Mitigation Plan provides a series of recommendations - many of which are closely related to the goals and objectives of existing planning programs. The City of Palos Verdes Estates will have the opportunity to implement recommended mitigation action items through existing programs and procedures. Existing staff members will be responsible for administering the development of the Hazard Mitigation Plan and its implementation. Financial resources are not available to specifically fund this process, therefore the plan will be developed by staff utilizing existing Planning department resources.

The City of Palos Verdes Estates Building & Safety Department is responsible for administering the Building & Safety Codes. In addition, the Hazard Advisory Committee will work with other agencies at the state level to review, develop and ensure Building & Safety Codes are adequate to mitigate or present damage by natural hazards. The City has adopted, by ordinance, the 2001 California Building Code. 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). The public works department develops CIP plans, and reviews them on an annual basis. Upon annual review of the CIPs, the Hazard Mitigation Advisory Committee will work with the public works department to ensure that the hazard mitigation plan action items are 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 Hazard Mitigation Advisory Committee will provide an opportunity for committee members to report back on the progress made on the integration of mitigation planning elements into city planning documents and procedures.

Economic Analysis of Mitigation Projects

FEMA's approach 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 Hazard Mitigation Advisory Committee will use a FEMA-approved benefit/cost analysis approach to identify and prioritize mitigation action items. For other projects and funding sources, the Hazard Mitigation Advisory 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 of the Plan.

Evaluating and Updating the Plan

Formal Review Process

The City of Palos Verdes Estates 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 time line, and identifies the local agencies and organizations participating in plan evaluation. The convener or designee will be responsible for contacting the Hazard Mitigation Advisory 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.

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 Hazard Committee members, and presenting it to the City Council. The Hazard Mitigation Advisory Committee will also notify all holders of the city 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 of Palos Verdes Estates is dedicated to involving the public directly in review and updates of the Hazard Mitigation Plan. The Hazard Mitigation 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 all of the appropriate agencies in the city. The existence and location of these copies will be publicized in the quarterly city newsletter, which reaches every household in the city. The plan also includes the address and the phone number of the city Planning Division, 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 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 when deemed necessary by the Hazard Mitigation Advisory Committee. The meetings will provide the public a forum for which they can express its concerns, opinions, or ideas about the Plan. The City Planning Department will be responsible for using city resources to publicize the annual public meetings and maintain public involvement through the public access channel, web page, and newspapers.

Section 6: Earthquakes

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Why are Earthquakes a Threat to the City of Palos Verdes Estates?

Earthquakes occur as a result of the Earth's plates moving against one another. In California, the Pacific Plate and the North American Plate meet at what is known as the San Andreas fault, extending 650 miles long and 10 miles deep. Many additional faults branch off from the San Andreas fault throughout California. Historically, California has experienced some of the most significant seismic activity in the country. Because Palos Verdes Estates is located in this seismically active zone (please see Exhibit 6A: Fault Lines Map), it is important to consider the impacts future earthquakes could have on the City.

Historic California Earthquakes

1906 San Francisco
Magnitude 8.3 caused 700-800 deaths and $400 million in damages

1952 Kern County
Magnitude 7.7 caused 12 deaths, 18 injuries and $50 million in damages

1983 Coalinga
Magnitude 6.4 caused 47 injuries and $31 in damages

1984 Morgan Hill
Magnitude 6.2 caused 27 injuries and $10 million in damages

1986 Palm Springs
Magnitude 5.9 caused $5.3 million in damages

1987 Whittier-Narrows
Magnitude 5.9 caused 8 deaths, 200 injuries and $358 million in damages

1989 Loma Prieta
Magnitude 7.1 caused 63 deaths, 3757 injuries and $5.9 billion in damages

1990 Upland
Magnitude 5.5 caused 38 injuries and $10.4 million in damages

1991 Sierra Madre
Magnitude 5.8 caused 1 death, over 30 injuries and $33.5 million in damages

1992 Humboldt County
Magnitude 6.9 caused $60 million in damages

1992 Landers/ Big Bear
Magnitudes 7.3 and 6.7, respectively, caused 1 death and $93 million in damages

1994 Northridge
Magnitude 6.7 caused 57 deaths, more than 11,000 injuries and $40+ billion in damages

Earthquake Characteristics

What is an earthquake?

"An earthquake is a sudden, rapid shaking of the Earth caused by the breaking and shifting of rock beneath the Earth's surface. For hundreds of millions of years, the forces of plate tectonics have shaped the Earth as the huge plates that form the Earth's surface move slowly over, under, and past each other. Sometimes the movement is gradual. At other times, the plates are locked together, unable to release the accumulating energy. When the accumulated energy grows strong enough, the plates break free causing the ground to shake. Most earthquakes occur at the boundaries where the plates meet; however, some earthquakes occur in the middle of plates."

Impacts of Development

Earthquakes are a natural occurrence and human activity and development cannot affect whether or not they occur. However, certain construction practices can minimize the impacts that an earthquake could cause to man made structures and facilities. The City of Palos Verdes Estates has adopted the 2002 California Building Code as its standard for building construction. Provisions contained within the building code require new construction to follow stringent standards to ensure minimal damage would be incurred during a potential earthquake.

Earthquake Hazard Assessment

Hazard Identification

Identifying hazardous locations is an essential step towards implementing more informed mitigation activities. All areas of the City are considered to be at equal risk to earthquakes. However, the existing conditions of certain structures render them more vulnerable to damage during an earthquake.

Vulnerability and Risk

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 the City of Palos Verdes Estates earthquake events, there are many qualitative factors that point to potential vulnerability. Earthquakes can impact major transportation arteries, blocking residents from essential services and businesses.

Earthquakes have historically caused the most damage to older, unreinforced masonry structures. Identifying structures in the City which meet this description may aid the City in preparing for potential impacts of future earthquakes.

Community Earthquake Issues

What is Susceptible to Earthquakes?

Earthquakes 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 earthquakes.

Roads and Bridges

Potential losses from earthquake hazards in the City of Palos Verdes Estates have been associated with roads. The City of Palos Verdes Estates Streets & Parks Department is responsible for clearing debris from these facilities after an earthquake. However, their ability to respond would depend on the damage incurred at other locations within the City and whether access to these areas is available.

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 earthquakes.

Earthquake Mitigation Activities

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

Community Issues Summary

Earthquakes are a known hazard in southern California, and particularly in the City of Palos Verdes Estates. Earthquakes often impact infrastructure as well as private property.

Earthquake Mitigation Action Items

The earthquake mitigation action items provide direction on specific activities that the city, organizations, and residents in the City of Palos Verdes Estates can undertake to reduce risk and prevent loss from earthquake 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.

Short Term Mitigation Activity for Earthquakes #l: Continue to implement building code

regulations for new construction, which require structures to be designed to withstand the impacts of future earthquakes.

- Provide continual training to building inspectors and plan checkers.

Coordinating Organization: City of Palos Verdes Estates Building Department
Timeline: Ongoing
Plan Goals Addressed: Protect Life and Property; Natural Systems
Constraints: none

Short Term Mitigation Activity for Earthquakes #2: Educate residents on the impacts of earthquakes and steps that can be taken to minimize their vulnerability.
Ideas for Implementation

- Create informational handouts for public distribution explaining earthquakes and suggested practices which can be implemented to minimize damages.
- Provide earthquake preparedness tips periodically in the City newsletter.

Coordinating Organization: City of Palos Verdes Estates Building Department
Timeline: Ongoing
Plan Goals Addressed: Protect Life and Property; public awareness
Constraints: none

Short Term Mitigation Activity for Earthquakes #3: Identify needs of City staff and other agencies to optimize their ability to respond in the event of an earthquake.
Ideas for Implementation

- Solicit the input of the police, fire, public works and streets and parks departments to determine if improvements are needed to optimize their responsiveness to earthquakes;
- Acquire necessary resources and/ or provide for training to optimize the earthquake responsiveness of City staff.

Coordinating Organization: City of Palos Verdes Estates Planning Department
Timeline: Ongoing
Plan Goals Addressed: Protect Life and Property; Emergency Services
Constraints: none

Earthquake Resource Directory (See details in Appendix A)

County Resources

- Los Angeles County Department of Public Works

State Resources

- Department of Conservation Headquarters
- California Geological Survey Headquarters/Office of the State Geologist
- California Division of Forestry
- Governor's Office of Emergency Services
- California Department of Transportation (Cal Trans)
- Southern California Earthquake Center (SCEC)
- Western States Seismic Policy Council (WSSPC)

Federal Resources and Programs

- Federal Emergency Management Agency (FEMA)
- Natural Resource Conservation Service (NRCS)
- US Geological Survey
- Building Seismic Safety Council (BSSC)

SECTION 7: EARTH MOVEMENT (LANDSLIDES & DEBRIS FLOWS)

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Why are Landslides a Threat to the City of Palos Verdes Estates?

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 a significant number of locations impacted by landslides. The City of Palos Verdes Estates has experienced a number of landslides in the recent past (please see Exhibit 7A: Historic Landslides Map). 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 (please see Exhibit 7B: Geological Hazards Map).

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, Rancho Palos Verdes, California

Cost, $14.6 million (2000 dollars) California Highway 14, Palos Verdes Hills. Land use in 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 1979-80 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 affecting 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 the City of Palos Verdes Estates. 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. The City is currently in the process of mapping liquefaction and historical landslides, which will aid in understanding areas most vulnerable to land movement.

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 the City of Palos Verdes Estates 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 Palos Verdes Estates have been associated with roads. The City of Palos Verdes Estates Streets & Parks Department is responsible for responding to slides that inhibit the flow of traffic or are damaging a road or a bridge. The streets & parks 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 streets & parks department alleviates problem areas by grading slides, and 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
The City of Palos Verdes Estates Municipal Code subsection 15.16.050 addresses the requirement for soils and geology reports. Generally, the ordinance requires soils and engineering geologic studies for all construction unless waived by the Building Official. This may include soils, vegetation, geologic formations, and drainage patterns.

Community Issues Summary
Landslides are a problem in the City of Palos Verdes Estates and often impact the city's infrastructure as well as private property.

Landslide Mitigation Action Items

The landslide mitigation action items provide direction on specific activities that the city, organizations, and residents in the City of Palos Verdes Estates 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.

Short Term Mitigation Activity for Landslides #l: Improve knowledge of landslide hazard areas and understanding of vulnerability and risk to life and property in hazard-prone areas.
Ideas for Implementation

- Conduct a landslide hazard mapping study in the City of Palos Verdes Estates.
- Develop public information to emphasize economic risk when building on potential or historical landslide areas.

Coordinating Organization: City of Palos Verdes Estates Building Department
Timeline: Ongoing
Plan Goals Addressed: Protect Life and Property; Public Awareness; Natural Systems
Constraints: none

Short Term Mitigation Activity for Landslides #2: Encourage construction design that can be applied to steep slopes to reduce the potential adverse impacts from development.
Ideas for Implementation

- Continue to require soils and geology reports for all new construction, unless it can be demonstrated that no risk of earth movement exists.
- Continue to enforce standards for footing and foundation designs on steep slopes.

Coordinating Organization: City of Palos Verdes Estates Building Department
Timeline: Ongoing
Plan Goals Addressed: Protect Life and Property
Constraints: none

Short Term Mitigation Activity for Landslides #3: Identify safe evacuation routes in high-risk debris flow and landslide areas.
Ideas for Implementation

- Identify potential debris removal resources;
- Map emergency transportation routes; and
- Identify and publicize information regarding emergency transportation routes.

Coordinating Organization: City of Palos Verdes Estates Public Works Department
Timeline: Ongoing
Plan Goals Addressed: Protect Life and Property; Emergency Services
Constraints: none

Long Term Mitigation Activity for Landslides #l: Review local ordinances regarding building and development in landslide prone areas.
Ideas for Implementation

- Conduct an annual review of the City Code to analyze whether changes are necessary to reduce the vulnerability of new construction to land movement.

Coordinating Organization: City of Palos Verdes Estates Building Department
Timeline: Ongoing
Plan Goals Addressed: Protect Life and Property
Constraints: none

Long Term Mitigation Activity for Landslides #2: Limit activities in identified potential and historical landslide areas through regulation and public outreach.
Ideas for Implementation

- Analyze existing regulations regarding development in landslide prone areas;
- Identify existing mechanisms for public outreach and enhance them, as needed.

Coordinating Organization: City of Palos Verdes Estates Building Department
Timeline: Ongoing
Plan Goals Addressed: Protect Life and Property; public awareness
Constraints: none

Landslide Resource Directory

County Resources

- Los Angeles County Department of Public Works

State Resources

- Department of Conservation Headquarters
- California Geological Survey Headquarters/Office of the State Geologist
- California Division of Forestry
- Department of Water Resources
- Governor's Office of Emergency Services
- California Department of Transportation (Cal Trans)

Federal Resources and Programs

- Federal Emergency Management Agency (FEMA)
- Natural Resource Conservation Service (NRCS)
- US Geological Survey, National Landslide Information Center

Publications

Olshansky, Robert B., Planning for Hillside Development (1996) American Planning Association.
This document describes the history, purpose, and functions of hillside development and regulation and the role of planning, and provides excerpts from hillside plans, ordinances, and guidelines from communities throughout the US.

Olshansky, Robert B. & Rogers, J. David, Unstable Ground: Landslide Policy in the United States (1987) Ecology Law Quarterly.

This is about the history and policy of landslide mitigation in the US.

Public Assistance Debris Management Guide (July 2000) Federal Emergency Management Agency.
The Debris Management Guide was developed to assist local officials in planning, mobilizing, organizing, and controlling large-scale debris clearance, removal, and disposal operations. Debris management is generally associated with post-disaster recovery. While it should be compliant with local and city emergency operations plans, developing strategies to ensure strong debris management is a way to integrate debris management within mitigation activities. The Guide is available in hard copy or on the FEMA website.

USGS Landslide Program Brochure. National Landslide Information Center (NLIC), United States Geologic Survey.
The brochure provides good, general information in simple terminology on the importance of landslide studies and a list of databases, outreach, and exhibits maintained by the NLLC. The brochure also includes information on the types and causes of landslides, rock falls, and earth flows.

Landslide Endnotes

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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

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

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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: FLOODS

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Why are Floods a Threat to the City of Palos Verdes Estates?

Floods are a serious and dangerous hazard throughout the country. Each year, in the United States, an average of 165 people are killed and about $2 billion worth of damage occurs as a result of floods.[1] Flooding poses a threat to the City of Palos Estates by causing a risk to life and safety for the community (please see Exhibit 8A: City of Palos Verdes Estates Flood Zone Map). Floods can cause damage to public as well as private property.

In the recent past, the City of Palos Verdes Estates has experienced severe damages due to floods. All records of flood damages were associated with heavy periods of rainfall.

The City was most recently affected by the floods during the winter of 1995. The City has also experienced flooding after prolonged precipitation in the mid 1980s as well as 1991. The City has taken measures since these events to upgrade and construct new storm drains to handle future heavy rainfall.

The mid-1980s flood damages extended to residences and infrastructure throughout the city. The city was insured by various private insurance companies. The damages caused by the floods cost the city and the insurance companies over $17 million. The city did not declare the floods as a state nor a federal disaster.

The 1991 floods caused extensive damages to the arterials of the city as well as on the Los Angeles County flood channel debris basin. About 3 inches of rain in a 4 hour time period caused tremendous amount of runoff. In this short period of time, there were extensive damages to residences, public roads and infrastructure. No federal disaster was declared.

The most recent floods of 1995 caused damages costing over $107,000. More than 32 homeowners reported flood damages. The floods also resulted in the warrant of 25 road closures.[2] The infrastructure was not able to handle the severe amount of rainfall in a short period of time. Over 13 inches of rain during a 10 day period caused extensive damage to the city.[3] A state and federal disaster emergency was declared for this event.

Historic Floods in Southern California

1938: Northern and Southern California

From December 9 – 12, 1937, a severe storm moved from the northern Pacific Ocean across the state of California. The storm caused areas of California to be flooded multiple times. Three months after the floods of northern California, southern California was flooded. This was the worst flood to hit southern California in 70 years causing 87 deaths and damages estimated at $79 million.[4]

1969: Coastal Basin from San Diego to San Luis Obispo
From January 18 – 27, 1969, a series of storms moved rapidly across central and southern California. From Monterey Bay to Los Angeles, a large amount of rain fell on the coastal mountains, ranging from 10-15 inches in the lowlands to 50 inches in the San Bernardino mountains. The floods caused 60 deaths with an estimated cost of $400 million in damages.[5]

1980: Central and Southern Coastal California
From January 1980 to February 1980, the areas of central and southern California were flooded. The floods were most severe in southern California causing 18 deaths and $350 million in damages.

1995: Southern California Floods

After the Old Topanga Firestorm in 1993 came the 1995 El Nino weather pattern, causing severe rainfall throughout California.

The first severe rainfall hit the Santa Monica Mountains in late January and continued through March. "In January a storm of only 2 year intensity hit the Las Flores Canyon, Carbon Canyon, and the Malibu/Cold Canyon watersheds. The damage from this storm alone was several million dollars and closed the Pacific Coast Highway in several locations for days, as well as most of the few remaining access route in and out of the city." In March, a storm in the mountains caused 3 inches of rain in 2 hours upon the Topanga Canyon, Tuna Canyon, and Pena Canyon watersheds.[6] The floods, along with the landslides, caused 11 deaths and $1.34 billion in damage costs.[7]

1996: California Floods
In December 1996, California experienced floods with an estimated $39,433,756 in damages.[8]

1998: Southern California Floods
In January 1998, southern California experienced floods with estimated $18,539,717 of damages.[9]

Flood Characteristics

What is a Flood?
Floods are a common natural disaster which most counties in the United States have experienced. Floods are most common after heavy rainfalls or thunderstorms.

According to the National Flood Insurance Program (NFIP), a flood is defined as "a general and temporary inundation of two or more acres of normally dry land area or of two or more properties from 1) overflow of inland or tidal waters, 2) unusual and rapid accumulation or runoff of surface waters from any source, or 3) a mudflow."[10]

Floods are caused by many occurrences, including rainstorms, slow water run-off, earthquakes,

broken dams, underwater volcanic eruptions and tsunamis, or hurricanes. Floods range in severity from minor floods to record floods, which exceeds the highest stage of rainfall given at any one time. The severities of floods are categorized in flood categories.

Floods occur when large bodies of water overflow due to heavy rainfall.[11] Areas not near a body of water can be at risk of a flash flood.

What is a Flash Flood?

A flash flood occurs after a heavy rainfall within a short period of time (usually within six hours), frequently without warning. A heavy rainfall may cause runoff which areas of soil can not store, or streams can not carry in their normal channel.[12]

What is Urban Flooding

Heavy rainfall during a short time causes urban flooding. Because hardscape, such as sidewalks and roads, is unable to absorb the rain, water flows down streets and into the storm drains. Urban flooding may also result in the formation of large bodies of water in roads due to poor drainage.[13]

Floods Events and Impacts

Floods are a common hazard in California. The locations of large floods throughout the United States show that largest flows are related to combinations of regional climatology, topography, and size of basin.

The key factors related to floods include the general trend of northward decreasing atmospheric moisture, the proximity to oceanic moisture sources such as the Pacific Ocean, and the course of topographic features in relations to the directions of moisture flow, with the largest flows are located where topographically high areas are oriented vertical to directions of moisture flow.[14] In addition, "the largest flows in large river basins are primarily caused by persistent climatologic conditions. In contrast, the largest flows in smaller basins are most commonly the result of intense precipitation due to convective storms."[15]

Flood Conditions

Floods are often caused by periods of heavy rainfall. "Various data can assist hydrologists to predict when and where floods might occur. The first and most important is monitoring the amount of rainfall taking place on a realtime (actual) basis. Second, monitoring the rate of change in river stage on a realtime basis can help indicate the severity and immediacy of the threat. Third, knowledge about the type of storm producing the moisture, such as duration, intensity, areal extent, etc., is valuable for determining possible severity of the flooding. And

fourth, knowledge about the characteristics of a river's drainage basin, such as soil-moisture conditions, ground temperature, snowpack, topography, vegetation cover, impermeable land area, etc., can help to predict how extensive and damaging an impending flood might become."[16]

"There are two basic kinds of floods, flash floods and the more widespread river flooding. Flash floods generally cause greater loss of life and river floods generally cause greater loss of property. A flash flood occurs when runoff from excessive rainfall causes a rapid rise in the stage of a stream or normally dry channel. Flash floods are more common in areas with a dry climate and rocky terrain because lack of soil or vegetation allows torrential rains (typically from summer thunderstorms) to flow overland rather than infiltrate into the ground. Most floods can be linked to a storm of some kind. The National Weather Service collects and interprets rainfall data throughout the United States and issues flood watches and warnings as appropriate. The National Weather Service uses statistical models and flood histories to try to predict the results of expected storms. Flood estimation maps are generally produced by estimating a flood with a certain recurrence interval or probability and simulating the inundation levels based on flood plain and channel characteristics."[17]

Although floods are a natural process, the incidence of floods and the impacts they have on the people can be intensified by human activities. New developments on natural lands hinder the land's natural ability to absorb water. With changing weather patterns, this has increased the chance of floods and made recent floods more serious.[18]

Wildfires are often an indication of floods. A wildfire destroys all plants on mountains and hillsides and so when rain falls, there is nothing disabling the water from penetrating into the soil. In addition, waxy compounds in plants and soil that are released during fires create a natural barrier in the soil that prevents rain water from seeping deep into the ground. The result is erosion, mudslides, and excess water running off the hillsides, often causing flash flooding.

Particularly Hazardous Flood Areas

Locations at risk from floods:

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. Hillside and mountains that have recently (within 1-6 years) been subjected to a wildland fire.
7. Dam or storm drainage failure.
8. Paved areas which increase the volume and velocity of runoff after a rainfall.

Impacts of Development

Human impacts can substantially affect the potential for floods in the City of Palos Verdes Estates. Proper planning and geotechnical engineering can be exercised to reduce the threat to the 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

Paving of roads can lead to an increase in volume and velocity of runoff after a rainfall. 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. Any activity that increases the amount of runoff can increase flood hazards. 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. Poor condition of storm drainage also increases the risk of floods.

Changes in Vegetation

Removing vegetation from very steep slopes can increase flood hazards. Areas that experience wildfire and land clearing for development may also be prone to floods.

Flood Hazard Assessment

Hazard Identification

Identifying hazardous locations is an essential step towards implementing more informed mitigation activities. The Federal Emergency Management Agency (FEMA) has identified and mapped the nation's flood-prone areas as well as established flood-risk zones in these specific areas.

The FEMA flood hazard maps are used for various reasons. FEMA's flood hazards maps are used extensively for State and the community floodplain management regulations. The flood

hazard maps are also used to calculate flood insurance premiums, and for deciding whether property owners are required to obtain, by law, flood insurance as a means of acquiring mortgage loans or other Federal related financial assistance.[19]

"FEMA's flood hazard maps are also used by States and communities for emergency management and for land use and water resources planning and by Federal agencies implementing Executive Order 11988, Floodplain Management for Federal actions proposed in or affecting floodplains."[20]

Communities across the nation have had a detailed Flood Insurance Study (FIS). These studies produce a Flood Insurance Rate Map (FIRM) which includes Base Flood Elevations (BFE) for Zones AE, A1-30, AH, AO, AR/AE, AR/A1-30, AR/AO, AR/AH, VE, and V1-30. "Most of these NFIP communities will have FIRMs that include a combination of Special Flood Hazard Area (SFHA) that have been studied in detail with BFEs and floodway data and SFHAs that have been studied using approximate methods which have been designated Zone A without BFEs or floodway designations."[21]

The studies accurately levee the flood risk within the flood-prone community. The studies show plans to identify and publicize the information within five years for all floodplain areas that have special flood hazards and also establish the flood-risk zones in areas to be completed over a 15-year period followed by the passage of the Act in 1968.[22]

Vulnerability and Risk

Vulnerability assessment for floods will assist in predicting how different types of property and population groups will be affected by a hazard. Data that includes specific flood-prone locations in the city can be used to assess the population and total value of property at risk for future flooding 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 the City of Palos Verdes Estates flooding events, there are many qualitative factors that point to potential vulnerability. Flooding can impact major transportation arteries, blocking residents from essential services and businesses.

Past flooding events have caused major property damage or significantly impacted city residents, and continuing to map city flooding areas will help in preventing future loss. Factors included in assessing flooding risk include population and property distribution in the hazard area, the frequency of flooding occurrences, slope steepness, soil characteristics, storm drain facilities and precipitation intensity. This type of analysis could generate estimates of the damages to the city due to a specific flooding 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 Flood Issues

What is Susceptible to Floods?

Floods 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.

Roads and Bridges

Damages incurred from flood hazards in the City of Palos Verdes Estates have been associated with roads. The City of Palos Verdes Estates Streets & Parks Department is responsible for responding to floods that inhibit the flow of traffic or are damaging a road or a bridge. The streets & parks department does its best to communicate with residents impacted by floods, but can usually only repair the road itself, as well as the areas where the city has the right of way.

It is not cost effective to eliminate all potential flooding because of limited funds. During flooding events, the streets and parks department makes sandbags available to residents and assists in placing them in strategic areas to minimize flooding damage. This type of response activity is often the most cost-effective in the short-term, but is only temporary. In the long term, the city public works department implements a Master Storm Drain Plan, which identifies the need for new or upgraded storm drain systems. Each year, several storm drain projects are designed and constructed per the Master Storm Drain Plan.

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 flooding 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.

Flood Mitigation Activities

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

Section 15.50 of the Palos Verdes Estates Municipal Code outlines methods and standards for floodplain management.

Hazard Mapping

A detailed Flood Insurance Study (FIS) produced a FIRM for the City of Palos Verdes Estates which designates areas of the City located within Zones A, D and X.. Please see Exhibit 8A: City of Palos Verdes Estates Flood Zone Map.

Community Issues Summary

Floods are a problem in the City of Palos Verdes Estates and often impact the city's infrastructure as well as private property.

Flood Mitigation Action Items

The flood mitigation action items provide direction on specific activities that the city, organizations, and residents in the City of Palos Verdes Estates can undertake to reduce risk and prevent loss from flooding 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.

Short Term Mitigation Activity for Flooding #l: Improve knowledge of flooding hazard areas and understanding of vulnerability and risk to life and property in hazard-prone areas.
Ideas for Implementation

- Continue to make FEMA flood maps available for citizens of Palos Verdes Estates.
- Continue to provide information to residents on modifying flood zone designations.

Coordinating Organization: City of Palos Verdes Estates Public Works Department
Timeline: Ongoing
Plan Goals Addressed: Protect Life and Property; Public Awareness; Natural Systems
Constraints: none

Short Term Mitigation Activity for Flooding #2: Require proper drainage design to minimize flooding for new construction.
Ideas for Implementation

- Continue to require submittal of an engineered drainage plan to be submitted to the City Engineer for all new construction.
- Provide standards to the public for adequate drainage design on private property.
- Continue to require drainage certification from a civil engineer prior to final of all new construction.
- Discourage the use of sump pumps on private property.

Coordinating Organization: City of Palos Verdes Estates Engineering and Building and Safety Department
Timeline: Ongoing
Plan Goals Addressed: Protect Life and Property; Public Awareness
Constraints: none

Short Term Mitigation Activity for Flooding #3: Improve public storm drain infrastructure.
Ideas for Implementation

- Design storm drain projects as identified and scheduled in the Master Storm Drain Plan.
- Build storm drain projects as identified and scheduled in the Master Storm Drain Plan.
- Conduct annual curb and gutter improvement projects throughout the City to improve drainage conditions.
- Continue to enforce standards for construction within the public right-of-way to ensure that storm water is properly conducted.

Coordinating Organization: City of Palos Verdes Estates Public Works Department
Timeline: Ongoing
Plan Goals Addressed: Protect Life and Property
Constraints: none

Flood Terminology

100-year flood: Often called Flood Base, the flood having a 1-percent or greater annual probability of occurring.

500-year flood: The flood having a 0.2-percent or greater annual probability of occurring.

Base Flood Elevation (BFE): The height of the base of 100-year flood in relation to a specified datum, usually the National Geodetic Vertical Datum of 1929 or the North American Vertical Datum of 1988. In general, the BFE is the elevation of the 100-year flood waters relative to "mean sea level" and not the depth.

El Nino: El Nino is a natural phenomenon that recurs every few years during which the trade winds, which normally blow from east to west across the Pacific Ocean just north of the equator, lose their intensity. This allows the warm water that is typically around Indonesia to move east to the area just west of the coast of South America near Peru and Ecuador. The change in the typical Pacific Ocean water temperatures causes worldwide changes in normal weather patterns. In the United States, El Nino causes winter temperatures to be warmer than normal, and floods occur in California and in the southeastern states."[23]

Federal Emergency Management Agency (FEMA): Specific communities work with this organization to conduct studies and assemble information on flood zones.

Flood Base: FEMA defines Flood Base as the flood having a 1-percent probability of being equaled or exceeded in any given year; also known as a 100-year flood.

Flood Insurance Study (FIS): A Flood Insurance Study is conducted by FEMA in order to produce a Flood Insurance Rate Map (FIRM). The studies and maps predict the probability of flooding at a particular location.

Floodplain: In relations to the 100-year floodplain, the land susceptible of being inundated by a stream resulting from water with a 1-percent chance of being equaled or exceeding in any given year. The areas with these limits are based on flood regulation ordinance maps or other methods

that meets the objectives of the SMP.

Flood Hazard: A condition in which flooding of normally dry land could occur, with the possibility to cause injury and loss of life or property.

Flood Insurance Rate Map (FIRM): Produced by the FEMA, the Flood Insurance Rate Map is an official map which delineates SFHA in communities where NFIP regulations apply. FIRMs are also used to determine whether flood insurance is required for property owners and at what rate. FIS and FIRMs made for the NFIP gives assessments of the probability of flooding at a specific location.

Flood Categories: Floods are categorized by severity. The severity of flooding is not the same at all locations due to existence of levees. The stage value assigned for a given flood category is usually associated with a water level where the most significant flood impacts occur in the reach. The flood categories used in the NWS are:

> **Minor flooding:** minimal or no property damage, but possibly some public threat or inconvenience.
> **Moderate flooding:** some inundation of structures and roads near stream. Some evacuations of people and/or transfer of property or higher elevation is necessary.
> **Major flooding:** extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations.
> **Record flooding:** flood which is equal to or exceeds the highest stage at any site during the period of record keeping.

National Flood Insurance Program (NFIP): Established in 1968, the National Flood Insurance Programs was created to provide low cost flood insurance for the flood prone communities throughout the nation.

National Weather Service (NWS): The National Weather Service is responsible for warning the public of the possibility of flooding.

Special Flood Hazard Area (SFHA): This includes any area designated within a “Special Flood Hazard Area” on a FIRM. This area is inundated by 1-percent annual chance flooding for which BFEs or velocity may have been determined. There is no difference from flood hazard zones that are included within the SFHA. These zone include Zones A, AE, AO, AH, A99, AR, V or VE. An area outside the “Special Flood Hazard Area” on a FIRM are inundated by 0.2-percent annual chance of flooding; an area inundated by 1-percent annual chance flooding with average depths of less than 1 foot or with drainage areas less than 1 square mile; an area protected by levees from 1-percent annual chance flooding; or an area determined to be outside the 1-percent and 0.2-percent annual chance floodplains. There are no distinctions between these different conditions. These may include both shaded and unshaded areas of Zone X.

Flood Resource Directory

County Resources

- Los Angeles County Department of Public Works

State Resources

- Governor's Office of Emergency Services
- Department of Water Resources
- California Environmental Resources Evaluation System
- California Department of Transportation (Cal Trans)

Federal Resources and Programs

- Federal Emergency Management Agency (FEMA)
- Natural Resource Conservation Service (NRCS)
- United States Department of the Interior
- The National Oceanic and Atmospheric Administration (NOAA)

Publications

Costa, John E. and Jim E. O'Connor. Large Floods in the United States: Where They Happen and Why. U.S. Geological Survey Circular 1245
This document describes the cause and location most prone to large floods.

Flood Endnotes

[1] United States Geological Survey (USGS) Web-site at: http://interactive2.er.usgs.gov/faq/list_faq_by_category/get_answer.asp?id=275

[2] Klosner, Dana. PV Pounded by Rainstorm survives with Little Damage. *Easy Reader*. January 12, 1995.

[3] Gafford, Wayne. Little Rain from Rains for Peninsula. PVP. January 12, 1995.

[4] *Major Floods and Droughts in California*. United States Geological Survey (USGS) Web-site at: http://geochange.er.usgs.gov/sw/impacts/hydrology/state_fd/cawater1.shtml

[5] *Major Floods and Droughts in California.* United States Geological Survey (USGS) Web-site at: http://geochange.er.usgs.gov/sw/impacts/hydrology/state_fd/cawater1.shtml

[6] Natural History of Fire & Flood Cycles. http://www.coastal.ca.gov/fire/ucsbfire.html California Coastal Commission

[7] Federal Emergency Management Agency. *Hazards Disaster Facts*: http://www.fema.gov/hazards/df_3.shtm.

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[16] United States Geological Survey (USGS) Web-site at: http://interactive2.er.usgs.gov/faq/list_faq_by_category/get_answer.asp?id=275

[17] United States Geological Survey (USGS) Web-site at:
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[18] National Flood Insurance Program. Web-site at:
http://www.floodsmart.gov/floodsmart/pages/whatflood.jsp

[19] National Flood Insurance Program: Program Description. (August 1, 2002). Federal Emergency Management Agency and Federal Insurance and Mitigation Administration.

[20] National Flood Insurance Program: Program Description. (August 1, 2002). Federal Emergency Management Agency and Federal Insurance and Mitigation Administration.

[21] National Flood Insurance Program: Program Description. (August 1, 2002). Federal Emergency Management Agency and Federal Insurance and Mitigation Administration.

[22] National Flood Insurance Program: Program Description. (August 1, 2002). Federal Emergency Management Agency and Federal Insurance and Mitigation Administration

[23] USGS Website:
http://interactive2.er.usgs.gov/faq/list_faq_by_category/get_answer.asp?id=274

SECTION 9: TSUNAMIS

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Why are Tsunamis a Threat to the City of Palos Verdes Estates?

Tsunamis have caused tragic loss of life and property damage in the coastal communities of California. Since 1992, worldwide local tsunamis have caused more than 4,200 deaths and hundreds of millions of dollars in damages.[1] According to FEMA, California on average experiences a destructive tsunami every 18 years.[2] Areas at greatest risk are less than 50 feet above sea level and within 1 mile of the shoreline.[3]

Tsunamis are generated by an earthquake underneath or near the ocean. It must be large and produce movements in the sea floor. All oceanic regions worldwide can experience tsunamis. However, in the Pacific Ocean tsunamis are much more frequent. Because many earthquakes occur along the margins of the Pacific Ocean, tsunamis are large and destructive around this geographical location.[4]

"About two-thirds of the earth is covered by the waters of the four oceans. The Pacific Ocean is the world's largest, covering more than one third of the total surface area of the planet. The Pacific Ocean is surrounded by a series of mountain chains, deep ocean trenches and islands, sometimes called the 'ring of fire.' The great size of the Pacific Ocean and the large earthquake potential associated with the 'ring of fire' combine to produce deadly tsunamis."[5]

Within a day, tsunamis can travel from one side of the Pacific to the other. People living near areas where large earthquakes occur may experience tsunami waves reaching their shores within a short period of time after the earthquakes. For these reasons, the tsunami's threat to the costal region of California, can be immediate (for tsunamis from earthquakes taking minutes to reach the coast) or less urgent (for tsunamis from earthquakes located further taking anywhere from 3 to 22 hours to reach the coast).[6]

Historic Southern California Tsunamis

1812: On December 21, 1812, a tsunami hit the coast of southern California with a maximum run-up of 3.4 meters. No fatalities were reported.

1878: On November 22, 1878, southern California experienced a tsunami and as a result, there was one death.

1927: On November 4, 1927, a tsunamis with a maximum run-up of 1.8 meters hit the coast.

1930: On August 31, 1930, a tsunami hit southern California with a maximum run-up of 6.2 meters and caused one death. The tsunami was reported at Redondo Beach, Santa Monica and Venice Beach.[7]

1934: On August 21, 1934, the coastal communities of southern California including communities at Balboa, Laguna Beach, Long Beach, Malibu Beach, Newport Beach and Santa Monica experience a tsunami with a maximum run-up at 12 meters located at Newport Beach.[8]

Tsunami Characteristics

What is a Tsunami?

The Federal Emergency Management Agency's (FEMA) definition of a tsunami is "a series of waves generated by an undersea disturbance such as an earthquake. From the area of the disturbance, the waves will travel outward in all directions. The time between wave crests may be from 5 to 90 minutes, and the wave speed in the ocean will average 450 miles per hour. Tsunamis reaching heights of more than 100 feet have been recorded. As the waves approach the shallow coastal waters, they appear normal and the speed decreases. Then as the tsunami nears the coastline, it may grow to great height and smash into the shore causing much destruction." [9]

Tsunamis may also be generated by volcanic eruptions, landslides, undersea slumps or meteor impacts. The waves generated by these disturbances emit waves outward in all directions across the ocean basin. A tsunami is not noticeable in the deep ocean. A tsunami is hazardous when it approaches land and shallow water because the waves slow down and compress which causes the waves to grow in height.[10]

Tsunamis differ from a "wind-driven ocean wave," which is the disturbance to the sea surface. In comparison, the energy of a tsunami wave extends to the ocean bottom.

Tsunami Events and Impacts

Even though tsunamis are not frequent, they can be the most terrifying and complex physical phenomena and can cause a great loss of life and destruction of property. "Because of their destructiveness, tsunamis have important impacts on human, social, and economic sectors of societies."[11] Tsunamis in the past have caused serious damages as well as destructions of coastal communities throughout the world. Historic data shows that in the Pacific Ocean, where most tsunamis are generated, destructions with massive loss of life and property have been caused by tsunamis.

"In Japan, which has one of the most populated coastal regions in the world and a long history of earthquake activity, tsunamis have destroyed entire coastal populations. There is also a history of severe tsunamis destruction in Alaska, the Hawaiian Islands, and South America, although records for these areas are not as extensive. The last major Pacific wide tsunami occurred in 1960. Many other local and regional destructive tsunamis have occurred with more localized effects."[12]

Tsunami Conditions

Tsunamis are often triggered by earthquakes in the ocean and coastal regions. Submarine landslides, volcanic eruptions and meteorite impact in the ocean may cause tsunamis as well. Coastal regions are susceptible to tsunamis. All oceanic regions are at risk of a tsunami, however some geologic locations, are more susceptible to tsunamis than others. The Pacific Ocean has more frequent large and destructive tsunamis because of the large earthquake along the margins of the Pacific Ocean.

The main issue which determines the initial size of a tsunami is the "amount of vertical sea floor deformation. This is controlled by the earthquake's magnitude, depth, fault characteristics and coincident slumping of sediments or secondary faulting." Other factors that determine the size of a tsunami when approaching the coast are the shoreline and bathymetric configuration, the sea floor deformation velocity, the depth of the water where the earthquake was located, and the efficiency which energy is transferred from the earth's crust to the water column.

Hazardous Tsunami Areas

Coastal areas with increasing population and development are at risk of tsunamis. The element of growth in both population and infrastructure development exposes more people and their homes, buildings, and transportation systems to the onslaught of tsunamis.

Tsunami Hazard Assessment

Hazard Identification

Identifying hazardous locations is an essential step towards implementing more informed mitigation activities. "Detailed maps of future flooding (inundation) are needed for delineation of evacuation routes and long-term planning in vulnerable coastal communities. In addition, these maps require maintenance and upgrades as better data becomes available and coastal changes occur."[13]

In 1998, California began creating inundation maps for its coastal regions using the funds from the National Tsunami Hazard Mitigation Program. The California Governor's Office of Emergency Services work in conjunction with tsunami inundation modelers to create inundation maps.

Vulnerability and Risk

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

For each coastal community, an assessment of the tsunami hazard is needed to identify the population at risk. "This assessment requires knowledge of probable tsunamis sources (such as earthquakes, landslides, and volcanic eruptions), their likelihood of occurrence, and the characteristics of tsunamis from those sources at different places along the coast."[14] For the majority of communities, tsunami indication are provided with numerical models which estimates the areas that will be flooded in the event of a local or distant tsunamigenic earthquake or landslide.[15]

The National Tsunami Hazard Mitigation Program and the Center for Tsunami Inundation Mapping Efforts provide mapping efforts for at-risk population for California communities. The table below provides information on the at-risk population for the City of Palos Verdes Estates as

well as the City of Los Angeles.

	Population			At-Risk Population		
Community	Total	Children	Adults	Total	Children	Adults
Palos Verdes Estates	16,406	3,779	12,627	8,743	1,940	6,803
Los Angeles	3,781,154	1,000,540	2,780,614	132,882	28,578	104,304

Source: National Tsunami Hazard Mitigation Program and Center for Tsunami Inundation Mapping Efforts California At-Risk Population. California Inundation Map Summary.

Community Tsunami Issues

What is Susceptible to Tsunamis?

A destructive tsunami can directly create severe damages causing a great loss and harm. More specifically, a tsunami can be summarized into the following:
1) deaths and injuries
2) property damages such as destruction of houses, partly destroyed, inundated flooded or burned.
3) other property damage
4) lumber washed away
5) damages to public utilities such as roads

Other damages can be:
1) damages by fire of houses or other facilities
2) environmental pollution caused by drifting materials, or other substances

Tsunami Mitigation Activities

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

Community Issues Summary

The only site in Palos Verdes Estates identified as having potential risk of tsunami damage is the Palos Verdes Beach and Athletic Club located at 389 Paseo Del Mar.

Tsunami Mitigation Action Items

The tsunami mitigation action items provide direction on specific activities that the city, organizations, and residents in the City of Palos Verdes Estates 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.

Short Term Mitigation Activity for Tsunamis #l: Tsunami Public Education Campaign

- Include tsunami education in all certified classes.
- Develop public information to educate residents on the risks associated with tsunamis.

Coordinating Organization: City of Palos Verdes Estates Police and Planning Departments
Timeline: Ongoing
Plan Goals Addressed: Protect Life and Property; Public Awareness; Natural Systems
Constraints: none

Long Term Mitigation Activity for Tsunamis #1: Work with the Beach and Athletic Club to minimize potential damage from tsunamis.
Ideas for Implementation

- Conduct annual inspections of the Beach and Athletic Club to determine if improvements are necessary to protect against tsunami damage.
- Educate the staff of the Beach and Athletic Club on the potential damages associated with tsunamis.
- Identify evacuation routes for the Beach and Athletic Club in the event of a tsunami.

Coordinating Organization: City of Palos Verdes Estates Building Department
Timeline: Ongoing
Plan Goals Addressed: Protect Life and Property; Public Awareness.
Constraints: none

Tsunami Terminology

Inundation: refers to the distance flooded by a tsunami as it travels inland

Run-up: Difference between the elevation of maximum tsunami penetration (inundation line) and the sea-level at the time of the tsunami attack. 2. Elevation reached by seawater measured relative to some stated datum such as mean sea level, mean low water, sea level at the time of the tsunami attack, etc. and measured ideally at a point that is a local maximum of the horizontal inundation 3. In practical terms, run-up is only measured where there is a clear evidence of the inundation limit on the shore.[16]

Tsunamigenic: Having generated a tsunami: a tsunamigenic earthquake, a tsunamigenic landslide

Tsunami Resource Directory

County Resources

- Los Angeles County Department of Public Works

State Resources

- Department of Conservation Headquarters
- California Geological Survey Headquarters/Office of the State Geologist
- Department of Water Resources
- Governor's Office of Emergency Services

Federal Resources and Programs

- Federal Emergency Management Agency (FEMA)
- Natural Resource Conservation Service (NRCS)
- National Oceanic and Atmospheric Administration (NOAA)
- The National Tsunami Hazard Mitigation Program
- The National Science Program

Publications

Tsunamis Affecting the West Coast of the United States, 1806-1992 by J. Lander, P. Lockridge, and M. Kozuch, (1993)
This publication builds on the section treating the west coast in United States Tsunamis, the amount of data, number of events, and their evaluation. As before, detailed description information is included to better characterize the tsunami hazard.

Catalog of Tsunamis in the Pacific, 1969-1982 by S.L. Soloviev, Ch.N. Go, and Kh.S. Kim (1992)
This publication was originally published by the Geophysical Committee of the Academy of the Sciences of the former Soviet Union. The material was then translated into English.

United States Tsunamis 1690-1988 by J. Lander and P. Lockridge (1989).
This publication complies the historical records of tsunamis that have been observed or recorded in United States coastal waters, up through 1988. The publication includes discussions of events occurring on the shores of Hawaii, Alaska, the west and east coasts of the United States, Puerto Rico, the Virgin Islands, and American Samoa and other U.S. possessions in the Pacific. It also contains descriptive data about each reported tsunami event, and details the effects of the waves.

Tsunamis in the Pacific Basin, 1900-1983 by P. Lockridge and R. Smith (1984)
This map illustrates 405 locations of events, including earthquakes, volcanic eruptions, and landslides, that caused tsunamis. In addition, the publication lists the dates of the events, earthquake and tsunami information, number of deaths, and type of damage. Locations reporting runup heights of 1.5 meters or larger are also shown on the map.

Tsunami Endnotes

[1] The Intergovernmental Oceanographic Commission of UNESCO Tsunami Glossary. National Oceanic and Atmospheric Administration website at:
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[12] The Intergovernmental Oceanographic Commission of UNESCO Tsunami Glossary. National Oceanic and Atmospheric Administration website at: http://www.prh.noaa.gov/pr/itc/library/pubs/glossary/glossary.html

[13] National Tsunami Hazard Mitigation Program Center for Tsunami Inundation Mapping Efforts Background at: http://www.pmel.noaa.gov/tsunami/time/background/index.shtml

[14] The IOC Tsunami Glossary. NOAA Website at: http://www.prh.noaa.gov/pr/itc/library/pubs/glossary/glossary.html

[15] The IOC Tsunami Glossary. NOAA Website at: http://www.prh.noaa.gov/pr/itc/library/pubs/glossary/glossary.html

[16] The IOC Tsunami Glossary. NOAA Website at:
http://www.prh.noaa.gov/pr/itc/library/pubs/glossary/glossary.html

SECTION 10: WILDFIRES

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Why are Wildfires a Threat to Palos Verdes Estates?

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) **(Southern California fires are shown in bold)**

	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 billion[5] 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 shrubland wildfires, nor has it proven effective in halting them.”” said Dr. Jon Keeley, a USGS fire researcher who studies both southern California shrublands 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- 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; and
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
Palos Verdes Estates residents are served by Los Angeles County Fire Department. 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; and
- Winds over 30 miles per hour.

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 resistant to 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.

Wildfire Mitigation Activities

Los Angeles County conducts an annual weed abatement program to minimize risks of wildfires in Palos Verdes Estates. The Fire Department routinely inspects occupied properties and notifies the owners if vegetation is in need of clearance. Additionally, the Fire Department also annually inspects vacant properties, clears any hazardous vegetation and bills the owner. The City's streets and parks department clears hazardous vegetation on City property, as needed.

The fire department provides essential public services in the communities they serve and their duties far surpass extinguishing fires. Most of the districts and departments provide other services to their jurisdictions, including Emergency Medical Services who can begin treatment and stabilize sick and injured patients in emergency situations. All of the fire service providers in the county are dedicated to fire prevention and use their resources to educate the public to reduce the threat of the fire hazard, especially in the wildland/urban interface. Fire prevention professionals throughout the county have taken the lead in providing many useful and educational services to Southern California residents, such as:

- Home fire safety inspection;
- Assistance developing home fire escape plans;
- Business Inspections;

Citizen Emergency Response Team (CERT) training;
Fire cause determination;
Counseling for juvenile fire-setters;
Teaching fire prevention in schools;
Coordinating educational programs with other agencies, hospitals and schools; and
Answering citizens' questions regarding fire hazards.

The Threat of Urban Conflagration

Although communities without an urban/wildland interface are much less likely to experience a catastrophic fire, in Southern California there is a scenario where any community might be exposed to an urban conflagration similar to the fires that occurred following the 1906 San Francisco earthquake.

> "Large fires following an earthquake in an urban region are relatively rare phenomena, but have occasionally been of catastrophic proportions. The two largest peace-time urban fires in history, 1906 San Francisco and 1923 Tokyo, were both caused by earthquakes.
>
> The fact that fire following earthquake has been little researched or considered in the United States is particularly surprising when one realizes that the conflagration in San Francisco after the 1906 earthquake was the single largest urban fire, and the single largest earthquake loss, in U.S. history. The loss over three days of more than 28,000 buildings within an area of 12 km^2 was staggering: $250 million in 1906 dollars, or about $5 billion at today's prices.
>
> The 1989 Loma Prieta Earthquake, the 1991 Oakland hills fire, and Japan's recent Hokkaido Nansei-oki Earthquake all demonstrate the current, real possibility of a large fire, such as a fire following an earthquake, developing into a conflagration. In the United States, all the elements that would hamper fire-fighting capabilities are present: density of wooden structures, limited personnel and equipment to address multiple fires, debris blocking the access of fire-fighting equipment, and a limited water supply."[12]

Thus in Southern California, this scenario highlights the need for fire mitigation activity in all sectors of the region, urban/wildland interface or not.

Fire Codes

Local and County Fire Codes

Palos Verdes Estates Municipal Code Section 8.12 documents the City's adoption of Title 32 of the Los Angeles County Fire Code.

Federal Programs

The role of the federal land managing agencies in the wildland /urban interface is reducing fuel hazards on the lands they administer; cooperating in prevention and education programs; providing technical and financial assistance; and developing agreements, partnerships and relationships with property owners, local protection agencies, states and other stakeholders in wildland/urban interface areas. These

relationships focus on activities before a fire occurs, which render structures and communities safer and better able to survive a fire occurrence.

Federal Emergency Management Agency (FEMA) Programs
FEMA is directly responsible for providing fire suppression assistance grants and, in certain cases, major disaster assistance and hazard mitigation grants in response to fires. The role of FEMA in the wildland /urban interface is to encourage comprehensive disaster preparedness plans and programs, increase the capability of state and local governments and provide for a greater understanding of FEMA programs at the federal, state and local levels.[13]

Fire Suppression Assistance Grants
Fire Suppression Assistance Grants may be provided to a state with an approved hazard mitigation plan for the suppression of a forest or grassland fire that threatens to become a major disaster on public or private lands. These grants are provided to protect life and improved property and encourage the development and implementation of viable multi-hazard mitigation measures and provide training to clarify FEMA's programs. The grant may include funds for equipment, supplies and personnel. A Fire Suppression Assistance Grant is the form of assistance most often provided by FEMA to a state for a fire. The grants are cost-shared with states. FEMA’s US Fire Administration (USFA) provides public education materials addressing wildland/urban interface issues and the USFA's National Fire Academy provides training programs.

Hazard Mitigation Grant Program
Following a major disaster declaration, the FEMA Hazard Mitigation Grant Program provides funding for long-term hazard mitigation projects and activities to reduce the possibility of damages from all future fire hazards and to reduce the costs to the nation for responding to and recovering from the disaster.

National Wildland/Urban Interface Fire Protection Program
Federal agencies can use the National Wildland/Urban Interface Fire Protection Program to focus on wildland/urban interface fire protection issues and actions. The Western Governors' Association (WGA) can act as a catalyst to involve state agencies, as well as local and private stakeholders, with the objective of developing an implementation plan to achieve a uniform, integrated national approach to hazard and risk assessment and fire prevention and protection in the wildland/urban interface. The program helps states develop viable and comprehensive wildland fire mitigation plans and performance-based partnerships.

U.S. Forest Service
The U. S. Forest Service (USFS) is involved in a fuel-loading program implemented to assess fuels and reduce hazardous buildup on forest lands. The USFS is a cooperating agency and, while it has little to no jurisdiction in the lower valleys, it has an interest in preventing fires in the interface, as fires often burn up the hills and into the higher elevation US forest lands.

Other Mitigation Programs and Activities
Some areas of the country are facing wildland/urban issues collaboratively. These are model programs that include local solutions. Summit County, Colorado, has developed a hazard and risk assessment process that mitigates hazards through zoning requirements. In California, the

Los Angeles County Fire Department has retrofitted more than 100 fire engines with fire retardant foam capability and Orange County is evaluating a pilot insurance grading and rating schedule specific to the wildland/urban interface. All are examples successful programs that demonstrate the value of pre-suppression and prevention efforts when combined with property owner support to mitigate hazards within the wildland/urban interface.

Prescribed Burning

The health and condition of a forest will determine the magnitude of wildfire. If fuels - slash, dry or dead vegetation, fallen limbs and branches - are allowed to accumulate over long periods of time without being methodically cleared, fire can move more quickly and destroy everything in its path. The results are more catastrophic than if the fuels are periodically eliminated. Prescribed burning is the most efficient method to get rid of these fuels. In California during 2003, various fire agencies conducted over 200 prescribed fires and burned over 33,000 acres to reduce the wildland fire hazard.[14]

Firewise

Firewise is a program developed within the National Wildland/ Urban Interface Fire Protection Program and it is the primary federal program addressing interface fire. It is administered through the National Wildfire Coordinating Group whose extensive list of participants includes a wide range of federal agencies. The program is intended to empower planners and decision makers at the local level. Through conferences and information dissemination, Firewise increases support for interface wildfire mitigation by educating professionals and the general public about hazard evaluation and policy implementation techniques. Firewise offers online wildfire protection information and checklists, as well as listings of other publications, videos and conferences. The interactive home page allows users to ask fire protection experts questions and to register for new information as it becomes available.

FireFree Program

FireFree is a unique private/public program for interface wildfire mitigation involving partnerships between an insurance company and local government agencies. It is an example of an effective non-regulatory approach to hazard mitigation. Originating in Bend, Oregon, the program was developed in response to the city's "Skeleton Fire" of 1996, which burned over 17,000 acres and damaged or destroyed 30 homes and structures. Bend sought to create a new kind of public education initiative that emphasized local involvement. SAFECO Insurance Corporation was a willing collaborator in this effort. Bend's pilot program included:

1. A short video production featuring local citizens as actors, made available at local video stores, libraries and fire stations;
2. Two city-wide yard debris removal events;
3. A 3D-minute program on a model FireFree home, aired on a local cable television station; and
4. Distribution of brochures, featuring a property owner evaluation checklist and a listing of fire-resistant indigenous plants.

Wildfire Mitigation Action Items

As stated in the Federal Wildland Fire Policy, “The problem is not one of finding new solutions to an old problem but of implementing known solutions. Deferred decision making is as much a problem as the fires themselves. If history is to

serve us in the resolution of the wildland/urban interface problem, we must take action on these issues now. To do anything less is to guarantee another review process in the aftermath of future catastrophic fires."[15]

The wildfire mitigation action items provide direction on specific activities that organizations and residents in Southern California can undertake to reduce risk and prevent loss from wildfire 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.

Short Term Mitigation Activity for Wildfires #1: Inventory alternative firefighting water sources and encourage the development of additional sources.
Ideas for Implementation:

- Advocate for water storage facilities with fire-resistant electrical pump systems in developments outside of fire protection districts that are not connected to a community water or hydrant system; and
- Develop a protocol for fire jurisdictions and water districts to communicate all hydrant outages and water shortage information.

Coordinating Organization: City of Palos Verdes Estates [Los Angeles County] Fire Department
Timeline: ongoing
Plan Goals Addressed: Protect Life and Property
Constraints: none

Long Term Mitigation Activity for Wildfires #1*:* Encourage development and dissemination of maps relating to the fire hazard to help educate and assist builders and homeowners in being engaged in wildfire mitigation activities and to help guide emergency services during response.
Ideas for Implementation:

- Update wildland/urban interface maps, as needed.
- Conduct risk analysis incorporating data and the created hazard maps using GIS technology to identify risk sites and further assist in prioritizing mitigation activities; and
- Encourage coordination between fire jurisdictions and sanitary districts to make sure that the most accurate elevation maps are being used.

Coordinating Organization: Palos Verdes Estates Planning Department and Fire Department
Timeline: 1-3 years
Plan Goals Addressed: Protect Life and Property
Constraints: none

Long Term Mitigation Activity for Wildfires #2: Enhance outreach and education programs aimed at mitigating wildfire hazards and reducing or preventing the exposure of citizens, public agencies, private property owners and businesses to natural hazards.
Ideas for Implementation:

- Conduct specific community-based demonstration projects of fire prevention and mitigation in the urban interface;
- Perform public outreach and information activities at fire stations by creating "Wildfire Awareness Week" activities, Fire stations can hold open houses and allow the public to visit, see the equipment and discuss wildfire mitigation with the station crews.

Coordinating Organization: Palos Verdes Estates [Los Angeles County] Fire Department
Timeline: Ongoing

Plan Goals Addressed: Protect Life and Property, Public Awareness
Constraints: none

Long Term Mitigation Activity for Wildfires #3*:* Continue the implementation of wildfire mitigation activities in a manner consistent with the goals of promoting sustainable ecological management and community stability.
Ideas for Implementation:

- Continue to implement the weed abatement program for clearing of trimmings, trees, brush and other debris completely from sites when performing routine maintenance and landscaping to reduce fire risk.
- Maintain City Parklands in a manner that is conducive to minimizing hazards associated with wildfires.

Coordinating Organization: Palos Verdes Estates [Los Angeles County] Fire Department and Streets and Parks Department.
Timeline: Ongoing
Plan Goals Addressed: Natural Systems
Constraints: none

Wildfire Resource Directory

County Resources
Los Angeles County Fire Department
1320 N. Eastern Ave.
Los Angeles, CA., 90063
Telephone: 323.881.2411
http://www.lacofd.org/default.htm

State Resources
California Division of Forestry & Fire Protection
1416 9th Street
PO Box 944246
Sacramento California 94244-2460
(916)653-5123
http://www.fire.ca.gov/php/index.php

Office of the State Fire Marshal (OSFM)
1131 "S" Street
Sacramento, CA 95814
PO Box 944246
Sacramento, CA 94244-2460
Tel. (916) 445-8200
Fax. (916) 445-8509

Federal Resources and Programs
Federal Wildland Fire Policy, Wildland/Urban Interface Protection
This is a report describing federal policy and interface fire. Areas of needed improvement are identified and addressed through recommended goals and actions.
http://www.fs.fed.us/land/wdfire7c.htm

National Fire Protection Association (NFPA)
This is the principal federal agency involved in the National Wildland/Urban Interface Fire Protection Initiative. NFPA has information on the Initiatives programs and documents.
Public Fire Protection Division
1 Battery March Park.
P.O. Box 9101
Quincy, MA 02269-9101
Phone: (617) 770-3000

National Interagency Fire Center (NIFC)
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. These agencies include the Bureau of Indian Affairs, Bureau of Land Management, Forest Service, Fish and Wildlife Service, National Park Service, National Weather Service and Office of Aircraft
National Interagency Fire Center
3833 S. Development Ave.
Boise, Idaho 83705
208-387-5512
http://www.nifc,gov/

United States Fire Administration (USFA) of the Federal Emergency Management Agency (FEMA)
As an entity of the Federal Emergency Management Agency, the mission of the USFA is to reduce life and economic losses due to fire and related emergencies through leadership, advocacy, coordination and support.
USFA, Planning Branch, Mitigation Directorate
16825 S. Seton Ave.
Emmitsburg, MD 21727
(301) 447-1000
http://www.fema.gov/hazards/fires/wildfires.shtm - Wildfire Mitigation
http://www.usfa.fema.gov/index.htm - U.S. Fire Administration

Additional Resources

Firewise - The National Wildland/Urban Interface Fire program
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.
1 Battery March Park.
P.O. Box 9101
Quincy, MA 02269-9101
Phone: (617) 770-3000
http://www.firewise.org/

Publications

National Fire Protection Association Standard 299: Protection of Life and Property from Wildfire, National Wildland/Urban Interface Fire Protection Program, (1991), National Fire Protection Association, Washington, D.

This document, developed by the NFPA Forest and Rural Fire Protection Committee, provides criteria for fire agencies, land use planners, architects, developers and local governments to use in the development of areas that may be threatened by wildfire. To obtain this resource:
National Fire Protection Association Publications
(800) 344-3555
http://www.nfpa.org or http://www.firewise.org

An International Collection of Wildland- Urban Interface Resource Materials
(Information Report NOR- 344). Hirsch, K., Pinedo, M., & Greenlee, J. (1996). Edmonton, Alberta: Canadian Forest Service.
This is a comprehensive bibliography of interface wildfire materials. Over 2,000 resources are included, grouped under the categories of general and technical reports, newspaper articles and public education materials. The citation format allows the reader to obtain most items through a library or directly from the publisher. The bibliography is available in hard copy or diskette at no cost. It is also available in downloadable PDF form.
Canadian Forest Service, Northern Forestry Centre, I-Zone Series
Phone: (780) 435-7210
http://www.prefire.ucfpl.ucop.edu/uwibib.htm

Wildland/Urban Interface Fire Hazard Assessment Methodology.
National Wildland/Urban Interface Fire Protection Program, (1998).
NFPA, Washington, D.C.
Firewise (NFPA Public Fire Protection Division)
Phone: (617) 984-7486
http://www.firewise.org

Fire Protection in the Wildland/Urban Interface: Everyone's Responsibility.
National Wildland/Urban Interface Fire Protection Program, (1998). Washington, D.
Firewise (NFPA Public Fire Protection Division)
Phone: (617) 984-7486
http://www.firewise.org

Wildfire Endnotes

[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

[12] http://www.eqe.com/publications/revf93/firefoll.htm

[13] Source: National Interagency Fire Center, Boise ID and California Division of Forestry, Riverside Fire Lab.

[14] Ibid

[15] http://www.fs.fed.us/land/wdfire7c.htm

SECTION 11: WINDSTORMS

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Why are Severe Windstorms a Threat to the City of Palos Verdes Estates?

Severe wind storms pose a significant risk to life and property in the region by creating conditions that disrupt essential systems such as public utilities, telecommunications, and transportation routes. High winds can and do occasionally cause tornado-like damage to local homes and businesses. Severe windstorms can present a very destabilizing effect on the dry brush that covers local hillsides and urban wildland interface areas. High winds can have destructive impacts, especially to trees, power lines, and utility services.

Windstorm Characteristics in Southern California

Santa Ana Winds and Tornado-Like Wind Activity

Based on local history, most incidents of high wind in the City of Palos Verdes Estates are the result of the Santa Ana wind conditions. While high impact wind incidents are not frequent in the area, significant Santa Ana Wind events have been known to negatively impact the local community.

What are Santa Ana Winds?

"Santa Ana winds are generally defined as warm, dry winds that blow from the east or northeast (offshore). These winds occur below the passes and canyons of the coastal ranges of Southern California and in the Los Angeles basin. Santa Ana winds often blow with exceptional speed in the Santa Ana Canyon (the canyon from which it derives its name). Forecasters at the National Weather Service offices in Oxnard and San Diego usually place speed minimums on these winds and reserve the use of "Santa Ana" for winds greater than 25 knots."[1] These winds accelerate to speeds of 35 knots as they move through canyons and passes, with gusts to 50 or even 60 knots.

"The complex topography of Southern California combined with various atmospheric conditions create numerous scenarios that may cause widespread or isolated Santa Ana events. Commonly, Santa Ana winds develop when a region of high pressure builds over the Great Basin (the high plateau east of the Sierra mountains and west of the Rocky mountains including most of Nevada and Utah). Clockwise circulation around the center of this high pressure area forces air downslope from the high plateau. The air warms as it descends toward the California coast at the rate of 5 degrees F per 1000 feet due to compressional heating. Thus, compressional heating provides the primary source of warming. The air is dry since it originated in the desert, and it dries out even more as it is heated."[2]

These regional winds typically occur from October to March, and, according to most accounts

are named either for the Santa Ana River Valley where they originate or for the Santa Ana Canyon, southeast of Los Angeles, where they pick up speed.

Microbursts

Microbursts, are strong, damaging winds which strike the ground and often give the impression a tornado has struck. They frequently occur during intense thunderstorms. The origin of a microburst is downward moving air from a thunderstorm's core. But unlike a tornado, they affect only a rather small area.

University of Chicago storm researcher Dr Ted Fujita first coined the term “downburst” to describe strong, downdraft winds flowing out of a thunderstorm cell that he believed were responsible for the crash of Eastern Airlines Flight 66 in June of 1975.[3]

A downburst is a straight-direction surface wind in excess of 39 mph caused by a small-scale, strong downdraft from the base of convective thundershowers and thunderstorms. In later investigations into the phenomena he defined two sub-categories of downbursts: the larger macrobursts and small microbursts.[4]

Macrobursts are downbursts with winds up to 117 mph which spread across a path greater than 2.5 miles wide at the surface and which last from 5 to 30 minutes. The microburst, on the other hand is confined to an even smaller area, less than 2.5 miles in diameter from the initial point of downdraft impact. An intense microburst can result in damaging winds near 270 km/hr (170 mph) and often last for less than five minutes.[5]

> “Downbursts of all sizes descend from the upper regions of severe thunderstorms when the air accelerates downward through either exceptionally strong evaporative cooling or by very heavy rain which drags dry air down with it. When the rapidly descending air strikes the ground, it spreads outward in all directions, like a fast-running faucet stream hitting the sink bottom.
>
> When the microburst wind hits an object on the ground such as a house, garage or tree, it can flatten the buildings and strip limbs and branches from the tree. After striking the ground, the powerful outward running gust can wreak further havoc along its path. Damage associated with a microburst is often mistaken for the work of a tornado, particularly directly under the microburst. However, damage patterns away from the impact area are characteristic of straight-line winds rather than the twisted pattern of tornado damage.”[6]

Tornados, like those that occur every year in the Midwest and Southeast parts of the United States, are a rare phenomenon in most of California, with most tornado-like activity coming from micro-bursts.

Local History of Windstorm Events

While the effects of Santa Ana Winds are often overlooked, it should be noted that in 2003, two deaths in Southern California were directly related to the fierce condition. A falling tree struck one woman in San Diego.[7] The second death occurred when a passenger in a vehicle was hit by a flying pickup truck cover launched by the Santa Ana Winds.[8]

The following Santa Ana wind events were featured in news resources during 2003:	
January 6, 2003 OC Register	"One of the strongest Santa Ana windstorms in a decade toppled 26 power poles in Orange early today, blew over a mobile derrick in Placentia, crushing two vehicles, and delayed Metrolink rail service." This windstorm also knocked out power to thousands of people in northeastern Orange County.
January 8, 2003 CBSNEWS.com	"Santa Ana's roared into Southern California late Sunday, blowing over trees, trucks and power poles. Thousands of people lost power."
March 16, 2003 dailybulletin.com	Fire Officials Brace for Santa Ana Winds - - "The forest is now so dry and so many trees have died that fires, during relatively calm conditions, are running as fast and as far as they might during Santa Ana Winds. Now the Santa Ana season is here. Combine the literally tinder dry conditions with humidity in the single digits and 60-80 mph winds, and fire officials shudder."

The following is a glimpse of some major Santa Ana wind/windstorm events to hit the local area:

Major Windstorms / Santa Ana Wind Events

Date	***Location and Damage***
November 5-6, 1961	*Santa Ana winds. Fire in Topanga Canyon*
February 10-11, 1973	*Strong storm winds:. 57 mph at Riverside, 46 Newport Beach. Some 200 trees uprooted in Pacific Beach alone*
October 26-27, 1993	*Santa Ana winds. Fire in Laguna Hills*
October 14, 1997	*Santa Ana winds: gusts 87 mph in central Orange County. Large fire in Orange County*
December 29, 1997	*Gusts 60+ mph at Santa Ana*
March 28-29, 1998	*Strong storm winds in Orange County: sustained 30-40 mph. Gust 70 mph at Newport Beach, gust 60 Huntington Beach. Trees down, power out, and damage across Orange and San Diego Counties. 1 illegal immigrant dead in Jamul.*
September 2, 1998	*Strong winds from thunderstorms in Orange County with gusts to 40mph. Large fires in Orange County*
December 6, 1998	*Thunderstorm in Los Alamitos and Garden Grove: gust 50-60 mph called "almost a tornado"*

December 21-22, 1999	*Santa Ana winds: gust 68 mph at Campo, 53 Huntington Beach, 44 Orange. House and tree damage in Hemet.*
March 5-6, 2000	*Strong thunderstorm winds at the coast: gust 60 mph at Huntington Beach Property damage and trees downed along the coast*
April 1, 2000	*Santa Ana winds: gust 93 mph at Mission Viejo, 67 Anaheim Hills*
December 25-26, 2000	*Santa Ana winds: gust 87 mph at Fremont Canyon. Damage and injuries in Mira Loma, Orange and Riverside Counties*
February 13, 2001	*Thunderstorm gust to 89 mph in east Orange*
Source:http://www.wrh.noaa.gov/sandiego/research/Guide/weatherhistory.pdf	

Windstorm Hazard Assessment

Hazard Identification

A windstorm event in the region can range from short term microburst activity lasting only minutes to a long duration Santa Ana wind condition that can last for several days as in the case of the January 2003 Santa Ana wind event. Windstorms in the City of Palos Verdes Estates area can cause extensive damage including heavy tree stands, exposed coastal properties, road and highway infrastructure, and critical utility facilities.

The map shows clearly the direction of the Santa Ana winds as they travel from the stable, high-pressure weather system called the Great Basin High through the canyons and towards the low-pressure system off the Pacific. Clearly the area of the City of Palos Verdes Estates is in the direct path of the ocean-bound Santa Ana winds.

With an analysis of the high wind and tornado events depicted in the "Local History" section, we can deduce the common windstorm impact areas including impacts on life, property, utilities, infrastructure and transportation. Additionally, if a windstorm disrupts power to local residential communities, the American Red Cross and City resources might be called upon for care and shelter duties. Displacing residents and utilizing City resources for shelter staffing and disaster cleanup can cause an economic hardship on the community.

1Map from NASA's "Observatorium"

Community Windstorm Issues

What is Susceptible to Windstorms?

Life and Property
Based on the history of the region, windstorm events can be expected, perhaps annually, across widespread areas of the region which can be adversely impacted during a windstorm event. This can result in the involvement of City of Palos Verdes Estates emergency response personnel during a wide-ranging windstorm or microburst tornadic activity. Both residential and commercial structures with weak reinforcement are susceptible to damage. Wind pressure can create a direct and frontal assault on a structure, pushing walls, doors, and windows inward. Conversely, passing currents can create lift suction forces that pull building components and surfaces outward. With extreme wind forces, the roof or entire building can fail causing considerable damage.

Debris carried along by extreme winds can directly contribute to loss of life and indirectly to the failure of protective building envelopes, siding, or walls. When severe windstorms strike a community, downed trees, power lines, and damaged property can be major hindrances to emergency response and disaster recovery.

The Beaufort Scale below, coined and developed by Sir Francis Beaufort in 1805, illustrates the effect that varying wind speed can have on sea swells and structures:

BEAUFORT SCALE

Beaufort Force	Speed (mph)	Wind Description - State of Sea - Effects on Land
0	Less 1	Calm - Mirror-like - Smoke rises vertically
1	1-3	Light - Air Ripples look like scales; No crests of foam - Smoke drift shows direction of wind, but wind vanes do not
2	4-7	Light Breeze - Small but pronounced wavelets; Crests do not break - Wind vanes move; Leaves rustle; You can feel wind on the face
3	8-12	Gentle Breeze - Large Wavelets; Crests break; Glassy foam; A few whitecaps - Leaves and small twigs move constantly; Small, light flags are extended
4	13-18	Moderate Breeze - Longer waves; Whitecaps - Wind lifts dust and loose paper; Small branches move
5	19-24	Fresh Breeze - Moderate, long waves; Many whitecaps; Some spray - Small trees with leaves begin to move

6	25-31	Strong Breeze - Some large waves; Crests of white foam; Spray - Large branches move; Telegraph wires whistle; Hard to hold umbrellas
7	32-38	Near Gale - White foam from breaking waves blows in streaks with the wind - Whole trees move; Resistance felt walking into wind
8	39-46	Gale - Waves high and moderately long; Crests break into spin drift, blowing foam in well marked streaks - Twigs and small branches break off trees; Difficult to walk
9	47-54	Strong Gale - High waves with wave crests that tumble; Dense streaks of foam in wind; Poor visibility from spray - Slight structural damage
10	55-63	Storm - Very high waves with long, curling crests; Sea surface appears white from blowing foam; Heavy tumbling of sea; Poor visibility - Trees broken or uprooted; Considerable structural damage
11	64-73	Violent Storm - Waves high enough to hide small and medium sized ships; Sea covered with patches of white foam; Edges of wave crests blown into froth; Poor visibility - Seldom experienced inland; Considerable structural damage
12	>74	Hurricane - Sea white with spray. Foam and spray render visibility almost non-existent - Widespread damage. Very rarely experienced on land.
Source: http://www.compuweather.com/decoder-charts.html		

Utilities

Historically, falling trees have been the major cause of power outages in the region. Windstorms such as strong microbursts and Santa Ana Wind conditions can cause flying debris and downed utility lines. For example, tree limbs breaking in winds of only 45 mph can be thrown over 75 feet. As such, overhead power lines can be damaged even in relatively minor windstorm events. Falling trees can bring electric power lines down to the pavement, creating the possibility of lethal electric shock. Rising population growth and new infrastructure in the region creates a higher probability for damage to occur from windstorms as more life and property are exposed to risk.

Infrastructure

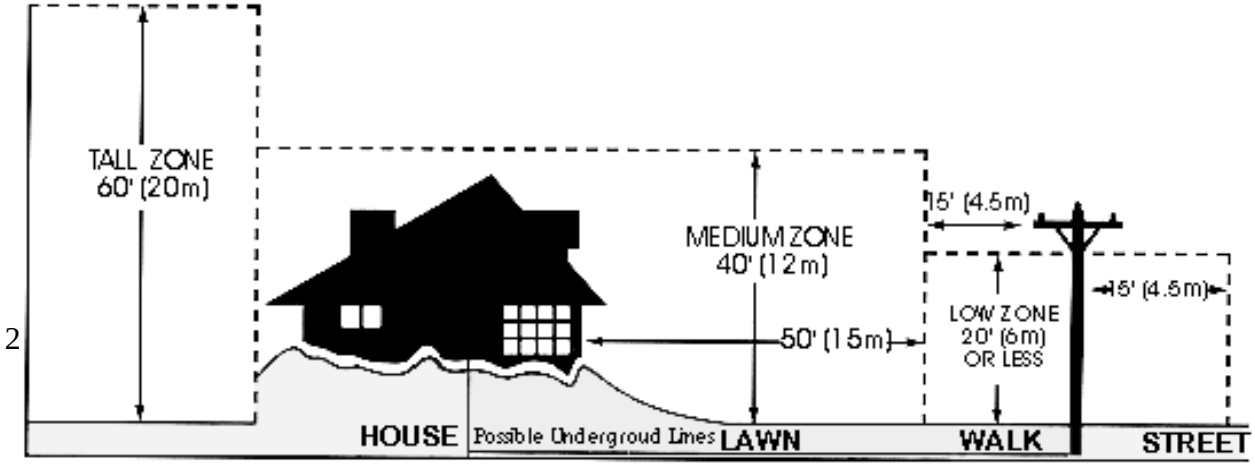
Windstorms can damage buildings, power lines, and other property and infrastructure due to falling trees and branches. During wet winters, saturated soils cause trees to become less stable and more vulnerable to uprooting from high winds.

Windstorms can result in collapsed or damaged buildings or blocked roads and bridges, damaged traffic signals, streetlights, and parks, among others. Roads blocked by fallen trees during a windstorm may have severe consequences to people who need access to emergency services. Emergency response operations can be complicated when roads are blocked or when power supplies are interrupted. Industry and commerce can suffer losses from interruptions in electric

services and from extended road closures. They can also sustain direct losses to buildings, personnel, and other vital equipment. There are direct consequences to the local economy resulting from windstorms related to both physical damages and interrupted services.

Increased Fire Threat

Perhaps the greatest danger from windstorm activity in Southern California comes from the



combination of the Santa Ana winds with the major fires that occur every few years in the urban/wildland interface. With the Santa Ana winds driving the flames, the speed and reach of the flames is even greater than in times of calm wind conditions. The higher fire hazard raised by a Santa Ana wind condition requires that even more care and attention be paid to proper brush clearances on property in the wildland/urban interface areas.

Transportation

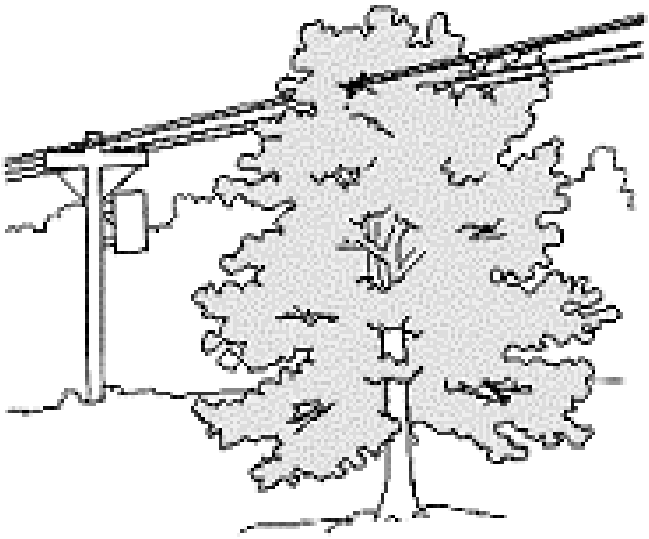
Windstorm activity can have an impact on local transportation in addition to the problems caused by downed trees and electrical wires blocking streets and highways. During periods of extremely strong Santa Ana winds, major highways can be temporarily closed to truck and recreational vehicle traffic. However, typically these disruptions are not long lasting, nor do they carry a severe long term economic impact on the region.

Existing Windstorm Mitigation Activities

As stated, one of the most common problems associated with windstorms is power outage. High winds commonly occur during winter storms, and can cause trees to bend, sag, or fail (tree limbs or entire trees), coming into contact with nearby distribution power lines. Fallen trees can cause short-circuiting and conductor overloading. Wind-induced damage to the power system causes power outages to customers, incurs cost to make repairs, and in some cases can lead to ignitions that start wild land fires.

One of the strongest and most widespread existing mitigation strategies pertains to tree clearance. Currently, California State Law requires utility companies to maintain specific

clearances (depending on the type of voltage running through the line) between electric power lines and all vegetation.



Enforcement of the following California Public Resource Code Sections provides guidance on tree pruning regulations:[9]

4293: Power Line Clearance Required
4292: Power Line Hazard Reduction
4291: Reduction of Fire Hazards Around Buildings
4171: Public Nuisances

The following pertain to tree pruning regulations and are taken from the California Code of Regulations:

Title 14: Minimum Clearance Provisions
Sections 1250-1258
General Industry Safety Orders
Title 8: Group 3: Articles 12, 13, 36, 37, 38
California Penal Code Section 385

Finally, the following California Public Utilities Commission section has additional guidance:

California Public Utilities Commission
General Order 95: Rule 35

Homeowner Liability:
Failure to allow a utility company to comply with the law can result in liability to the homeowner for damages or injuries resulting from a vegetation hazard.
Many insurance companies do not cover these types of damages if the policy owner has refused to allow the hazard to be eliminated.

The power companies, in compliance with the above regulations, collect data about tree failures and their impact on power lines. This mitigation strategy assists the power company in preventing future tree failure. From the collection of this data, the power company can advise residents as to the most appropriate vegetative planting and pruning procedures.

Windstorm Mitigation Action Items

The windstorm mitigation action items provide direction on specific activities that organizations and residents in City of Palos Verdes Estates can undertake to reduce risk and prevent loss from

windstorm events. Each action item is followed by ideas for implementation, which can be used by the Hazard Mitigation Planning Committee and local decision makers in pursuing strategies for implementation.

City of Palos Verdes Estates Mitigation Strategy Recommendations

Short Term Mitigation Activity for Windstorms #l: Public Awareness Campaign: To provide public education materials to City of Palos Verdes Estates residents and all School District staff, parents and age-appropriate students with mitigation materials pertaining to the protection of life and property before, during, and after a windstorm.
Ideas for Implementation:

- Compile mitigation brochures from the following organizations: FEMA; California Public Utilities Commission; Los Angeles County Public Works; Southern California Edison; Tree Line Connection
- Distribute these materials to City of Palos Verdes Estates residents and school district members. Materials can be distributed at City Council Meetings, Commission Meetings, City Hall, Fire Department, Police Department, Chamber of Commerce Meetings, School Administration Offices and other appropriate venues.

Coordinating Organization: City of Palos Verdes Estates Planning Department
Timeline: Ongoing
Plan Goals Addressed: Public Awareness, Protection of Life and Property
Constraints: none

Short Term Mitigation Activity for Windstorms #2*:* Improve local City and utility awareness of tree pruning and Fire Code Sections relevant to wind-resistant utility operations.
Ideas for Implementation: Provide information to City Planning Departments and local utility companies encouraging compliance with State and Local tree clearance and integrity guidelines by:

- Compile comprehensive list of pertinent State and local regulations
- Send letters of encouragement from Hazard Mitigation Planning Committee and local City and School officials encouraging utility compliance with guidelines

Coordinating Organization: City of Palos Verdes Estates Planning Department
Timeline: Ongoing
Plan Goals Addressed: Public Awareness, Protection of Life and Property
Constraints: none

Long Term Mitigation Activity for Windstorms #1*:* Encourage Critical City Facilities to purchase and/or test backup power facilities for use during a power failure. Create a equipment/testing log, if needed, to ensure backup power equipment is in working service.
Ideas for Implementation:

- Gather all databases of backup power equipment for critical facilities.
- Test all critical facility backup power generators.
- Keep an accurate record of equipment specification and testing date information.

Coordinating Organization: Public Works Department, Streets and Parks Department
Timeline: Ongoing
Plan Goals Addressed: Protection of Life and Property
Constraints: none

Windstorm Resource Directory

State Resources

California Division of Forestry & Fire Protection
1416 9th Street
PO Box 944246
Sacramento California 94244-2460
916-653-5123
http://www.fire.ca.gov/php/index.php

Federal Resources and Programs

National Weather Service
Los Angeles/Oxnard Weather Forecast Office
520 North Elevar Street
Oxnard, CA 93030
Forecast and weather info: 805-988-6610
Administrative issues: 805-988-6615
E-mail: Webmaster.LOX@noaa.gov
http://weather.noaa.gov/

Additional Resources

International Society of Arboriculture.
P.O. Box 3129
Champaign, IL 61826-3129
Phone: 217.355.9411
Fax: 217.355.9516
Web: www.isa-arbor.com
E-mail: isa@isa-arbor.com

Publications

WINDSTORMS: Protect Your Family and Property from the Hazards of Violent Windstorms
http://emd.wa.gov/5-prep/trng/pubed/Windstrm.pdf

Preparing Your Home for Severe Windstorms is available from
http://www.chubb.com/personal/html/helpful_tips_home_windstorm.html

Windstorm Endnotes

[1] http://nimbo.wrh.noaa.gov/Sandiego/snawind.html

[2] Ibid

[3] Keith C. Heidorn at http://www.suite101.com/article.cfm/13646/100918, June 1, 2003

[4] Ibid

[5] Ibid

[6] Ibid

[7] http://www.cbsnews.com, January 8, 2003

[8] http://www.cbsnews.com/stories/2003/01/06/national/

[9] http://www.cpuc.ca.gov/js.asp